PROCEEDINGS OF THE 8th cidb POSTGRADUATE CONFERENCE

10-11 February 2014

University of the Witwatersrand, Johannesburg, South Africa

Theme:
Advancing construction industry development through innovative research and new thinking

Programme and Full Papers

Editors
A/Prof Samuel Laryea
Dr Eziyi Offia Ibem

Proceedings of the 8th Construction Industry Development Board (CIDB) Postrgraduate Conference hosted at the University of the Wiwatersrand, Johannesburg, South Africa (Programme and Full Papers)

10th -11th February 2014

Editors

A/Professor Samuel Laryea and Dr Eziyi Offia Ibem
University of the Witwatersrand, Johannesburg, South Africa

First published in February 2014, Johannesburg, South Africa

ISBN 978-0-9566060-8-2

Published by:
School of Construction Economics and Management
University of the Witwatersrand, Johannesburg, South Africa
1 Jan Smuts Avenue
PO Box 20
Wits 2050
Johannesburg, South Africa
Email: c/o Samuel.Laryea@wits.ac.za

Declaration

All full papers in this publication have been through a peer review process involving initial screening of abstracts, scientific review by referees, reporting of referee comments to authors, modifications of papers by authors and re-evaluation of re-submitted papers by the Scientific Committee to ensure quality of content.

Professional accreditation

The 8th CIDB Postgraduate Conference is accredited by the Association of South African Quantity Surveyors (ASAQS) for 8 hours CPD credits in Category 1.

The conference is also accredited by the South African Council for Project and Construction Management Professionals (SACPCMP) for 5 CPD points under Category A: Core.

Correspondence

All correspondence relating to the 8th CIDB Postgraduate Conference should be addressed to:
Dr Eziyi O. Ibem
Conference Secretary
Email: eziyi.ibem@wits.ac.za

For more information, please visit our website: http://wits-enterprise.co.za/cidb/pages/home

FOREWORD

A very warm welcome to the 8th CIDB conference hosted by the Construction Industry Development Board (CIDB) and the School of Construction Economics and Management, University of the Witwatersrand under the theme: "*Advancing construction industry development through innovative research and new thinking*".

In a new age of sustainable and digital technologies, this conference seeks to encourage new ideas for delivering value for money and a critical examination of conventional business and delivery models in construction. We called for research papers that point us in alternative directions and new ways of doing business or delivering projects across construction supply chains. Following a thorough process of scientific review, 52 out of 90+ papers submitted initially were accepted by the scientific committee for inclusion in this published proceedings. We trust that some of the ideas flowing from the papers will help to facilitate construction industry development in South Africa and elsewhere.

I would like to thank our scientific committee and everyone who has joined us for this conference. I particularly wish to express profound gratitude to our keynote speakers who will be speaking to us on an array of fascinating topics connected with the conference theme. We are privileged to have with us Prof Will Hughes from the University of Reading in UK, Prof Chimay Anumba from Penn State University in the US, Dr Ron Watermeyer from Infrastructure Options in South Africa, Dr Libby Schweber from University of Reading in UK , Prof Chrisna Du Plessis from University of Pretoria in South Africa and Mr Alex Lubbock from Carillion Construction Services in the UK. I believe that our team of expert keynote speakers will share some thought-provoking experiences and ideas with us over the course of this conference.

The cidb deserves special thanks for establishing and being the main sponsor for this all important conference now in its 8th edition. We are very grateful for the financial assistance received from Murray and Dickson Construction (Pty) Ltd, Master Builders South Africa, and the Federated Employers' Mutual Assurance Company. The South African Council for Project and Construction Management Professions (SACPCMP) has been dynamic in helping to organise this conference and they deserve our appreciation. Appreciation is also due to the ASAQS, SACQSP, Project and Construction Management (Media Partners) and Wits University. Thank you so much to all of you for helping to organise this conference successfully.

I would like to thank again every participant at this conference for making the time to come. Given the richness and diversity of people we have here from different backgrounds and countries, please take every chance to interact and enjoy the conference.

Samuel Laryea PhD
Associate Professor & Conference Chair
University of the Witwatersrand, Johannesburg, South Africa
February 2014

PREFACE BY CEO OF CIDB

The cidb congratulates the School of Construction Economics and Management of the University of the Witwatersrand in hosting the 8th cidb postgraduate conference.

The theme of the conference "Advancing construction industry development through innovative research and new thinking" reflects the stage of development in the construction industry and the response that the academic community has to adopt to remain relevant. It is particularly important to mention here that as the country embarks on the massive infrastructure investment as laid out in the Strategic Infrastructure Projects, academic institutions are challenged to provide the skills and new ways of thinking that will make this investment a reality.

The 8th cidb Postgraduate Conference brings together representatives from South African and international institutions, and the papers presented at this conference cover a wide range of topics relevant to the development of our construction industry. While active debate of research findings at this conference on issues of relevance to the growth and development of our industry is important, so too are the opportunities for the growth and development of the researchers and other participants.

It is my sincere hope that the presence of international academics at this conference motivates our young academics and postgraduate students to aspire to higher levels of excellence, and that they may in turn present at international meetings.

It is therefore with pleasure that I extend a warm welcome to all the participants at this Conference, and I trust that this Conference will provide an ongoing platform for interaction between the academic community and industry stakeholders. Conferences, such as these play an important role in the professional development of the skills base in our industry.

I would also like to thank the organizers of the conference for their hard work and commitment – and in particular to Prof. Sam Laryea and Dr Eziyi Ibem of the University of the Witwatersrand and Ms Ntebo Ngozwana of the cidb. An special word of gratitude is also extended to our conference sponsors, the School of Construction Economics and Management at the University of the Witwatersrand, MBSA, SACPCMP and Murray and Dickson for their generous support and participation.

Mzwandile Sokupa, CEO, cidb

February, 2014

SCIENTIFIC COMMITTEE

A/Prof Samuel Laryea, University of the Witwatersrand, South Africa (Chair)
Prof PD Rwelamila, UNISA Graduate School of Business Leadership, South Africa
Prof Raymond Nkado, University of the Witwatersrand, South Africa
Prof Kathy Michell, University of Cape Town, South Africa
Dr Rodney Milford, Construction Industry Development Board, South Africa
Prof Dave Root, University of the Witwatersrand, South Africa
Prof Tinus Maritz, University of Pretoria, South Africa
Dr Sena Agyepong, Ashesi University College, Ghana
Prof John Smallwood, Nelson Mandela Metropolitan University, South Africa
Dr Senthilkumar Venkatachalam, University of the Witwatersrand, South Africa
Prof Wellington Didibhuku Thwala, University of Johannesburg, South Africa
Dr Llewellyn Tang, University of Nottingham, Ningbo, China
Dr Roine Leiringer, The University of Hong Kong, Hong Kong
Dr Obinna Ozumba, University of the Witwatersrand, South Africa
Dr Joseph Ssegawa, University of Botswana, Botswana
Dr Boipuso Nkwae, University of Botswana, Botswana
Dr Fidelis Emuze, Central University of Technology, Free State, South Africa
Prof Will Hughes, University of Reading, UK
Dr Libby Schweber, University of Reading, UK
Dr Samuel Azasu, University of the Witwatersrand, South Africa
Dr Kola Akinsomi, University of the Witwatersrand, South Africa
Prof Jan Wium, University of Stellenbosch, South Africa
Dr Ron Watermeyer, Infrastructure Options, South Africa
Dr Emmanuel Essah, University of Reading, UK
Prof George Ofori, National University of Singapore, Singapore
Prof Alfred Talukhaba, Tshwane University of Technology, South Africa
Dr Abimbola Windapo, University of Cape Town, South Africa
Prof Phoebe Bolton, University of Stellenbosch, South Africa
Dr Cynthia Adeokun, Covenant University, Nigeria
Prof Chimay J. Anumba, Pennsylvania State University, USA
Dr Chris Harty, University of Reading, UK
Dr Taibat Lawanson, University of Lagos, Nigeria
Mrs Paula Cardellino, Universidad ORT Uruguay, Uruguay
Dr Jasper Mbachu, Massey University, New Zealand
Dr Franklin Obeng-Odoom, University of Technology, Sydney, Australia
Prof Winston Shakantu, Nelson Mandela Metropolitan University, South Africa
Prof Paul Bowen, University of Cape Town, South Africa
Dr Zanele Bridgette Gasa, The Elilox Group Pty Ltd, South Africa
Dr Eziyi O. Ibem, University of the Witwatersrand, South Africa (Conference Secretary)

ADDITIONAL REVIEWERS

The peer review process for a conference of this nature requires the expertise and voluntary contribution of a number of academics from various countries. We are grateful to the following people who assisted by carrying out the review of abstracts and papers for the 8th cidb conference in addition to the members of our Scientific Committee.

Dr. David Jiboye, Obafemi Awolowo University, Ile-Ife, Nigeria

A/Prof Abraham Taiwo, Federal University of Technology, Akure, Nigeria

Olumuyiwa B. Adegun, University of the Witwatersrand, South Africa

Dr. Jennifer Charlson, University of Wolverhampton, UK

Dr. Clinton.O. Aigbavboa, University of Johannesburg, South Africa

Dr. Nwabueze. M. Anosike, Gregory University, Uturu, Nigeria

Dr. Adedapo Oluwatayo, Covenant University, Ota, Nigeria

Dr. Ssemwogerere Kenneth, Makerere University, Kampala, Uganda

Ikotun Jacob Olumuyiwa, University of the Witwatersrand, South Africa

Dr. Julius Fapohunda, Cape Peninsula University of Technology, South Africa

Dr. Adebanji Ogbiye, Covenant University, Ota, Nigeria

Dr. Ariyo A. Adebiyi, Covenant University, Ota, Nigeria

Dr. Christian Henjewele, Anglia Ruskin University, Chelmsford, UK

Dr. Julius Agumba, University of Johannesburg, South Africa

SPONSORS AND PARTNERS

We would like to express our appreciation to the following sponsors and partners of the 8th CIDB postgraduate conference.

cidb
Construction Industry Development Board
DEVELOPMENT THROUGH PARTNERSHIP

SACPCMP
The South African Council for the Project and Construction Management Professions

SCHOOL OF CONSTRUCTION ECONOMICS & MANAGEMENT

Project & Construction Management

FEM
THE FEDERATED EMPLOYERS' MUTUAL ASSURANCE COMPANY PROPRIETARY LIMITED (RF)

NATIONAL SOCIETY OF BLACK ENGINEERS (SA)
NSBE
OF SOUTH AFRICA

MBSA
MASTER BUILDERS
SOUTH AFRICA

M&D
MURRAY AND DICKSON CONSTRUCTION (PTY) LTD.

More information is available on our website http://wits-enterprise.co.za/cidb/pages/home

KEYNOTE SPEAKERS

Chimay J. Anumba

Professor Chimay Anumba is Department Head and Professor of Architectural Engineering at the Pennsylvania State University in the USA. He is a Fellow of the Royal Academy of Engineering. He holds a Ph.D. in Civil Engineering from the University of Leeds, UK; a higher doctorate – D.Sc. (Doctor of Science) - from Loughborough University, UK; and an Honorary Doctorate (Dr.h.c.) from Delft University of Technology in The Netherlands for outstanding scientific contributions to Building and Construction Engineering. His research interests are in the fields of advanced engineering informatics, concurrent engineering, knowledge management, distributed collaboration systems, and intelligent systems. He has over 450 scientific publications in these fields and his work has received support worth over $150m from a variety of sources. He has also supervised more than 43 doctoral graduates and mentored over 20 postdoctoral scholars. He is a Chartered Engineer and Fellow of the ICE, IStructE, ASCE and CIOB.

Chrisna Du Plessis

Professor Chrisna du Plessis is Associate Professor at the Department of Construction Economics, University of Pretoria, South Africa where she is currently leading a National Research Foundation funded research project on resiliency strategies for aspirational African cities. She is also the CIB Theme Coordinator for Sustainable Construction. Until end July 2010 she was employed as Principal Researcher at the Council for Scientific and Industrial Research (CSIR), where she concentrated on urban sustainability science at both a theoretical and technological level. She holds graduate and post-graduate degrees in architecture and sustainable development from the University of Pretoria, a PhD in Urban Sustainability from the University of Salford and an honorary doctorate from Chalmers University of Technology in Sweden. She has more than 20 years' experience in sustainable human settlement development, both as practitioner and as researcher. Her contribution as researcher has focused on developing the principles and guiding frameworks for the practices of sustainable construction and human settlement development. She has applied this in a body of work that spanned the fields of housing, construction industry performance, urban/human settlement development and infrastructure design. She is a popular speaker and has been invited to speak as keynote at 17 major international conferences. Chrisna's previous keynotes include the American Institute of Architects' 150th National Convention in 2007, the Local Government Summit at the 2002 World Summit for Sustainable Development, the CIB Triennial World Congress in 2001, and the World Sustainable Building conferences in 2000, 2002 and 2005.

Ron Watermeyer

Dr Ron Watermeyer (DEng, CEng, PrEng, PrCM, PrCPM, FSAICE, FIStructE, FICE) is the founder of Infrastructure Options. He has been at the forefront of many development initiatives in South Africa since the early 1990s including the reinterpretation of building regulations, the classification of sites in terms of geotechnical characteristics and building practice, changing construction methods, technologies and practices to facilitate socio-economic development imperatives and the development of construction procurement procedures and practices. His work on procurement has formed the basis for not only South African standards for construction procurement but also the recently published ISO 10845 family of standards. He has in recent years piloted the implementation of target contracts and framework agreements for the delivery of civil engineering and building projects within the public sector. He has also led the development the National Treasury Standards for a Construction Procurement System and an Infrastructure Delivery Management System. He served as the South African Institution of Civil Engineering's 101st President in 2004. In 2009 he was awarded a senior doctorate (Doctor of Engineering) from the University of the Witwatersrand for his published work on Contributions to the delivery of infrastructure for the advancement of a changing South African society and in 2010 the Institution of Civil Engineer's International medal for his contribution over time in the delivery of enabling engineering mechanisms for the UN Millennium Development Goals.

Libby Schweber

Dr Libby Schweber is an Associate Professor in the Sociology of Sustainable Construction in the School of Construction Management at the University of Reading, UK. She holds a Ph.D. in Sociology from Princeton University and is the recipient of the American Sociological Association's prestigious Robert K. Merton book prize for her book Disciplining Statistics (2006). Libby's qualifications also include a BA from Harvard University, MA from Hebrew University and MA from Princeton University. She shifted fields from the Sociology of Knowledge, Science and Technology to Construction Research in 2010. Her work in construction research focuses on the relation between innovation and standardization, on the uptake and diffusion of technical and process innovation and on the role of instruments in the mainstreaming of sustainability at both the firm and project level. Building on her earlier career as a sociologist, she also has an interest in social theory, epistemology and research methods as applied to construction research.

Will Hughes

Will Hughes is a Professor of Construction Management and Economics at the School of Construction Management and Engineering, University of Reading, UK where he is School Director of Postgraduate Taught Studies and Programme Director for both the MSc Construction Management and the MSc Construction in Emerging Economies. He is the Editor-in-Chief of Construction Management and Economics. His research is focused on construction procurement and project organization. This research includes the control and management of building contracts, the management of design in construction, professional issues, the analysis of organizational structure and the analysis of procurement systems. The focus of his work is the commercial processes of structuring, negotiating, recording and enforcing business deals in construction. His recent work includes being part of the drafting committee for a new British Standard, BS8534:2011 Construction procurement policies, strategies and Procedures – Code of practice. He is currently working closely with organizations who are developing new business practices that will transform the way that professionals, contractors and sub-contractors participate in construction business. The aim is to find out what happens when the traditional market and institutional obstacles to technological innovation are removed. He is particularly interested in business processes that enable the introduction of sustainable technologies, especially in the context of developing countries.

Alex Lubbock

Alex Lubbock is BIM Development Manager for Carillion Construction Services. Carillion is an integrated project and service delivery provider based in the UK and internationally in the Middle East, North Africa and North American regions. His role is to portfolio manage the integration of Building Information Modelling into everyday working practices in both the construction and services markets Carillion operate within. Whilst with Carillion, over the last five years, Alex has carried out various roles including Estimating, Quantity Surveying, Project Management and Change Management whilst completing his masters in Project Management. Alex has now specialised in the culture and change management of BIM within the business. One area of focus has been in upstream and downstream procurement practices with BIM and the identification of risks and opportunities to existing process and future goals of clients, contractors and suppliers with BIM. This is allied to the opportunity to truly offer an integrated project from end to end through BIM. Alex is also in the final stages of completing the Carillion Leadership Programme which is a two year in house talent development programme; he is a member of the Association of Project Management (APM) and is in the process of achieving chartered status with the Chartered Institute of Building (CIOB) whilst managing a great work life balance.

On behalf of the Conference Organizing Committee, I would like to thank our keynote speakers for accepting our invitation to come and share your presence and thoughts with us. Thank you very much.

Samuel Laryea
Conference Chair

PROGRAMME FOR 8TH CIDB POSTGRADUATE CONFERENCE

MONDAY 10TH FEBRUARY 2014

07:30-08:50 ARRIVAL AND REGISTRATION

08:50-09:45 OPENING SESSION (MAIN HALL)

08:50-09:00	Introduction of guests - Sam Laryea (Chair of 8th cidb postgraduate conference)
09:00-09:10	Welcome Remarks by Professor Ian Jandrell, Dean of the Faculty of Engineering and the Built Environment
09:10-09:20	Remarks by CEO of Construction Industry Development Board (CIDB) – Mr. Mzwandile Sokupa
09:20-09:40	Address by Professor Adam Habib – Vice Chancellor and Principal of Wits University
09:40-09:45	Group Photograph

09:45-10:00 BREAK

10:00-10:30 KEYNOTE ADDRESS BY PROFESSOR WILL HUGHES

Professor of Construction Management and Economics and Editor-in-chief of Construction Management and Economics (CM and E) Journal, School of Construction Management and Engineering, University of Reading, UK

Title: Advancing construction industry development, innovative research and new thinking

10:30-10:40 Q and A

Session chair for Keynote Address: Professor Raymond Nkado, University of the Witwatersrand, South Africa

10:40-11:00 BREAK

11:00-12:00 PARALLEL SESSION (STREAM 1)

Chairperson: Prof Jan Wium, Stellenbosch University, South Africa

11:00-11:10	Analysis of the effectiveness of quality assurance systems towards delivering low-cost houses in Cape Town South Africa - V. Ngquba; J. Crowe and J. Fapohunda
11:10-11:20	Discussion

11:20-11:30	The Risk Management Practices and Techniques Utilized in Swaziland Construction Industry: A Review - Olutope Olamiwale Ibidapo ; Alfred A. Talukhaba and James Okumbe
11:30-11:40	Discussion
11:40-11:50	Risk Management by Property developers in the Gauteng Province, South Africa - Thabiso B. Maphalala and Chris E. Cloete
11:50-12:00	Discussion

12:00-12:10 BREAK

12:10-12:40 KEYNOTE ADDRESS BY DR RON WATERMEYER

Infrastructure Options (Pty)Ltd, Bordeaux, Randburg, South Africa

Title: Realising value for money through procurement strategy in the delivery of public infrastructure

12:40-12:50 Q and A

Session chair for Keynote Address: Professor Will Hughes, University of Reading, UK

12:50-14:00 LUNCH BREAK

14:00-15:00 PARALLEL SESSION (STREAM 1)

Chairperson: Dr Cynthia Adeokun, Covenant University, Nigeria

14:00-14:10	The impact of Design Changes on the budgeted cost of building Projects in South Africa - I.J. Akindele and J.A. Fapohunda
14:10-14:20	Correlates of clients' payment pattern and construction project performance - Akinsiku O. Emmanuel and Olubunmi A. Johnson
14:20-14:30	Discussion
14:30-14:40	A Systematic Review of Factors Influencing the Cost Performance of Building Projects - Sunday J. Odediran and Abimbola O. Windapo
14:40-14:50	Perceptions on the importance of offering monetary and non-monetary incentives to team members of construction projects - Ndihokubwayo, R.; Craffford, G.J. and Buys F.
14:50-15:00	Discussion

15:05-15:40	**KEYNOTE ADDRESS BY DR LIBBY SCHEBWER**
	Associate Professor in the Sociology of Sustainable Construction, School of Construction Management and Engineering, University of Reading, UK
	Title: Putting theory to work: The use of theory in construction research
15:40-15:50	Q and A
	Session chair for Keynote Address: Prof John Smallwood, Nelson Mandela Metropolitan University, South Africa
16:00-17:00	**PARALLEL SESSION (STREAM 1)**
	Chairperson: Prof Chris Cloete, University of Pretoria, South Africa
16:00-16:10	A Review of Research Methodologies in Building Energy Efficiency Assessment - Michael N. Addy; Emmanuel Adinyira and Christian Koranteng
16:10-16:20	The Influence of Project Management Service Provision on Role-Players within the South African Construction Industry - Hefer . A; Vosloo, D. and Botha, B.
16:20-16:30	Discussion
16:30-16:40	Healing Gardens for the Construction Site: An Innovative Organizational Management Strategy- Rita A. Obiozo and John S. Smallwood
16:40-16:50	Awareness and Prospect of Agile Project Management in the Ghanaian Construction Industry - Simon O. Ametepey; Samuel K. Ansah and Clinton Aigbavboa
16:50-17:00	Discussion
17:00	
	CLOSE
18:00-20:00	**COCKTAIL RECEPTION**
	Venue: New John Moffat Building (School of Construction Economics and Management, University of the Witwatersrand) Welcome remarks by Professor Dave Root, Head of School of Construction Economics and Management & Remarks by Professor Ian Jandrell, Dean of the Faculty of Engineering and the Built Environment Drinks and Food

MONDAY	**10TH FEBRUARY 2014**
07:30-09:00	**ARRIVAL AND REGISTRATION**
08:50-09:45	**OPENING SESSION (MAIN HALL)**
08:50-09:00	Introduction of guests - Sam Laryea (Chair of 8th cidb postgraduate conference)
09:00-09:10	Welcome Remarks by Professor Ian Jandrell, Dean of the Faculty of Engineering and the Built Environment
09:10-09:20	Remarks by CEO of Construction Industry Development Board (CIDB) – Mr. Mzwandile Sokupa
09:20-09:40	Address by Professor Adam Habib – Vice Chancellor and Principal of Wits University
09:40-09:45	Group Photograph
09:45-10:00	**BREAK**
10:00-10:30	**KEYNOTE ADDRESS BY PROFESSOR WILL HUGHES**
	Professor of Construction Management and Economics and Editor-in-chief of Construction Management and Economics (CM and E) Journal, School of Construction Management and Engineering, University of Reading, UK
	Title: Advancing construction industry development, innovative research and new thinking
10:30-10:40	Q and A
	Session chair for Keynote Address: Professor Raymond Nkado, University of the Witwatersrand, South Africa
10:40-11:00	**BREAK**
11:00-12:00	**PARALLEL SESSION (STREAM 2)**
	Chairperson: Prof Didi Thwala, University of Johannesburg, South Africa
11:00-11:10	Reworking Traditional fund raising Institutions for Affordable Housing Provision: A review of Nigerian and Kenyan Case-Studies - C.O. Adeokun, B.A. Adewale and O.C.Oloke
11:10-11:20	Discussion
11:20-11:30	Investigating the Relationship between the Age- Stage Demographic and Preferences in Dwelling Type-S.A. Agyepong and A.W. Wuni

11:30-11:40	Discussion
11:40-11:50	Delivering Affordable Dwellings for Key Workers: the Shared-Ownership Option in Sub-Saharan Africa - C.O. Adeokun and F. Isaacs-Sodeye
11:50-12:00	Discussion

12:00-12:10 BREAK

12:10-12:40 KEYNOTE ADDRESS BY DR RON WATERMEYER

Infrastructure Options (Pty)Ltd, Bordeaux, Randburg, South Africa

Title: Realising value for money through procurement strategy in the delivery of public infrastructure

12:40-12:50 Q and A

Session chair for Keynote Address: Professor Will Hughes, University of Reading, UK

12:50-14:00 LUNCH BREAK

14:00-15:00 PARALLEL SESSION (STREAM 2)

Chairperson: Dr Sena Agyepong, Ashesi University College, Ghana

14:00-14:10	Innovation for Sustainability in the Design and Construction of Public Housing: the Case of Lagos Home Ownership and Mortgage Scheme (Lagos HOMs) - Isidore C. Ezema
14:10-14:20	Discussion
14:20-14:30	Employee-Driven Innovations in Large Project Organizations - Henrick Sorensen; Soren Wandahl and Randi Muff Chrisensen
14:30-14:40	Discussion
14:40-14:50	Managing Stakeholders' Needs and Expectations in the Architectectural Design Process: A Knowledge Management Approach - A.S.A Halim and A.A.E. Othman
14:50-15:00	Discussion

15:05-15:40 KEYNOTE ADDRESS BY DR LIBBY SCHEBWER

Associate Professor in the Sociology of Sustainable Construction, School of Construction Management and Engineering, University of Reading, UK

Title: Putting theory to work: The use of theory in construction research

15:40-15:50 Q and A

Session chair for Keynote Address: Prof John Smallwood, Nelson Mandela Metropolitan University, South Africa

15:50-16:00 **BREAK**

16:00-17:00 PARALLEL SESSION (STREAM 2)

Chairperson: Dr Brink Botha, Nelson Mandela Metropolitan University, South Africa

16:00-16:10	Assessing Areas and Trends of Bamboo Usage in Building Construction in Ghana - J. Ayarkwa; D. Opoku and K. Agyekum
16:10-16:20	Economic Characteristics of Compressed Laterite Bricks in Housing Construction in Nigeria - Pearl A. Opoko and Eziyi O. Ibem
16:20-16:30	Discussion
16:30-16:40	Investigating the impact of site activities and conditions on concrete quality between in-situ and precast construction methods - Wesley Solomons and Jan Wium
16:40-16:50	Structural efficiency of concrete Masonry Rebated Filler Blocks for the Beam and Block Slab System Used around Durban , South Africa - Bonga Khuzwayo
16:50-17:00	Discussion

17:00 CLOSE

18:00-20:00 COCKTAIL RECEPTION

Venue: New John Moffat Building (School of Construction Economics and Management, University of the Witwatersrand)
Welcome remarks by Professor Dave Root, Head of School of Construction Economics and Management &
Remarks by Professor Ian Jandrell, Dean of the Faculty of Engineering and the Built Environment
Drinks and Food

TUESDAY 11TH FEBRUARY 2014

09:00-09:30 KEYNOTE ADDRESS BY PROFESSOR CHIMAY ANUMBA

Department Head and Professor of Architectural Engineering, The Pennsylvania State University, USA

Title: New developments and future directions in the built environment field

09:30-09:40 *Q and A*

Session chair for Keynote Address: Professor Raymond Nkado, University of the Witwatersrand, South Africa

09:40-10:00 BREAK

10:00-12:00 PARALLEL SESSION (STREAM 1)

Chairperson: Dr Senthilkumar Venkatachalam, Wits University, South Africa

10:00-10:10	Competitive strategy, decision-making style and organisational performance: a contingency approach - Luqman O. Oyewobi; Abimbola O. Windapo and Keith S. Cattell
10:10-10:20	Geographic Diversification of Listed South African Property Companies into Africa - Omokolade Akinsomi; Radiyya Pahad; Lebogang Nape and Joshua Margolis
10:20-10:30	Discussion
10:30-10:40	Identification of Critical Success Factors for the Survival of Small, Medium and Micro Enterprise Contracting Firms in the Greater Johannesburg Metropolitan Area - Clinton O. Aigbavboa ; L.M. Tshikhudo and W.D. Thawla
10:40-10:50	Discussion
10:50-11:00	Assessing the Implementation Structure for Public-Private Partnerships in Urban Housing in Nigeria - Eziyi.O. Ibem; Albert Adeboye and Oluwole Alagbe
11:00-11:10	An Exploration of Public Private Partnership in Infrastructure Development in South Africa - M. Liphadzi ; C.O.Aigbavboa and W.D.Thwala
11:10-11:20	Discussion
11:20-11:30	Development of a Framework for Ethical Sourcing Supply Chain in the Nigerian Construction Industry - Ibrahim Kabir; Mbamali Ikem and Ahmed Doko Ibrahim
11:30-11:40	Discussion
11:40-11:50	Challenges Facing Emerging Contractors Within the Construction Industry in Gauteng Province - Dikeledi D. Maongane; Alfred A. Talukhaba and James Okumbe

11:50-12:00	Discussion
12:00-12:10	**BREAK**
12:10-12:40	**KEYNOTE ADDRESS BY MR ALEX LUBBOCK**
	BIM Development Manager, Carillion Construction Services, UK
	Title: Use and implications of Building Information Modelling in construction procurement and integrated project delivery
12:40-12:50	Q and A
	Session chair for Keynote Address: Professor Dave Root, University of the Witwatersrand, South Africa
12:50-14:00	**LUNCH BREAK**
14:00-15:00	**PARALLEL SESSION (STREAM 1)**
	Chairperson: Dr Kola Akinsomi, Wits University, South Africa
14:00-14:10	ICT Competences of Built-Environment Student in a Nigerian Polytechnic - Iyanu Pelumi Oguntuyi and Olumiyiwa B. Adegun
14:10-14:20	Discussion
14:20-14:30	A Process to Assist Technology Investment Decisions in Construction-A case study on Labour Productivity - Jean-Jacques Kriel
14:30-14:40	Integrated Project Ideology and its impact on the South African Construction Industry- Chris Allen and John Smallwood
14:40-15:00	Discussion

15:00-15:10	**BREAK**
15:10-15:40	**KEYNOTE ADDRESS BY PROFESSOR CHRISNA DU PLESSIS** *School of Construction Economics and Management, University of Pretoria, South Africa* **Title: Adapting the built environment to climate change in a post-sustainable world**
15:40-15:50	Q and A ***Session chair for Keynote Address: Dr Libby Schweber, University of Reading, UK***
15:50-16:00	**BREAK**
16:00-16:30	**CLOSING SESSION**
16:00-16:10	Closing remarks - Dr Rodney Milford, Construction Industry Development Board
16:10-16:20	Presentation of prizes for Best Paper and Best Presentation – Mrs Ntebo Ngozwana and Sam Laryea
16:20-16:30	Appreciation and closing remarks – Sam Laryea
16:30	**CLOSE OF 8TH CIDB CONFERENCE**

TUESDAY 11TH FEBRUARY 2014

09:00-09:30 KEYNOTE ADDRESS BY PROFESSOR CHIMAY ANUMBA

Department Head and Professor of Architectural Engineering, The Pennsylvania State University, USA

Title: New developments and future directions in the built environment field

09:30-09:40 *Q and A*

Session chair for Keynote Address: Professor Raymond Nkado, University of the Witwatersrand, South Africa

09:40-10:00 BREAK

10:00-12:00 PARALLEL SESSION (STREAM 2)

Chairperson: Dr Sam Azasu, Wits University, South Africa

10:00-10:10	Adverse Impacts of Design Team on Construction Workforce Productivity - Adeowale Oluseyi J. and Fapohunda J.A.
10:10-10:20	Causes of Disputes in Construction Projects in South Africa: A case of Gauteng Province- Miehleketo Baloyi and Justus N. Agumba
10:20-10:30	Discussion
10:30-10:40	A Case Study of Labour Intensive Construction in South Africa: An Exploratory Study - Fidelis Emuze and Loe Sorensen
10:40-10:50	Health and Safety Regulations Enforcement at Building Construction Sites in Ghana - Zakari Mustapha
10:50-11:00	Discussion
11:00-11:10	Evaluating Causes of Workers Fatality on Construction Sites in the City of Tshwane Metropolitan Municipality - Oladele S. Opaleye and Alfred A. Talukhaba
11:10-11:20	Mentoring Functions that Contribute to Career Advancement in the Construction Industry: Perspectives of Female Mentees - Ntombekhaya R. Yokwana; Ruben Ndihokubwayo and Abimbola Windapo
11:20-11:30	Discussion
11:30-11:40	The Efficacy of Informal Social Networks in the Construction Industry : Construction Artisan in the Western Cape - Martin Lekarapa and David Root
11:40-11:50	Discussion

12:00-12:10 BREAK

12:10-12:40 KEYNOTE ADDRESS BY MR ALEX LUBBOCK

BIM Development Manager, Carillion Construction Services, UK

Title: Use and implications of Building Information Modelling in construction procurement and integrated project delivery

12:40-12:50 Q and A

Session chair for Keynote Address: Professor Dave Root, University of the Witwatersrand, South Africa

12:50-14:00 LUNCH BREAK

14:00-15:00 PARALLEL SESSION (STREAM 2)

Chairperson: Prof Alfred Talukhaba, Tshwane University of Technology, South Africa

14:00-14:10	Students' involvement strategies for lecture theatre maintenance management - Fredrick Simpeh
14:10-14:20	Toward Sustainable Development: Alternatives for Affordable Housing Delivery in Developing Countries - Yakubu M. Zaki ; Yakubu G. Musa-Haddary; James Jatau and Suraj Abdullahi
14:20-14:30	Discussion
14:30-14:40	A Framework for Modeling Sustainable Construction Practices for the Execution of Low-Carbon Construction - Sarfo Mensah ; Joshua Ayarkwa and Gabriel Nani
14:40-14:50	Overview of Scope and value of building maintenance management - Fredrick Simpeh; Zainu Mohamed and Andreas Hartmann
14:50-15:00	Discussion

15:00-15:10	**BREAK**
15:10-15:40	**KEYNOTE ADDRESS BY PROFESSOR CHRISNA DU PLESSIS**
	School of Construction Economics and Management, University of Pretoria, South Africa
	Title: Adapting the built environment to climate change in a post-sustainable world
15:40-15:50	Q and A
	Session chair for Keynote Address: Dr Libby Schweber, University of Reading, UK
15:50-16:00	**BREAK**
16:00-16:30	**CLOSING SESSION**
16:00-16:10	Closing remarks - Dr Rodney Milford, Construction Industry Development Board
16:10-16:20	Presentation of prizes for Best Paper and Best Presentation – Mrs Ntebo Ngozwana and Sam Laryea
16:20-16:30	Appreciation and closing remarks – Sam Laryea
16:30	**CLOSE OF 8TH CIDB CONFERENCE**

CONTENTS

SECTION 1: KEYNOTE PAPERS

SECTION 2: CONFERENCE PAPERS

SECTION 1: KEYNOTE PAPERS

ADVANCING CONSTRUCTION INDUSTRY DEVELOPMENT, INNOVATIVE RESEARCH AND NEW THINKING

Professor Will Hughes[1]

[1] *School of Construction Management and Engineering, University of Reading, PO Box 219, Reading, RG6 6AW, UK*

Academic writing has a tendency to be turgid and impenetrable. This is not only anathema to communication between academics, but also a major barrier to advancing construction industry development. Clarity in our communication is a prerequisite to effective collaboration with industry. An exploration of what it means to be an academic in a University is presented in order to provide a context for a discussion on how academics might collaborate with industry to advance development. There are conflicting agendas that pull the academic in different directions: peer group recognition, institutional success and industry development. None can be achieved without the other, which results in the need for a careful balancing act. While academics search for better understandings and provisional explanations within the context of conceptual models, industry seeks the practical application of new ideas, whether the ideas come from research or experience. Universities have a key role to play in industry development and in economic development.

Keywords: editing, peer review, publishing, refereeing, writing.

INTRODUCTION

The idea of helping to develop the construction industry through innovative research and new thinking is an interesting one. On the one hand, it seems self-evident that innovative research and creative thinking will be beneficial to any industry. On the other hand, working in such an applied field as construction management, at the interface between industry and academia, reveals two worrying phenomena. First, a lot of the research papers in our field are badly written. The style can be turgid and uninteresting. They often lack a clear research methodology. Sometimes, they fail to explain a clear method of analysis. Some lack a critical appraisal of results in which alternative explanations for observations are explored. Clearly, academic writing is not easy for most of us (we could all heed the advice given by Sword 2012, in her guidance on academic writing, in which she states “there is a massive gap between what most readers consider being good writing and what academics typically produce and publish”). Worryingly, the problem is as likely to occur with seasoned academics as with research students; Sword (2012) found from a survey of academics that they rarely read books about how to improve their writing style. There is a message here for all of us! The second worrying phenomenon, partly a result of the first, is that

[1] w.p.hughes@reading.ac.uk

Hughes, W. (2014) Advancing construction industry development, innovative research and new thinking *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 1-10.

practitioners of construction management rarely pay attention to the research that is meant to improve the industry. While this may be a result of impenetrable papers, there is also the risk that academics concern themselves with issues that are not of interest to the practitioner community. The alienation of practitioners from academic research is, perhaps, inevitable with this combination of factors.

There are many routes to influencing construction industry development: teaching, professional training, involvement in policy setting, research and publication. The focus of this keynote paper is on the last two, but it must always be remembered that carrying out original research and publishing our results in journals and academic conferences are not the only ways to achieve the aims of industry development. They are also not the easiest.

A good paper should be a pleasure to read, but too many of them report research that fails to advance construction industry development. Together, we need to figure out how to produce research that is innovative and relevant to the construction sector. Perhaps part of the problem lies in ill-conceived notions of what an academic CV should look like. I often come across academics who believe that an individual's list of publications must be long, regardless of whether anyone finds the work useful. As I have written before (Hughes 2005) it is not merely the quantity of publications that matters in evaluating the case for appointing or promoting an academic. Moreover, if we behave as if the purpose of publishing our research was to get ourselves promoted, then we should not wonder why practitioners seem disinterested in what we write. After all, most people get irritated when confronted with an endless stream of marketing and advertising material. If academic writing looks like nothing more than self-promotion, then there is no wonder that others are disinterested.

The reason that journal papers are often regarded as the most important type of publication is because of the vetting process through which papers are put. Generally, the more rigorous the vetting process, the higher it is rated by the academic community. The challenge, then, is to ensure that our papers will stand up to the kind of scrutiny to which they will be put by those who act as gatekeepers to publication. This means that papers have to be well-written, reporting well-designed and executed research, with a tangible connection to the practice we seek to influence and develop. But it must always be remembered that academic journal papers are not necessarily the route to influencing or developing the construction industry.

WHY ARE YOU DOING THIS?

One question that often runs through my mind at conferences is, "why are you doing this?" A presentation may consist of 10-15 minutes of witty erudition and entertainment with a snappy and thoughtful overview of some interesting and useful points that mean something to the audience. Such a speaker would make clear at the outset why this was important and how the work was carried out. On the other hand, someone else might drone on long past their allotted time about some dreary piece of work that has no connection to advancing practice, understanding or research. That is when I start to wonder "why are they doing this to us?" Of course, good presenters are not necessarily good researchers, and vice versa. At a conference, it is nice if speakers are entertaining, but being entertaining *per se* is not the point. Anyone who specializes in the topic of the conference will be delighted to listen to a paper on a topic close to their heart, and will be fascinated with it, and involved in the dialogue, as long as they can follow it. So, the key thing about presenting research is not simply to be entertaining, but to be clear about what, in fact, the topic of your researching actually is. This leads to the first question that needs to be answered in any piece of communication about research: What is it about? I have lost count of the number of presentations and papers where it has been impossible to discern even this much from the communication. Is it because of difficult science or is it because of poor communication skills? Some of the most complex and difficult science I have come across has been explained very clearly by experts, so I presume that the problem is in communication skills, coupled with relevance.

I want to hear explicit answers to three questions early in any report of research, whether spoken or written:

- Why is it important? What is of value here, and to whom is it of value?
- How was the research carried out? Not just what was done in terms of methods and techniques, but also some discussion of methodology (which is not just fancy word for method!) Why were these techniques used and how to they relate to the kind of question that has been researched?
- What was discovered and how does that help anyone? Who does it help?

If we all started with these points, then every conference would be a more enjoyable exchange of ideas and learning. Of course, listening to presentations and Q and A sessions is not the sole purpose of a conference, which is just as much about networking as anything else (for more thoughts on academic networking, see Agre 2005).

ACADEMIC RESEARCH IN AN APPLIED FIELD

In considering the purposes of this conference, it is clear that when we talk of research and publication in the construction management arena, we have an obligation to focus on the relevance of our research to practitioners. Are the academic and industry agendas complementary or in conflict? In a previous paper (Hughes 1999) I considered what it meant to carry out academic research in an applied field. Of course, even within a University, the agendas of the individual academic are not necessarily the same as those of the department or the University. Dealing with conflicting agendas within the University is hard enough. The conflict between these agendas may distract us from thinking further about how to relate our work to the industry and, perhaps to wider society.

Clearly, when dealing with academic work, we are members of multiple academic constituencies. At the individual level, we develop an expertise; an interest in an area or topic that we have studied and research extensively over many years. In order to develop as an academic, research is undertaken, papers published, students taught, and ultimately invitations arrive from companies or governments for advice. One hopes for a consistent thread that links these activities so that each enriches the other during the development of one’s career. Each individual academic will find career progression facilitated by being known for a specific topic. But we work not only as individuals.

Many of the activities we engage in can only be done when we are members of departments or faculties in universities. There may be conflict between the need of a department and the need of an individual academic. For example, the teaching of specific modules has to be done, but there may be no-one with the specific research background to teach it. What may happen in this situation is that the teaching is not based on research, but on existing knowledge and text books. In this way, departmental pressures may cause us to become teachers, rather than researchers.

Departments and faculties are organizational units of a larger organization; the university. To what extent is there conflict between the levels of activity as individual academics, departments and the University? An example of the conflicting agendas between the individual academic and the University is the choice of where to publish papers. While the individual may wish to place a paper in a journal that is most appropriate in terms of peer group, the University may insist that only journals in certain lists, or of a certain rank, may be used as an outlet for publications. The lunacy of such a policy has been articulated elsewhere (e.g. Editage, 2013; Yandell 2013) and the idea that a high-impact journal publishes only high-impact papers is clearly ludicrous.

In terms of thinking about journals, each has a specific community of editors, authors and referees. What they see as significant and useful will, perhaps, be part of what makes them distinctive. Moreover, whether commercial publishers are involved or not, the individual might find that his or her framing of a research topic, or style of presentation, might not match the expectations of a journal. Each journal may have its own view of what is acceptable and this may be in conflict with the individual academic's approach.

As noted above, the CM research community is inextricably bound to practitioners in the construction sector. How do the requirements for practical problem-solving, or the requirements for the teaching of students, square with the notion of what the individual academic, the department and/or the University feel that they need to do? Clearly, the University and its staff are not merely a service sector providing the industry with what it requests. There is more to a University than that!

The diversity of objectives we seek to fulfil as academics, then, arise from our individual agendas clashing with those arising from departments, faculties, universities, journals and research funders, as well as industry and broader society. A regular feature of organizational life is that personal involvement in an organizational is partial and temporary (Scott 1981); the people who take part in any organization do not take part to the exclusion of everything else. So the task of dealing with a complex array of clashing objectives should be a normal part of working life for all of us. And this raises a serious question for each of us: What does it mean to be an "academic"? Some of the key elements of academic life in relation to this issue are articulated below, before returning to the issue of how all of this relates to the practitioner community.

ACADEMIC PREOCCUPATIONS

The purpose of a university may be seen as its distinctive task, which has been said to be "the methodical discovery and teaching of truths about serious and important things" (Shils 1997). Of course, the idea that the "truth" is out there waiting to be discovered is, in itself, a contentious issue. This carries an implication about the nature of reality, the role of the researcher and the very definition of what it means to do research. This is not the place to begin an argument about the different traditions of research in comparing, say, the social sciences with the natural sciences, save to point out that Shils was using the language of a natural scientist. In the CM community, we are typically dealing with social sciences such as behavioural studies, economics, management, law and so on. Thus, we are not seeking universal truths, but better understanding. And there is a seductive attraction to the fundamental idea that science proceeds by developing provisional truths by consensus that will suffice until better explanations are developed.

No matter what our focus is, or what kind of science we do, the focus on research is the source of our legitimacy to teach. This why we may not compete in the same area as consultants or other practitioners, whose legitimacy arises from personal experience. The question that this reveals is in the area of training vs education; consultancy vs research. Education involves training, of course, but vocational training alone is not what Universities do. What I see in the relationship between Universities, industry and governments is an increasing pressure on Universities to focus less on what makes them distinctive. Many of us feel the push into consultancy and training, which is not what we signed up for.

While not wanting to privilege Shils' view of what constitutes research, the idea of a scientific truth may still be a useful touchstone for discussion. As mentioned above, scientific endeavours of all kinds tend to be oriented around the development of a provisional consensus. Unlike other kinds of truth, this means that everything we think we have discovered or understood is always open to question and re-visiting. Research may be seen as the observation of certain specific phenomena within a theoretical framework in order to develop better explanations that improve our collective understanding. This is what we have to offer the construction sector. However, despite pressures to the contrary, we are not merely reporting phenomena - i.e. science is not journalism. This is what underpins my fundamental objection to endless questionnaire surveys that are carried out in our field, of the kind where the "researcher" lists some draft conclusions, than asks some practitioners to confirm them. Simply asking practitioners what they think will not develop or advance our understanding. It provides only a journalistic exercise that will inevitably preserve the status quo (Seymour and Rooke 1995). Sample surveys can be incredibly useful as fact-finding exercises, when they are well-designed and carefully executed. But in the CM literature, many of them are neither fact-finding nor useful. In thinking about how best to develop the construction sector, I have repeatedly come across the phenomenon that practitioners in the construction sector seem not to conceptualize what they do. Indeed, many of our academics seem to fail to conceptualize, too, which is a singular failure.

To repeat the basis of my stance: research may be seen as the observation of certain specific phenomena within a theoretical framework in order to develop better explanations that improve our collective understanding. My feeling about failures in research and publications is driven by the preponderance of papers that have no explicit theoretical positioning and no conceptual models. The best papers connect a question to a particular theory, develop or articulate a conceptual model, then use that model as basis for making observations and analysing them in order to say something useful about something specific. We have a duty to conceptualize, rather than merely report, otherwise we do not deserve the appellation of "academic" and we would not earn the right to teach students at this level.

Why the focus on academic outputs?

Academic outputs are not the only kinds of output that we can produce. While not wishing to sound patronizing, industry tends to need more prosaic forms of communication. The so-called “busy practitioner” is, I am told, not going to read scientific papers or try to disentangle different conceptualizations of the kind of things that influence and shape practice. Rather, we are asked for the “elevator-pitch” or a précis of no more than one piece of paper, as if we were a salesforce trying to peddle the latest solution to the ills of the industry. But this should not blind us to the need for recognition beyond our immediate peer group. Instead, we need to embrace the need for different kinds of output. What is reported in an academic journal paper, if it has relevance for more than our peer group, should be also reported in entirely different media as magazine articles, blogs, tweets, radio interviews and so on. There are many avenues available to us for reporting the results of our research in our quest to respond to “the intensifying search for recognition in the wider disciplinary community” (Silver 2003: 164).

While recognition from industry/practice and wider society is vital, it is often not the kind of recognition that is rewarded by funding agencies, promotion and appointment committees. The competition for promotion tends to reduce the evaluation of the quality of academic work to a very low common denominator. One of the interesting ideas put forward by Silver (2003) in his discussion of the culture of academic life is that the community of scholars does not exclusively possess the University and does not necessarily reside within it. The boundaries around the University are blurred and porous.

In this kind of world, our publications must serve many purposes and interests. Of course, we seek to record scientific progress in the field. This is what archival research journals are for. As Silver points out, we also seek to create the sense of a “bundle of knowledge” or community of specialist scholars. Through such activities we may be able to develop recognition in academic community and provide evidence for promotion cases. But these aims are not served by writing like journalists and are not typically seen as techniques for wide dissemination, which is why I think that they are not necessarily useful for industry. It is better that we do not try to use our archival journal papers as vehicles for dissemination; therefore, such papers are not the only fruit of academic effort. If we want to advance the construction industry, in other words, we need first to understand the issues that confront the construction sector and then develop new insights that make conceptual sense within a community of specialist scholars, tested through the vetting process of refereeing. Subsequently, the work should be disseminated through other channels in different formats. This follow-through is essential, to provide feedback to industry and seek to address

INDUSTRY/UNIVERSITY COLLABORATION IN BUILT ENVIRONMENT RESEARCH

The models of academic research and publication that have emerged in traditional academic disciplines are an important part of what academics are expected to do. But such activities form only a part of the overall picture. Built environment research involves close collaboration between industry and Universities. Therein lies danger! If practitioner-academic collaboration is too close, there may be a perception (even a mistaken perception) that it could be difficult for academics to earn the peer group recognition that is needed for career progression and University rankings. Practical application of new ideas is not always sufficient for the academic agenda. If practitioner-academic collaboration is too distant, then the research and publications of academics quickly become obscure and irrelevant to industry; even to students. This means that there is a delicate balancing act for academics to manage when designing and carrying out their research. This was discussed by Seymour and Rooke (1995) who carried out a very interesting enquiry into how CM research was oriented around a rationalist view of research to the detriment of progress in understanding. They argued that the kind of rational, quantitative studies that dominated CM research in the latter part of the 20th century served to do nothing more than endorsing and preserving the very attitudes and industry practices that ultimately had to change.

Much of the activities in which academics are engaged is fuelled by business cases of one kind or another. There is a business case for funding research, avidly pursued by research councils who can only respond to political pressures to fulfil electoral promises. The democratic processes result in a growing need for politicians to be able to point to the results from government-funded research, which means that practical outputs are sometimes the only game in town. There is a business case for funding journals; a successful side of publishing that sees the growth of highly successful multi-multinational publishing companies voraciously acquiring academic journals. These journals make good business, even when they are targeted at relatively small subsets of narrowly defined academic interest, because a well-founded library has to support the activities of academic departments. This is true whether the traditional subscription model applies (reader pays) or the newer open access model applies (author pays). Either way, someone pays; publishers are interested in that revenue stream. Such business exigencies may have the unintended consequence of be re-writing the academic agenda. In the past, the gatekeeping process of editing and refereeing were designed to filter out badly executed and/or badly written research. In the future, especially if authors are paying for publication, will the new customers demand something else from journals? The jury is still out on that issue.

Another question which remains unresolved is how academics might respond to these pressures. Sometimes, it boils down to a choice between institutional and ethical responses. As an individual academic, my needs to develop peer-group recognition (long-term career-building) may conflict with the University's short-term institution-building agenda. Both deserve a response, and neither should be disregarded. For the reasons given earlier in this paper, the consequences for career development depend on the mode of research-output measurement, which differs between disciplines, institutions and between countries. This is why we cannot simply transplant academic practice and academic ethics from one place to another. Indeed, there is a common misconception of the relationship between quality and quantity. When quantity is seen as the important measure, what chance is there of developing high-quality research outputs? Is the academic ethic based around developing new insights or is it about making money through teaching and consultancy? This underpins the essential question of what universities seek from industry. However, none of it seems to help us focus on what industry seeks from universities.

We are often asked to think about what industry and universities can do together. We would do well to provide a list of potential engagements, in order that we can respond quickly and intelligently to interest from industry. Such a list could include:

- Co-funded research projects such as the UK's Knowledge Transfer Partnerships and Engineering Doctorates.
- Collaborative proposals to research councils.

- Student placements and guest lectures.
- Access to case study material for academic staff and students.
- Involvement in seminars/workshops
- Sponsored lectureships/professorships
- Membership of advisory boards – informing syllabus development
- Careers fairs and graduate recruitment
- Endowed scholarships/bursaries

Industry offers the potential for the practical application of ideas. Indeed, Universities are not the sole source of innovation; collaboration requires understanding from both sides. Universities can offer industry a number of benefits; indeed they have a role to play in regional economic development (Goldstein and Drucker 2005):

- Sharing risks and costs of innovation
- Links from discovery (exploration) to entrepreneurship (exploitation)
- Access to specialist know-how
- Screening of publications relating to new developments
- Knowledge of the archival research in the topic
- Learning from case studies
- Networks of potential collaborators (brokerage)
- Challenges to conventional wisdom
- Access to graduates and students for placements

These lists of potential interactions reveal plenty of scope for collaboration. The question of how to make it happen is not a question of technique. In other industry sectors, there is more movement of ideas and people between academia and industry. Why should there be a barrier between academia and industry in the construction sector? In dwelling upon this, it is clearly not through lack of opportunity to engage. The bullet-point lists above illustrate that there are extensive opportunities for mutual engagement and collaboration. Where there are serious barriers, it may be because the issues that seem to be of interest to academics are not seen as relevant by industry. And the perceptions of many academics about the boxes they need to tick for academic progress will not be ticked merely by responding to simple requests for problem-solving.

I return to the comments on Shils' characterization of the distinctive task of the University. It is probably not an over-simplification to say that his idea of "discovering truths" represents a popular view of science. This dominant view has been successfully challenged by the many in the built environment research community over the last 20 years. The difficulty of working in a multi-disciplinary area like CM is that if we are not careful, we become non-disciplinary. If we are asking economics-type questions, we need the discipline of economics. If we are asking legal questions, we need the discipline of law. Similarly for psychology, statistics, engineering and other myriad disciplines that might be brought to bear on questions in the construction sector. Many academics have realized the usefulness of social sciences in dealing with issues in the construction sector. But a lot of what passes for the application of social science in CM is obscure and, apparently, of little relevance outside of the highly specialized people who can deal with that kind of thing. It is not obvious that there is the same kind of disconnection in other industry sectors and academic work on management, organization, economics and law. So perhaps the issue, after all, is not a failure on the part of the construction industry but failure on the part of the built environment research community to engage with major, practical issues in the industry. A recent special issue of *Building Research and Information* (Bordass and Leaman 2013) was an interesting exception to the trend, demonstrating that academic journals can produce papers that deal with the issues confronting practitioners. There are other exceptions, of course. But the key thing in all of our research is to remember why we are doing this.

There are many ways in which the built environment research community may contribute to the construction sector and to the wider academic community. Both agendas need careful attention or neither will achieve its full potential. But the barriers to the effective exchange of ideas could be reduced if we focused more seriously on them.

CONCLUSIONS

What helps academics to progress is peer recognition, rather than simply the impact factors sought by administrators. However, success in bureaucratic measures is what makes academics useful to departments and universities. The agenda for success, then, is a combination of recognition and impact. What makes a scientific paper useful is conformance with the customs and practice of the particular academic field. What makes academics useful to industry is being able to provide practical and positive advice through less academic channels. What makes industry useful to academics is regular and reliable interactions in all aspects of scholarship and application.

We are involved in a collaborative effort. None of us can survive without a fully-developed network of influence. Not every individual can simply bring such a network of influence into existence. It takes time, care and effort. But a successful University department will be fully-engaged with industry and will seek to create the kind of opportunities and forums whereby academics and practitioners can successfully and profitably share ideas and insights.

ACKNOWLEDGEMENTS

I am grateful to John Connaughton and to Cathy Hughes, both of University of Reading, for their help in formulating and articulating the ideas about the disconnection between industry and academia. These ideas involve challenging ourselves at every level, and their proclivity for challenge and debate has been extremely helpful. I am also grateful to Sam Laryea for setting me this challenging agenda! I hope that I have done justice to his question.

REFERENCES

Agre, P. (2005) Networking on the network: a guide to professional skills for PhD students. Department of Information Studies, University of California, Los Angeles**.** http://polaris.gseis.ucla.edu/pagre/network.html (Accessed 7 Nov 2005)

Editage (2013) Why you should not use the journal impact factor to evaluate research, *Editage Insights*, http://t.co/IAxTXFSf2e (accessed 1 Jan 2014).

Goldstein, H. and Drucker, J. (2006) The economic development impacts of universities on regions: do size and distance matter? *Economic Development Quarterly*, **20**(1), 22-43.

Hughes, W.P. (1999) *Construction research: a field of application.* Australian Institute of Building Papers, **9**, 51-58. http://centaur.reading.ac.uk/4293/ (Accessed 31 Dec 2013)

Hughes, W.P. (2005) Refereed journal papers: practice and process. *In: The 2nd Scottish Conference for Postgraduate Researchers of the Built and Natural Environment (PRoBE)*, 16-17 November 2005, Glasgow Caledonian University. http://centaur.reading.ac.uk/35500/ (Accessed 31 December 2013)

Bordass, B and Leaman, A (2013) Special issue: new professionalism. *Building Research and Information*, **41**(1), 1-128.

Scott, W.R. (1981) *Organizations: rational, natural and open systems.* Englewood Cliffs, NJ: Prentice-Hall.

Seymour, D.E. and Rooke, J. (1995) The culture of the industry and the culture of research. *Construction Management and Economics,* **13**(6)**,** 511-523.

Shils, E. (1997) *The calling of education: the academic ethic and other essays on higher education*. Chicago: The University of Chicago Press.

Silver, H. (2003) Does a university have a culture? *Studies in Higher Education*, **28**(2), 157-169.

Sword, H. (2012) *Stylish academic writing*. Cambridge, MA: Harvard University Press.

Yandell, K. (2013) Scientists take aim at impact factor. *The Scientist Magazine*, http://shar.es/94WeG (Accessed 1 Jan 2014).

.

REALISING VALUE FOR MONEY THROUGH PROCUREMENT STRATEGY IN THE DELIVERY OF PUBLIC INFRASTRUCTURE

Dr Ron Watermeyer[1]
Infrastructure Options (Pty) Ltd, Bordeaux, Randburg, South Africa

Value for money may be regarded as the optimal use of resources to achieve the intended outcomes. Underlying value for money is an explicit commitment to ensure that the best results possible are obtained from the money spent or maximum benefit is derived from the resources available. A key question that is most often asked whenever new public infrastructure is contemplated or delivered is "does the investment provide value for money?" Optimism bias and strategic misrepresentation has frequently been cited as root causes for lack of project success. These two causes are however confined to the planning stages of a project which ends with a decision being made to proceed with a project. The question that begs asking is "what proactive action can be taken during implementation to minimise any gaps between achieved and projected outcomes?" Procurement strategy relates to the choices made in determining what is to be delivered through a particular contract and the procurement and contracting arrangements. Procurement strategy has the potential to contribute to "efficiency" during implementation and to reduce the gap between achieved and projected outcomes by minimising time delays, scope creep and unproductive costs and in so doing maintain the value for money proposition formulated at the outset of the project. The decision to proceed with an infrastructure project is typically taken when between 10 and 40% of the design is complete. It is therefore important to adopt procurement strategies in the implementation of project which enable projects to be delivered on time and within budget. It is important to integrate design with construction and to manage contracts proactively so that the risks associated with budget and schedule overruns are managed. The University of the Witwatersrand changed its procurement strategy and approach to the managing of contracts to improve project outcomes relating to schedule and budget. Procurement strategies which integrated design and construction (develop and construct and design by employer with early contractor involvement) and the use of the NEC3 forms of contracts to manage contracts has resulted in the overall cost overrun (difference between outturn cost and control budget established at the time that a decisions was taken to implement the project) of not more than 5% on a R1,5 billion programme over a six year period . In addition, projects have been delivered on time. The factors in the author's experience inhibiting changes in procurement strategy in South Africa include transactional teaching at tertiary intuitions of forms of contract rather than educating students in contracting principles and the range of available strategies, guidelines fees published by built environment councils which entrench a single strategy to delivery infrastructure, the profession's resistance to change, a lack of evidence based research to enable informed choices to be made, a one size fits all approach to procurement propagated by supply chain managers, a lack of standardised documentation and poor procurement skills. Procurement strategy has the potential to maintain the value for money proposition established at the time that a decision to proceed with a project is made. Its effective implementation, however, requires a culture change.

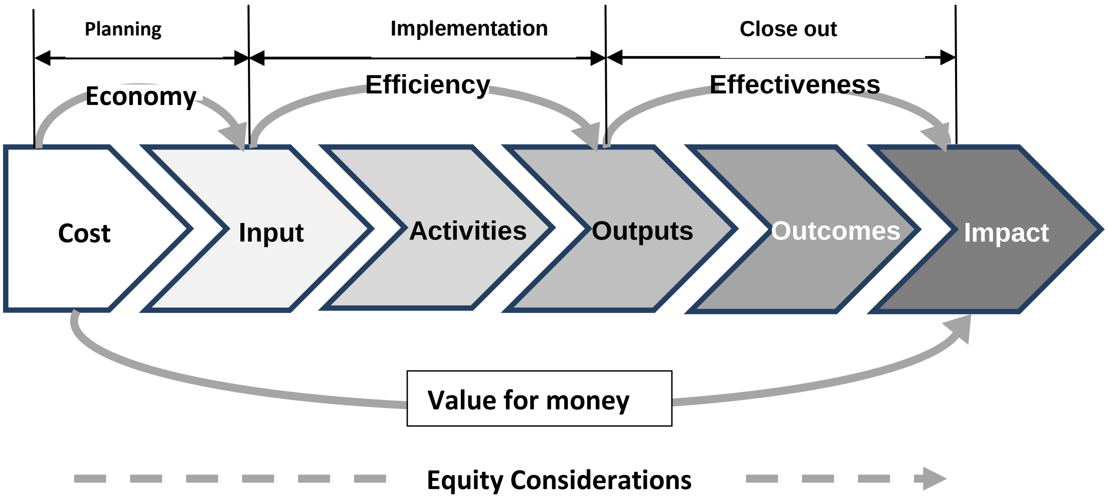
Keywords: public infrastructure, value for money, procurement strategy

[1] watermeyer@ioptions.co.za

Watermeyer, R. (2014) Realising value for money through procurement strategy in the delivery of public infrastructure *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 11-28.

INTRODUCTION

Public infrastructure, which is central to the economy of a country, has little inherent value, but creates value through the economic and social activities it supports. Public infrastructure which provides improvements or efficiencies in services, production or export capabilities and which is delivered and maintained in a manner which minimizes waste of materials, time, and effort in order to generate the maximum possible amount of value, is most likely to contribute to economic growth. A key question that is most often asked whenever new public infrastructure is contemplated or delivered is “does the investment provide value for money?” (Watermeyer, 2013)



Cost	Sum of money required to fund the intervention
Input	Inputs cover all the materially significant financial, human and material resources used for a development intervention
Activities	Activities are used to deliver outputs
Outputs	Outputs relate to products, capital assets and services which result from a development intervention. Outputs are limited to the specific, direct deliverable of the intervention.
Outcomes	Outcomes are the likely or realised short-term/medium-term effects of the outputs of any intervention. Outcomes are used to identify (a) what will change, (b) who will benefit and (c) how it will contribute to poverty reduction and/or the Millennium Development Goals
Impact	Longer-term effects are produced, directly or indirectly, by a development intervention. Impact refers to higher level identified achievements that the intervention will contribute towards

Figure 1: Results chain framework (Watermeyer, 2013)

Value for money may be regarded as the optimal use of resources to achieve the intended outcomes. Underlying value for money is an explicit commitment to ensure that the best results possible are obtained from the money spent or maximum benefit is derived from the resources available. It is a means for developing a better understanding (and better articulation) of costs and results so that more informed, evidence-based choices can be made. Value for money needs to be assessed during the delivery cycle using the so-called three "Es" − economy, efficiency and effectiveness at the end of the planning, implementation and close out stages of a project, respectively (see Figure 1). An overarching fourth "E" also needs to be considered when delivering infrastructure, namely equity (Watermeyer, 2013).

Optimism bias (the human mind's cognitive bias in presenting the future in a positive light) and strategic misrepresentation (behaviour that deliberately underestimates costs and overestimates benefits for strategic advantage usually in response to incentives during the budget process) has frequently been cited as root causes for lack of project success (Flyvbjerg *et al*, 2003). These two causes are however confined to the planning (economy) stages of a project which ends with a decision being made to proceed with a project and relate to the quality of the information upon which a decision is made. The question that begs asking is what proactive action can be taken during implementation (efficiency) to minimise any gaps between achieved and projected outcomes irrespective of whether or not optimism bias and strategic misrepresentation is present at the time that a decision was taken to implement a project?

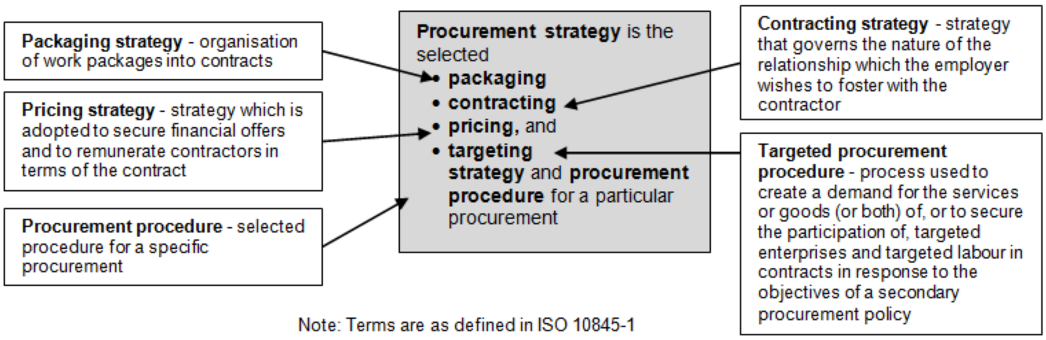


Figure 2 – Components of a procurement strategy according to ISO 10845-1 (Watermeyer 2012)

Strategy in the delivery and maintenance of infrastructure may be considered as the skilful planning and management of the delivery process. It involves a carefully devised plan of action which needs to be implemented. It is all about taking appropriate decisions in relation to available options and prevailing circumstances in order to achieve optimal outcomes. Procurement strategy (see Figure 2) is all about the choices made in determining what is to be delivered through a particular contract, the procurement and contracting arrangements and how secondary procurement objectives are to be promoted during the implementation phase of an infrastructure project (Watermeyer, 2012). Procurement strategy has the potential to contribute to "efficiency" during implementation and to reduce the gap between achieved and projected outcomes.

LOCATING THE FOUR "ES" ASSOCIATED WITH VALUE FOR MONEY WITHIN THE STAGES OF DELIVERY

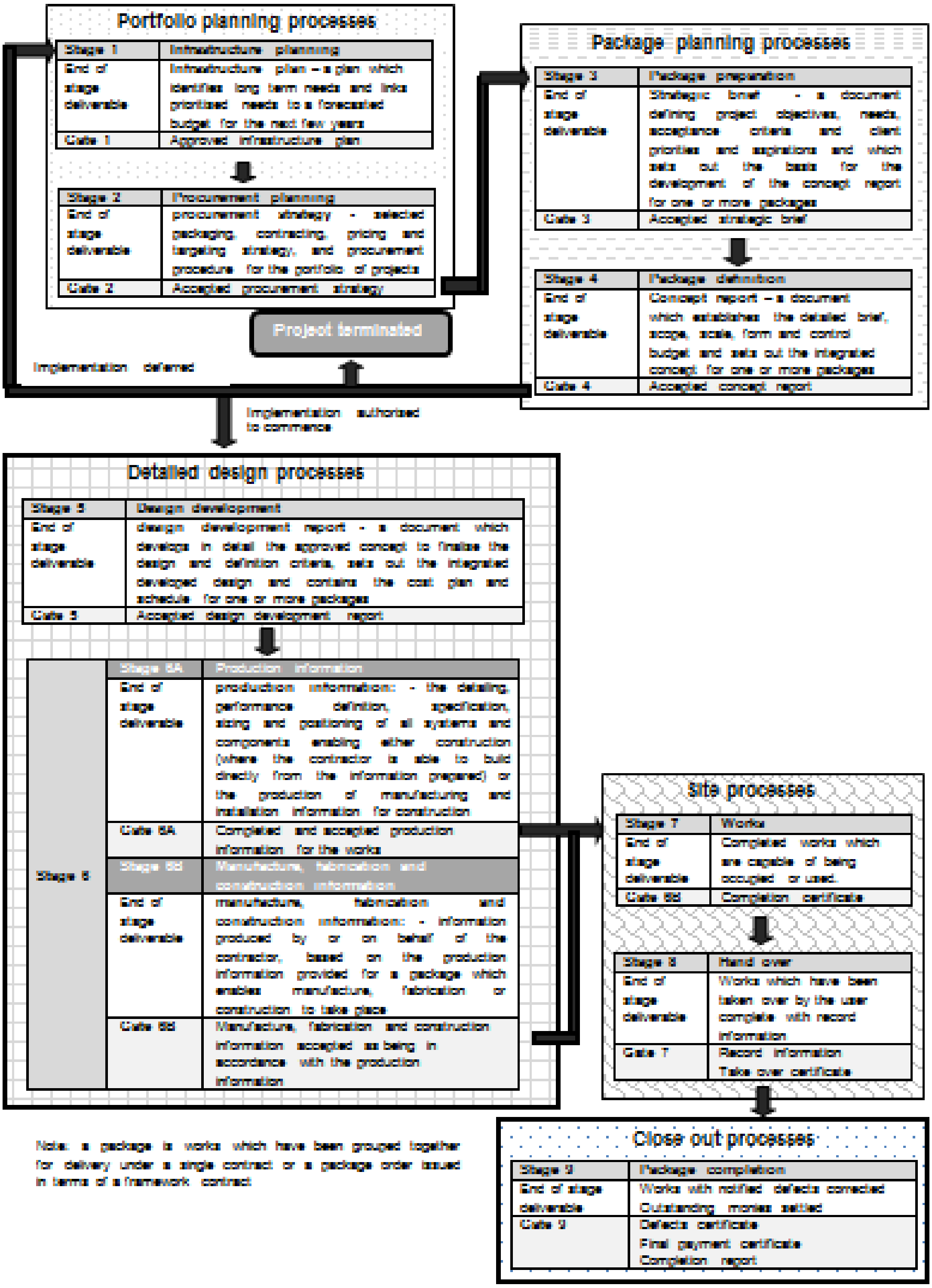


Figure 3: Stages and gates within the CIDB Infrastructure Gateway System

Value for money in the context of the delivery of infrastructure needs to be linked to a set of related activities in the infrastructure delivery cycle that culminates in the completion of a major deliverable i.e. a stage. Figure 3 outlines the stage of the CIDB Infrastructure Gateway System described by Watermeyer *et al* (2012). Figure 4 links the four "Es" associated with value for money to these stages.

The critical starting point in delivering value for money through projects is to clearly define objectives and expected outcomes for given inputs as well as parameters such as the time lines, cost and levels of uncertainty at the end of the planning stages. This frames the value for money proposition that needs to be implemented at the point in time that a decision is taken to proceed with the implementation of a project. It establishes "economy" and identifies opportunities for "equity" at the end of stage 4 (package definition) when design concepts or solutions have been sufficiently developed to establish the feasibility of the works or to select a particular conceptual approach to pursue. It is also the point where the scope of a project is frozen. Should the works not prove to be viable as conceptualised (e.g. insufficient budget, unacceptable risk profile, geotechnical / environmental / community constraints, poor return on investment etc.), the project is either consciously modified in order to satisfy "economy" considerations before proceeding with implementation or is terminated.

During the close out of a project (Stage 9) the projected outcomes are compared against the actual outcomes. This confirms the "effectiveness" of the project in delivering value for money. This typically involves the comparing of the scope, schedule and cost plan and, where relevant, the performance as documented at the end of Stages 4 and 9.

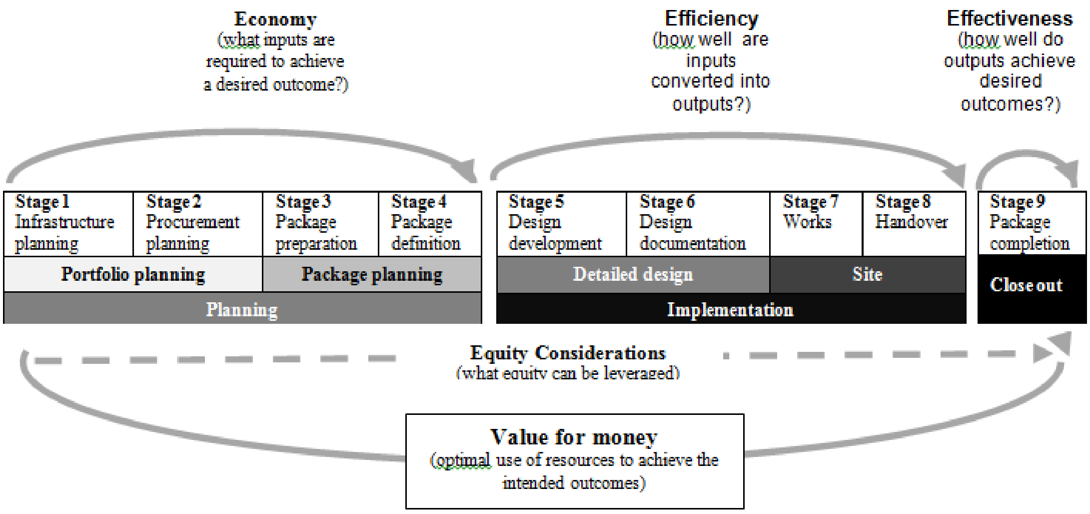


Figure 4: Value for money in the context of the stages of the CIDB Infrastructure Gateway System

The implementation of infrastructure projects needs to be responsive to the project objectives, deliver the expected outcomes and remain as far as possible within the confines of the parameters upon which the decision to proceed with the project was based. Implementation sits between the bookends of "economy" and "effectiveness" in the results chain framework shown in Figure 1 i.e. between Stages 4 and 9. It needs to be executed "efficiently" in order to minimise time delays, scope creep and unproductive costs and to mitigate the effects of uncertainty on objectives (risks) so as to maintain the value for money proposition formulated at the outset of the project. This necessitates that the implementer of the project exercise due care and reasonableness during implementation. Failure to do so may result in substandard or unacceptable performance which results in a gap between intended and achieved outcomes. This gap puts value for money for a project at risk.

THE CONTEXT WITHIN WHICH "ECONOMY" IS ESTABLISHED

The value for money proposition at the time when the decision is taken to proceed with the implementation of a project is based on sets of assumptions and the available data. It is therefore important to understand the context within which the value for money proposition is established, particularly that relating to cost.

Table 1: Apportionment of fees in the SACAP (2011) and ECSA (2013) guideline fees

<table>
<tr><th rowspan="3">CIDB Infrastructure Gateway Stages</th><th rowspan="3">SACAP and ECSA Work Stages</th><th colspan="5">Apportionment of fees as per published guideline fees</th></tr>
<tr><th rowspan="2">Architectural fees</th><th colspan="4">Engineering fees</th></tr>
<tr><th>Engineering and building projects - civil</th><th>Engineering and projects - structural</th><th>Building projects - structural</th><th>Mechanical, electrical and electronic projects</th></tr>
<tr><td>3 Package preparation</td><td>1 Inception</td><td>5%</td><td>5%</td><td>5%</td><td>5%</td><td>5%</td></tr>
<tr><td>4 Package definition</td><td>2 Concept and viability</td><td>15%</td><td>25%</td><td>25%</td><td>20%</td><td>15%</td></tr>
<tr><td>5 Design development</td><td>3 Design development</td><td>20%</td><td>25%</td><td>30%</td><td>30%</td><td rowspan="2">30%</td></tr>
<tr><td>6 Design documentation
6a (Production information)</td><td>4 Documentation and procurement</td><td>30%</td><td>15%</td><td>10%</td><td>15%</td></tr>
<tr><td>6b (Manufacture, fabrication and construction information)</td><td rowspan="3">5 Contract administration and inspection</td><td rowspan="3">27%</td><td rowspan="3">25%</td><td rowspan="3">25%</td><td rowspan="3">25%</td><td rowspan="3">40%</td></tr>
<tr><td>7 Works</td></tr>
<tr><td>8 Hand over</td></tr>
<tr><td>9 Package completion</td><td>6 Close out</td><td>3%</td><td>5%</td><td>5%</td><td>5%</td><td>10%</td></tr>
</table>

The degree of project definition as measured by the percentage of design completed at the end of stage 4 can be estimated from the fee apportionments contained in the guideline fees published by the South African Council for the Architectural Profession (SACAP) and the Engineering Council of South Africa (ECSA) as set out in Table 1. It is somewhere between about 20 to 40%, depending upon the nature of the works that are being designed.

The US Department of Energy uses the classification of estimates indicated in Table 2 to enable the quality of the cost estimate to be appropriately considered through the evolution of a project. Class 3, 2 and 1 estimates typically occur towards the end of Stages 4, 5 and 6, respectively. As a result, the decision to proceed with a project may be based on a class 3 estimate with a -20 to + 30% accuracy where the degree of project definition is between 10 and 40%. The value for money proposition upon which the "economy" of a project is based may also need to be viewed with some caution as Flyvbjerg *et a*l (2003) point out that it may be tainted by optimism bias and strategic misrepresentation.

Table 2: Generic Cost Estimate Classifications and Primary Characteristics (US Department of Energy, 2011)

	Primary characteristic	Secondary characteristic		
Estimate Class	Degree of project definition (expressed as % of complete definition)	Typical purpose of estimate	Methodology	Expected accuracy range (typical variation in low and high ranges)*
Class 5	0% to 2%	Concept screening	Capacity factored parametric models judgment or analogy	-20 to – 50% +30 to +100%
Class 4	1% to 15%	Study or Feasibility	Equipment factored or parametric models	-15 to -30% +20 to +50%
Class 3	10% to 40%	Budget, Authorization, or Control	Semi-detailed unit costs with assembly level line items	-10 to -20% +10 to +30%
Class 2	30% to 70%	Control or Bid/Tender	Detailed unit costs with forced detailed take off	-5 to -15% +5 to +20%
Class 1	70% to 100%	Check Estimate or Bid/Tender	Detailed unit cost with detailed take-off	-3 to -10% +3 to +15%
* The state of process technology and the availability of applicable reference cost data affect the range markedly. The ± value represents the typical percentage variation of actual costs from the cost estimate after application of contingency (typically at a 50% level of confidence) for given scope.				

Value for money will occur when what is achieved equals or exceeds what was expected provided that the assumptions and data upon which "economy" is based are valid. An assumption can, however be made that if the implementer exercises due care and reasonableness during implementation, value for money will be achieved. Put differently if due care and reasonableness is exercised during implementation and what is achieved is less than what was expected, the difference lies not in the efficiency of implementation but in the inherent project risks materialising or shortcomings in framing the value for money proposition at the start of the project. .

PROJECT LIFE CYCLES LINKED TO THE ALLOCATION OF DESIGN RESPONSIBILITIES

Barnes (1999) in his Smeaton Lecture in 1999, pointed out that virtually no civil engineering was carried out in the UK, after the Romans left, until the 17th century, the two notable major works being the Exeter Ship Canal (1567) and the drainage the Fens. This all changed between the 1760s and the 1850s. John Smeaton, who is often regarded as the founder of civil engineering and whose largest project was the Forth and Clyde Canal linking the eastern side of Scotland to the western side, developed his approach to managing works. In 1768, he set down his management scheme for the construction phase with detailed tables of responsibility. His team comprised the engineer in chief, the resident engineer and the 'surveyors' for the various geographical sections working under him, and contractors (as opposed to direct labour). This 'master – servant' model has remained in use for the majority of civil engineering projects in Anglophone countries for more than 200 years and is still used on projects managed in the traditional manner.

The Royal British Institute of Architects' (RIBA, 2000) Plan of Work and the stages currently contained in the South African Council for the Architectural Profession (SACAP, 2011) and Engineering Council of South Africa's (ECSA, 2014) are based on this traditional master servant relationship (see first two columns of Table 3). The contractor is only procured after the design of the works has been completed.

The approach to construction in Europe has taken a different route as indicated in the third column of Table 3. The contractor is procured before the design is completed and documented. The contractor is responsible for finalising the design.

In 1998, Bath University carried out a study to examine the UK Government's performance as a client of the construction industry. The study was carried out against the backdrop of major failures by the Government, as client, and demonstrated failings in areas such as poor management, poor project flow, a risk-averse culture, focus on low-cost rather than value for money, a lack of integration and short-term relationships. A benchmarking study of the same year showed that 73 per cent of UK Government client contracts were delivered over budget and 70 per cent delivered late. These studies highlighted the need for a cultural change in order to achieve the required level of improvement within Government's delivery chain.

The Achieving Excellence in Construction (AEC) initiative was introduced in March 1999 by the Chief Secretary to the UK Treasury to improve the performance of Government as a client of the construction industry. In 2002, the initiative's success was clear from evidence, which showed a significant improvement in the delivery of public sector construction projects to time and within budget. These key findings paved the way for the continuance of the initiative and the setting of new Strategic Targets against which departments should monitor their progress (OGC, 2003).

Results of the Achieving Excellence in Construction Strategic Targets in 2005 demonstrated that significant improvements have been achieved since the introduction of the initiative in 1999. 65% of projects were being delivered on time and 61% within budget.

The UK Office of Government Commerce published Common Minimum Standards in 2006. These standards require that procurement strategies and contract types support the development of collaborative relationships between the government client and its suppliers and facilitate the early appointment of integrated supply teams. This Standard also states that "*traditional, non-integrated procurement approaches should not be used unless it can be clearly shown that they offer best value for money – this means, in practice they will seldom be used*."

Table 3: Comparison of life cycle stages

<table>
<tr><th>RIBA Enterprises (2000)</th><th>ECSA and SACAP (2011)</th><th>ISO 29481-1 (2010)</th><th>CIDB (2010)</th><th>CIC (2007)</th></tr>
<tr><td rowspan="2"></td><td rowspan="2"></td><td>0 Portfolio requirements</td><td>1 Infrastructure planning</td><td rowspan="2"></td></tr>
<tr><td></td><td>2 Procurement planning</td></tr>
<tr><td>A Appraisal</td><td rowspan="2">1 Inception</td><td rowspan="2">1 Conception of need</td><td rowspan="2">3 Package preparation</td><td rowspan="2">1 Preparation</td></tr>
<tr><td>B Strategic briefing</td></tr>
<tr><td>C Outline proposals</td><td>2 Concept and viability</td><td>2 Outline feasibility;</td><td>4:Package definition</td><td>2 Concept</td></tr>
<tr><td rowspan="2">D Detailed proposals</td><td rowspan="3">3 Design development</td><td>3 Substantive feasibility</td><td rowspan="3">5 Design development</td><td rowspan="3">3 Design Development</td></tr>
<tr><td>4 Outline conceptual design;</td></tr>
<tr><td>E Final proposals</td><td>5 Full conceptual design</td></tr>
<tr><td rowspan="2">F Production information</td><td rowspan="4">4 Documentation and procurement</td><td>6 Co-ordinated design and procurement</td><td rowspan="2">6 Design documentation
6A Production information</td><td rowspan="2">4 Production information</td></tr>
<tr><td>7 Production information</td></tr>
<tr><td>G Tender documentation</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>H Tender action</td></tr>
<tr><td>I Mobilisation</td><td rowspan="3">5 Contract administration and inspection</td><td rowspan="5">Construction</td><td rowspan="2">6 Design documentation
6B Manufacture, fabrication and construction information)</td><td rowspan="3">5 Manufacture, fabrication and construction information)</td></tr>
<tr><td rowspan="2">J Construction to practical completion</td></tr>
<tr><td>7 Works</td></tr>
<tr><td rowspan="2">K After practical completion</td><td rowspan="2">6 Close out</td><td>8 Hand over</td><td rowspan="2">6 Post practical completion</td></tr>
<tr><td>9 Close out</td></tr>
</table>

The Construction Industry Council in 2007 published the CIC Scope of Services for use on major building projects designed by a multi-disciplinary team, whatever the procurement route (see last column in Table 3). The CIDB Infrastructure Gateway System (CIDB, 2010), which is designed for any type of construction works, has been designed so that the deliverables associated with the end of a stage form the basis of the scope of work for taking the package forward in terms of the selected contracting strategy as shown in shown in Table 4.

INTEGRATING DESIGN WITH CONSTRUCTION

The Euroscan facility, a new security scanning facility on either side of the Euro tunnel, presented a researchers with a unique opportunity to compare project performance in the UK and France with a functionally equivalent building, a common design and a common client (Research Focus, 2000). A leading architectural practice was commissioned to design the facility on either side of the channel. Both project teams faced the same challenges largely generated by problems with the scanning technology. The French contractor was appointed after the RIBA stage D shown in Table 3 whereas the UK contractor was appointed after the RIBA stage H. Table 5 compares the UK and French performance.

Table 4: Key deliverables associated with the scope of work of a contracting strategy

Contracting strategy		Key deliverable which forms the basis of the scope of work associated with a contract	
Strategy	Description	Stage associated with the deliverable	Deliverable
Management contractor*	Contract under which a contractor provides consultation during the design stage and is responsible for planning and managing all post-contract activities and for the performance of the whole of the contract	3 Package preparation	Client accepted strategic brief*
Design and construct	Contract in which a contractor designs a project based on a brief provided by the client and constructs it	4 Package definition	Client accepted concept report
Develop and construct	Contract based on a scheme design prepared by the client under which a contractor produces drawings and constructs it	5 Design development	Client accepted design development report
Design by employer	Contract under which a contractor undertakes only construction on the basis of full designs issued by the employer	6a Design documentation (Production information)	Completed and client accepted production information

* A management contractor can also be appointed after Stage 4, 5 or 6A in which case the client accepted concept report, design development report or production information, respectively, can serve as the basis of the scope of work.

The French team coped with the issues much more smoothly due to the differences in organisation of these two projects. The French contract included detailed design which enabled the project to be re-engineered - the design was simplified so that it was easier, simpler and cheaper to build. Under the French contract, the British architect could not object to these changes. In contrast, the professional indemnity considerations under the British contract meant that the architect refused to allow the British contractor to copy the French changes. Once the British contract began to run late, work on construction became even less effective as the team had to start working around the installation of the scanning equipment.

Table 5: Project performance comparison on a functionally equivalent building, a common design and a common client

Performance indicator	French performance	British Performance
Design costs	£ 323 523	£ 465 000
Contractor tender price	£ 3 852 754	£ 3 897 00
Contractor out-turn cost	£ 4 178 652	£ 4 482 375
Total acquisition cost	£ 4 502 178	£ 4 947 375
Contractor cost increase	8.5%	15%
Contract programme	equal	equal
Programme overrun	0%	28%
Site management staff	4	8
Procurement	Lump sum after stage D; bespoke contract	Approximate bill of quantities at stage H; full JCT 80
Strengths / weaknesses	Contractor's engineering capability means value engineering the norm	Architects liability insurance prevents value engineering Process complexity

NOTE: costs are converted at the 1992 Purchasing Power Parity

Research has indicated that in order to provide higher value and less waste the fragmentation in design needs to be addressed, preferably before 25% of the design is complete (Lichtig, 2006). Target cost contracts can be used to facilitate early contractor involvement in terms of the design by employer, develop and construct and design and construct contracting strategies. This is possible as contractors can be contracted on the basis of their cost parameters and a target price can be negotiated when there is sufficient production information available to agree a target price. Escape clauses can be inserted into design and construct contracts to enable the employer to use the designs and approach the open market in the event that agreement cannot be reached regarding the target price (Watermeyer, 2012).

DIFFERENT FORMS OF CONTRACT

ISO 6707-2 (1993) defines conditions of contract as the "*terms that collectively describe the rights and obligations of contracting Parties and the agreed procedures for the administration of their contract*."

A standard form of contract or standard contract, on the other hand, is a contract between two parties that is published by an authoritative industry body with fixed terms and conditions which are deemed to be agreed and are not subject to further negotiation or amendment.

The first standard form of contract in the UK was developed for the London Metropolitan Board of Works during the 1860s, based on a master servant relationship. Current forms of contract are drafted around significantly different objectives and principles e.g. master-servant relationships or collaboration between two experts, risk sharing or risk transfer, independent or integrated design, short-term relationships based on one-sided gain or long-term relationships focused on maximizing efficiency and shared value, etc. (Watermeyer, 2012).

There are, however, two international families of standard contracts that are used in many jurisdictions including sub-Saraha Africa, namely those published by the International Federation of Consulting Engineers (FIDIC) and the Institution of Civil Engineers (NEC3). These standard forms of contract cover a range of procurement types, service responsibilities and contracting and pricing strategies that are drafted to cater for a wide spectrum of objectives and methods of managing risks.

The FIDIC and NEC3 forms of contract cover engineering and construction works and professional services. The NEC3 forms of contract, however, also include supply, term service and framework contracts. The FIDIC forms of contract are based on the traditional approach to drafting and administering contracts, assessing variations to the contract and effecting payment to contractors in terms of standard price-based pricing strategies (i.e. lump sum or bill of quantities). The NEC3 forms of contract on the other hand, facilitate the implementation of sound project and risk management principles and practices in a flexible manner. They also offer a wide range of price-based (activity schedule, price list and bill of quantities) and cost-based pricing strategies (i.e. time based contract, cost reimbursable contract and target contract). They are drafted on a relational contracting basis, based on the belief that collaboration and teamwork across the whole supply chain optimises the likely project outcomes and are therefore based on "discussion at the time" rather than "argument later." They contains clear procedures with defined time limits for actions to be taken, and provide for effective control of change, speedy agreement of time, quality and cost impacts of change, improved forecasting of end costs and end dates. They assess compensation events (events for which the employer is at risk) which entitle the contractor to more money on the basis of cost, as defined in terms of the contract, uplifted by any percentages for overheads and profit or fees provided for in the contract for work already done, or a forecast for the work not yet done.

Delays and disruptions need to be managed. Extensions of time caused by events which are beyond the contractor's control are necessary to relieve the contractor of delay damages and to establish a new contract completion date. The Society of Construction and Law's Delay and Disruption Protocol (2002) contains 21 core principles to provide a means by which the parties can resolve these matters and avoid unnecessary disputes. These core principles suggest that delays and disruptions be handled in terms of the following principles:

- The contractor should prepare a programme showing the manner and sequence in which the contractor plans to carry out the works and have such a programme accepted by the contract administrator. The programme should be updated to record actual progress and any extensions of time granted. Applications of extensions of time relating to events or causes of delay for which the employer has assumed risk and responsibility should be made and dealt with as close in time as possible to the event that gives rise to the application for an extension of time.

- The parties should attempt so far as possible to deal with the impact of employer risk events to mitigate its effect on the works as the work proceeds, both in terms of extension of time and compensation.

- The extension of time should be granted to the extent that the employer risk event is reasonably predicted to prevent the works being completed by the agreed completion date, taking into account the float other than terminal float (difference between planned and contractual completion) that is available on the activity paths affected by the delay.

- The granting of an extension of time does not automatically lead to entitlement to compensation. Where practicable, the total likely effect of variations should be pre-agreed to arrive if possible at a fixed price of a variation based not only on the direct costs (labour, plant and materials) but also the time related costs, an agreed extension of time and the necessary revisions to the programme.

- Compensation for prolongation should be based on the actual additional cost incurred by the contractor and evaluated by reference to the period when the effect of the employer's risk event was felt and to the extended period at the end of the contract.

Points can be assigned to each of the 21 core principles to a particular form of contract to gage where each of these forms of contract sit with respect to these principles i.e. -1 for non- compliance; 0 for some compliance; 1 for partial compliant and 2 full compliant. Based on this rating, the FIDIC Red Book has a moderate correlation (> 0,5 but ≤ 1,5), while the NEC3 ECC has an excellent fit (>1,5).

The NEC3 family of contracts also embrace the recently published DFID's *Statement of Priorities and Expectations for Suppliers* in the areas of reduction of waste and efficiency, the engagement of subcontractors, collaborative working, an open book approach to the cost of change and the application of pricing structures that align payments to results and reflect a more balanced sharing of performance risk.

A comparison between the international and local families of standard contracts which are endorsed for use in South Africa is shown in Table 6.

Table 6: Comparison of different forms of engineering and construction works contracts endorsed by the Construction Industry Development Board

Criteria		FIDIC	GCC 2010	JBCC 2000	NEC3
1	Correlation / fit with respect to Society of Construction and Law's Delay and Disruption Protocol (2002)	Moderate	Poor	Poor	Excellent
2	Potential for collaborative working	Moderate	Poor	Poor	Excellent
3	Target contract option for application in framework contracts, collaborative working and early contractor involvement	No	No	No	Yes
4	May be used for both engineering infrastructure and building projects	Yes	Yes	No	Yes
5	The main contractor may be required to assume responsibility for the design or the works or the finalisation of the design	Yes (yellow and silver)	Yes	No	Yes
6	The main contractor may be required to operate as a management contractor	Yes (silver)	No	No	Yes
7	Cost based pricing strategies, including target cost contracts	No	No	No	Yes
8	Back to back subcontracts	Yes	No	Yes	Yes
9	Short forms of contract suitable for use where risks are low and there is no requirement for sophisticated management techniques	Yes	None	Same management requirements as for principal contract but no subcontracts	Yes
10	An open book approach to the cost of change	No	No	No	Yes
11	Pricing structures that align payments to results and reflect a more balanced sharing of performance risk	No	No	No	Yes

RECENT SOUTH AFRICAN EXPERIENCE AT THE UNIVERSITY OF THE WITWATERSRAND

The University of the Witwatersrand's Capital Projects Program (CPP) was established in 2008 to direct a project portfolio exceeding R1 billion by 2012. The building environment at the University is a complex one due to the multiplicity of client users and competing requirements, noise and disruption to academic programmes, the health and safety of not only workers but also students and the public, the mix of new buildings, extensions and refurbishments, the limited or no space for decanting staff and students and the complex operational requirements within Wit's management systems. The Department of Higher Education and Training had stringent cost norms attached to their grant funding conditions linked to the delivery of teaching spaces. Loans were taken out against income streams for the new residences. The University's ability to fund capital expenditure was limited. As a result, cost overruns had to be funded primarily through fund raising initiatives. The academic calendar also dictated the time for completion. Simply put, the University environment was sensitive to cost and time overruns. (Hodgson *et al*, 2009)

Those responsible for the Capital Projects Programme took a conscious decision to move away from the pre-planned traditional contracting approach ("them-and-us") towards an integrated project team approach following initial experiences in the early phase of the programme where projects overrun budgets by as much as 30% with a significant portion of the overrun only becoming apparent after practical completion. This was done to improve project performance during implementation. A decision was taken to change over to the NEC contracting system in order to stimulate a culture shift towards collaboration, efficiency and greater certainty (Watermeyer, 2010) as indicated in Table 7.

Table 7: Culture change sought at Wits to improve project outcomes (Hodgson *et al*, 2009)

Form	To
Master-servant relationship of adversity	Collaboration towards shared goals
Fragmentation of design and construct	Integration of design and construct
Allow risks to take their course	Active risk management and mitigation
Meetings focused on past - what has been done, who is responsible, claims. etc.	Meetings focused on "How can we finish project within time and budget available?"
Develop the project in response to a stakeholder wish list	Deliver the optimal project within the budget available
"Pay as you go" delivery culture	Discipline of continuous budget control
Constructability and cost model determined by design team and Quantity Surveyor only	Constructability and cost model developed with contractor's insights
Short-term "*hit-and-run*" relationships focused on one-sided gain	Long-term relationships focused on maximising efficiency and shared value

R 1.5 billion of works was completed in six years. The overall cost overrun (difference between outturn cost and control budget established at the time that a decsions was taken to implment the project) has been less than 5% (Hodgson, 2013). This includes scope changes during implementation to accommodate late changes to the design. Projects were also generally completed on time or ahead of time.

This remarkable acheivement has been achieved through a combination of proactive project management, the application of the NEC3 contracting system, the adoption of the develop and construct and design by employer contracting strategies with early contractor involvement, the use of appropriate procurement strategies including framework agreements which enabled long term relationships to be developed and the use of priced based and target contracts with activity schedules, and the culture change that underpinned the programme.

The programme was delivered using public sector procurement rules and endorsed forms of contract. The successful implementation of the programme has resulted in the Department of Higher Education and Training appointing the Univerity of the Witwatersrand as its implementing agent to develop two new univerities – the Sol Plaatje University in Kimberly and the University of Mpumalnag in Nelspruit.

FACTORS INHIBITING CHANGES IN PROCUREMENT STRATEGY

The author has not only been intimately involved with the Wits Capital Project Programme since 2008 but also in the development of the National Treasury and Construction Industry Development Board's Delivery Management Guidelines, *Practice Guide 2 - Construction Procurement Strategy* (2010) and its promotion within provincial government. Very few public sector clients are satisfied with project outcomes in terms of schedule, performance or budget and the quantum of delivery. Project budget overruns and late delivery and portfolio underspending are the order of the day. In the face of this, many clients and their professional advisers are attempting to fix the traditional preplanned approach to delivery in the hope of a better outcome rather than taking a step back and developing an appropriate procurement strategy.

The factors in the author's experience which inhibit the adoption of strategies other than the traditional pre-planned approach are:

1) Most South African universities, particularly the departments of construction economics, teach contracts in a transactional manner in that they instruct students in the application of a single local form of contract, based on a design by employer contracting strategy with a bill of quantities and fail to educate them on contracting principles and the range of strategies that are embedded in different forms of contract.

2) The guideline fees published by the various built environment councils which provide stage payments based on the traditional preplanned approach to construction entrench a single predetermined strategy and a rigid culture in the delivery of infrastructure.

3) The resistance of built environment professionals, particularly the architectural and quantity surveying professions, to make any departure from the "time honoured" traditional approach to the delivery of infrastructure.

4) A lack of broad minded project and programme managers who are prepared to change the culture in order to improve project outcomes..

5) A lack of evidence based research which enables participants in projects to make informed choices in the development of a procurement strategy.

6) A one size fits all approach to procurement propagated by supply chain managers. (The supply chain for goods typically involves the procurement of off the shelf products or readily available commodities which once purchased are taken into inventory while that for general services involves standard well defined and scoped services. On the other hand, the supply chain for infrastructure involves the planning and production of a product on a site (Watermeyer *et al*, 2013))

7) A lack of standardised procurement documentation to support the implementation of alternative contracting and pricing strategies.

8) Poor procurement skills amongst those responsible for conceptualising and executing procurement processes.

CONCLUSIONS

Procurement strategy has the potential to maintain the value for money proposition established at the time that a decision to proceed with a project is made. Its effective implementation, however, requires a culture change.

REFERENCES

Barnes, M. (1999) Smeaton to Egan– the Extraordinary History of Civil Engineering Management. Smeaton Lecture, Institution of Civil Engineers.

Construction Industry Council. (2007). The CIC Scope of Services.

Construction Industry Development Board (2010). CIDB Infrastructure Gateway System. Inform practice #22.

Engineering Council of South Africa. (2013). Board Notice 117 or 2013. Government Gazette No 36529 of 3 June 2013.

Flyvberg, B, Bruzelius, N and Rothengatter, W. (2003). Megaprojects and risk: an anatomy of ambition. Cambridge: Cambridge University Press.

Hodgson, S. (2013). Personal communication.

Hodgson, S, Prinsloo, P, Watermeyer, R and Barnes, D. (2009). The learning curve for the Wits' Capital Projects Program. The School of Civil and Environmental Engineering of the University of the Witwatersrand hosted a Construction Symposium on The project management profession: adding value, August.

ISO 6707-2: 1993, Building and civil engineering - Vocabulary - Part 2: Contract terms

ISO 29481-1: 2010, *Building information modelling - Information delivery manual -Part 1: Methodology and format*

Lichtig, WA. (2006). The Integrated Agreement for Lean Project Delivery. *Construction Law*yer, 26(3) pp 1-8, Summer.

OGC. (2003). Achieving Excellence in Construction - Procurement Guide no 1. Office of Government Commence.

OGC. (2006). Common Minimum Standards for the Procurement of Built Environments in the Public Sector. Office of Government Commerce

RIBA Enterprises (2001). The Architect's Plan of Work for the procurement of feasibility studies, a fully designed building project, employer's requirements or contractor's proposals.

Research Focus.(2000). French and British project comparison. Issue 42 August. Institution of Civil Engineers.

South African Council for the Architectural Profession (2011). Board Notice No 194 of 2011. Government Gazette No 34788 of 1 December 2011.

US Department of Energy (2011) Cost Estimating Guide. https://www.directives.doe.gov.

Watermeyer, R, Nevin, G. and Langenhoven, K (2012). The supply chain management system for the delivery and maintenance of infrastructure by organs of state, *Civil Engineering July*

Watermeyer, R, Wall, K and Pirie, G. (2013) How infrastructure delivery can find its way again. IMIESA March pp 17-29

Watermeyer, R.B. (2010). Perspectives expressed at the Wits Project Management Symposium (August 2009). Civil Engineering, January / February

Watermeyer, R.B. (2012) A framework for developing construction procurement strategy. Proceedings of the Institution of Civil Engineers, Management, Procurement and Law. Volume 165, Issue 4, pp. 223–237 (15)

Watermeyer, R. (2013). Value for Money in the Delivery of Public Infrastructure. West Africa Built Environment Research Conference, Accra, Ghana, August.

PUTTING THEORY TO WORK: THE USE OF THEORY IN CONSTRUCTION RESEARCH

Dr. Libby Schweber[1]

School of Construction Management and Engineering, University of Reading, PO Box 219, Reading, RG6 6AW, UK

The paper explores the contribution of theory to empirical social research in the field of construction research. By analysing three distinct philosophical positions – inductive positivism, logical positivism and interpretivism – the paper underlines the movement of construction research beyond the simplistic search for universal laws to a more nuanced view of the contribution of theory. The discussion underlines the role of both inductive and deductive reasoning in all types of social research. It distinguishes between different aims of science, uses of theory and types of explanation. Whereas positivism focuses on the search for probabilistic laws to account for general features of construction work, interpretivist research looks for the role of meaning, process and context in accounting for variations across instances and cases. An argument is made for the contribution of theory to originality, to the development of a cumulative body of knowledge with value for practitioners and policy makers and for the engagement of construction researchers with business and management studies as well as other social science disciplines.

Keywords: positivism, interpretivism, theory, construction research

INTRODUCTION

The aim of this presentation is to reflect on what theory adds to construction research. Before beginning, it will be helpful to briefly specify the scope of the argument and to situate it in its broader intellectual and institutional context.

In terms of scope, the presentation focuses exclusively on empirical social research. By this, I mean empirical research which includes an examination of social behaviour, be it the interaction between stakeholders in a project or the behaviour of organizations or markets. As such, this excludes research into the physical properties of building materials or the design of a new management method or tool – unless, of course, the research extends to the empirical study of implementation, in which case it too is all about people.

Turning to the interest and relevance of the topic, here the argument is both institutional and intellectual. I begin from the observation that, at a very general level, the fields of science and social science are changing and more to the point, the pace of change is accelerating. Intellectually, this acceleration is associated with a growing recognition of both the context dependence of all academic knowledge and the need for creativity and flexibility, even in the "hardest" of sciences. Within construction

[1] libby.schweber@reading.ac.uk

Schweber, L. (2014) Putting theory to work: The use of theory in construction research *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 29-40.

research, this general development has led to a new concern for ‘theory’ and its promise to link empirical research with a dynamic body of knowledge.

Within construction research a number of institutional developments support this claim. Whereas 10 or even 5 years ago, the word ‘theory’ rarely figured in the abstracts of articles in construction research journals such as *Building Research and Information* or *Construction, Management and Economics,* today, the term is increasingly present. Stated differently, research which engages with theory is increasingly being supported and even sought after by leading journals. Similarly, whereas 10 or even 5 years ago, PhD candidates in leading construction programs did not have to think about theory; today having a clear theoretical framework and deploying it properly is an important criterion of evaluation. As these observations suggest, the gatekeepers of academic construction research increasingly think that theory ‘adds (intellectual) value’. Moreover, its importance as a criterion of evaluation can be expected to increase.

If one asks: “Why this relatively recent concern with social theory?” one answer is that the academic audience for construction research is changing. Whereas 20 or even 10 years ago, academics in construction management and related departments published almost exclusively in engineering and construction journals, today scholars writing at the business and management end of the spectrum are expected to publish in high end academic journals. And these journals require theory. Similarly whereas 20 or even 10 years ago, industry used academics as consultants, today they also turn to universities for cutting edge, original research. And this, I will argue, requires theory.

All of these observations point to a change in the criteria for academic construction research. They suggest that many of the gatekeepers[2] of our field believe that theory adds intellectual value. More specifically, they think that it is one of the things which differentiates academic research from other forms of reporting and which contributes to our originality. Used properly, it should help us, and more importantly our students, to respond effectively to the needs of policy makers and industry stakeholders and to participate in ongoing academic discussions within construction research and beyond.

The aim of this presentation is to open a conversation on what that added intellectual value entails and how to cultivate or maximize it in our own research. The presentation asks: What work does theory do for academic construction research and how can we as academics use theory to the benefit of everyone concerned.

To get at these questions, I’d like to engage in a brief philosophical exercise, looking at what is meant by (social) science and the place of theory therein. This will help move the discussion of theory and methods beyond simple contrasts between induction and deduction to a more nuanced and realistic understanding of the promise and use of theory in social science. I’ll conclude with two rules or precepts which seem to me to be particularly central to using theory in academic research. These include the importance of methodological fit (between theory and method or data) and the importance of construct consistency.

To illustrate my points today, I will draw on two articles in the area of Innovation Studies. I’ve chosen Innovation Studies because it is both a well-established, relatively mature area of research as well as the focus for the introduction of new and

[2] The term ‘gatekeeper’ refers to those in a position to influence and control the criteria of recognition and thus the direction of the discipline.

novel theories and approaches into construction research. As such, it includes work from a wide variety of theoretical perspectives. In the interest of simplicity, only two articles will be used to illustrate the discussion, although far more could have been selected. These include Reichstein, Salter and Gann's (2005) quantitative study of attitudes towards innovation in the construction sector and Harty's (2008) paper on technological innovation. Reichstein *et al*'s study is driven by a concern to explain the supposedly low level of innovation in construction. To address this question the authors conducted a quantitative sector level analysis of levels of innovation across manufacturing, service and construction sectors. In contrast, Harty explored the introduction of a new building service modelling tool into a large, complex construction project. Harty is particularly interested in the contrast between the envisioned use and function of ICT technology, as specified by its technical designers, and its actual use.

A LITTLE BIT OF PHILOSOPHY

If one asks philosophers of science today what makes science different from other types of knowledge they would give you a very different answer than if you had asked them fifty years ago. Whereas 50 or 60 years ago they might have pointed to the use of theory and data to identify universal laws, today their answer would be much more nuanced. Like their historic counterpart, they would point to the crucial role of theory and data, although with the advent of computing technology the extent to which natural sciences is data driven has increased. But they would also tell you about the importance of reflexivity[3] whereby otherwise taken for granted assumptions are rendered explicit, examined, refined and then deployed. They might suggest that almost all scientific research is qualified by some kind of scoping conditions under which particular claims are said to apply. Thus, Newton's law of gravity is only valid under fairly well specified conditions. When black holes are involved or cosmological scale problems are addressed, Einstein's theory of general relativity is the more appropriate. Finally, they would almost certainly argue that all scientific laws are context dependent, noting that physics' great success depends in part on the fact that it focuses on the study of systems that can be isolated from their environment, while the laws of chemistry are valid in terrestrial environments.

How you ask, is this relevant for construction research? For the purposes of today's talk, it serves to dispel the view that only general universal claims have value, thus opening the way for a more realistic and variable vision of what counts as a finding or contribution in construction research. Moreover, while these general elements are common to all sciences – and one might argue to all academic research, what form they assume and how they combine varies considerably.

Within the philosophy of the social sciences one of, if not the, key issue is whether there is one science or many? Proponents of the unified or naturalist view, argue that social phenomenon can and should be studied in the same way as natural phenomenon, while proponents of the non-unified (or anti-naturalist) view argue that social phenomenon are different and require a different type of science (or no science

[3] In social science, 'reflexivity' refers to the conscious analysis of core assumptions, of the effect of the researcher on the research process and of the effect of the research process on the researcher. The process is important is that it allows the research to decide what assumptions to adopt and protects them from bias introduced by taken for granted assumptions and unexamined claims.

at all). Three related issues which distinguish between these positions are: 1. the aims of science, 2. the use of theory and 3. the nature of explanation. The discussion which follows contrasts the unified and multiple science view along these dimensions.

THE NATURALIST POSITION: POSITIVISM(S)

The most well known version of the naturalist position is Positivism. While Positivism is often presented as a single research approach, the term covers a range of different epistemological positions (Hollis, 1994, p.41-42). Two historical reference help to highlight some of these differences. These include inductive positivism, associated with Auguste Comte (1798-1859) and logical positivism, associated with Karl Popper (1902-1994). While neither fully describes what scientists actually do, both continue to be used as points of reference in supporting and justifying scientific activity. As such it’s important to engage with them, if only so as to not to fall prey to excessively mechanistic interpretations.

INDUCTIVE POSITIVISM

The term ‘positivism’ is generally ascribed to 19th century philosopher Auguste Comte to refer to the highest or most developed form of knowledge. Comte worked with a model of knowledge as divided into different topics or disciplines, including chemistry, biology, physics and sociology. He argued that each of them develops through the same set of historical stages from the theological to the metaphysical to the positivist or scientific. The primary characteristic of positivist knowledge (the final and highest stage) is the search for general or universal laws, grounded in observation. ‘Laws’ in Comte’s sense refer to patterns or regularities in the relations between variables. In its purest version, Comtean positivism involves a form of inductivism whereby empirical observation leads to the identification of general laws. While this aim has been much criticized (see below), it captures the aim of much construction research. For example, in Reichtein *et al*’s study, general laws concern the effect of sector level characteristics on sector levels of innovation.

One of the main criticisms of Comtean positivism is that, just as the fact that the sun rose this morning doesn’t guarantee that it will necessarily rise tomorrow, so too empirical observation alone cannot establish the truth of a law (certainty). As Keat and Urry explain, the problem is: “how can one justifiably argue from past events to future events, from the known to the unknown” (1982, p.15). To deal with this criticism, positivists tend to use statistics. This allows them to quantify initially observed patterns and to identify probabilistic rather than certain laws.

Reichstein *et al*’s paper illustrates a positivist approach to innovation. The aim of the study is to account for reportedly low levels of innovation in the construction sector relative to other sectors. More specifically, the paper sets out first, to examine this claim using national level survey data on professional perceptions of innovation across many sectors and, secondly, to link observed differences in innovation performance to sector specific characteristics. In keeping with a positivist approach, the paper frames the problem in terms of the relation between variables. More specifically it examines the statistical relation between a number of sector characteristics which are deemed to inhibit innovation (which they refer to as ‘liabilities) and levels of innovation. Sector level liabilities include: the project based character of construction work, in-situ production (and the associated liability of immobility), uncertainty of demand, the small size of many firms, the separation of design and production and the nature of the supply chain.

LOGICAL POSITIVISM

In the 20th century a second response to the problem of certainty involved a shift in focus from pure inductivism to a form of deductivism or logical positivism, associated with Karl Popper. In addition to the issue of whether observations alone can establish laws, logical positivism also addressed the sticky issue of where do variables come from. Instead of treating them as contained in the social world (just waiting to be observed), Popper argued that positivist science begins from conjectures or theories which use logic to suggest possible patterns or relationships between variables. These laws are then tested against independent observations. While it is not possible to confirm hypotheses (after all, the sun might not rise tomorrow!), it is possible to falsify them. In logical positivism, "observations should be used to solely to show that putative theories are false"(Keat and Urry, 1982, p.15). The essence of science, according to this view, is the testing and potential falsification of theoretically derived hypotheses.

This version of positivism is often referred to as the hypothetico-deductive method; however, the label is misleading. As should be evident from the above description, it combines deductive and inductive analysis. Hypotheses are formulated via deduction from theories; but they are tested via empirical induction.

Between roughly 1930 and 1970 this view of science dominated academic thinking, especially in North America. It provides the epistemological foundations for theories such as structural functionalism, rational choice, behavourism and exchange theory. It is also the dominant approach for most applied research. Today, positivist research remains an important, although no longer dominant epistemological approach in management studies and organizational theory. While not the purpose of this paper, it is important to note that very few if any (natural) scientific experiments are actually reproduced or tested (Briefing, The Economist). This is in part because there is no funding for replication; it is also because it is notoriously difficult to reproduce a study, partly because scientific research depends on specialized tacit knowledge which is not easily transferable(Collins, 1985). As these observations suggest, the impact of logical positivism is on the popular image of science rather than the actual practice. It should also be noted that attempts to apply this method to explanation in history and other social sciences have largely failed (Outhwaite, 2000, p.53)

To summarize the positivist view of explanation, both inductive positivism and logical positivism set the aim of research as the identification of (general or universal) covering laws. In this view, the aim of scientific research is to 'explain' particular cases or phenomenon by relating them to general covering laws. Thus, one can say that y is caused by x, because y and x are specific instances of a causal law (Neumann, 2006, pp., p.84). Explanatory theories involve probabilistic statements about the correlation between variables. For positivists, the 'added intellectual value' of science lies in its ability to predict what will happen in a specific instance and thereby control aspects of the social world. A good explanation is one which has no logical contradictions and which is consistent with observed facts (Neumann, 2006, p.84).

CRITICISMS OF POSITIVISM

As many of you will be aware, positivism has come under a number of criticisms, especially since the 1970's. A key issue concerns the presumed independence of observation. Both Comtean and Popperian positivism assume that observations and thus empirical data exist independently of the observer, their theories and their hypotheses (for it is only if they are independent that they can be used to confirm or falsify particular laws). In a very influential critique, Peter Winch (1958) argued that observations are always shaped by concepts in the minds of the observer. As such, they are never independent of theory or received understandings. For example, in Reichstein *et al*'s study, observations are taken from the UK segment of the Eurostat Community Innovation Survey (CIS) of innovation. The survey has been administered since the early 1990s and the questions (which produce the observations) have been evaluated and reworked extensively since then. Thus, while they are 'independent' of Reichstein *et al*'s own analytic framework, they are not based on 'pure' observation. Instead the data has been shaped by other scholars' theories of innovation and research (much of which Reichstein *et al* can be presumed to have read). Far from discrediting this type of positivist research, the theory laden character of observations is inevitable. Winch and other critics point is not that we should not do quantiatitve or positivist social research, but rather that scholars should acknowledge their 'theoretical biases' and take that effect into account when they draw conclusions.

A second type of criticism concerns the question of whether general laws explain the correlations which they predict. Critical realists (a very different naturalist approach), for example, argue that they fail to identify the processes and mechanisms which produce observed associations between variables (Keat and Urry, 1982, pp., p.143).

THE ANTI-NATURALIST VIEW: INTERPRETIVISM

In the 1970's, these criticisms led to a revival of 19th debates over social science and method and an interest in the anti-naturalist stance. As indicated above, anti-naturalists argued that social phenomena are qualitatively (sic) different from natural phenomena and as such should not be studied in the same way. Instead of one science, they argued for many. In discussing this position, it's important to note that while anti-naturalists reject the idea of a singled unified science, they do not necessarily reject that possibility of a science of society. Historically, anti-naturalists argued for a different kind of social science; today interpretivists are divided as to whether they see their research as 'science' or 'not-science'. For this reason, I will refer to their work as academic research (rather than social science).

The 'many sciences' view built on the work of Wilhelm Dilthey (1833-1911) and Max Weber (1864-1920); anti-naturalists began from the observation that human behaviour is shaped by meaning in the form of understandings, intentions and motivations. Moreover, it is mediated by language and symbols. This position has implications for their view of academic research. It means that to 'explain' social phenomena, scholars need to study the meanings which people ascribe to acts and objects. To study meaning, scholars need to interpret their data. Thus, whereas positivists assume that facts can be read directly off of observations, interpretivists argue that the social science depends on the interpretation of data.

Like positivism, interpretivism comes in many versions. Whereas positivists share a number of core assumptions, theories associated with interpretivism span a much wider range of positions about the nature of knowledge, research methods and social phenomenon. Other labels associated with the anti-naturalist view of science include: constructivism, phenomenology, ethnomethodology, pragmatism and post-modernism, to name but a few. And each of these more philosophic or epistemological stances are associated with a range of ontological positions and specific theories. As such it is difficult to characterize them as a group (although numerous research methods textbooks do just that).

For interpretivists writ large, the notion and importance of causal explanation varies. For some, causal explanation remains a key aim, although with a different understanding of explanation than the positivists. Thus, whereas for positivists explanation involves the association of a particular case with an already established general law, for interpretivists explanation involves reconstructing the meanings and understandings which led people (or firms or teams) to act in a particular way. For others, the aim of academic research is to document process (as well as meaning). In contrast to positivists, interpretivist researchers are often interested in sequences of events. For still others, the focus is on context and an associated concern with variation. Thus, whereas positivism generally focuses on similarities across cases, leading to the formulation of general laws, interpretivist research is often more interested in differences.

The Harty article cited above offers an example of one (among many very different) interpretivist approaches to innovation. In his study of a new building service modeling tool, Harty focuses on innovation as a process which encompasses what is usually described as implementation or diffusion. Instead of looking for the variables which explain the success or failure of the tool in a specific project, Harty asked: Who was involved in implementing the tool? What were their expectations and interests? What meaning did each of them ascribe to this new tool? and How did they use it? The primary aim of the research is not to predict the use of the tool, but rather to document how it came to be used in a particular way. The analysis focuses on the network of actors and artefacts which are mobilized around the use of new ICT.

As this brief description suggests, a number of assumptions inform his study. First, Harty begins from the assumption that the use of ICT is not determined by the technology but instead varies, secondly, his analysis assumes that the experience and meaning of innovation varies across subjects and thirdly, the study treats innovation as a dynamic process rather than as a fixed entity. The main point that I wish to make here is that explanation in interpetivist research depends not only on getting into the heads of the subjects (and the cultural resources which informed their interpretations), but also in documenting the sequence of events and contexts which produced a particular outcome.

If one asks: “what is the aim of interpretivist research?” the answer is once again “multiple”. Very generally, the aim varies from the discovery of new and surprising aspects of a social phenomenon to the production of novel explanations to step-by-step accounts of particular social processes. At its best, interpretivists approach empirical research as a way of developing new theory, although what counts as theory varies considerably. According to Bryman and Bell (2003, p. 21), one of the main contributions of interpretive research lies in the discovery of surprises, which open the way for new understandings and further theory development.

This focus on theory development can be illustrated by Harty’s article. A key contribution of the article lies in the introduction of a new concept – namely the relative boundedness of innovation – and the types of processes which this abstract (theoretical) process involves. The concept of boundedness refers to the effect of a local context on an innovation and its use. A bounded innovation is one which is relatively untouched by the context; an unbounded one is an innovation whose effect extends well beyond what is originally intended. In the case of new ICT, the technology developers had a clear vision of how the technology would be used. However, construction professionals in the case study did not adopt this model. Instead they combined 3D and 2D images, the re-invented ICT and used it to suit their purposes and they were guided by other standards. In his paper, Harty uses this analysis to identify general processes which contribute to the unboundedness of an innovation. In other words, he used the empirical case study to contribute to theory development.

As this account suggests, interpretivism is often 'more inductive' than positivism, in the sense that the movement is from empirical cases to theory development. However, just as positivism combines both deductivism and inductivism in practice, so too interpretivist research involves an iterative process whereby theory is used to specify initial constructs, which are used to begin exploring an empirical case, which in turn provides the basis for theoretical revision and redefinition. Thus, while Harty did not begin with a clear theoretical framework, he began with a very specific method –Actor Network Theory – which focused attention on the network of actors and artefacts engaged in the introduction and development of a new technology. This method focused his attention on the scope of the network and thereby to the concept of unbounded innovation.

CRITICISMS OF INTERPRETIVISM

One of the main criticisms of much interpretivist research – and a key challenge for construction research – lies in the neglect of theory. All too often interpretivist studies stop at the rich description of a single case or couple of cases, with no reflection on the implications of that analysis for more abstract analytical frameworks or general understandings (Bryman and Bell, 2003, p.14). In other words, with no attention to theory development. As Harty's article illustrate, the function of theory is to link rich empirical description to more general processes and concepts which can be mobilized in future studies on similar and very different empirical cases.

In closing, it's helpful to say a few words about the definition of theory which emerges from this discussion. Textbooks often define social theory as a distillation (and ordering) of knowledge about a particular phenomenon (Neumann, 2006, p.8) or as a system of constructs, linked together by propositions (Suddaby 2010, pp. 346-347). The discussion above provides an opportunity to nuance this understanding a bit. It suggests that the nature of theory varies with the basic approach to research. For positivists, its often involves probabilistic statements about the relation between variables. For interpretivists, it ranges from accounts of the interaction between action and structure, to the role of meaning in human behavior to key concepts which draw attention to previously ignored aspects of social life. To the extent that social scientists are concerned with explanation, then theories contain explanations. In all cases, theories involve statements about social phenomenon which are more general and more abstract than any specific case study or instance.

WHAT DOES THEORY DO?

Having argued that the aim of academic research to produce knowledge which differs in kind from consultancy and policy work and having suggested that one of the key distinguishing features of academic research is the dialogue between theory and empirical research, I can now return to the original two questions, namely: what work does theory do – what's the 'added intellectual value' - and how to do it.

Based on the discussion above, theory potentially plays a number of roles in scientific research. In some approaches, it promises to move analysis beyond common sense description to something approximating causal explanation. For positivists, this is valuable as it provides a basis for prediction and for controlled interventions or management. For interpretivist, it is of interest as it serves to de-familiarize the familiar, offering novel insights and establishing previously unseen relationships across a particular domain. For other interpretivists, it helps to explain particular outcomes by identifying the chain of events and meanings which produced them (DiMaggio (1995), cited in Van Maanen, Sørensen, and Mitchell, 2007, p. 1147). When it comes to construction research, this approach should be particularly appealing. We know that management and technological fixes don't always work the way they are intended. We also know that they work better in some instances than in others. What we don't know is why. Intepretivist studies of processes – be it studies of actual project team dynamics or procurement or innovation – promise to complement more idealized formal models, to the benefit of practitioners as well as academics.

That said, theoretically informed research is hard work. It demands a degree of intellectual rigor and epistemological discipline as well as a break with common sense which the time frame and aims of consultancy and industry and policy reporting tend to preclude. In closing, I would like to underline two precepts which are essential for realizing the promise of social theory.

PRECEPTS FOR USING THEORY

Methodological fit

The first precept concerns the importance of ''methodological fit. The term refers to the fit between theory and method or type of data; it is one of the many criteria which journal editors and referees evoke in their evaluation of paper submissions (Edmondson and McManus, 2007). The problem of the relation between theory and observation has already been raised. While positivists posit a radical separation theory and data, philosophers and practicing social scientists increasingly recognise the role of theory in the construction of data. This acknowledgement of the infusion of theory into data and data into theory in most research does not, however, remove the need to manage the fit between the two. To the contrary, it makes it far more important.

A common flaw in much social research is the misalignment between theory and method. Different theories require and support different methods (which produce different types of data). Very generally, positivists tend to privilege quantitative data, which may be produced through surveys or experiments, while interpretivists rely on interviews, focus groups, participant observation and a variety of types of documents and other visual and written traces.

But the issue of method and data does not end with the choice of data collection method. Other decisions include the choice of measures, sampling, the level and unit of analysis and the type of concepts or constructs adopted. Thus, in Reichstein *et al*'s article, their positivist, quantitative research design called for the analysis of sector level trends (unit of analysis). This in turn depended on an empirical data set with representative quantitative data on attitudes to innovation across a number of different sectors. One of the main flaws in much construction research is the application of statistical methods and techniques to very small data sets (often made even smaller by their *a priori* division into pre-specified sub-populations of firms or types of firms). Reichstein *et al* could conduct their study because they had access to an existing, large multi-sector national statistical survey. In contrast, Harty's interpetivist study called for real time analysis of informal networks. The research relied on a variety of types of data, including participant observation extending over a full year. Moreover, as the research unfolded, new and additional sources of data were sought.

Concept clarity

Like methodological fit, concept clarity is another criteria which reviewers and journal editors often evoke in evaluating a paper submission (Suddaby 2010). As should be evident by now, the specification of concepts is the core activity of both theory development and data collection. All theories are made up of concepts; just as data, by definition, is produced and organized in categories (other concepts). A key challenge in all empirical research is establishing the relation between relatively more general and abstract theoretical concepts and relatively more concrete, data concepts. In positivist research, the problem is how to translate the more abstract concepts in a hypothesis into operational or observational terms. In interpretive research, it involves an iterative process of continually adjusting theoretical and empirical concepts to achieve a ‘fit’. One of the main contrasts between science or academic research on the one hand and everyday knowledge is the clarity of scientific concepts. Stated more strongly, the ‘added value’ of theory depends on a very rigorous use of concepts across the entire research project. The more ambiguity, the less chance there is of discovering something new.

For Reichstein *et al*, the use of an existing secondary data base posed a particular problem. Their task was to link their theoretical problem, including the concept of ‘the construction sector’ and six sector level characteristics which their theory suggested impacted on levels of innovation, with specific survey questions contained in the Eurostat study. As the authors noted, the national level innovation survey which they used did not have a specific category for ‘construction’. Thus, the authors had to construct one by combining existing categories. Concept clarity depends both on using terms consistently and providing clear explanations of why a particular empirical index captures the more abstract concept it is designed to measure. In addition, the questions in the survey had been designed to study innovation in manufacturing and were not directly suited to a study of the construction sector. To address these issues, they decided to compare construction to service sector firms as well as manufacturing firms, on the grounds that aspects of construction work was closer to service work. As anyone who has taken statistics knows, the choice of variables and indices is never given by the topic, but instead must be justified by clear explanation as to why those factors are presumed to be relevant. Stated differently, they require a theoretical rationale.

In the case of Harty’s paper, the challenge for each was to move from general theoretical concepts such as actor networks to empirical analysis and back to a theoretical elaboration of their initial constructs. Much of the strength of Harty’s analysis depends on a very clear and consistent use of the concept of ‘bounded innovation’. Too narrow a definition would exclude processes and associations essential to understand the impact of a new ICT on everyday practice; too general a definition would bring in too many different types of processes, thereby opening the way for an inconsistent use of the term (appealing to different meanings at different moments in the research and undermining the explanatory value of the new concept.

While the call to focus on concept clarity and on the ‘fit’ between theoretical or abstract concepts and empirical concepts seems quite straightforward, the challenge is significant. Most research draws on concepts which have meaning in everyday vocabulary. Terms such as procurement and project team dynamics and innovation make intuitive sense to most construction researchers and to the construction professionals and other stakeholders who they study. As such it's easy to slip back into common sense understandings, thereby introducing a range of implicit, unexamined meanings. While this is acceptable in consultancy work and industry and policy reports, it is at odds with the specificity of scientific or academic research. The problem is twofold: first there's the need for clear, examined definitions of each concept, as well as on the relation between them – at the level of theory, at the level of data collection and in the translation between them. Secondly, there's an issue of consistency throughout the study.

CONCLUSION

In closing, let me repeat the main argument, namely that theory is one of the things that distinguishes academic research and science from other types of research and that the 'added intellectual value' of theory lies in its ability to move beyond common sense understandings to the discovery of new and original ideas. For academics, the systematic, rigorous use of theory – with attention to methodological fit and concept clarity – is increasingly taken as a measure of good science or good academic work. For our industry and policy partners, it is the tool and skills which allow us to think outside of the box and to propose innovative perspectives and solutions to practical problems. However, to get the most out of theory, it is essential to use theoretical concepts rigorously, making sure that there is a fit between theory and every step of the research process (methodological fit) and being vigilant about concept clarity and consistency in the use of terms.

ACKNOWLEDGEMENTS

I'd like to thank the PhD students in the Post Graduate Theory Workshop at the School of Construction Management and Engineering at the University of Reading for their constructive comments and discussion. I'd also like to thank my father, Silvan S. Schweber for getting the physics right and for insisting on the broader context of this presentation.

REFERENCES

Briefing. (October 19, 2013). Unreliable research: Trouble at the lab. The Economist.

Bryman, A., and Bell, E. (2003). Business Research Methods. Oxford: Oxford University Press.

Collins, H. M. (1985). Changing Order: Replication and Induction in Scientific Practice. Chicago: University of Chicago Press.

Edmondson, A. C., and McManus, S. E. (2007). Methodological Fit in Management Field Research. Academy o f Management Review, 324, 1155-1179.

Harty, C. (2008). Implementing innovation in construction: contexts, relative boundedness and actor-network theory. Construction Management and Economics 26, 1029-1041.

Hollis, M. (1994). The philosophy of social science. Cambridge: University of Cambridge Press.

Keat, R., and Urry, J. (1982). Social Theory as Science. London: Routledge and Kegan Paul.

Neumann, W. L. (2006). Social Research Methods, sixth edition. Boston, MA: Pearson International Edition.

Outhwaite, W. (2000). The Philosophy of Social Science. In B. S. Turner (Ed.), The Blackwell Companion to Social Theory (pp. 47-70). Oxford: Blackwell Publishers.

Reichstein, T., Salter, A. J., and Gann, D. M. (2005). Last among equals: a comparison of innovation in construction, services and manufacturinng in the UK. 23, 631-644.

Suddaby , R. (2010). Construct Clarity in Theories of Management and Organization. Academy o f Management Review, 36(3), 346-357.

Van Maanen, J., Sørensen, J. B., and Mitchell, T. R. (2007). The Interplay between Theory and Method. Academy o f Management Review, 32(4), 1145-1154.

Winch, P. (1958). The Idea of a Social Science and its Relation to Philosophy. New York: Routledge.

NEW DEVELOPMENTS AND FUTURE DIRECTIONS IN THE BUILT ENVIRONMENT FIELD

Professor Chimay J. Anumba[1]

Department of Architectural Engineering, The Pennsylvania State University, University Park PA 16802

The context for research in the built environment is changing in line with technological developments, changing industry needs, and global challenges. For example, the move towards more integrated and collaborative project delivery methods has accentuated the need for new research on the social aspects of construction, and increased interest in technologies such as building information models (BIM) that support distributed construction project teams. The global energy crisis has necessitated a greater focus on energy efficiency in buildings and greener construction, which has introduced new challenges for built environment researchers. There is also growing concern about the state of civil infrastructure in many countries and the lack of dependency information between different sub-systems, which is critical when failures based on natural or man-made hazards occur. The increasing pressure on improving healthcare provision in both developed and developing countries has also led to new research needs at the intersection of the healthcare delivery process and the so-called 'environment of care' (i.e. the healthcare facilities). In parallel with the above, information and communication technologies have continued to advance in ways that enable the issues emanating from these trends and challenges to be addressed more effectively. Drawing on examples from ongoing research projects, this lecture will discuss recent developments in built environment research and potential future directions that are needed to tackle these new challenges and opportunities. Particular emphasis will be placed on research in construction informatics.

Keywords: building information models, energy efficiency, healthcare facilities, integrated and collaborative project delivery, technological developments.

[1] anumba@engr.psu.edu

Anumba, C.J. (2014) New developments and future directions in the built environment field *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 41-41.

USE AND IMPLICATIONS OF BUILDING INFORMATION MODELLING IN CONSTRUCTION PROCUREMENT AND INTEGRATED PROJECT DELIVERY

Mr Alex Lubbock[1]
[1] *Carillion Plc, 25 Maddox Street, London, W1S 2QN*

The UK Government Construction Strategy has set the UK drive to be best in class as a procurer and in integrated project delivery and proposes Building Information Modelling as one of the cornerstones to the achievement of this goal. Building Information Modelling or BIM is a technology enabled process of collaboration across the full project lifecycle driven by people. Hence, integrated project delivery theory and procurement approach is intrinsic to the achievement of the UK's goals. Although this paper does not invest time in the theory of Integrated Project Delivery and is written in the practical context of an operator in the UK Contracting Industry, it is worth noting the benefits to Integrated Project Delivery that BIM enables and the importance of the procurement approach at inception of a project in relation to an asset.

Keywords: asset management, building information modelling, COBie, procurement culture, digital procurement, integrated project delivery, project lifecycle, transparency

INTRODUCTION

Construction Procurement and the use of Digital have accelerated in the UK due to a strategic focused direction from the UK Government cabinet office. The key drivers for change are articulated within the UK Government Construction Strategy (2011) and the Construction 2025, both written in conjunction with the Cabinet Office.

This paper looks at the implementation of that change and the impacts this has had on procurement across the UK Construction Industry. There are worldwide moves towards digital involvement in construction in some part to emulate the benefits the automotive and manufacturing have seen from this. This paper discusses the strategic approach and highlights the opportunity to learn from the challenges the UK are currently facing in meeting the challenge of these strategies and in particular the implementation of BIM geared towards Integrated Project Delivery. The paper articulates examples and challenges at an industry, corporation and individual level.

The paper relates to works around digital procurement and integrated project delivery because of the broad impact upon the project lifecycle and all tiers of the supply chain that BIM has. The paper seeks to focus in on particular exchanges between client and

[1] alex.lubbock@carillionplc.com

Lubbock, A. (2014) Use and implications of building information modelling in construction procurement and integrated project delivery *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 43-49.

contractor, contractor and supply chain and the opportunity created in integrated project delivery as well as understanding the micro effect on the individual.

EMPIRICAL EVIDENCE OF THE IMPORTANCE OF CONSTRUCTION PROCUREMENT DECISIONS

In 2010 the Chartered Institute of Building (CIOB) produced a report exploring procurement in the construction industry. Of the five hundred and twenty five respondents to the survey, 87% of respondents believed good procurement was synonymous with a successful project and 77% of respondents believed clients do not have a sufficient understanding of construction industry procurement.

93% of the respondents had been involved on projects that had overrun on costs. Of those, 56% cited that the procurement method directly contributed to the project overrunning in terms of cost. 94% had been involved on projects that went over their allocated time frame; 49% of that figure believed that the procurement method directly contributed to the time overruns.

The CIOB suggests partnering is the “most efficient way of undertaking all kinds of construction work including new buildings and infrastructure, alterations, refurbishment and maintenance".

PROCUREMENT STYLES

The CIOB research results also suggest that despite the recommendations and guidance from previous UK Government Reports including 'Constructing the Team' Sir Michael Latham (1994) , 'The Levene Efficiency Scrutiny into Construction Procurement by Government' (1995), 'Rethinking Construction' Sir John Egan (1998), Efficiency in Civil Government Procurement, The Gershon Report (1999), Modernising Construction, The National Audit Office (2001) lessons have not been learnt in regards to procurement approaches.

The UK Government Construction Strategy 2011 echo's this view, particularly in regards to public sector procurement strategies and proposed reform in the following areas in 2011:

1. Overcome the lack of integration in the industry (Project Lifecycle Approach)

2. Increase standardisation and repetition in the product (Consistency and Pipeline Visibility)

3. Increased efficiency in the process of procurement (Right first time delivery)

The Strategic Objectives to reach the goals of the reform were (2011):

- Governance and Client Skills Improvement
- Structures Challenge from HM Treasury and the Cabinet Office
- Value for Money, Standards and Cost Benchmarking
- Efficiency and Elimination of Waste
- Building Information Modelling (BIM)
- Alignment of Design and Construction with Asset and Lifecycle Management

- Supplier Relationship Management
- Competition and Reducing Duplication
- New Procurement Models
- Client Relationship Management
- Implementation of Existing and Emerging Government Policy in relation to Sustainability and Carbon

Trial Projects were proposed to test propositions set out in this strategy, including the phased introduction of Building Information Modelling; with a view to testing practice which can, if successful, be rolled out across Government.

SOUTH AFRICAN PROCUREMENT VALUES AND STRATEGY

Five Pillars, similar values as in the UK ultimately:

- Value for Money
- Open and Effective Competition
- Ethics and Fair Dealing
- Accountability and Reporting
- Equity

Structure in place:

- Standards Act 2008
- SABS (South African Bureau of Standards)
- Electronic Communication and Transactions Act 2002
- International Standards adoptable
- Risk: Broadband penetration - Common Data Environments hosted in the cloud

BIM STRATEGY THEN AND NOW

The UK Government Construction Strategy (2011) description of the impact of BIM within the overall strategy was limited to optioneering; co-ordination, design for manufacture and assembly and a basis for asset management. However, they did propose the staged move towards the 2016 legislative demands for BIM on all public sector procurement and articulating BIM to an industry soon became a requirement to support meeting the other objectives also.

In 2013 Cabinet Office also produced the 'Construction 2025 document setting targets for the industry such as 33% lower costs, 50% faster delivery, 50% lower emissions, 50% improvements in exports. The basis for the targets was a clear vision to achieve the following in its procurement practices and as a result enable the UK to exploit the global market:

- PEOPLE - An industry that is known for its talented and diverse workforce
- SMART - An industry that is efficient and technologically advanced

- SUSTAINABLE - An industry that leads the world in low-carbon and green construction exports
- GROWTH - An industry that drives growth across the entire economy
- LEADERSHIP - An industry with clear leadership from a Construction Leadership Council

SO WHERE ARE WE NOW? THE IMPACT

Educating the Procurer - BIM

- The Customer / Client Expectations
- The Contractor and Consultants
- The Supply Chain

BIM Culture

All stakeholders are adapting their mind set to collaboration and transparency in procurement.

- Collaborative mind-set
- Investment in up front Resource
- Operational uncertainty
- Fear of change

Contract

- Forms of contract
- NEC
- Appointments
- Stepping Down to Suppliers
- Project Insurance
- Project Bank Accounts

What does BIM do for procurers of Construction Work?

- Communication of asset
- Reduction in priced wastage (estimating)
- Increased collaboration
- Time efficiencies
- Increased Right first time delivery
- Reduction in Risk Realisation

- Effective Operation

How has it changed the way things have been done traditionally?

- Simply added a new dimension as a layer of opportunity
- Reduction in Risk in design and construction phase
- Increased right first time delivery

STAGES OF IMPACT ACROSS THE PROJECT LIFECYCLE

Concept Stage

- Visualisation
- Concept Modelling
- Laser Scanning of existing
- Photogrammetry

Design

- Visualisation
- Design Co-ordination in 3D
- Laser Scan integration
- Programme simulation
- Consultant Appointments
- Specialist Sub-contract Appointments

Calculation of Price

- Dynamic Cost Planning
- Optioneering

Tendering

- Quality of Documentation
- Common Data Environments
- 3D Visualisations
- Data Transfer
- Client Requirements

Construction

- Project Management
- Operational Delivery
- Design Management
- Planning and Programming
- Commercial
- Inductions / Project Communications

Asset Management

- E-Maintenance, repair and operation procurement
- Asset Verification
- Space Planning

Further Procurement Opportunities

- Additional layer of opportunity
- Auditable decision making
- Embedded soft landing media
- E-MRO+C+S
- E-Market Site

POTENTIAL AREAS OF RESEARCH

- Space Planning and Behaviour
- Procurement practices
- Facilities Management Professional Indemnity
- Big data translation into key metrics e.g. Tesco Club card
- Transactional relationships between stakeholders
- Dark Processes - silo working in desperate fashion

CONCLUSIONS

BIM has already changed the UK Construction procurement landscape and in the design and construction stages this is no longer a differentiator as to whether it is done or not by main contractors, consultants and specialist sub-contractors and quality is now assessed and must increase to meet the strategic challenges the UK government have laid out. This is still a differentiator in the facilities management and services environments and as such the industry is yet to truly harness the engagement of specialists in the operation of assets to inform the design process and help structure the operation to the optimum of whole life cost and sustainability.

What must be understood in the operations stage of the asset is procurement of capability to estate managed not just meeting a key performance indicator or a service level agreement. When you collect and maintain data for the asset, this data must be used to inform intelligent decision making about the asset(s). This should incorporate space planning and behavioural data as well as maintenance, repair and operation data to truly inform the process, hence the government soft landing objectives. Once we can harness the data and interpret this to inform intelligently we can truly move towards the e-market site potential of the industry.

BIBLIOGRAPHY

https://www.gov.uk/government/publications/government-digital-strategy/government-digital-strategy

http://www.arcom.ac.uk/res-journals.php

'Constructing the Team' Sir Michael Latham (1994)

'The Levene Efficiency Scrutiny into Construction Procurement by Government' (1995)

'Rethinking Construction' Sir John Egan (1998),

Efficiency in Civil Government Procurement, The Gershon Report (1999),

Modernising Construction, The National Audit Office (2001)

CIOB Report Exploring Procurement in the Construction Industry (2010)

http://www.treasury.gov.za/legislation/pfma/supplychain/General%20Procurement%20Guidelines.pdf

http://www.thedti.gov.za/economic_empowerment/bee_veri.jsp

ADAPTING THE BUILT ENVIRONMENT TO CLIMATE CHANGE IN A POST-SUSTAINABLE WORLD

Professor Chrisna du Plessis[1]
Department of Construction Economics, University of Pretoria, South Africa

It is just over twenty years since the Earth Summit in Rio that formally introduced the concept of sustainable development to the world, and fifteen years since the first conference on sustainable construction was held in Vancouver. Since then a number of things have changed, some fairly dramatically. The first is that the reality of climate change and rapidly declining ecosystem services is shifting the goals of society from those of sustainable development to those of survival and reconstruction, with increasing emphasis on building resilience and adaptive capacity into our systems. The second is that while green building has become mainstream, there is a growing realisation that going green is not enough. The third change is a gradual societal shift towards a whole systems/ ecological worldview with its emphasis on relationship and uncertainty. Together these changes are not only moving us into a post-sustainable world where the as yet uncertain rules of sustainable construction are changing again, but they are also requiring us to reconsider the educational methods and curricula of the built environment professions, and to rethink what we see as the major research questions of the 21st century. This presentation explores these larger systemic changes and their implications for built environment education and research.

Keywords: climate change, sustainable development, sustainability

CHANGE 1 – CLIMATE CHANGE IS A REALITY

At the time of writing the Intergovernmental Panel on Climate Change (IPCC) is in the final stages of its Fifth Assessment Report. The report of Working Group 1 that discusses the Physical Science Basis has already been published and the message is clear: “Warming of the climate system is unequivocal, and since the 1950’s, many of the observed changes are unprecedented over decades to millennia” (IPCC, 2013:2). Changes already visible are more frequent heat waves, increased frequency and intensity of rainfall and flooding events, increased average temperatures, increases in intense tropical cyclone activity, rising sea levels and changes in the salinity and acidity of the ocean; and loss of both glacier and polar sea ice. The report further points out that the changes are directly related to human influence and that “most aspects of climate change will persist for many centuries even if emissions of CO2 are stopped” (ibid.: 25). Depending on the emissions pathways we follow, the report predicts that by the end of the century the global average surface temperature will be between 0.3°C and 4.8°C warmer than the average for the period 1986-2005. To achieve the lower (0.3-1.7°C) increase in temperature, it is estimated that the combined CO2 equivalent concentrations in the atmosphere should be kept below

[1] chrisna.duplessis@up.ac.za

DuPlesis, C. (2014) Adapting the built environment to climate change in a post-sustainable world *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 51-54.

475ppm. However, our current CO2 equivalent concentrations already stand at 478ppm (MIT, 2013). This means that we will have to not only reduce emissions, but also substantially reduce greenhouse gasses already in the atmosphere.

The realities of climate change are forcing us to think differently about the current assumptions underlying the design and development of the built environment. Shifting climatic conditions such as temperature and storm strength will make many buildings designed according to current climatic parameters vulnerable, if not obsolete, while rising sea levels and increased flooding risk will result in large scale damages to and losses of infrastructure. While there are numerous models that attempt to predict the probability of conditions under various scenarios, the fact is that historical data on temperature and climate has become irrelevant and there is no way to predict accurately what the future holds. The focus is therefore on shifting towards building adaptive capacity into both social and technological systems so that they can adapt to unknown future conditions.

CHANGE 2 – GOING GREEN IS NOT ENOUGH

KPMG found in a 2009 global survey of the construction industry that being green is no longer seen as a competitive advantage, but as becoming a minimum entry requirement to the market, especially for high-end commercial and government buildings. A year before, 70% of senior construction executives still thought of green as providing such a competitive advantage. However, green building only addresses the issues of resource efficiency, while what climate change and environmental degradation requires from us is a regenerative approach. We need to move beyond green and even beyond sustainability to where our actions have a positive impact. Instead of doing a bad thing less bad, we need to create a built environment that helps to regenerate critical environmental systems and allow us to heal our global social-ecological system.

CHANGE 3 – SHIFTING WORLDVIEWS

As Einstein famously said: “One cannot solve a problem from within the consciousness that created the problem”. There is a growing argument that the currently dominant mechanistic worldview, while having been very successful in improving living conditions for many, is not able to deal with the complexities of the problems that is a result of its success. We need to shift to a worldview that is more relevant to the complex living systems of which we form part. Such a worldview has been gaining ground during the past century based on findings in the fields of quantum physics, ecology and even neurobiology (Du Plessis, 2012). Variously described as an ecological or living/whole system worldview, the key characteristics of this worldview is an emphasis on seeing the world as comprising of interconnected and interdependent nested systems that exist in complex and dynamic relationships. The dynamic nature of the world also leads to unpredictable change, requiring a precautionary and adaptive approach that draws on many knowledge sources to find solutions to wicked problems.

This worldview is shifting the sustainability discourse from triple bottom lines and rating systems to whole systems thinking; from reducing negative impact and ecological footprints to increasing positive impact; from resisting change to embracing and adapting to change; and from problem-based to possibility thinking.

TEACHING FOR A CHANGING ENVIRONMENT

To prepare the next generation of built environment practitioners for a post-sustainable world requires that our educational curricula and methods take into account new ways of thinking, new ways of doing, new skills and capabilities, and new subject areas.

New ways of thinking include systems thinking, options thinking, as well as different interpretations of concepts such as value and performance. New ways of working include more collaborative working in integrated design processes, and an emphasis on regenerative design and development. This will require skills that go beyond the standard professional skills, such as facilitation, communication, social entrepreneurship, and knowledge management. Curricula also need to be adjusted to include new subjects such systems modelling, ecological thinking and the role of the built environment professional as social change agent.

RESEARCH FIELDS

The first major change for research practice is the switch to not only inter-disciplinary, but transdisciplinary research methodologies that are problem focused and require not only working across disciplines but also with clients, suppliers and stakeholders as co-producers of knowledge. There are three major areas in which knowledge need to be developed. The first is in a number of new fields and their relationship to the built environment and design and construction practices. These include the ecology of social-ecological systems, systems modelling, climate adaptation strategies, management of resilience and human behaviour and ethics. The second knowledge area regards changing roles and responsibilities of the stakeholders and members of the development team. There are many questions regarding the implications of a more integrated way of working that has to take into consideration the creation of a built environment with a net positive footprint for design; new procurement processes, contracts and fee structures; as well as changing project management requirements and client relationships. The third area lies in new ways of doing brought about by integrated design and development work processes, and new kinds of activities that need to be performed such as assessing adaptive capacity and mapping systemic change so as to be able to respond faster and in an appropriate manner.

CONCLUSION

This post-sustainable world is shifting the discourses of sustainability and practices of design and construction in new directions. To enable the professionals of the future to deal with this new operating environment, we need to change what we teach and how we teach, understanding that transformed education in construction is as much about new ways of thinking about the world as it is about new ways of doing like integrated design and delivery. And to help us find our way through all these changes, we need research questions that help us understand what this means for how we work and behave, and research methods that combine scientific knowledge with the experience of practitioners and which include clients, suppliers and stakeholders in the innovation process.

REFERENCES

Du Plessis, C. 2012. Towards a Regenerative Paradigm for the Built Environment. *Building Research and Information*, 40(1),7-22.

IPCC (Intergovernmental Panel on Climate Change) (2013) *Climate Change 2013. The Physical Science Basis. Summary for Policymakers. Working Group 1 contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Available online at www.climatechange2013.org Accessed 05/12/2013.

KPMG (2009) *Global Construction Survey 2009 – Navigating the Storm*. Available online at http://www.kpmg.com Accessed 20/01/2014.

MIT (Massachusetts Institute of Technology) (2013). 400 ppm CO2? Add Other GHGs, and it's equivalent to 478 ppm. *Oceans at MIT,* 06 June 2013. Available online at http://oceans.mit.edu\featured-stories/5-questions-mits-ron-prinn-400-ppm-threshold. Accessed: 20/01/2014.

SECTION 2: CONFERENCE PAPERS

A CASE STUDY OF LABOUR INTENSIVE CONSTRUCTION IN SOUTH AFRICA: AN EXPLORATORY STUDY

Fidelis Emuze[1] and Leo Sorensen[2]

1 Department of Built Environment, Central University of Technology, Free State, Bloemfontein, South Africa

2 Department of Construction Management, Nelson Mandela Metropolitan University, Port Elizabeth, South Africa

Labour intensive construction is usually advocated whenever employment creation through infrastructure project delivery is a key project consideration. However, in spite of such goals, the literature suggests that general contractors (GCs) prefer the use of equipment in order to avert poor performance that may eventuate in such projects. This study was conducted in order to confirm or refute the reasons why contractors prefer to use equipment intensive as opposed to labour intensive construction methods despite the socio-economic gains of doing so in the context of the South Africa society. A qualitative study was conducted with the use of a questionnaire for primary data collection. Open- and close-ended questions were asked through the use of the questionnaire. The questionnaire was distributed among workers in a construction firm. At the time of the study, the firm was handling two labour intensive construction projects. The findings from the case study were clarified through the results from a survey conducted among GCs known to have undertaken similar labour intensive construction projects. The findings suggest that the respondents indicate that rework, non-conformances and time overruns occur in labour intensive construction. It was also observed that project implementation is less efficient due to lack of required skills among artisans. In other words, it can be argued that there appears to be a major scope for improvement in labour intensive projects.

Keywords: labour intensive construction, South Africa

INTRODUCTION

Labour intensive construction methods can be identified in projects where the majority of works completed were done through the use of manual labour rather than plant and equipment (Thwala, 2006). It involves developing programmes to ensure that such methods are carried out effectively and efficiently when undertaking construction activities so that the quality and cost of a project is not affected negatively (McCutcheon, 2006). The idea of maximising labour use in construction indicates that developmental goals (such as job creation) are inclusive in the project parameters. Labour intensive projects thus involve the use of minimal equipment to achieve optimum performance in terms of client satisfaction, cost, quality and other

[1] femuze@cut.ac.za

Emuze, F. and Sorenson, L. (2014) A Case Study of Labour Intensive Construction in South Africa: An Exploratory Study *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 57-65.

considerations (Ngebulana, 2006). The use of extensive labour should not however form the basis for poor quality and insignificant value (McCutcheon, 2008).

Base on the description by various authors, it can be assumed that the use of labour intensive construction methods should not compromise the achievement of key milestones in a project. The use of labour intensive methods have been argued not to be an excuse for poor performance recorded on projects in terms of cost and time overruns as well as poor quality. However, anecdotal evidences (personal accounts of events) suggest that general contractors (GCs) prefer the use of suitable equipment for most construction processes instead of labour because of the perception that benefits of labour intensive construction methods are not apparent to GCs; slower completion of construction tasks and in worse cases, time overruns occur on such projects, and non-conformances in the form of rework and defects tend to be higher in such projects.

As a result, the aim of this study was centred on the need to understand the reasons why GCs prefer to use equipment instead of labour intensive construction methods even when developmental goals are desirable in a particular project context. The study also sought responses questions that would ascertain if skilled artisans contribute positively to labour intensive construction projects; and whether employee involved in such projects were adequately trained in the use of labour intensive methods.

REVIEW OF THE RELATED LITERATURE

There have been several labour intensive programmes in various parts of Africa in countries such as Kenya, Botswana, Ghana, Malawi, and Mozambique. All these projects were in aid of addressing unemployment and alleviating poverty. These projects involved governments implementing rural development programmes (McCutcheon, 2003). These involved a wide range of labour intensive methods, especially in the road construction sector. According to the literature, these projects conceived as were emergency relief projects that were eventually implemented properly, despite the minimal use of plant and equipment. Specifically, the Kenyan Rural Access Roads programme project of1974 used labour intensive construction methods for a long term project and the government kept the project funded from start until completion. This made the project one of the most successful and best organised labour road construction programmes in the region (McCutcheon, 2008). The success factors connected to Kenyan project showed that an understanding of the various labour intensive construction methods. The fact that the projects were planned properly instead of following an ad hoc approach contributed to the success story (McCutcheon, 2008).

In South Africa, a measure of success has been recorded too as evident in the work of Musekene (2010). The Gundo Lashu programme in the Limpopo province showed some positive results; the programme achieved higher employment rate in than the target rate that was set at the beginning of the project. This achievement benefitted the unskilled and poor people, namely women and the youth. In another community based project (Mashiri, Thevadasan and Zukulu, 2005); it was revealed that the project had major socio-economic benefits in the community. The findings suggested that an improved quality of life was experienced at different levels of the community. The Zibambele Road Maintenance system in the KwaZulu- Natal province of South Africa was also one of the successful government programmes that sought to alleviate unemployment in communities through the use of labour intensive construction methods. The programme insisted on a household, mainly women headed, who were assigned a portion of rural road to maintain. The success resulting from this programme seems to stem from the fact that a long term plan was developed. Another positive factor was a close collaboration between all parties involved. This was vital to the success of the programme and resulted in an effective maintenance of the infrastructure. The other major factor was the availability of resources and then, the training of the household, which involved regular inspections and assistance where necessary (Strebel, 2004).

The findings from the programmes seem to suggest that through proper planning and support from government, there is a good chance that such projects can work. But, it will depend on how serious and committed the government are to service delivery. Understanding the importance of supervision for the projects can be a major factor in project success, especially when it comes to achieving quality and ensuring no additional cost overrun occurs on such projects. It is vital to understand that subcontractors will have their own labour force, which means management must communicate the importance of supervision to their own staff. If audits can be carried out on site by inspectors it will ensure that the labour force maintains an attitude of awareness of the seriousness of high standard of work that should be conducted on labour intensive construction projects (Kazaz, 2008).

However, failures in labour intensive projects have been noted in the literature (Ngebulana, 2006). For example, a study was conducted on municipal projects that involved bulk water infrastructure. The study found out that projects that were run on a ‘project to project’ basis instead of a ‘phase approach’ did not succeed. Within the project there was also a lack of sufficient transfer of information during the different phases of the projects. There were significant interferences with regards to production, as absenteeism and constant rotation of labour teams dominated the execution phase. Another example can be taken from Botswana.

The Botswana study was undertaken by Muatjetjeja (2006) who evaluated several roads development programmes. It was observed that in some projects where labour intensive methods were used, it could have been more effective if serious thoughts were put into planning, design, training of supervisory staff and the introduction of properly organised systems. The lack of continuity of projects for emerging contractors who participate in such projects is also a concern because if projects could be planned in succession to each other, then valuable experience could be gained (Lachman, 2006).

Labour intensive construction projects can also lead to additional costs. This obviously is normally an immediate negative occurrence among most construction professionals and clients. The extra costs are likely to arise on site where administration is involved. It is not unusual to understand the concept that managing people is not an easy task in a multicultural environment. In other sub-Saharan African projects mentioned by Thwala (2006), some of the problems that exist include the balance between centralisation and effective involvement of local administrations that lacked proper structures. This impacts the ability to make crucial programme, planning and implementation decisions. Thwala (2006) also observed that some programmes lacked proper political commitment from government authorities and by so doing, they lacked required financial backing.

METHODOLOGY

The research method chosen for this exploratory study was qualitative in nature. The qualitative technique used semi-structured instrument for data collection. The qualitative research as the name suggests is based on non-quantitative method and assumption in the form of a case study (Springer, 2007). A case study involves the collection of data through observation, interviews and documents. It involves recording details about the context surrounding the case in terms of information about the physical environment, historical and economic factors (Leedy and Ormrod, 2009). The information obtained in case studies are thus not intended for generalisation. However, the case study findings were supplemented with findings related to a survey conducted among civil engineering GCs involved in labour intensive projects. A survey is a technique for collecting information by questioning individuals who were the object of the research and who belong to a representative sample, through a standardised questioning procedure, with the aim of studying the relationship among variables that were under investigation (Corbetta, 2003).

For both the case study and survey, a purposive sampling method was used. Purposive sampling is a procedure in which the research samples whoever he or she believes to be representative of a given population (Springer, 2010). For the survey, the sample size was fifty (50) GCs. Out of this number only eleven (11) responded, which equate to a 22% response rate. The case study was for a project undertaken by LS Plant Hire and Civil contractors (the name of the original firm is not used for confidentiality reasons). The project was an Expanded Public Works Programme (EPWP) project that incorporated labour intensive construction methods. The project was undertaken in Green Valley, Wittedrift (a small settlement close to Plettenberg Bay). It involved two contracts: the repair and reconstruction of houses and the upgrading of a civil infrastructure.

On the project where house damages occurred, the scope of work varied from demolition of complete houses to replacing windows in houses. The damages to be rectified in the project were as a result of heavy rainfalls. Demolished houses were reconstructed and in general, replacement of doors, windows, floor screeds, ceilings and the painting of houses were the main scope of the works. On the upgrading of civil infrastructure, works consisted of excavations, sub base, base course, kerbing, paving, channels and a complete storm water system including catch grids, kerb inlets and wingwall outlets. The GC can be considered to be a small and medium size (SME) contractor. Ten employees of the GC were approached to be interviewed with the semi structured instrument. However, only five of them agreed to participate in the study. The five interviews were then carried out with the employees of the GC that were designated as site manager (2), foreman (2) and supervisor (1).

FINDINGS AND DISCUSSION

Concerning demographic information, the respondents confirm that their organisation has been involved with the construction of infrastructure projects for more than 15 years. The types of infrastructure projects that the GC has undertaken in the past include transport (roads), water (storm water) and other non-residential construction projects. Four of the respondents also confirmed their involvement in EPWP programmes. They noted that labour intensive construction methods were adequately utilised in the EPWP projects that they have undertaken in the past.

When asked if rework and non-conformances occur during the implementation of such projects, the respondents rated the frequency of occurrence from sometime to often and / or always. Given that the GC is deemed to be involved in EPWP related projects, information related to training in how to make proper use of labour intensive methods were elicited from the respondents. It is notable that 4 of the respondents opined that construction managers and site agents were always trained in how to make use of labour intensive construction methods. However, the 4 respondents were of the opinion that the number of foremen, supervisors, and general workers that have undertaken training related to labour intensive methods is smaller when compared to site management. This perhaps explains why the implementation of labour intensive methods is vulnerable to poor performance.

The findings indicate that two of respondents perceive poor workmanship as the major reason for the frequency of rework and non-conformances on labour intensive projects. In particular, three of the respondents were of the opinion that poor site management, damages during construction, setting out errors and inadequate supervision affect the frequency of rework and non-conformances to a minor extent. This statistics indicate that the five respondents were not entirely in agreement about the impact that rework and non-conformances have on labour intensive construction projects.

In addition, the respondents perceive that labour intensive construction methods impact project performance, albeit at varying degrees. It is notable that time was rated first among the project parameters that could be impacted by labour intensive construction methods. In particular, three respondents were of the opinion that labour intensive construction methods have major impact on timely delivery of projects; two of them perceive that it has a major impact on site productivity; and three perceive that it has a near major impact on client satisfaction. Because the literature reviewed mentioned that the skills of construction workers can influence the frequency of rework and non-conformance that occurs in construction, the respondents were requested to indicate if the implementation of training programmes for unskilled / semi-skilled workers can alleviate the quality related problems.

It is notable that the five respondents perceived that training unskilled and semi-skilled workers can reduce rework and / or non-conformances significantly. The respondents however have different perceptions about efficiency levels when labour intensive projects are compared with equipment intensive projects. For instance, one of the respondents contends that it is very inefficient, while two of them merely said it is efficient. Nevertheless, the respondents were asked ‘what do they perceive to constitute the causes of low work rate among general workers that are involved in labour intensive construction projects.’ In response to this question, it was observed that the response of the respondents in terms of ‘lack of knowledge / skills and the inability to carry out assignment’ among general workers was unanimous. Even four respondents were of the opinion that lack of motivation is a factor, while three of them mentioned the contributions of fatigue.

Due to a number of these reasons, the GC seems to be experiencing time overruns on its construction projects according to four informants. In most cases the extent of time overrun experienced on a typical project usually exceed four weeks according to them. The time overruns experienced were however linked to the quality of work produced by the skilled artisans in the employ of the GCs. Although none of the respondents consider the skills of these artisans to be excellent, the five respondents however were of the opinion that the skills of artisans working in the firm range from average to very good.

In fact, three of the respondents agreed or strongly agreed that the lack of skilled artisans can potential have a negative effect on labour intensive construction programmes in the future though they perceive that government insistence on the use of labour intensive construction methods are already reducing the appetite required for tendering for such projects. The respondents were therefore requested to rate factors that could lead to tender apathy concerning labour intensive construction projects.

Table 1 indicates if the under listed problems contribute to tendering apathy in labour intensive related projects. The responses are tabulated in terms of percentage responses ranging from 1 (minor) to 5 (major) and a mean score ranging between 1.00 and 5.00. It is notable that poor quality and poor productivity contributes the most to tendering apathy. In particular, all (100.0 %) of respondents indicate that poor quality contributes the most to tendering apathy, while 66.7% of the respondents also perceive that cost overrun and time overrun contribution could be described as a near major extent.

Table 1 Factors Contributing to tendering apathy in Labour Intensive Projects

Factors	Unsure	Minor………………….………...Major					MS	Rank
		1	2	3	4	5		
Poor quality and defects	0.0	0.0	0.0	0.0	0.0	100.0	5.00	1
Poor productivity	0.0	0.0	0.0	0.0	33.3	66.7	4.67	2
Cost overrun	0.0	0.0	0.0	0.0	66.7	33.3	4.33	3
Time overrun	0.0	0.0	0.0	0.0	66.7	33.3	4.33	4
Poor client satisfaction	0.0	0.0	0.0	66.7	33.3	0.0	3.33	5
Injuries and accidents	0.0	0.0	0.0	66.7	33.3	0.0	3.33	6
Lack of skilled artisans	0.0	33.3	0.0	0.0	33.3	33.3	3.33	7

As mentioned in the previous section, a further survey was conducted with the same instrument among other GCs that have implemented labour intensive construction methods on their projects. Table 2 presents the comparisons between the case study findings and that of the survey. In general, the survey results corroborate the perceptions of the informants of the case study. Even the general comments made by the survey respondents provided additional insight into the discourse. Such comments, inter-alia, include:

• "The more general workers that participate in labour intensive construction, the higher the probability of strikes occurring on such project sites";

• "The implementation of labour intensive construction is not at all understood by municipalities. This relates to a misconception of many areas of the project and its deliverables";

• "People think that because a project is labour intensive, it will be significantly cheaper to implement. This is not true as a properly implemented labour intensive project in the rural areas will usually be more costly than a conventional contractor equivalent";

- "Corruption is a big factor in gaining work on tenders which require labour intensive construction methods to be incorporated", and
- "Labour intensive construction methods are time consuming and expensive to undertake in construction projects."

Table 2 Comparisons between the findings of the case study and survey

Case Study	Quantitative Survey
Two respondents observe that rework and non-conformances sometimes occur	Seven respondents observe that rework and non-conformances sometimes occur
Management employees receive training in labour intensive construction methods	Management employees receive training in labour intensive construction methods
The top factors contributing to rework and non-conformances include poor workmanship, design changes and designer errors	The top factors contributing to rework and non-conformances include poor workmanship, inadequate supervision, and poor information flow
Labour intensive methods impact project time, productivity and quality the most	Labour intensive methods impact project time, productivity, and cost the most
Two interviewees were of the opinion that training of unskilled and semi-skilled workers can reduce rework and non-conformances majorly	Four respondents were of the opinion that training of unskilled and semi-skilled workers can reduce rework and non-conformances majorly
All the interviewees perceive the causes of low work rate among workers to include the Lack of knowledge / skills and inability to perform necessary work	Almost (10) all the respondents perceive the causes of low work rate among workers to include the lack of knowledge / skills and lack of motivation.
Four interviewees have experienced time overruns in labour intensive construction projects	Six respondents have experienced time overruns in labour intensive construction projects
Almost all the interviewees have experienced over 4 weeks of time overrun	Six of the respondents have experienced over 4 weeks of time overrun
Two interviewees strongly opined that the lack of skilled artisans have negative effect on the utilisation of labour intensive construction methods	Three respondents strongly agreed that lack of skilled artisans have negative effect on the utilisation of labour intensive construction methods
The interviewees perceive that under listed problems contribute towards tendering apathy: 1. Poor quality and defects; 2. Poor productivity, and 3. Cost overrun.	The respondents perceive that under listed problems contribute towards tendering apathy: 1. Cost overrun; 2. Time overrun, and 3. Lack of skilled artisans.

The implication of these findings is related to the identified drivers of change in South African construction. Among the twelve (12) drivers of change identified by Rust and Koen (2011), it is notable that environment and energy impact, urbanisation, skills for today and tomorrow, job creation and job quality as well as advances in technology have implications for how well labour intensive construction methods become engendered in the sector. Even regulation and legislation as a driver of change has implications for procurement (tender awards) associated with labour intensive construction projects. Given the reported high rate of unemployment among the youth in South Africa, the use of labour intensive methods in the industry should be improved as it is an avenue for short term employment and skills transfer.

CONCLUDING REMARKS

The exploratory study was centred on the need to understand why GCs prefer to use equipment instead of labour intensive construction methods even when developmental goals are evidently desirable in South Africa. Based on the reviewed literature, a semi-structured instrument was used to interrogate informant working for GCs that are conversant with labour intensive construction projects. The study suggests that labour intensive construction could affect the performance of projects in terms of cost as it could be bedevilled by rework and non-conformances. The study also shows that to some extent, the experience of labour intensive construction is not entirely satisfactory. Taking into account the review of the related literature and the findings presented in this pilot study, certain conclusions can be drawn. These include:

• Rework and non-conformances does occur in labour intensive construction projects;

• There is a need to enhance the training of junior construction workers, especially artisans and general workers involved in labour intensive construction projects;

• Poor workmanship, inadequate supervision, poor information flow, client / design changes and designer errors constitute significant causes of rework in labour intensive construction projects, and

• Certain factors such as lack of knowledge and inability to carry out construction activities by artisans and general workers may lead to low work rate on labour intensive construction projects.

As a result of the above conclusions, it can be argued that the perceptions related to labour intensive construction in South Africa has created a negative impression among the GCs that took part in this study because in most construction projects cost, time and quality of work are affected. However, the benefits of employment opportunities that form the basis of labour intensive construction projects cannot be overlooked especially in South Africa where job creation is a major challenge. Furthermore, there must be sufficient support from government to ensure that the EPWP does reach its desired goal of creating sustainable jobs for the nation. Thus, the way forward entails:

• Increased government funding for trade skills improvement so that an increase in skilled artisans within labour intensive construction projects can be engendered;

• Improved supervision quality concerning artisan and general workers engaged in labour intensive construction projects;

• Careful analysis of project scope to see the areas that labour intensive methods can be implemented efficiently, and

• Provision of a long term programme to ensure proper planning is incorporated by avoiding short term projects, which only provide short term employment.

However, given that a limited number of respondents took part in the study, the findings presented in the pilot study should be treated as insightful. The limitations of the study thus preclude wholesome generalizations of the findings that emanated from this study. In this context, a research that will examine the issues identified among a larger sample frame and size is envisaged to be conducted in the future.

ACKNOWLEDGEMENT

The authors are grateful to the NMMU-cidb Centre of Excellence, hosted by the Built Environment Research Centre (BERC), for supporting this research project in 2012.

REFERENCES

Adendorff, C, Appels, G and Botha, B (2011) Strategic management: An Eastern Cape construction SME case study. Acta Structilia, 18(2), pp. 40-63.

Allan, A, Yin, Y and Scheepbouwer, E (2008) A study into the cyclical performance of the New Zealand construction industry. New Zealand Centre for Advanced Engineering, Chrishchurch, New Zealand.

Corbetta, P. (2003) Social research: theory, methods and techniques. Thousand Oaks, CA: Sage.

Kazaz A., Manisali E. and Ulubeyli S. (2008). Effect of basic motivational factors on construction workforce productivity in Turkey. Journal of Civil Engineering and Management, 14(2), 95–106.

Leedy, P.D. and Ormond, J.E. (2009) Practical research planning and design. 9th ed. New York: Pearson.

Mashiri, M., Thevadasan D. and Zukulu, R. (2005) Community-based labour –intensive road construction: Findings of an Impact study of the Amadiba Road. In: Proceedings of the 24th Southern African transport Conference (SATC), 11-13 July 2005, Pretoria.

McCutheon, R. T. (2008) The generation of productive employment opportunities for the unskilled: principles, potential and pitfalls of labour-intensive construction. 10th Path to Full Employment Conference / 15th National Unemployment Conference 4-5 December 2008, Centre of Full Employment and Equity (CofFEE) University of Newcastle, Australia, 3-20.

McCutcheon, R. T. (2003) Concepts, potential, principles, issues, lessons and guidelines, in McCutcheon and Taylor Parkins (eds.). 10th Path to Full Employment Conference / 15th National Unemployment Conference 4-5 December 2008, Centre of Full Employment and Equity (CofFEE) University of Newcastle, Australia, 15-56.

Muatjetjeja, M. M. (2006) Labour intensive work in Botswana: A description and evaluation of six programmes. Unpublished MSc Treatise. University of Witwatersrand.

Musekene, E. N. (2010) A geographic perspective of labour intensive methods in the development and maintenance of transport infrastructure. Unpublished PhD Thesis. University of South Africa.

Ngebulana, M.R. (2006) Evaluation of labour intensive construction projects in the Madibeng Municipality North West Province South Africa. Unpublished MSc Treatise. University of the Witwatersrand.

Rust, F.C. and Koen, R. (2011) Positioning technology development in the South African construction industry: a technology study. Journal of the South African Institution of Civil Engineering, 53(1), pp. 2-8.

Springer, K. (2010) Educational research: a contextual approach. New Jersey: John Wiley and Sons.

Strebel, A. (2004) Maintaining Rural Roads through Job Creation Healing the fabric of society, for Sekao Headways Research, Training, and Development. Pretoria: Centre for Public Service Innovation (CPSI).

Thwala W.D. (2006) Urban renewal through labor-intensive construction technology in South Africa: problems and potentials. African Studies Quarterly. 8(4): 36-44.**Error! Bookmark not defined.**

A PROCESS TO ASSIST TECHNOLOGY INVESTMENT DECISIONS IN CONSTRUCTION: A CASE STUDY ON LABOUR PRODUCTIVITY

Jean-Jacques Kriel[1] and Jan Wium[2]
Stellenbosch University, South Africa

In this study the usage of technology-aided construction as well as research and developments in technology was found to be below standard in the South African construction industry. With the stated intentions of African leaders to increase the technology usage and development in the continent, decisions regarding technology investments were seen as inevitable. The focus of this research was therefore to establish if a process can be formulated that can assist technology investment decisions. An area of concern within the South African construction industry was identified and steps were taken to try and solve the concern by identifying and evaluating technology alternatives. The steps taken were based on theories of feasibility studies as well as decision making models for technology investment decisions. Based on surveys conducted, low labour productivity was the most influential area of concern and was used as a case study in this research. The dissection of the area of concern was used and incorporated into the complex criteria structure that is used together with a fuzzy Multi-Criteria Decision Model (MCDM) to determine the suitability of the technology alternative. The findings provided evidence that a flexible and generic process can be formulated that can assist technology investment decisions that addresses specific areas of concern by incorporating an array of stakeholders without wasting time.

Keywords: investment decision; labour productivity; multi-criteria decision model; technology

INTRODUCTION

Worldwide the civil construction industry is one of the biggest and most influential industries but has proven to be lacking in the development of technology-aided construction. Even though construction is regarded as one of the biggest and fasted growing industries worldwide it is slow to recognise the benefits of information technology (IT) as a major tool beyond communication (Egbu, Bates, and Botteril, 2001). Reasons for this retarded development in technology usage in South African construction could be attributed to the age gap in the civil engineering profession, the way in which construction companies make decisions at pre-project phase, the implementation of the Expanded Public Works Programme (EPWP) or the way in which contractors often refer to the past when confronted with similar problems.

[1] *jjkriel9@gmail.com*
[2] *janw@sun.ac.za*

Kriel, J. and Wium, J. (2014) A process to assist technology investment decisions in construction: a case study on labour productivity *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 67-83.

In contrast to construction, literature on the automotive manufacturing industry showed that technology has infiltrated this industry at a rapid pace and changed the way in which it operates. The manufacturing companies who invested in technology-aided construction methods have succeeded to reduce costs and time of manufacturing, increased product quality and mitigated many risks. The successes in the manufacturing industry can partly be contributed to the focus on research and development (R and D) which, according to Godwin (2009), ensures long term competitiveness.

To further the problem with the lack of technology development in South African construction, literature showed that South Africa is behind when compared to other counterparts in terms of overall technology development and technology usage (OSEC, 2011). The Knowledge Economy Index (KEI) of South Africa, which is an indicator of innovation, education and Information Communication Technology (ICT), has dropped with 15 positions from 2000 to 2012. This puts South Africa in 67th position from 146 other economies globally, and among the top 10 countries with the largest drop of KEI ratings in the world (World bank , 2012). The Economist Intelligence Unit Limited (2011) rated South Africa 47th from 66 countries in terms of their overall IT industry competitiveness index.

The ICT Indaba, held in Cape Town from 4 to 7 June 2012, served as a call to African delegates to set up a continental policy and to expand the growth of the ICT industry in Africa (ICT Indaba, 2012). The ICT Indaba aimed to optimally and appropriately use technology to increase the performance of six key sectors of which business and infrastructure are prioritised as the first two (ICT Indaba, 2012). This aim of the ICT Indaba directly supports the argument that construction companies, as major role players in infrastructure development, should incorporate ICT in an appropriate and optimal way.

Together, the two broad streams of literature reviewed, namely the comparison of manufacturing and construction and the technology developments in South Africa, provided sufficient evidence to support the importance of investigating technology investment in construction. Given the intent of various African delegates to invest into technology and infrastructure, a process that can assist the decision-making of technology investments in construction was seen as the research field that demands attention.

ANALYTICAL FRAMEWORK

The analytic framework of the research was structured so that five research questions could be answered which provided data that was used to test a hypothesis. The research questions were structured in such a way that a single area of concern in South African construction could be identified. The questions further facilitated the identification of aspects of this concern that can be improved on as well as proposing technological solutions to solve this concern. The questions were further aimed at determining how to evaluate the effects of these technological solutions. The research questions that were used as part of the analytical framework for investigation were as follows:

Research questions discussed:

a) Are there any generic areas of concern in the different divisions of civil engineering construction?

b) What is the most influential area of concern in the South African construction industry?
c) What aspects of this area of concern can be improved on?
d) What technology can be used to improve this area of concern?
e) How will the effects of the technology be quantified in terms of cost versus benefit?

The research aim was to propose solutions to the identified area of concern by utilising a process that assists the identification and evaluation of technology solutions. Solving this one area of concern served as a case study to establish the steps and procedures of solving problems with the use of this process. The steps taken in this process was structured around steps taken in a feasibility study and was supplemented by models and criteria used when making decisions regarding technology investments. The steps of a feasibility study formed the basis of the process and typically include the following steps:

- Investigate the present organizational system
- Identify stakeholders, users, functions and objectives
- Identify areas of concern with the present system
- Stipulate Inconsistencies, inadequacies in functionality, performance policies
- Propose possible solution alternatives
- Differentiate different levels/types of the solutions
- Identify different business processes for solving the problems
- Evaluate advantages and disadvantages of the alternatives

The criteria that needed to be used for the technology investment decisions were selected after investigating the research of Bacon (1992), Jones and Beatty (1998), Irani (2002), Mirani and Lederer (1998), Iacovou, et al.(1995), Escobar-Perez (1998), Ryan and Harrison (2000), Chou, et al.(2006), Banerjee and Golhar (1994) and O'Callaghan, et al. (1992). The tailored criteria structure that was created by incorporating these references can be seen in Appendix A.

As part of the analytical framework a hypothesis that needed to be tested. This was done based on the discussion of the research questions. The hypothesis originated from the thought of the next step that should be taken given the background of technology developments in South Africa and the intention of many African delegates to encourage technology investments. Technology investments in infrastructure development companies therefore seemed inevitable in South Africa and given the difficulty of making technology investment decisions, a flexible and generic process that could assist companies to make technology investment decisions was identified as essential. The hypothesis was therefore structured to determine if such a flexible and generic ***process*** can be formulated.

Hypothesis to be tested:

1.) A generic and customizable process can be formulated to assist construction companies in making decisions with regards to technological investments.

A *process* refers to specific actions or steps that should be taken, in a sequence, in order to have a specific end result (Oxford Dicionaries, 2013). Based on the commitments of the ICT delegates to promote technology in business and infrastructure, *construction companies* were identified as the area within which research will be conducted. *Informed decisions* refer to decisions that considered a reasonable amount of accurate information from sources that show experience or knowledge about the situation (Oxford Dicionaries, 2013). *Investments in technology* refer to the attainment of technology to be incorporated in the way business is done within a company. The goal of the process and the decisions on investments are to improve the way business is done. This is done by *solving areas* that are *of concern* to the business which keep the company from performing optimally.

RESEARCH METHOD

The questions which form part of the analytical framework were discussed after a literature study was conducted using published books, peer reviewed articles, electronic sources and technical dictionaries. The first research question was analysed by asking four experienced South African construction representatives to rank 49 construction related areas of concern, identified in literature. The areas of concern were ranked by the four representatives in terms of highest impact on the operations phase of construction projects in South Africa. This was done by assigning a vale, from zero to ten, representing the combined impact each concern has on cost, time, quality and risk of a construction project. Another survey was conducted and 38 experts ranked the top 9 areas of concern, which had been identified by the first survey, in terms of the highest combined impact on construction projects. The 38 expert representatives were all surveyed at the 2012 Construction Management Programme (CMP), hosted in Stellenbosch, and were asked to rank the areas of concern in terms of their impact on construction projects, again using impact areas such as cost, time, quality and risk. The group of 38 delegates from the 2012 CMP survey included directors, managers and site agents with up to 30 years' experience in construction. The delegates gained their experience within private construction companies, private consultant companies and government authorities. The delegates therefore represented a large scope within the construction industry.

In the following step the 2012 CMP delegates were used to give their opinions about what they regard as the most influential area of concern in South African construction. Their opinions were captured using a questionnaire which included a table similar to Table 1.

After the results of the questionnaire were analysed, the most influential area of concern was identified based on the highest average impact the area of concern had on a project's time, cost, quality and risks. This area of concern was dissected by means of in-depth investigation into the factors influencing this concern and different methods of managing or measuring this concern.

The dissection of the area of concern was used to identify technology that could be used as a solution to the problem created by the area of concern. The identification of the technology was done based on learning from other industries. This was done by considering the factors that influence productivity and the areas of the *productivity improvement system* that can be improved on. These two areas were used to determine the essence of the most influential area of concern. Once the essence was determined other industries who overcame similar challenges with technology were investigated and the technology these industries used was selected for further investigation.

The final step of the research was to determine how to evaluate the technology alternatives that have been selected for further investigation. In order to be able to correctly evaluate the technology alternatives different Multi Criteria Decision Models (MCDM) were investigated. The fuzzy Analytical Hierarchy Process (AHP) MCDM

was chosen as the best suited model based on a literature review on the benefits and shortcomings of different MCDM's.
The research process used in this study was used as an example with which the process to assist technology investment decisions was determined and calibrated.

RESEARCH FINDINGS

The analytical framework of the research provided a structure to the research process and its objectives. For this reason the findings of the research will be summarised within the discussions of the research questions and the hypothesis.

Research questions:

In this section the five research questions will be discussed, making reference to the findings within the various elements of the research study.

Are there any generic areas of concern in the different divisions of civil engineering construction?

In the context of a discussion regarding areas of concern in construction, a 'generic' area of concern is a worry or anxiety that is related to the construction industry as group and therefore not specific to one division within the construction industry.
Assaf and Al-Hejji (2005) conducted an extensive survey, with industry representatives from different divisions of civil engineering construction in Saudi Arabia, to identify the main areas of concern in construction. In their study they found 73 areas of concern that had a high frequency of identification by the survey respondents. The 49 areas of concern with the highest frequency of identification were used for further investigation. The four respondents that participated in the first survey of this research, using the top 49 areas of concern, all acknowledged that all 49 areas of concern identified in the list were present in their projects, suggesting that although different civil engineering divisions execute projects in different ways, generic areas of concerns do exist.
The results of the second survey conducted in this research study showed that, again, all the areas of concern were present in each of the different civil engineering divisions. This further supports the statement that there are generic areas of concern in the different civil engineering construction divisions. This statement is supported by the acknowledgement of the existence of specific areas of concern by various industry representatives, with experience in different divisions of the South African construction industry.

What is the most influential area of concern in the South African construction industry?

During the research of the South African construction industry it was found that it is a big and complex industry. By investigating the different divisions of civil engineering construction, it could be seen that the different divisions operate in a unique way.
The results of the first two surveys showed that there are in fact generic areas of concern in construction. However, it was seen from the survey data that even though

most construction companies have a generic list of concerns, not all companies, or even divisions within a company, rate the impact of these areas of concern equally.
The results of the questionnaire conducted at the 2012 CMP are shown in Table 1. The results show that there are areas of concern that have bigger impacts on construction projects than others. These areas of concern were particularly important in this research in order to narrow down the focus of the investigation. The 38 delegates of the 2012 CMP identified '*Low labour productivity of labourers'* as the most influential area of concern.

Table 1: Calculated averages of the impacts that areas of concern have on the impact areas.

Area of concern (O)	Description of area of concern	Impact Area (I)				
		Time (I_T)	Cost (I_C)	Quality (I_Q)	Risk (I_R)	Average (I_{AVE})
3	Low productivity level of labourers	7.69	7.72	8.19	7.92	7.88
5	Unqualified workforce	7.97	7.94	6.69	7.94	7.64
7	Inadequate experience of consultant	7.97	8.03	6.17	7.75	7.48
4	Ineffective planning and scheduling of project by contractor	7.89	7.92	6.67	6.89	7.34
1	Delay in approving major changes in the scope of work by consultant	8.50	8.31	5.11	6.94	7.22
6	Delays in sub-contractors work	7.69	6.97	6.19	7.42	7.07
2	Late in reviewing and approving design documents by consultant	8.19	7.92	4.81	7.03	6.99
8	Equipment breakdowns	6.31	6.67	4.64	6.22	5.96
9	Accident during construction	6.39	5.86	3.89	6.75	5.72

What aspects of this area of concern can be improved on?

The area of concern that was identified by the 2012 CMP delegates to be the most influential was low labour productivity, and this area of concern was therefore chosen for further investigation.
In light of *low labour productivity* being identified as the most influential area of concern, a *productivity improvement system*, seen in Figure 1, was identified (Dozzi and Abourizk, 1993). According to Dozzi and Abourizk (1993) this *productivity improvement system* can be used to improve productivity on construction projects and all areas of this system influences productivity of the operations phase of a project. For this reason the system in Figure 1 was investigated and areas within the system that could be improved on were identified. The areas investigated included inputs to the system, factors influencing productivity, measuring productivity, comparing actual to estimated productivity and taking action with feedback.
Various references have identified that technology can be used to improve aspects of business including labour productivity (Teizer, Venugopal, and Walia, 2008) (Jiang, Skibniewski, Yuan, and Sun, 2010). For this reason technology was proposed as an input that is needed to improve this *productivity improvement system*. The specific technologies that were identified as possible additional inputs to the system are discussed in the next section.
There are many factors influencing labour productivity and they can be grouped into three categories. These categories are labour effectiveness, management practices and

material timeliness. All three of these categories have a large number of areas that can be improved on and can be seen in Table 2.

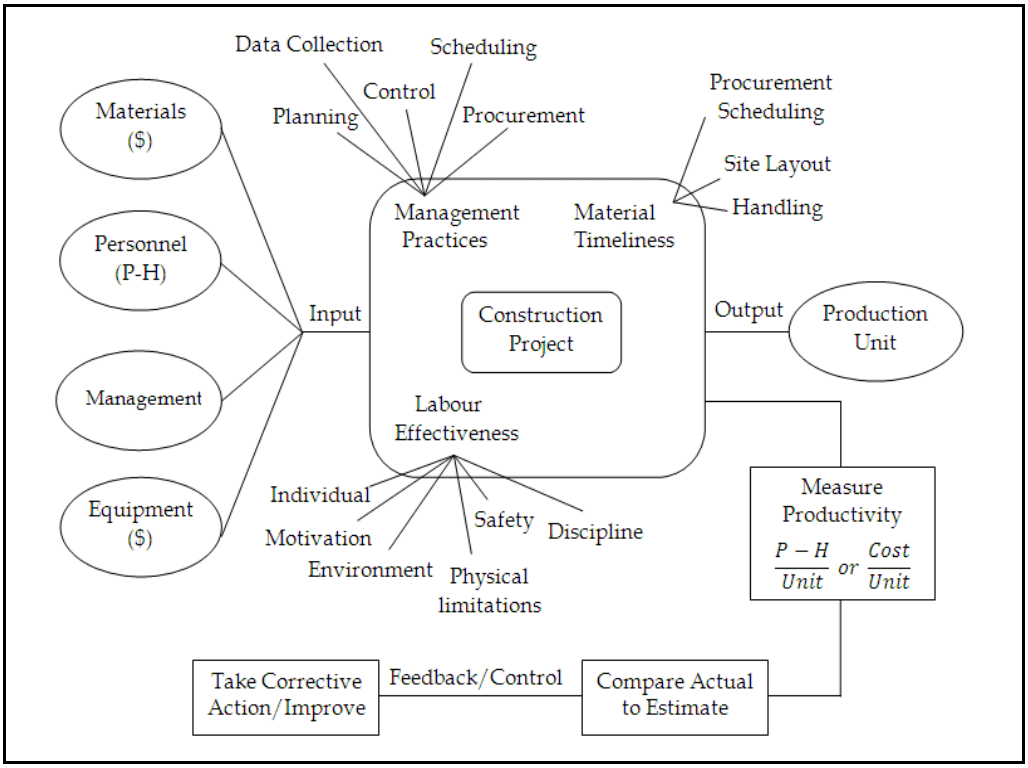


Figure 1 - Productivity improvement system (Dozzi and Abourizk, 1993)

Each of the different methods of measuring productivity had areas that could be improved on and each posed different problems. It was realised that the problems with regards to measuring productivity are method specific and just as the method of measuring productivity can differ on every project, so can the problematic areas with regards to productivity measurement. The methods of productivity measurement investigated as well as the shortcomings can be seen in Table 3.

If the amount and the correctness of data regarding productivity were to be increased, it could have beneficial effects for productivity on site. Data capturing was, therefore, also identified as an area for productivity improvement. Jaing *et al.* (2010) and Teizer *et al.* (2008) showed how technology can assist many of these areas in the *productivity improvement system* and giving feedback is another one of these areas. If the feedback on productivity is understandable it can contribute to the motivation of the workforce and further improve productivity.

Another area that could be improved on regarding productivity of labourers is to focus on eliminating productivity inhibitors. Management related inhibitors are the most susceptible to change and 50% of all inhibitors are related to management (Bardenhorst, 1985).

What technology can be used to improve the area of concern?

After investigating the factors that influence productivity and the productivity improvement system the essence of the labour productivity problem lay in two valuable realisations, the first of which is that increased monitoring of labourers was needed to improve the quality and amount of usable data for productivity management. Another realisation was that the behaviour of the labourers must be optimised towards completing tasks more efficiently.

While investigating other industries, the industries of sport and traffic control had similar problems which they solved with technology. Traffic lights and traffic cameras manage to dictate and optimise motorists' behaviour. The industry of professional sports is an example of another industry that managed to improve the behaviour of players on a field by closely monitoring their behaviour and movements. The technologies used in these industries were wireless tracking and visual analysis.

Table 2 - Summary of factors influencing productivity.

Management Practises	
Planning - Work schedule distribution (Crowding) - Phase planning (Sequence of events) - Reduced rework and design change (Method used) - Specific trades locations (Logistics and Crowding) - Availability of materials (Locating and Logistics)	Data collection - Timely data (Real-time analysis) - Progress data (What the project looks like) - Legal data (Position of resources, Progress, Activities) - Track productivity (Whereabouts of resources)
Control - Security (Restricted areas, Theft) - Situation awareness - Rework management	Procurement - Stacking of trades - Improved team communication - Late crew build-up and Size of crew
Scheduling - Stop-and-Go - Approval of work (Time loss after completion of tasks) - Ripple effect - Multiple shifts and overtime - Concurrent operations (Actions not accounted for in the schedule)	
Labour efficiency	
Individual - Attitude and personality - Safety conscious and healthy - Interruptions and 'unlearning curve' - Method inputs from labourers - Education/Training	Motivation - Minimal control mechanisms - Accountability increase - Additional authority - Performance reports - New and more difficult tasks - Specific tasks assignment
Safety - Restricted or hazardous areas	Physical limitations - Potential to perform - Nutrition
Environment - Basic needs - Temperature and humidity measure - Organised workspace and Noise	Discipline - Absenteeism - Turnover
Material and Tool Timeliness	
Handling - Tools need and location - Material need - Communication	Legislation - Working hours - Leave - Remuneration
Site Layout - Jobsite planning	Procurement - Material procurement planning

Visual analysis and image processing is done by analysing video material or a sequence of frames and estimating movements based on the different position of the resource. This analysis can be done manually or automatically and research is currently done to improve the automated video tracking of resources. Wireless tracking has many alternative methods of tracking such as, GPS, Wi-Fi, RFID, Bluetooth and UWB. UWB proved to be the best performing wireless tracking method for construction sites and works on the principle of attaching a transmitter on the resource that is picked up by the local receivers (Jaing, Jang, and Skibniewski, 2012). These receivers and accompanying software can then determine the position, movement and speed of the resource in a 3D context.

Table 3- Summary of problematic areas with productivity measuring models

Productivity measuring models	
Field rating Fail to identify sources of problems Foreman and supervisors are always regarded as working Observations are dependent on the observer's time and place Junior and senior supervisors have different amount of crew members to supervise (added 10%)	Five minute rating Observations are dependent on the observer's time and place Represents only a short time of the activity Lack to identify the cause of inhibitors of productivity
Charting techniques Many cycles need to be observed Simultaneous timing of all the trades is hard	Method productivity delay model Difficulty in timing consecutive cycles of work Difficulty in timing cycle and specific delays at once
Field surveys Data based on estimates of the foreman Timely process to analyse data	Simulation modelling Lack of interpreting the changing environment
Work Sampling Observations are dependent on the observer's time and place Observe and analyse data with calculations afterwards Large number of observations needed Indirect measure of productivity due to classifications Lack to identify the cause of inhibitors of productivity	

Investigation into these groups of alternatives showed that the technology can have the following advantages:

- Accurate 3D tracking of resource's behaviour such as position, speed and direction of movement,
- Providing data that can be used to monitor and manage work task schedules,
- Improving productivity measurements,
- Real time data that can be used for improved safety on site,
- Improved monitoring of resources even within buildings and underground areas.

By improved monitoring and capturing more data with either one of the above mentioned groups of alternatives, labourers' behaviour could be improved and better data could be acquired for improved productivity management.

How will the effects of the technology be quantified in terms of cost versus benefit?

Decisions on whether or not to invest in a technological alternative should be done based on a feasibility study. This often includes the evaluation of the relationship between the costs of the investment versus the benefit it could provide. However, when an investment is proposed for the improvement of an area of concern, it makes sense to include criteria to evaluate whether the benefits sought after to solve the concern will be achieved. Based on the results of various references, summarised by Chou et al. (2006), this research investigated five categories of criteria namely, external -, internal -, risk -, cost - and benefit criteria. Together these categories form the criteria structure for technology investment evaluation.

The external criteria are included in the criteria structure to evaluate alternatives in terms of the benefits it can provide regarding allying with other partners and how other competitors will react to the investment decision. The internal criteria were included to evaluate the ability of the alternatives to integrate with current company systems and how the users will accept the alternatives. The internal criteria play an integral part in strategic alignment of IT and business strategies. The risk criteria are included so that the probability of achieving the desired outcome can be evaluated. The cost criteria evaluate the financial impact of each alternative. The benefit criteria were specifically included to assess the alternatives' ability to satisfy the needs of solving the area of concern identified.

Many technology investments fail due to the lack of compliance with the needs of all parties affected by the investment (Chou et al. (2006). User rejection is one of the main examples of this phenomenon and for this reason the evaluation of the possible investment includes two teams that assist with the decision making (Chou et al. (2006). Both of these teams comprises of stakeholders that include: executive managers, technology experts, accountants, auditors, external consultants and users.

The first team is the weighting team, and their task is to assign weights to the criteria. This is done with pairwise comparison whilst considering the company strategy and how important some of the criteria are to the company (Chou et al. (2006). The second team is the scoring team and their job is to evaluate how well an alternative performs against each of the criteria. For the scoring team to evaluate the performance of the alternative, the specifications of the alternatives are needed to fully understand what each alternative has to offer when used (Chou et al. (2006). This is an ideal task for an in-house R and D division, especially because they could investigate the alternative based on the specific needs of the company.

It is challenging to give precise values for the weight of a criterion or to assign an accurate score for the performance of an alternative. Besides being challenging, assigning crisp values to these aspects are dangerous when working with technology investments (Chou et al. (2006). For this reason a fuzzy logic approach can be used so that the team members can use linguistic terms to describe their choices. These linguistic terms were translated into fuzzy numbers which represent a range of values rather than a precise value.

Together with the teams of stakeholders, fuzzy logic approach and the complex criteria structure, a specific fuzzy Multi-Criteria Decision Model (MCDM) can be created for decision making. Although the model is specifically aimed at making decisions with regards to technology to improve labour productivity, the criteria can be changed so that it evaluates other problems.

A fuzzy MCDM not only provides a structured way to compare the cost versus benefit of investments but manages to provide the following additional benefits (Chou et al. (2006):

- Incorporates the opinions of the stakeholders in every level of the business,
- Integrate risk, benefit and cost criteria into one model,
- Has the flexibility to change with regards to weights given to criteria,
- Combines quantitative and qualitative decision making into one model,
- It structures and simplifies the complexity of decision making and saves time.

Testing the hypothesis:

The first step of testing the hypothesis is to clarify what the requirements are so that the hypothesis can be tested. Secondly findings that address the requirements of the hypothesis are given. Finally the justification of the hypothesis will be explained.

Requirements of hypothesis:

When referring back to the hypothesis in the start of this paper, the terms *generic* and *flexible* need to be explained in the context of this research to fully understand the hypothesis. In the context of this research a generic and flexible process refers to the following:

1.) The process is not only applicable to a specific area within construction, but usable in more than one division, company or even country.
2.) The process is able to adapt to changes that occur in business strategies, company employees, criteria or area of concern.

Supporting findings

A synthesis of the research findings, that support the arguments to test the hypothesis, is presented in the following paragraphs to demonstrate how this research established a flexible and generic process that is applicable to solve other problems. The steps of the process that is proposed from the findings of this research is summarised in Figure 3.

Step1- Identification of areas of concern:

The first step of the process is supported by Rummler and Brache (1995) as well as Coleman and Endsley (1999) who stated that the identification and solving of existing areas of concern are part of the first steps to improvement

The core of correctly identifying an area of concern is to have enough data that is accurate (El-Omari and Moselhi, 2009). Whether data is obtained from global indexes, published surveys or company performance reports, the identified concern should be supported by sufficient data. If the identification of a concern is done for a specific company, a good understanding of the company strategy is needed so that the data obtained can be understood and be seen within a company specific context.

The automotive manufacturing industry focuses on innovation within their dedicated R and D divisions. According to Godwin (2009) this is how these manufacturing companies ensure long-term competitiveness. These R and D divisions constantly provide management with information about possible concerns and solutions to these concerns.

The lack of dedicated R and D divisions can force the researcher to gather information through other means. The identification of areas of concern can, however, be done by means of prior research followed by interviews and the analyses of well-constructed surveys.

Step 2 -Dissecting the identified area of concern:

The next step of the process is to dissect the area of concern that was identified in Step 1. This dissection involves identifying how the data received from Step 1 compares to other countries or companies. It should then be considered if the problematic area could be eliminated and how this can be done. If the area of concern is something that is not removable, then factors influencing the area of concern should identified. Having a sound understanding of the problem can assist the identification of possible problematic areas and help to determine what is needed for improvement.

Step 3 –Identify technological alternatives:

In this step of the process, the findings of Step 2 have to be considered to determine the essence of the area of concern. Based on the essence of the concern, examples of similar problems in other industries should be researched where possible. This research can be done by an internal R and D division within a company or by the individual responsible for the decision making. This gives the researcher the opportunity to find the essence of the problem faced and also to learn from other industries and to identify what solutions the other industries used to overcome similar problems.

By identifying the essence of the problem and by combining it with lessons learned from other industries, the solution alternatives will be more easily selected due to the narrowed scope of alternatives. Once the alternatives have been selected for evaluation, full details regarding the performance and specifications of the alternatives need to be researched by either the internal R and D or by the individual.

Step 4 –Evaluate technological alternatives:

The fourth and final step involves the evaluation of solution alternatives and it is where the actual decision making is done. To make an evaluation, the effects of the investment need to be quantified in order to determine how the costs compare to the benefits of the investment. The discussion of the last research question explains how this quantifying procedure works.

The evaluation process is done by incorporating multiple criteria and the opinions of different stakeholders in a FMCDM. The steps of using this model are started by selecting the criteria and incorporating the needs of the specific problem in the benefit criteria. The next step of the evaluation is to assign weights by using a weighting team consisting of various stakeholders on different levels of management. The weighting is followed by scoring the performance of each alternative with regards to the different criteria. This is done by the scoring team who also consist of different stakeholders as in the case of the weighting team.

The weighting team assigns the weights according to company values and strategy. The scoring of the alternatives can only be accurate if enough information is given to the scoring team with regards to the performance and specifications of each alternative. This can be provided by the supplier or salesperson of each alternative or it can be researched to find out how these alternatives performed in other applications.

The weighting and scoring is done by using linguistic terms that translate into fuzzy numbers. These fuzzy numbers express the degree of the team members’ feelings when weighing criteria or scoring alternatives. This is safer and easier to use because Chou et al. (2006) stated that it is dangerous to assign crisp values when working with technology investments, and they therefore advise that fuzzy numbers be used.

The fuzzy logic approach, complex criteria structure, and a process of weighting and scoring is used in a specific FMCDM that determines the best alternative. This model utilizes the scores and weights of the team members, equations and matrix calculations together with translation tables to determine the best alternative.

This process can be used for various areas of concern, various team members and different criteria. It was found that this process is systematic, understandable and that it incorporates different stakeholders during the process of decision making.

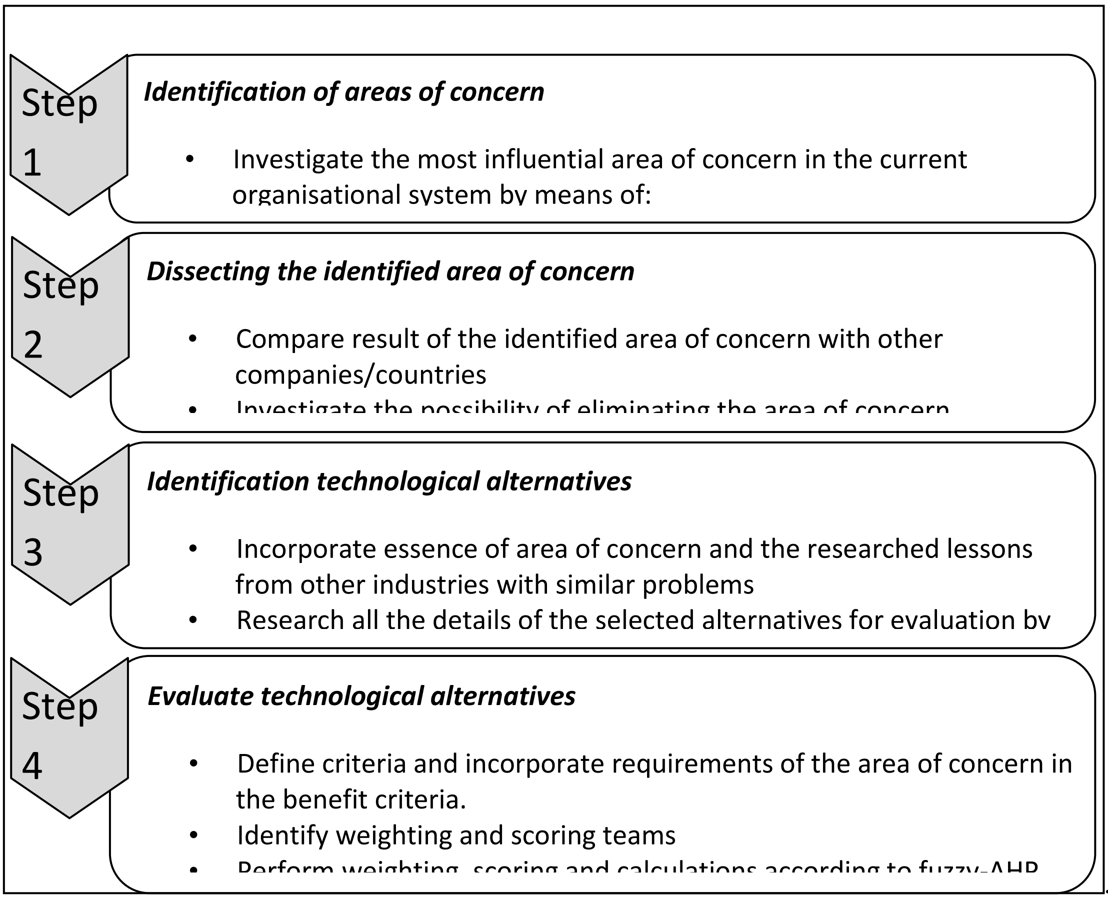


Figure 3 - Summarised process assisting technological investment decisions in construction

The evaluation process is done by incorporating multiple criteria and the opinions of different stakeholders in a FMCDM. The steps of using this model are started by selecting the criteria and incorporating the needs of the specific problem in the benefit criteria. The next step of the evaluation is to assign weights by using a weighting team consisting of various stakeholders on different levels of management. The weighting is followed by scoring the performance of each alternative with regards to the different criteria. This is done by the scoring team who also consist of different stakeholders as in the case of the weighting team.

The weighting team assigns the weights according to company values and strategy. The scoring of the alternatives can only be accurate if enough information is given to the scoring team with regards to the performance and specifications of each alternative. This can be provided by the supplier or salesperson of each alternative or it can be researched to find out how these alternatives performed in other applications.

The weighting and scoring is done by using linguistic terms that translate into fuzzy numbers. These fuzzy numbers express the degree of the team members' feelings when weighing criteria or scoring alternatives. This is safer and easier to use because

Chou *et al.* (2006) stated that it is dangerous to assign crisp values when working with technology investments, and they therefore advise that fuzzy numbers be used.
The fuzzy logic approach, complex criteria structure, and a process of weighting and scoring is used in a specific FMCDM that determines the best alternative. This model utilizes the scores and weights of the team members, equations and matrix calculations together with translation tables to determine the best alternative.
This process can be used for various areas of concern, various team members and different criteria. It was found that this process is systematic, understandable and that it incorporates different stakeholders during the process of decision making.

Justification

The first requirement to prove this hypothesis is that the process should be generic, and that it should be able to be used by various divisions of construction in different companies and even in different countries. The proposed process is able to be used in this regard, because the research during the identification and dissection of areas of concern as well as identifying solutions can be done for specific contexts. Furthermore the evaluation of the alternatives is done by teams of which the members can be chosen and changed. The findings of this research only highlighted the value of specific types of representatives and each division can choose their own appropriate representatives in their teams. Lastly, the calculations used are universal mathematic principles and are not dependent on countries or other external factors of units of conventions.
The second requirement of the hypothesis is that the process must be able to change when business strategies, employees, criteria or the area of concern change. This proposed model is able to adapt to any of these changes because of the following reasons:

- Business strategies are reflected by the weighting of the criteria and these weights can be changed with each new decision.
- If employees change, the team members may not necessarily have to change but if, for some reason, a team member resigns, a replacement representative can be incorporated for the new decision.
- If the area of concern changes, which is highly likely if the company wants to improve more concerns, the benefit criteria can be altered according to the new benefit requirements of the chosen alternative.

Based on the justification of the two requirements of the hypothesis, with the findings of this research, this hypothesis is proven to be true.
A systematic process that embeds these challenging investment decisions was structured so that companies could use it to possibly improve the way their construction is done. The steps of this process include identification and dissecting of areas of concern, identifying technological solutions and evaluating the alternatives.

CONCLUSION

After answering the research questions the following can be stated:
1)There are generic areas of concern in construction, 2)labour productivity was found to be the most influential area of concern 3) wireless tracking and video analysis were identified as possible technological solutions to that can improve many aspects of labour productivity and 4) that a fuzzy MCDM can assist in executing the final step of technology investments.

By proving the hypothesis to be true in addition to the discussion of the questions the following deductions can be made:
The simple four step process, proposed in this study is indeed a valuable tool that could be used for making challenging technology investment decisions. The models and theories incorporated in this process have been used by many decision makers and it was found that the duration of the final step of such a technology investment procedure takes one work day depending on the detail of the investigation Chou *et al.* (2006). If a dedicated R and D division exists within the company the team managers and users involved with this process, may be used for an even shorter period. This process is flexible and can adapt to the ever changing world of technology by simply adjusting some of the criteria. The process can transform challenging decisions to simple and structured tasks that integrate the company's strategy as well as inputs from an array of stakeholders.

REFERENCES

African Economic Outlook. (2013). Innovation and ICT in Africa. Retrieved February 28, 2013, from African Economic Outlook: http://www.africaneconomicoutlook.org/en/in-depth/ict-africa/

Assaf, S. A., and Al-Hejji, S. (2006, November 11). Causes of delay in large construction projects. International Journal of Project management, 24(4), 349-357.

Assaf, S., and Al-Heijji, S. (2005, November 11). Causes of delay in large construction projects. International journal of project management, 349-357.

Bacon, C. (1992). The use of decision criteria in selecting information systems/technology investments. MIS Quaterly, 16(3), pp. 335-353.

Banerjee, S., and Golhar, D. (1994). Electronic data interchange: Characteristics of users and nonusers. Journal of Information Management, 26, 65-74.

Bardenhorst, A. (1985). Identified factors prohibiting productivity improvement in black construction workers. The planning, implementation and evaluation of productivity improvement programs (pp. 1-3). Stellenbosch: National Productivity Institute.

Basant, R., and Fikkert, B. (1993). Impact of R and D, Foreign Technology Purchase and Technology Spillovers on Indian Industrial Productivity (1 ed.). Maastricht: Wendy Williams Desktop Publishing.

Byrd, T., Lewis, B., and Bryan, R. (2006). The leveraging influence of strategic alignment on IT investment: An empirical examination. Information and Management, 308-321.

Chou, T., Chou, S., and Tzeng, G. (2006). Evaluating IT/IS investments: A fuzzy multi-criteria decision model approach. European Journal of Operational Research, 173(3), 1021-1026.

Coleman, M. T., and Endsley, S. (1999, March 6). Quality Improvement. Retrieved March 11, 2013, from American Academy of Family Physicians: http://www.aafp.org/fpm/1999/0300/p23.html

Coleman, M., and Endsley, S. (1999, March 6). Quality Improvement. Retrieved March 11, 2013, from http://www.aafp.org/fmp/1999/0300/p23.html

Dozzi, S., and Abourizk, S. (1993). Productivity in construction. Ottawa: National research council Canada.

du Preez, N., Essman, H., Louw, L., Schutte, C., and Marais, S. (2010). Enterprise Engineering. Stellenbosch, Sout Africa.

Egbu, C. O., Bates, M., and Botteril, K. (2001). A conseptual research framework for studying knowledge management in project based environments. University of Stanford, UK: International Postgraduate research Conference in the Built and Human Environment.

Egbu, C., Bates, M., and Botteril, K. (2001). A conseptual research framework for studying knowledge management in project based invironments. University of Stanford, UK: International Postgraduate Research Conference in the Built and Human Environment.

Egerton, C. (2013, February 6). Mr.

El-Omari, S.and Moselhi, O. (2009, May). Data acquisition from construction sites for tracking purposes. Engineering, Construction and Architectural Management, 16(5), 490-503.

Escobar-Perez, B. (1998). Information System investments decisions in business practice: The Spanish case. European Journal of Information Systems, 7(3), 202-209.

Godwin, S. (2009, November 10). European Council for Automotive R and D. Retrieved April 2, 2013, from http://www.acea.be/images/uploads/files/20091110_PR_EUCAR.pdf

Godwin, S. (2009, November 10). European Council for Automotive R and D. Retrieved April 2, 2013, from http://www.acea.be/images/uploads/files/20091110_PR_EUCAR.pdf

Gounden, S. (2000). The Impact of the National Department of Public Works' Affirmative Procurement Policy onthe Participation and Growth of Affirmable Business Enterprises in the South African Construction Sector. Phd Thesis, University of Natal.

Iacovou, C., Benbasat, I. and Dexter, A. (1995). Electric data interchange and small organisations: Adoption and impact of technology. MIS Quaterly, 19(4), pp. 456-485.

ICT Indaba. (2012). ICT Indaba 2012. Retrieved May 24, 2012, from http://www.ictindaba.com/2012/.

Irani, Z. (2002). Information systems evaluation: Navigating through the problem domain. Journal of Information Management, 40(1), 14-24.

Jackson, C. (2013, February 11). Mr. (J.-J. Kriel, Interviewer)

Jaing, S., Jang, W.and Skibniewski, M. (2012). Selection of wireless technology for tracking construction materials using a fuzzy decision model. Journal of Civil Engineering and Management, 18(1), 43-59.

Jiang, S., Skibniewski, M., Yuan, Y., and Sun, C. (2010). ultra-wide band technology applications in. Organization, Technology and Management in Construction, 2(2), 207-213.

Jones, M.and Beatty, R. (1998). Towards the development of measures of percieved benifits and compatibility of EDI:A comparitive assesment of competing first order factor models. European Journal of Information Systems, 7(3), 210-220.

Mirani, R.and Lederer, A. (1998). An instrument for assessing tha organizational benifits of IS projects. Decision Siences, 29(4), 803-838.

Moodley, S. (2012, November 16). Retrieved January 24, 2013, from Engineering News: http://www.engineeringnews.co.za/article/industry-activity-low-not-expected-to-slump-further-2012-11-16

O'Callaghan, R., Kaufmann, P.and Konsynski, B. (1992). Adoption correlates and share effects of electronic data interchange systems in marketing channels. Journal of Marketing, 56, 45-56.

OSEC. (2011, December). South African ICT. Retrieved March 04, 2013, from Osec Business Network Switzerland: http://www.osec.ch/sites/default/files/ICT%20South%20Africa_SBHSA_December-2011.pdf

Oxford Dicionaries. (2013). Oxford Dicionaries. Retrieved May 25, 2013, from http://oxforddictionaries.com/definition/english/process?q=process

Oxford Economics. (2011). Global Construction 2020. Retrieved 09 14, 2011, from Global Construction 2020: http://www.globalconstruction2020.com/

Oxford University Press. (2006). Oxford Thesaurus of English (2nd ed.). New York: Oxford University Press.

Rummler, G. A.and Brache, A. P. (1995). Improving performance: How to manage the white space on the organization chart. San Francisco: Jossey-Bass Publishers.

Rummler, G.and Brache, A. (1995). Improving performance: How to manage the white space on the organisation chart. San Francisco: Jossey-bass Publishers.

Ryan, S., and Harrison, D. (2000). Considering social subsystem costs and benifits in information technology investment decisions: A view from the field on anticipated payoffs. Journal of Management information Systems, 16(4), 11-40.

Salami, A. (2007, March). Africa's Top 200 companies. Retrieved April 22, 2013, from http://www.africasia.com/uploads/top_comapanies_07_ab_march_main_ranking.pdf

Sun, G.-J., Liu, Y.-K., and Lan, Y.-F. (2010). Optimizing material procurement planning problem by two-stage fuzzy programming. Journal of Computers and Industrial Engineering, 58, 97–107.

Teizer, J., Caldas, C., and Haas, C. (2007). Real-Time Three-Dimensional Occupancy Grid Modeling for the Detection and Tracking of Construction Resources. Journal of Construction Engineering and Management, 133(11), 880-888.

Teizer, J., Venugopal, M., and Walia, A. (2008). Ultrawideband for Automated Real-Time Three-Dimentional Location Sensing for Workforce, Equipment and Material Positioning and Tracking. Journal of the Transportation Research Board, 56-64.

The Department of Public Works. (2013). Expanded Pulic Works Programme. Retrieved July 30, 2013, from Department of Public works: http://www.epwp.gov.za/index.html

The Economist Intelligence Unit Limited. (2011). Investment for the Future-Benchmarking IT IndustryCompetitiveness 2011. Washington, DC: BSA Worldwide Headquarters.

World bank . (2012). Knowledge Assessment Methodology 2012. Retrieved March 04, 2013, from WorldBank.org: http://siteresources.worldbank.org/INTUNIKAM/Resources/2012.pdf

A REVIEW OF RESEARCH METHODOLOGIES IN BUILDING ENERGY EFFICIENCY ASSESSMENT

Michael Nii Addy[1], Emmanuel Adinyira[2] and Christian Koranteng[3]

1,2 Department of Building Technology, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

3 Department of Architecture, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

Building energy efficiency assessment (BEEA) is an important area in both the built environment and energy management. Over the years it has received increasing attention among researchers due to the pertinent sustainability issues. What is the common practice in building energy assessment research methodology? This study attempts to find the common practice in BEEA research methodology to find out how developing countries can be equipped to do more research in this field. In this paper five major journals in the field of building energy are quantitatively reviewed with a particular interest in identifying what methods and approaches have been presented or employed in BEEA. A scanning of the search results gave a list of 63 articles that are considered relevant to the research interest. The assessment methods were introduced and categorized in a manner that helps the readers get the best sense of the overall picture. The results indicate that 65% of the studies employed more than one research method and documentation dominated BEEA research. The study showed that to develop the research capacity of developing countries in this area the need for expertise, availability of data and policy direction needs to be in place.

Keywords: building energy efficiency, research methodology, developing countries

INTRODUCTION

Energy efficient building has many benefits firstly it reduces the negative impact on the environment and advances on energy security (Poel *et al*., 2007; Levine *et al*., 2007). The negative effects on the environment include both resource consumption and pollution in the building sector (Dawood *et al*., 2009). The continuous environmental deterioration and the scarcity of available natural resources have raised global concerns on the exploitation of renewable energy sources and the effective application of energy conservation strategies in all energy consuming sectors (Kibert *et al*., 2000).

Incorporating energy efficiency concepts into new buildings has special significance for developing economies. Fast-growing economies, such as China, India, and some Latin American countries, have substantially boosted energy demand in the building sector due to construction booms (Sabapathy *et al*., 2010). Due to the long life cycle of buildings and the projected new demand for public and private construction, energy consumption in the building sector is expected to continue to grow dramatically over the next 30 years (World Business Council, 2007). The demand for energy efficient

[1] mljaddy@yahoo.co.uk

Addy *et al*. (2014) A review of research methodologies in building energy efficiency assessment *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 85-100.

buildings has increased over the decade and research into this area keeps expanding more and more as more countries and researchers pick up the interest to investigate into this area bringing about solutions to efficient buildings (Perez-Lombard et al., 2009; Wang *et al*., 2012; Bertoldi *et al*., 2010).
This study intends to explore the common practices related to research methodologies in building energy efficiency. The aim of this paper is to contribute to the existing knowledge base of research methods in building energy efficiency in two main areas. Firstly, the paper uncovers the current status of the development of research methods through a review of the methodological aspects. This is based on a survey of 63 empirical articles published in five leading building, energy and building energy journals from 2000 to 2013. Secondly the study seeks to elicit lessons from the 63 published articles most relevant to the African context in the area of building energy research to provide a basis to enhance and promote research in this field within this region.

CONCEPTUAL BACKGROUND

The field of building energy efficiency assessment

Few studies on building energy efficiency have actually defined what is meant by the term "building energy efficiency" (Wang *et al*., 2012 and Poel *et al*., 2007 are a few exceptions). UNEP (1997) defined building energy efficiency as "using less energy without compromising the performance of the building and which can be achieved by reducing unnecessary energy use in buildings". Poel *et al* (2007) also defined energy performance as the amount of energy actually consumed or estimated to meet the different needs associated with a standardized use of the building'. Wang *et al*., 2012 observed that at the crux of energy efficiency is the assessment of the building energy performance and judging whether any unnecessary energy use occurs in a building.

Classification of building energy efficiency assessment

Two main classifications exist in energy performance assessment approaches in the building sector, namely performance-based and feature-specific approaches (Wang *et al*., 2012).Using performance-based approach, assessment results are obtained by comparing the performance indicators (e.g. EUI or CO_2 emission) against established benchmarks (Roderick *et al*., 2009; Lee and Burnett, 2008). Performance-based approach set maximum allowable energy consumption levels without specifying the methods, materials and processes employed to achieve that level. While using feature-specific approaches, credits are awarded when criteria of specified features are met (Lee *et al*., 2003). Use of the performance-based approach to assess the energy performance of a building is much more precise and often preferable as it is based on the quantifiable performance indicators (Yang *et al*., 2010). However, the development of the assessment methods and the assessment procedures is more complex and involves the establishment of an appropriate method for quantification of the energy performance and suitable criteria to judge the performance of the assessed buildings (Bagheri *et al*., 2013).
Energy quantification is the basis of any quantitative energy performance assessment method (Poel *et al*, 2007). Utility bills, building audit data, end-use sub-metering system or building management monitoring system, and computer simulations are common sources to quantify building energy uses (Akbari, 1995). Wang *et al*., (2012)

noted that energy performance assessment schemes and methods are established mainly for two purposes: energy classification and energy performance diagnosis. They further stated that energy classification provides uniform or authorized means to communicate a building's relative energy efficiency and carbon emissions to both the owners and the public to encourage ongoing efficiency and conservation gains. Energy classification include energy benchmarking, energy rating, energy labeling, energy certification (Perez-Lombard *et al*., 2009). Energy performance diagnosis aims at detecting faults and diagnosing the causes of poor performance in buildings, and accordingly providing specific energy efficient measures to improve energy performance (Wang *et al*., 2012).

Application of building energy efficiency assessment

Building energy performance assessment methods/tools differ significantly regarding issues concerned (e.g. environmental, energy), their objectives (e.g. certification, decision making, performance diagnosis), and the details concerned (e.g. whole-building level only, multi-level). According to above differences, the applications of energy performance assessment can be classified into four categories including: (1) building environment assessment schemes, (2) energy certification, (3) whole-building benchmarking tools, (4) hierarchical assessment and diagnosis tools.

The assessment of the effectiveness of energy use is one of the major tasks of most commonly used building environment assessment schemes while they might also include water, waste, material and site. Typical tools include LEED (Leadership in Energy and Environmental Design) in USA, BREEAM (Building Research Establishment Environmental Assessment Method) in UK, CASBEE (Comprehensive Assessment System for Building Environmental Efficiency) in Japan, Green Star in Australian and HK-BEAM (Building Environmental Assessment Method) in Hong Kong.

Many energy performance certification methods have been developed by various EPBD (Energy Performance of Buildings Directive) participants (Corrado, 2007). European Union is currently the major catalyst who drives energy efficiency policies in building sectors. This situation is further highlighted with the implementation of the EPBD, which requires the building energy performance assessment as compulsory in Europe (Corrado, 2007). Building energy performance assessment has become compulsory in Europe after the issue of the European Directive on the "Energy performance of buildings" (EPBD, European Union 2003).

Whole-building benchmarking refers to an overall operational assessment of existing buildings (Wang *et al*., 2012). Hierarchical assessment and diagnosis tools are done in order to obtain and diagnose the performance of specific systems or facilities. An example is a study conducted by Lee *et al*., (2003) where they proposed a method to assess the energy performance of a commercial complex comprising of premises, including offices, restaurants and retail shops in Hong Kong.

SUMMARY OF PREVIOUS REVIEWS

There have been various review studies (Lee and Burnett, 2008; Asdrubali *et al*., 2008; Hernandez, *et al*., 2008) carried out to try and benchmark the building environmental schemes that are currently in use, this research outcome have been both qualitative and quantitative. Lee and Burnett, (2008) compared the baseline buildings, performance criteria, credit scales and simulation tools between the schemes of LEED, BREEAM and HK-BEAM (Hong Kong Building Environmental Assessment

Method) based on a statistical energy assessment analysis, while Asdrubali *et al*., (2008) conducted a comparative study of energy regulations for buildings in Italy and Spain based on a semidetached house. Lamberto *et al*., (2008) assessed the energy performance of a single-family house in Italy based on three different reference standards. Hernandez *et al*. (2008) investigated the energy performance benchmarks and building energy ratings by using both calculated and measured rating methods based on a sample Irish school. Roderick *et al*., (2009) presents of review of three schemes; BREEAM, LEED and Green Star Scheme with regards to their assessment methods, scopes, performance criteria and energy rating scales are presented. Findings from these studies show that the energy performance of a building and the corresponding energy rating obtained are strongly dependent on the assessment scheme used.

Review studies in the area of building energy certification have also been conducted. Perez-Lombard *et al*., (2009) in their paper look at the energy certification in buildings and analyses the origin and the historic development of energy certification schemes in buildings along with the definition and scope of a building energy certificate and critical aspects of its implementation. Concepts such as benchmarking tools, energy ratings and energy labelling are clarified within the wider topic of certification schemes. They propose a seven steps process as a guide for implementing building energy certification. Bertoldi *et al*., (2010) in their paper provide an up-to-date review and analysis of results of white certificate (building energy savings) schemes in the European Union. Dascalaki *et al*., (2012) provide an overview of the development and current EPBD stage of implementation in Greece, along with a first assessment of the lessons learned and experiences gained. Findings from these reviews show that the use of certificates has a positive impact on building energy efficiency howbeit many challenges were and are still being encountered including delay in implementation of regulatory structures and low involvement by stakeholders. Other findings show that the role of building energy certificates also acts as a behavior change tool that drives improvements in the energy performance of public buildings as evidence by Bull *et al*., (2012) in their work. Murphy *et al*., (2012) conducting research into building energy policy in the Netherlands found out that current instruments are poorly equipped to forge a long-term energy saving strategy for existing dwellings.

Despite the high level of scholarly interest, a comprehensive understanding of research methodologies adopted for building energy efficiency research is noticeably absent from the literature. To date, a systematic quantitative analysis of the research methods used in building energy efficiency has not been undertaken. This paper begins to address that knowledge gap.

Janda (2008) made a survey of building energy standards for 80 countries worldwide. They show that very little is reported of building energy efficiency assessment in most developing countries especially African countries (Janda, 2008). In addition to the above the effective use of BEER tools presupposes the existence of appropriate substructure at a national or regional level (extensive databases, regulations, and statistics) (Sinou and Kyvelou, 2006). This paper thus reviews research methods used in building energy efficiency assessment based on a survey of published articles and draws out information useful for enhancing research in the area of building energy efficiency in developing countries and more specifically African countries.

RESEARCH METHODS IN BUILDING ENERGY EFFICIENCY ASSESSMENT

Different data collection methods for the building environmental and energy performance are reported in the literature. Standard reporting protocols, energy audits, specific questionnaires to perform surveys, questionnaires uploaded on websites, case study, documentation are some of the preferred methods. In a study by Sabapathy *et al*., (2010) they adopted a structured questionnaire to collect information on billed electricity consumption as well as operational characteristics from IT facilities in Bangalore city in India. Documentation is quite frequently used in building energy efficiency assessment. For the purpose of this paper documentation in building energy research is defined as the process of writing down the activities that a researcher goes through in the development of a building energy efficiency tool which could either be a building environment assessment schemes, energy certification or whole-building benchmarking tools. An example is by Rey *et al*, (2007) who use documentation to report on an assessment carried out on a building energy labelling in Spain. Case study is also adopted in building energy efficiency research. A typical example is the work by Elena *et al*., (2011) on a work which was performed as a case study to demonstrate the use of building typologies to model the national energy balance in Greece. Hygh *et al*., (2012) argues that building simulation models i.e. the use of dynamic simulation can accurately quantify building energy loads, but are not totally useful in the early design stages. They adopted the use of energy plus, a computer energy simulation software in their work. Data acquisition in this paper refers to getting information from a data bank or from an already existing organized collection of information resource. This is illustrated by Lee and Kung, (2011) data acquisition was mainly use to gather some specific data from buildings including hourly consumption data, indoor temperature and local weather conditions.

RESEARCH DESIGN

A systematic quantitative literature review was conducted using a methodology which has been extensively used in the social sciences and health sciences (Petticrew, 2001). Petticrew (2001) indicated that the ways papers are found using this methodology, selected and catergorised is clearly articulated apriori, thus minimizing potential biases that can occur in some narrative style reviews. Such reviews provide reproducible, reliable assessments of the current status of a field of research by systematically searching and categorizing the relevant literature (Roy *et al*., 2012).

In this review, papers relevant to building energy efficiency assessment published in the following five leading building, energy and building energy journals were used: Energy Policy, Energy and Buildings, Building and Environment, Energy and Applied Energy. The authors of this paper followed the method of Al-Sharif and Kaka (2004) to employ a systematic search to identify papers with the following phrases in subjects, titles, keywords, or abstracts: ‘building energy assessment’, ‘building energy efficiency evaluation’, ‘building energy performance measurement’ and ‘efficiency measurement of building energy’. The search procedure for papers related to building energy assessment research involves the following three steps:

1. The titles, keywords, and abstracts were scanned with the related keywords. The authors scaled down the search by focusing on the papers published from January, 2000 to June, 2013.

2. A brief review of the abstract of the papers was conducted to filter out less related or unrelated papers.
3. After filtering, 63 articles with relevant contents regarding building energy efficiency assessment were selected for further analysis.

From each original research paper examining building energy assessment, the following seven items of information were recorded in a Microsoft Excel database: (i) author(s), (ii) journal, (iii) year of publication, (iv) study location (country and continent), (v) research methods, (vi) major research theme and (vii) any other relevant aspect. Classification of papers under the methodologies used included case study, energy audits, field observation, documentation, questionnaire, reporting protocols, experimental measurement, literature, interview, dynamic simulation, data acquisition and Delphi study.

The current demand for energy has been in its peak in the last decade necessitating a drive in research. Main stream studies in building energy efficiency assessment has thus emerged mostly in the 2000's and this is the rationale for selecting the time frame for the searched journal articles. Secondly the purpose of the research was also to elicit relevant knowledge that is useful for developing countries to enhance research into building energy assessment. Thus the timeframe selected provides a profound opportunity to identify the current research methods.

RESULTS AND DISCUSSIONS

Table 1 exhibits the number of papers published in the target journals during the period from 2000 to 2013.

Table 1. Number of Articles Related to Building Energy Efficiency Assessment Studies in the Selected Journals from 2000 to 2013

Journal Title	Number of Papers
Energy Policy	18
Energy and Buildings	38
Building and Environment	4
Energy	2
Applied Energy	1
Total	**63**

Over this period, Energy and Buildings has published the largest number of building energy efficiency assessment journals papers (=38), followed by Energy Policy (=18), Building and Environment (=4), Energy (=2) and Applied Energy (=1). Documentation predominates in collecting data in BEEA and account for 42% of the studies. The second most popular method is case study which accounted for almost 25%; and papers using questionnaire were about 9%. The least used methods include interviews and experimental measurement. Literature Review studies and energy audits both accounted for 5% (6 number). Data acquisition and dynamic simulation studies were 6.84% and 5.13% respectively. Only three studies used field observation. Fig 2 shows the distribution of quantity of research methods. Table 2 also presents the distribution of the research methods across the various targeted journals. The most common method to all of the journals was Case Study and Documentation. Energy policy used more of Documentation than all of the other journals. Experimental measurement was also only conducted by the Applied Energy Journal. Field observation and reporting protocols was only conducted by the Energy and Buildings journal.

Table 2. Distribution of Research Methods According to the Selected Journals.

Research Method	Energy Policy	Energy and Buildings	Building and Environment	Energy	Applied Energy
Case Study	8	17	2	1	1
Energy Audits	0	3	0	0	0
Field Observation	0	3	0	0	0
Documentation	15	29	3	1	1
Questionnaire	2	7	0	1	0
Reporting Protocols	0	1	0	0	0
Experimental Measurement	0	0	0	0	1
Literature	1	2	0	0	0
Interview	1	0	0	0	0
Dynamic Simulation	1	3	1	0	1
Data Acquisition	1	6	0	1	0
Delphi	2	0	0	0	0

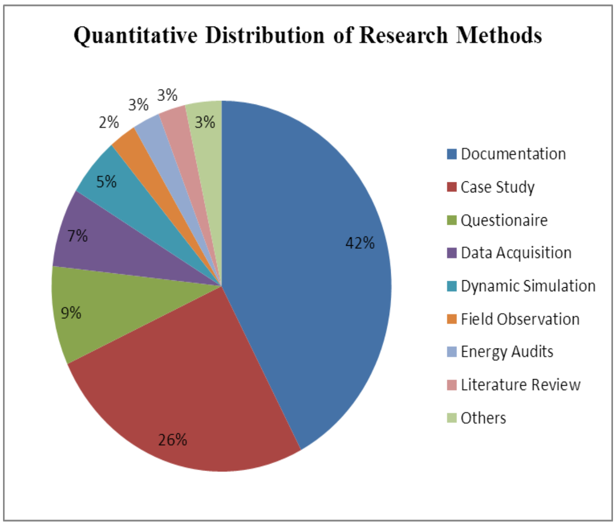


Figure 1. Quantitative Distribution of Research Methods

Documentation

Documentation is one of the most popular research method observed in the area of building energy research. Among the papers studied 42% used documentation in their research. Eang *et al*., (2008) used documentation to report on a building energy efficiency labelling programme conducted in Singapore. They report on methodologies used to achieve the process including benchmarking database and an independent audit conducted by a private accredited Energy Service Company (ESCO) are highlighted. Bagheri *et al*., (2013) in their paper, a technical procedure for developing energy performance label for office buildings in Iran is presented. The paper used documentation to take account of how a building energy simulator software tool was developed, validated, and applied to simulate an exhaustive sample society of office buildings. The paper also includes the use of energy audits and survey questionnaire. Rey *et al*, (2007) use documentation to also report on an assessment carried out on a building energy labelling in Spain. Sjo¨gren *et al*., (2007); Olesen (2007); Díaz *et al*., (2013) all employed the use of documentation to report on the process involved in the design, development and evaluation tasks, including profiling the design and development context.

Out of the studies conducted with documentation 29% used only the documentation method. Most of the studies adopted the used of other research method together with documentation. Case study was the most commonly used with documentation followed by the survey questionnaire and site survey. A typical example was the study conducted by Bagheri *et al*., (2013); Farrou *et al*., (2012) and Carlo and Lamberts (2008).

Case study

The second common research method used was case study which totalled 30 out of the 63 papers studied. Most research conducted in building energy efficiency have to select a particular case in which to study in depth and to apply the building energy assessment method developed.

Some of the studies conducted into case study include Lee and Kung (2011); in their paper they propose an adjustment to the traditional approach by using climate classification and data envelopment analysis. The study first adopts cluster analysis to classify the evaluated buildings into different climate clusters. The samples of 122 office buildings in Taiwan in summer are classified into three climate clusters. This study was performed also with data acquisition of weather data and already existing data from power utility. Another study by Congradac *et al*., (2012) developed a design tool and a case study performed to test that tool.

Other studies that researched into the assessment of building energy efficiency tool also used case study. Entrop *et al.*, (2010) in their paper a comparison is made between the methodologies and accuracies of three Dutch energy performance indicators by applying them to eight houses. Lee (2008) used multiple linear regression method and data envelopment analysis to examine the effectiveness of energy management. In his paper, 47 government office buildings are analyzed in Taiwan. Elena *et al*., (2011) presented a work which was performed as a case study to demonstrate the use of building typologies to model the national energy balance in Greece. The Hellenic typology consists of 24 building types, derived after a classification of the residential building stock in three time construction periods – age bands (pre-1980, 1981–2000 and 2001–2010), two sizes (single family, multifamily) and four climate zones.

There was no single study that was conducted solely on case study. Case study was mostly used with documentation than any other method. For studies that were concentrated on the development of a tool 28% used case study, whilst almost 70% of the study related to assessment used case study, 50% of impact studies used case study.

Questionnaire

Questionnaire used made up of almost 10% of the papers studied. Questionnaire was used gather data from users of buildings mainly about the buildings and also from building expert. For example Hernandez *et al*., (2008) in their paper outlines a methodology to develop energy benchmarks and rating systems starting from the very first step of data collection from the building stock. A first set of detailed questionnaires was distributed to 500 schools in Ireland, with the aim of collecting details on construction, activities and energy uses in each building. Sixty-seven completed questionnaires were returned (13%). This paper employed the use of only questionnaire. Also Bagheri *et al.*,(2013) used a comprehensive questionnaire which was filled by the energy experts while making a transient (short-term) energy audit for every office building for their work. Farrou *et al*., (2012) in their work the energy data of the hotels is collected using questionnaires and visits on site. Around 500 questionnaires were sent via emails to hotels of a particular climatic zone due to poor feedback the questionnaire were administered through visits to the areas of interest. Out of 100 visits finally 90 hotels fully corresponded to the research.

In Yang *et al.*, (2010) the research method applied a wide-ranging literature review and a questionnaire survey involving experts in the field. The snowball sampling method was used to select qualified experts in the survey. Affiliation types of the experts involved in the survey were mainly from academy, builder and consultancy, 67% of respondents were from an academy with practical experiences, 20% were from a builder or the building industry and 13% were from a building consultancy. Sabapathy *et al*., (2010) used a structured questionnaire to collect information on billed electricity consumption as well as operational characteristics from IT and ITES facilities in Bangalore city in India. Amecke (2012) used an email questionnaire survey. Of the 2056 recipients who started the survey, 1239 completed it.

Data acquisition

The total number of research papers that adopted the use of data acquisition was 8 representing about 7%. Data acquisition was mainly use to gather some specific data from buildings including hourly consumption data, indoor temperature and local weather conditions. The following studies illustrate this. Lee and Kung, (2011) in their study proposed an adjustment to the traditional approach by using climate classification and data envelopment analysis. Based on the data collected from climate measurement stations, temperature and rain hour are used as the clustering variable. In their study they employed the use of a case study with the data acquisition method. The floor area data and the number of occupants of the evaluated buildings were provided by their energy manager. Data on weather conditions, such as outdoor temperature and hours of rain,was collected from 11 climate measurement stations of the Central Weather Bureau.

Escrivá-Escrivá *et al*., (2011) in their research paper they introduce new indices based on energy consumption during different periods. In this work, measurements of hourly consumption data at two electrical points: total consumption of the building, and total consumption of the HVAC system were obtained using a flexible energy management and control system (EMCS). Escrivá-Escrivá *et al*., (2012) also used data acquisition of building energy consumption: hourly consumption data was obtained at different electrical points. The methodology was applied to 55 buildings at the Universitat Politècnica de València campus during an entire year.

Majcen *et al*., (2013) used data set which was provided by Agents chap NL—a public sector organisation appointed by the Dutch Ministry of the Interior and Kingdom Relations. This data was, on the basis of the addresses of the households, linked to actual energy use data, which was provided from the energy companies. Dall’O’*et al*., (2012a) in their work, data-loggers were installed in three flats to detect and record actual temperature values during operational periods. Their paper reports and comments on the results of monitoring a high-performance building located in Milan.

Data acquisition studies were observed to be done always with another research method. It was however done mostly with case study and documentation.

Dynamic simulation

Six papers were identified to have used dynamic simulation in their work. Pisello *et al*., (2012) posited that bbuildings' dynamic analysis is by now a well-established procedure to study effective building energy performance given real climate considerations. The following papers research was based on the use of a dynamic simulation. Carlo and Lamberts (2008) carred out a local survey in 5 Brazilian cities as a basis for the simulation of 5000 alternatives in order to investigate building energy performance as a function of parameters involved in the energy efficiency. Pisello *et al*., (2012) in their work, a concise and effective methodology for analyzing buildings' thermal performance in a dynamic environment is proposed and applied to different case studies, consisting of single-family residential buildings' prototypes.

Hygh *et al*., (2012) presented a new modeling approach to quantify building energy performance in early design stages. They argue that building simulation models can accurately quantify building energy loads, but are not amenable to the early design stages when architects need an assessment tool that can provide rapid feedback based on changes to high level design parameters. They utilize EnergyPlus, an existing whole building energy simulation program, within a Monte Carlo framework to develop a multivariate linear regression model based on 27 building parameters relevant to the early design stages. Xu *et al*., (2013) investigated the energy saving potential in Hot Summer and Cold Winter Zone under different level of energy efficiency standards (China local, China national, and UK standard). Chongqing was taken as an example, and a commercial energy simulation tool eQuest was applied to analyze the building end-use energy.

Energy audits and field observation

The total number of papers from energy audits and field observation made up of the research method. This included 3 from energy audits and 3 from field observation. Dall'O *et al*., (2012b) in their paper data regarding the energy performance of buildings are collected using energy audits on sample buildings, which are selected using a statistical approach. This methodology was tested in a medium sized town in the Lombardy region (Italy). Bagheri *et al*., (2013) used a widespread field activity to gather the modeling data from 285 office buildings through all the 4 climatic zones in Iran. A precise and detailed energy audit activity was conducted for 12 office buildings throughout the different climatic zones of Iran.

Escrivá-Escrivá *et al*., (2011) used an energy audit to collect fundamental information for the analysis of the building: architectural drawings to calculate the area and volume that is air-conditioned, number of users, schedules of use of the facilities, energy requirements of the users, activities that are performed in the building, and characteristics of the heating, ventilation, and air conditioning system (HVAC), etc. In Carlo and Lamberts' (2008) study a photographic survey was performed in 5 Brazilian cities and was completed with a site survey in Floriano´ polis to develop prototype buildings for simulation. This served as a basis for the simulation of 5000 alternatives in order to investigate building energy performance as a function of parameters involved in the energy efficiency.

Reilly *et al*., (2013) used a survey performed by the City of Dublin Energy Management Agency (CODEMA) for their work. A set of 159 dwellings were comprehensively surveyed by trained energy assessors for the study which was conducted in 2006. The dwellings surveyed in the study were chosen using a stratified sampling process, guaranteeing the samples statistical significance for construction year, dwelling type and tenure type for the Irish housing stock.

Others

Other methods used included Delphi method, experimental activities and interviews. Zhao *et al*., (2009) used a Delphi method combined with comparison between close indices method to determine the weight of indices. Pisello *et al*., (2012) performed experimental activities to measure the opaque envelope transmittance of two existing houses, representing the transmittance's range extremes. To validate this approach, the assessments results obtained are then compared with a commonly used performance indicator, the Degree Hours, with reference to the European thermal comfort standard EN 15251 which assess the thermal comfort within a long-term, adaptive approach. They posit that to better define the important envelope parameters necessary to calibrate the numerical models, experimental activities were conducted.

ENHANCING BUILDING ENERGY RESEARCH IN DEVELOPING COUNTRIES

This study seeks to find the common practice in BEEA research methodology to acquire knowledge that can be used especially in developing countries. Through the study the following observations were made;

The need for expertise

The use of documentation in building energy research suggests that the researcher must be well trained in this area of research due to the nature of this research. A strong knowledge base in building energy tools, building energy simulation is key in the area of this research. The researcher must be able to document his process of developing a research tool and or his process of assessing a tool. Also the researcher must also be able identify relevant areas and clearly note the area that are topical in the study. In Bagheri *et al.,* (2013) averred that the studies are conducted either by using the energy audit instruments or by applying the energy simulator software tools. Afterwards, results of the studies are concluded as the energy consumption indexes and applied to develop the standard energy indexes for buildings. Comparison of the cited methodologies (Detailed Energy Audit versus Software Tools) indicates that software tools are more common and have been applied rather than time-consuming and costly energy audit activities. In addition, in many countries, software tools are used to estimate the energy performance grade for an existent or designed (not built) building.
Secondly the availability and accessibility of building energy experts is key as the process of development of a tool or its assessment the target population is likely to be building energy experts. This assertion is supported Bagheri *et al.,* (2013) in their work they targeted energy experts to do the evaluation also Yang *et al*., (2010) employed experts in building energy to complete their research. Also in Reilly *et al*., (2013) a set of 159 dwellings were comprehensively surveyed by trained energy assessors for the study which was conducted in 2006. A number of research methodologies chosen arguably can be performed on only experts such as Delphi,

analytical hierarchal process and also energy audit can only be performed by trained personnel.

Availability of data such as energy consumption and weather data profile:

The availability of data is major determining factor for the success of energy research. This is mainly due to the reason that the research relies heavily on data including building energy consumption profiles, general building characteristics, weather data and the like (Lee and Kung, 2011). Survey of similar standard and labeling procedures for buildings throughout the world shows that in most of the valid and comprehensive research activities, a sample society of buildings is considered as the data bank for studies (Bagheri *et al*., 2013).

Also the existence of building energy standards defines the framework for more studies and actually drives research into many other areas. However Janda (2008) in their study show that most African countries lack building energy standard. This gap acts in two ways first of all it's a strong basis for African countries to start researching into this area and secondly the development of the standard would also serve as a catalyst for research into these areas. A study in Iran exploring energy label for office buildings was based on their existing standards (Bagheri *et al*., 2013). It is been noted that lack of energy consumption data remains a significant drawback for extracting general conclusions on the energy performance of the building stock (Nikolaou *et al*., 2009)

The role of policy instruments

The Energy Performance Building Directive (Directive 2002/91/EC) introduced the compulsory energy certification of buildings in the EU from 2006 and it has played a key role in the common policy to monitor and reduce energy consumption. The introduction of this directive has also directed more research into energy buildings as member states of the European commission explore ways of meeting this directive. A study by Andaloro *et al*., (2010) show how varied the situation regarding energy certification in each country is in terms of implementation and scope of application and it also reveals that most countries are still at a halfway stage towards achieving excellence.

Majcen et al., (2013) noted that more research on the relationship between policy instruments and their effects is needed to validate the efficiency of these instruments and improve them. They argue that Simulation tools are often used to support policy but do not always provide results that correspond to reality. This assertion is based on that fact that because much is still unknown, especially in the field of statistically valid and standardized dwelling use and the relationships between dwelling use, dwelling type and occupant characteristics.

CONCLUSION

In this paper five major journals in the field of building energy were reviewed with a particular interest in identifying what methods and approaches have been presented or employed in Building energy efficiency research. The study showed that documentation predominates in BEEA and account for 42% of the studies. The second most popular method is case study which accounted for almost 25%; and papers using questionnaire were about 9%. Three main observations were made in the study; the need for expertise, the availability of data and the role of policy instruments. It was indentified that the availability and accessibility of building energy experts is key. Secondly, understanding of software tools and building energy construct is critical for the researcher in building energy. The availability of data is also very crucial as building energy research relies heavily on data including building energy consumption profiles, general building characteristics and weather data. Lastly, it was observed that policy instruments play a pivotal role in driving building energy research. This research, like any other, had limitations in its conduct and scope, which suggest further research. The research only investigated five main journals on building energy and these journals are European based journals. It should however be noted that the European countries has the highest number of energy standards for building than any other continent (Janda, 2008). Future studies may also include other outlets, particularly conference proceedings and other journals based in other continents. Second, the scope of our survey of research methods is rather limited by only reviewing one major aspect i.e. data collection methods. Other important methodological issues include the choice of statistical tools and the power of the findings. Finally, future research can undertake systematic examination of these areas so as to provide additional insights and a comprehensive review of research methods in BEEA.

REFERENCES

Akbari, H. (1995). Validation of an algorithm to disaggregate whole-building hourly. Energy 20 , 1291–1301.

Al-Sharif, F. and Kaka, A., 2004. PFI/PPP topic coverage in construction journals. In: ARCOM 20th Annual Conference. Heriot Watt University, Blackwell, pp. 711–719.

Amecke, H. (2012). The impact of energy performance certificates: A survey of German home. *Energy Policy 46* , 4-14.

Andaloro, A. P. F., Salomone, R., Ioppolo, G. and Andaloro, L. (2010). Energy certification of buildings: A comparative analysis of progress towards implementation in European countries. *Energy and Policy 38* , 5840-5866.

Asdrubali, F., Bonaut, M., Battisti, M. and Venegas. (2008). Comparative study of energy regulations for building in Italy and Spain. *Energy and Buildings 40* , 1805-1815.

Bagheri, F., Mokarizadeh, V. and Jabbar, M. (2013). Developing energy performance label for office buildings in Iran. *Energy and Buildings 61* , 116-124.

Bertoldi, P., Rezessy, S., Lees, E., Baudry, P., Jeandel, A., and Labanca, N. (2010). Energy supplier obligations and white certificate schemes:. *Energy Policy 38* , 1455-1469.

Bull, R., Chang, N. and Fleming, P. (2012). The use of building energy certificates to reduce energy consumptioon in European public buildings. *Journal of Energy and Buildings 50* , 103-110.

Carlo, J. and Lamberts, R. (2008). Development of envelope efficiency labels for commercial buildings: Effect of different variables on electricity consumption. *Energy and Buildings 40* , 2002-2008.

Congradac, V., Prebiracevic, B., Jorgovanovic, N. and Stanisic, D. (2012). Assessing the energy consumption for heating and cooling in hospitals. *Energy and Buildings 48* , 146-154.

Corrado, V., Mechri, H.E., and Fabrizio, E. (2007). Building energy performance assessment through simplified models: application of the ISO 13790 quasi-steady state method, Proceedings of the 10th Conference of the International Building Performance Simulation Association, 3-6 September (2007),Tsinghua University, Beijing, China, 79-86.

Dall'O', G., Sarto, L., Galante, A. and Pasetti, G. (2012a). Comparison between predicted and actual energy performance for winter heating in high-performance residential buildings in the Lombardy region (Italy). *Energy and Buildings 47* , 247–253.

Dall'O, G., Galante, A. and Torri, M. (2012b). A methodology for the energy performance classification of residential building stock on an urban scale. *Energy and Buildings 48* , 211–219.

Dascalaki, E.G., Balaras, C. A., Gaglia, A. G., Droutsa, K. G. and Kontoyiannidis, S. (2012). Energy performance of buildings — EPBD in Greece. *Energy Policy 45* , 469-477.

Dawood, S., Lord, R., and Dawood, N. (2009). Development of a visual whole life-cycle energy assessment framework for built environment. *Proceedings of the 2009 Winter Simulation Conference.*

Díaz, J. J. V., Wilby, M. R., González, A. B. R. and Munoz, J. G. (2013). EEOnt: An ontological model for a unified representation of energy efficiency in buildings. *Energy and Buildings 60* , 20–27.

Eang, L. S. and Priyadarsini, R. (2008). Building energy efficiency labeling programme in Singapore. *Energy Policy 36* , 3982-3992.

Entrop, A. G., Brouwers, H. J. H. and Reinders, A. H. M. E. (2010). Evaluation of energy performance indicators and financial aspects of energy saving techniques in residential real estate. *Energy and Buildings 42* , 618-629.

Escrivá-Escrivá, G., Álvarez-Bel, C. and Penalvo-López, E. (2011). New indices to assess building energy efficiency at the use stage. *Energy and Buildings 43* , 476-484.

Escrivá-Escrivá, G., Santamaria-Orts, O. and Mugarra-Llopis, F. (2012). Continuous assessment of energy efficiency in commercial buildings using energy rating factors. *Energy and Buildings 49* , 78-84.

Farrou, I, Kolokotroni, M. and Santamouris, M. (2012). A method for energy classification of hotels: A case-study of Greece. *Energy and Buildings 55* , 553–562.

Hernandez, P., Burke, K. and Lewis, J. O. (2008). Development of energy performance benchmarks and building energy ratings for non-domestic buildings: An example for Irish primary schools. *Energy and Buildings 40* , 249–254.

Hygh, J. S., DeCarolis, J. F., Hill, D. B. and Ranjithan, S. R. (2012). Multivariate regression as an energy assessment tool in early building design. *Building and Environment 57* , 165-175.

Hyman, M. R., and Yang, Z. (2001). International marketing journals: A retrospective. *International Marketing Review 18(6)* , 667-716.

Janda, K. B. (2008). Worldwide status of energy standards for buildings. *Proceedings of the Fifth Annual IEECB, April 9-10*, (pp. 1761-1769). Frankfurt Germany.

Kibert C. J., Sendzimir, J. and Guy, B. (2000). Construction ecology and metabolism: natural system analogues for a sustaina-ble built environment. *Construction Management and Economics*, 18: 903-916.

Lee, W.L., Yik, F.W.H. and Burnett, J. (2003) A method to assess the energy performance of existing commercial complexes, Indoor and Built Environment 12 (5) 311–327.

Lee, W., S. (2008). Benchmarking the energy efficiency of government buildings with data envelopment analysis. *Energy and Buildings 40* , 891-895.

Lee, W.L. and Burnett, J. (2008). Benchmarking energy use assessment of HK-BEAM, BREEAM and LEED. *Building and Environment 43* , 1882–1891.

Lee, W. and Kung, C. (2011). Using climate classification to evaluate building energy performance. *Energy 36* , 1797-1801.

Levine, M., Ürge-Vorsatz, D., Blok, K., Geng, L., Harvey, D., Lang, S., Levermore, G., Mehlwana, M., Mirasgedis, S., Novikova, A., Rilling, J. and Yoshino, H. (2007). Residential and commercial buildings Climate Change 2007: Mitigation, Contribution of Working Group III to The Fourth Assessment Report of The Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, U.K. and New York, U.S.A.

Majcen, D., Itard, L. C. M. and Visscher, H. (2013). Theoretical vs. actual energy consumption of labelled dwellings in the Netherlands: Discrepancies and policy implications. *Energy Policy 54* , 125-136.

Nikolaou, T., Skias, I., Kolokotsa, D. and Stavrakakis, G. (2009). Virtual building dataset for energy and indoor thermal comfort benchmarking of office buildings in Greece. *Energy and Buildings 41* , 1409-1416.

Olesen, B. W. (2007). The philosophy behind EN15251: Indoor environmental criteria for design and calculation of energy performance of buildings. *Energy and Buildings 39* , 740–749.

Perez-Lombard, L., Ortiz, J., Gonzalez, R. and Maestre, I. R. (2009). A review of benchmarking, rating and labelling concepts within the frameworkd of building energy certification schemes. *Energy and Buildings* , 272-278.

Pisello, A. L., Goretti, M. and Cotana, F. (2012). A method for assessing buildings' energy efficiency by dynamic simulation and experimental activity. *Applied Energy 97* , 419-429.

Poel, B., Cruchten, G. van and Balaras, C. A. (2007). Energy performance assessment of existing dwellings, Energy and Buildings 39 (4) 393–403.

Reilly, D., Duffy, A., Willis, D. and Conlon, M. (2013). Development and Implementation of a Simplified Residential Energy Asset Rating Model. *Energy and Buildings 65* , 159-166.

Rey, F. J., Velasco, E. and Varela, F. (2007). Building Energy Analysis (BEA): A methodology to assess building energy labelling. *Energy and Buildings 39* , 709–716.

Roderick, Y., McEwan, D., Wheatley, C. and Alonso, C. (2009). Comparison of energy performance assessment between LEED, BREEAM and Green Star Schemes. *Eleventh International IBPSA Conference*, (pp. 1167 - 1176). Glasgow, Scotland.

Sabapathy, A., Ragavan, S. K. V., Vijendra, M. and Nataraja, A. G. (2010). Energy efficiency benchmarks and the performance of LEED rated buildings for Information Technology facilities in Bangalore, India. *Energy and Buildings 42* , 2206-2212.

Sinou, M. and Kyvelou, S. (2006). Present and future of building performance assessment tools. *Management of Environmental Quality: An International Journal* , Vol. 17 No. 5.

Sjo¨gren, J. U., Andersson, S. and Olofsson, T. (2007). An approach to evaluate the energy performance of buildings based on incomplete monthly data. *Energy and Buildings 39* , 945–95.

World Business Council (2007). Energy Efficiency in Buildings: Business Realities and Opportunities, World Business Council for Sustainable Development, Geneva, Switzerland, 2007.

United Nations Environmental Program (UNEP) and United States Environmental Protection Agency (EPA). (1997). Reducing greenhouse gas emissions: The role of voluntary programs, United Nations Environmental Program Publication.

Xu, L., Liu, J., Pei, J. and XuHan. (2013). Building energy saving potential in Hot Summer and Cold Winter. *Energy Policy 57* , 253-262.

Yang, Y., Li, B. and Yao, R. (2010). A method of identifying and weighting indicators of energy efficiency assessment in Chinese residential buildings. *Energy Policy 38* , 7687–7697.

Zhao, J, Wu, Y. and Zhu, N. (2009). Check and evaluation system on heat metering and energy efficiency retrofit of existing residential buildings in northern heating areas of china based on multi-index comprehensive evaluation method. *Energy Policy 37* , 2124-2130.

AN EXPLORATION OF PUBLIC PRIVATE PARTNERSHIP IN INFRASTRUCTURE DEVELOPMENT IN SOUTH AFRICA

Aigbavboa C.O.[1], Liphadzi, M. and [2] Thwala W.D.[3]
Department of Construction Management, University of Johannesburg, Johannesburg, South Africa

Public-Private Partnerships (PPPs) are generally envisaged by countries around the world as innovative strategy to remeding the lack of dynamism in traditional public service delivery by increasing investment in infrastructure, as well as improving the delivery of social services. To this end, the South African Government since 1999 through the National Treasury has adopted the use of PPPs as an integral strategy in its national and international developmental plan. This research explores the relevance of PPP's in South Africa and the challenges facing PPP adoption and framework as we further suggests some techniques that could serve in fast-tracking infrastructure.The data used in this research were derived from both primary and secondary sources. The secondary data were collected via a detailed review of related literature. The primary data was collected through a structure questionnaire aimed at 50 construction government and private officials who have the knowledge of PPPs. Findings revealed that PPPs is a viable option for infrastructure delivery in South Africa and should be better explored; as it was also found that PPPs is currently unpopular because it has been under-explored. Also, the respondents informed that current PPP regulations in South Africa may have to be changed or better adapted to be effective in the administration of PPP transactions.The study suggets that government should pay special attention to the creation of skills within government to deal with PPPs and have equal responsibility to play in ensuring that PPP is promoted amongst the private sector during the procurement phase of the PPP by creating an enabling environment which is fair.

Keywords: infrastructure development, public private partnership, Gauteng Province Government

INTRODUCTION

Infrastructure development remains a critical catalyst of development, economic growth and social welfare in a developing country such as South Africa. The delivery of key infrastructure through Public Private Partnership (PPP) initiatives has become an important policy instrument by which both the public and private sectors could assist in alleviating some of the backlog in infrastructure that exists in developing countries. Trevor Manuel (2006) pronounced that PPPs in South Africa are an important service delivery mechanism because they can facilitate rapid infrastructure delivery as envisaged under the Accelerated and Shared Growth Initiative for South.

Procurement of projects is something that has been happening in the past, but the burden to change the standard model of public procurement arose primarily from concerns about the level of public debt, which grew rapidly during the macroeconomic dislocation of the 1970s

[1] aigclinton@gmail.com
[2] Rendy017@gmail.com
[3]

Aigbavboa *et al*. (2014) An exploration of public private partnership in infrastructure development in South Africa *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 101-109.

and 1980s. Initially, most public–private partnerships were negotiated individually, as one-off deals, and much of this activity began in the early 1990s (Quium, 2011). Since 1999, Public Private Partnerships (PPPs) in South Africa have been regulated under the Public Finance Management Act (PFMA), providing a clear and transparent framework for government and its private sector partners to enter into mutually beneficial commercial transactions, for the public good. At the heart of the South African PPP structure is the National Treasury's PPP Unit constituted in 2000. This dedicated PPP unit plays a key role particularly in the creation of PPPs where it has the final authority in the approval of PPP agreements.

PPPs should be seen as a catalyst for providing basic infrastructure services that have the intent of improving the quality of lives for ordinary citizens. PPP also operates in a manner that the private party uses its own funds to ensure that the construction is completed on time and within budget. Within South Africa most infrastructure development has traditionally been done by the state through tax revenue collection, which is why the use of PPPs as a way of mobilizing economic development and infrastructure spend needs significant consideration (Malao, 2011). As the PPP market grows in South Africa, it is clear that the public sector needs to improve its understanding of PPPs and in which sectors they should be pursued, to complement traditional procurement practices (National Treasury PPP Unit, 2007). According to (Akintoye) 2005 it is imperative that the public and private sectors move towards a greater shared vision of the role that PPPs can play in delivering infrastructure and services in South Africa. The onus is on both parties to make PPPs viable through a genuine spirit of co-operation that produces trust.

In spite of several challenges PPP has shown, some developed countries have successfully implemented PPP projects which have concurrently presented opportunities and lessons that South Africa can draw from. Therefore, this paper investigates Public Private Partnerships in South Africa towards infrastructure development and also looks into the fundamental causes of the challenges within the PPP framework. The paper starts with an overview of the concept of Public Private Partnership followed by an explanation of the methodology design; presentation of the findings and discussions before conclusion are drawn and recommendation made.

PUBLIC PRIVATE PARTNERSHIP TOWARDS INFRASTRUCTURE DEVELOPMENT

PPP is described as a long-term contract between the public and private sectors where government pays the private sector to deliver infrastructure and related services on behalf, or in support, of government's broader service responsibilities. The private sector participation should not replace government, but should complement government capacity. PPP projects cover economic and social infrastructure and typically include both a capital component and an ongoing service delivery component of non-core services (Malao, 2011).

PPP projects are part of a broader spectrum of contracted relationships between the public and private sectors to produce an asset or deliver a service. However, the intention is to apply the private provision of services for which there is a public infrastructure element and a private financing element called Public Private Contracts co over different forms of long-term contracts drawn-up between legal entities and public authorities (Sagalyn, 1997). According to Chege (2003) Public Private Partnerships covers all current legal/economic forms that make it possible for private funds to invest in public infrastructure and services. Basically a public authority (federal or local) entrusts a private operator with the long-term implementation of a project. Frequently, this involves large-scale and complex construction and operation.

However there is a traditional method of procurement that has been already there which is traditionally known to be more input specification driven, which has therefore limited the scope for innovation and creativity pertaining to the design of the related infrastructure facility (Regan, 2009). PPPs in contrast are more output specification driven often requiring better innovation from the private sector. The contractor and operators assume significant risk which they would price for and agree on at financial close. (Regan, 2009) cites that this innovative approach creates an incentive for the private sector to deliver quality facilities and to maintain the infrastructure over the concession period. The PPP project cycle uses three key measures of approval which are governed by (Treasury Regulation 16, 2004), namely: affordability; value for money; and risk transfer. Moreover if government departments and agencies contracts with the private sector it creates opportunities to deliver improved public services and can potentially deliver significant benefits in design, quality of services, while drawing best available skills and knowledge and resources.

Within the South African context PPPs have a very short history and it still faces major institutional and political challenges which have led to the slow implementation and progression of PPP projects thus far and although certain improvements have been made to catalyze and improve the state of infrastructure in South Africa. A set of regulatory frameworks and guidelines for the use of PPPs by national and provincial government institutions in South Africa has been instituted. This legislation which governs PPPs for national and provincial government is known as Treasury Regulation 16 and is included in the Public Finance Management Act, 1999 (PFMA). Municipalities are governed by a different piece of legislation known as the Municipal Systems Act, 2000 and the Municipal Finance Management Act, 2003 (Malao, 2011).

CHALLENGES FACING PPPS

The challenges faced by PPPs in South Africa are extensive to particular projects within the diverse government departments, although some improvements have been made in developing the country's infrastructure; these developments have not been enough to reach all jurisdictions throughout South Africa. Most of the greatest infrastructure needs are controlled by local government. These challenges have unfortunately affected many municipal PPPs due to the lack of resources and proper skills. Political inference and unwillingness have been some of the core causes of instability in the South African PPP arena. With the various types of PPP projects being implemented at the three tiers of government, namely national; provincial and local level, decisions needed to be taken regarding the approval and implementation of such projects are frequently taken at a political level making the decision-making processes challenging. Concerns arise when there is change in the administration of government or where there is a restructuring of political positions, particularly if the individuals who are responsible for managing the PPP contract with the private party concerned are no longer the same as those who negotiated the contract in the first place (Flinders,2004: 12).

However according to McQuaid (2000), the factors he believes success will depend upon include leadership, legitimacy, resources, governance and evaluation. The key principles of partnership suggested by Plummer (2011) also inform the formation of a set recommendation to promote partnership success. These suggested principles include: transparency and accountability; competition and contestability; legitimacy and legality; specificity; stakeholder participation; equity; clarity and predictability; risk management; and economic, financial and environmental sustainability.

RESEARCH METHODOLOGY

This research adopted a quantitative approach which will comprise of a questionnaire. The questionnaire survey led to the compilation of the primary data. The data used in this paper were derived from both primary and secondary sources. The primary data was obtained through the survey method which used purposive sampling, while the secondary data was derived from the review of literature and archival records. The primary data was obtained through the use of a structured questionnaire survey. The format of the questionnaire has three sections. The first section is based on demographic data of the professionals and officials; this reflects the experience in the field, gender, race, and professional status. Section two comprises of questions relating to the relevance of PPP towards infrastructure development and that will be based on the Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Section 3 deals with the challenges facing PPPs with regard to infrastructure development. The fourth section consists of questions and statements relating to possible conditions needed for fast tracking infrastructure through PPPs. This was distributed to a collective total of 50 Quantity Surveyors, Engineers, Government officials and financial officials in both the private and public sector around Gauteng province. This yardstick was considered vital for the survey in order to explore Public Private Partnerships in South Africa. Out of the 50 questionnaires sent out, 34 were received back representing a 68% response rate. This was considered adequate for the analysis based on the assertion by Moser and Kalton (1971) that the result of a survey could be considered as biased and of little value if the return rate was lower than 30–40%. The data presentation and analysis made use of frequency distributions and percentages of all the respondents. The research was conducted between the months of June to September 2013.

MEAN ITEM SCORE (MIS)

A five point Likert scale was used to determine the relevance of PPPs towards infrastructure development and the challenges facing PPPs. The adopted scale was as follows:

1 = Strongly disagree

2 = Disagree

3 = Neutral

4 = Agree

5 = Strongly agree

The five-point scale was transformed to mean item score (MIS) for each of the factors of causes and effects delays as assessed by the respondents. The indices were then used to determine the rank of each item. The ranking made it possible to cross compare the relative importance of the items as perceived by the respondents. This method was used to analyse the data collected from the questionnaires survey. The mean item score (MIS) was calculated for each item as follows;

MIS= 1n1 + 2n2 + 3n3 +4n4+5n5 …………………….Equation 1.0

∑N

Where;

n1 = Number of respondents for strongly disagree;

n2 = Number of respondents for disagree;

n3 = Number of respondents for neutral;

n4 = Number of respondents for agree;

n5 = Number of respondents for strongly agree;

N = Total number of respondents

After mathematical computations, the criteria are then ranked in descending order of their mean item score (from the highest to the lowest).

RESULTS AND ANALYSIS

Table 1: Relevance of PPPs towards infrastructure development

RELEVANCE OF PPP TOWARDS INFRASTRUCTRE DEVELOPMENT	MIS	R
PPP is important in accelerating and enhancing infrastructure Development.	4.62	1
PPP are more advantageous than traditional procurement methods	4.44	2
PPP delivers better value for money than traditional procurement.	4.38	3
PPP’s creates Jobs	4.35	4
PPP Improves the quality of services	4.26	5
PPP can be good for project management development planning	4.24	6
PPPs encourage the injection of private sector capital	4.24	6
PPP Advances expertise and experience	4.18	7
Both parties play a key role at each stage of the of the PPP project.	4.15	8
PPP’s provide better chances of completion on time and within the budget	4.15	8
PPP’s allows the spreading of funds in a long term period	4.12	9
PPP agreements should comply with the legal requirements of affordability	4.06	10
PPPs force the public sector to focus on outputs and benefits from the start	4.03	11
PPP free up public funds for immediate use	4.00	12
PPP help capacitate employees	3.91	13
Adequate Risk allocation within the PPP	3.88	14
PPP is structured to advance BEE options in South Africa	3.79	15
PPP is not a solution option to an infrastructure service problem but it is a viable project implementation mechanism for a preferred solution option	3.65	16

Findings from the 32 usable questionnaires revealed that 35% of the respondents had post graduate degree as their highest qualification while 32% had bachelor’s degrees and Post matric diploma. Further findings revealed that 35% of the respondents are in the public sector, 21% in the private sector and 44% of the respondents owned the companies thereof. The statistical mode for years of experience in the construction industry of the respondents was in the range of 1-5 years, However of the respondents only (68%) had PPP experience.

Based on the ranking (R) of the weighted average of the relative importance indices (MIS) for the listed factors (see Table 1.0), It is quite evident through the median item score (MIS) that majority of the respondents indicated that PPPs is important and relevant towards enhancing and accelerating infrastructure development (MIS = 4.62; R=1). Further the table indicates that the respondents feel that PPP are more advantageous than the traditional public procurement method (MIS = 4.44; R = 2), delivers better value for money towards a project (MIS=4.38; R=3), create more jobs (MIS=4.35; R=4)

Other factors explored which the level of agreement was low include; PPP free up public funds immediately (MIS =4; R=12), Adequate risk allocation in PPPs (MIS=3.88; R=14) and Structured to advance BEE options in South Africa (MIS=3.79; R=15).

Table 2.0 PPP tests

IMPORTANT TESTS WITHIN IMPLEMENTING PPP	MIS	RANK
Avenue for job creation	4.59	1
Assists in skills transfer	4.41	2
Affordability	4.38	3
Value for money	4.29	4
Appropriate risks transfer	4.18	5
SME development	4.09	6
Community development	4.00	7

Table 3: Challenges facing PPP

CHALLENGES IN THE ADOPTION OF PUBLIC PRIVATE PARTNERSHIP IN SOUTH AFRICA	MIS	R
There is sufficient capital to deploy PPP model in South Africa.	4.07	1
Suspicion or mistrust of private sector involvement in infrastructure.	3.97	2
Policy Bias toward Traditional Public Procurement	3.85	3
PPP awareness	3.85	3
The operational definition of PPPs remains unclear.	3.74	4
Insufficient research in PPP	3.74	4
Public sector lacks understanding of PPP's	3.65	5
Skills shortages affects the implementation of PPP models	3.47	6
The Government has an ability to deal with external risks associated with PPPs	3.47	6
Reshuffling result in changes in departmental priorities and commitment	3.47	6
Government structures are a problem in implementing PPP Models.	3.44	7
Capacity constraints in both the public and private sectors in the delivery of PPPs in South Africa	3.44	7
The South African regulatory environment provides a conducive environment for PPP transactions	3.41	8
Lack of Resources Dedicated to Fostering Public Private Partnerships Government	3.38	9
PPPs are undesirable since they are costly to government	3.15	10

DISCUSSIONS

Findings from the survey support the work done by Malao (2011) that PPPs are relevant towards building and accelerating infrastructure. PPU (2007) outlines the progress done in implementing PPP and the good progress done shows how vital PPP is towards building South African infrastructure. Findings relating to PPP being more advantageous over the traditional method is in agreement with work by Regan (2009), were it is found that PPP increases the scope for innovation and creativity. Literature reviewed shows us the PPP tests and how important they are in building a PPP project, the importance was in agreement with the findings, were respondents agreed with PPP creating value for money, creating jobs and assisting in skills transfer. However, the findings don't support work done by Malao (2011) were it was discovered that PPPs don't transfer risk adequately.

Findings from the survey support the work done by (Hurst and Reeves) 2004 that many challenges remain in enhancing the use of PPP's as a means of delivering infrastructure and that a number of these challenges are not so much in the set-up of the process but in the support and articulation of approach that is applied, government departments lack the skills required to drive PPP's with the private sector. One is persuaded to say that the capacity and the lack of skills is the influencing challenge towards the lack of implementing PPPs. In the absence of such capability, certain inherent inefficiencies associated with the public sector act as an inhibitor the PPP process.

Table 4.0: PPP success conditions

PPP SUCCESS CONDITIONS	Freq	Rank
Transparent PPP procurement processes	22	1
Institutions should have a strong management skills	19	2
Government support	18	3
Commitment to the partnership process by all partners	14	4
Clarity and openness about individual and collective agendas and purpose.	13	5
Clear PPP law, process, standard terms	12	6
Buy-in from all parts of the organizations is needed, from the leadership to the grassroots.	12	6
Proper training and communication	12	6
Good project estimating	12	7
The on-going PPP education of all involved is needed	12	7
Previous experience of partners in partnerships	10	8
Both institutions knowing more about the outcomes of PPPs	8	9
On-going performance management	8	9
Focus on appropriate product development and service delivery	8	9
Strong financial markets, competitive private sector	7	10
Establish sound partnership principles.	7	10
Open competition in the selection of partners.	6	11
Clear description of the responsibilities of each partner.	5	12
Continued active involvement of public partner.	5	12
Pay attention to governance issues in partnerships.	5	12

Findings revealed success factors that include; transparency in all processes (ranked at 1st), strong management skills (ranked at 2nd). Government support and commitment by both parties ranked at 3rd and 4th respectively. Other findings revealed that buy in by all parties involved is of paramount importance and adequate PPP training and communication (both ranked at 6th). The findings further revealed factors which are of low importance in bringing success within a PPP project. These factors were strong financial markets and establishing sound principles both and ranked 10th

Findings are in agreement with work by (Minnie, 2011:497), were it is evident that transparency and accountability is essential for partnerships, and especially partnerships involving public funds. Findings are further in correlation with research done by (UNDP 2008) and (McQuaid, 2000; 30) that government support and strong leadership backing is vital in bringing success in a PPP project. McQuaid further sets out principles as discussed in the literature which are important in developing PPPs, his principles are in agreement with all the findings. There are many additional success factors which can further define success and degrees of success, all of which are descriptions of desired conditions. A large collection of such success factors was developed in this study and this collection forms a reference point for the construction of a new hypothesis which can serve as the basis for future research.

CONCLUSION

The paper sets out to explore PPPs in South Africa and how they can help in building infrastructure. PPP concept in this dissertation has shown that PPPs exist and are successful in a wide variety of settings and sectors. Also, literature further revealed the importance of a PPP which includes, accelerating and enhancing infrastructure, avenue for creating more jobs and value for money, Improves the quality of a service and skills within an entity and creates adequate risk transfers within a project. Findings revealed that there is lack of PPP awareness and insufficient research done on PPP and this affects the PPP growth. Skills shortage and capacity constraints are some of the challenges that affect the adoption of PPP. PPPs should be seen as a catalyst for providing basic services to households with the intention of improving the quality of lives for ordinary citizens. Transparency and capacity building is pivotal to overcoming the elements that can lead to success.

It is therefore recommended that commitment towards implementing PPP should be shown by both parties. This should, however, be accompanied by a thorough dialogue amongst PPP stakeholders and those in government in order to drive an educational discussion around PPPs and the need for employing them as a form of procurement mechanism. Implementing and sustaining a successful PPP project requires co-operation, however complexity of PPP’s cannot be entirely removed hence focusing on a number of key success elements may influence the objective of fast-tracking infrastructure. To this end the question that is ought to be asked is whether government is fit to provide a particular service through PPP or if indeed the traditional approach to service delivery should be taken. PPPs should be used to serve the best interests of public citizens and not as a public relations or profit intensification mechanism by the private sector.

REFERENCES

Akintoye, A , Edwards, P.J. and Hardcastle, C. (2005) Critical success factors for PPP/PFI projects in the UK construction industry. Construction Management and Economics.

Chege, L. and Rwelamila, P.D. 2003. Private Financing of Construction Projects and Procurement systems: An Integrated Approach. Paper delivered at the CIB World Building Congress, Wellington, New Zealand

Harris, S. (2004). Public Private Partnerships: Delivering Better Infrastructure Services. Working Paper, Inter-American Development Bank, Working (Journal Article).

Claire Hurst, Eoin Reeves, (2004) "An economic analysis of Ireland's first public private partnership", International Journal of Public Sector Management

Malao (2011). M. (2011) Delivery of infrastructure development through Public partnerships. Thesis, North West University, North west

Manuel, TA. 2006. Address to parliament on the budget votes of the Ministry of Finance. Accessed: www.treasury.gov.za on 15 June 2013

McQuaid, R.W. 1993. Economic development in local authorities: The Scottish case. Local Economy

McQuaid, R.W. 2000. The theory of partnership: Why have partnerships? In S.P. Osborne (ed.). Public-private partnerships: Theory and practice in international perspective. London: Routledge

Minnie, J.A. 2011. PPP critical success factors. Master’s degree thesis. University of Stellenbosch.

Moser, C. A. and G. Kalton (1971), Survey methods in social investigation. UK, Heinemann Educational.

National Treasury PPP Unit, 2007. PPP Quarterly, February, issue Number 28, 6.

National Treasury. 2004. PPP Manual, Module 1. South African Regulations for PPPs

Ngamlana. P, 2009. Improving Public Private Partnerships deal flow for infrastructure delivery in South Africa: The Role of the National Treasury, Thesis

Plummer, J. 2002. Focusing partnerships: a sourcebook for municipal capacity building in Public-Private Partnerships. London: Earthscan Publications

Quium A. (2011). A guidebook on public-private partnership in infrastructure Bangkok: UNESCAP

Regan, M. 2009. The survey of alternative financing mechanisms for Public Private Partnership's .Australia: Bond University

Sagalyn, L.B. 1997. Negotiating for public benefits: The bargaining calculus of public-private development. Urban studies.

UNDP (United Nations Development Programme). 2008. Guidelines for public-private partnerships [Online]. Available at http://ncppp.org/undp/guidelines.html.

ADVERSE IMPACTS OF DESIGN TEAM ON CONSTRUCTION WORKFORCE PRODUCTIVITY

Adebowale Oluseyi J[1] and Fapohunda, J A [2]

Department of Construction Management and Quantity Surveying, Cape Peninsula University of Technology, South Africa.

Construction industry is generally identified with poor productivity, extension in project duration and cost overruns. Production efficiencies attributed to construction sector has been comparatively low compare to manufacturing industries. This poor performance is instigated by several participants in the construction field, while this makes the objectives of most construction projects rarely achievable. Due to the significance of design professionals in construction building production, the study explores design team production information, and design related factors affecting construction workforce efficiency. This will afford adequate control and co-ordination of workforce during construction production processes. As a result of vast growth of construction activities within the city of Cape Town, the research was conducted in the Western Cape Province, Cape Town, South Africa. The study involves professionals in the construction organisations; exploring quantitative questionnaire surveys with contract managers, quantity surveyors, site supervisors, site managers and project managers. Being a pilot study to an on-going research, questionnaires administered to respondents were limited to twenty-five repondents through physical means. Twelve of the questionnaires were retrieved through direct contacts, while ten were valid and analysed with SPSS statistical tool. The study reveals the design related factors that affect construction workforce productivity. From the findings, the prevalent factors affecting the performance of construction organisations include; missing details in architectural working drawings, slow response of architect to drawing questions, non-clarity of architectural specifications, complexities involved in construction drawings, buildability problem, contract documents conflicting construction drawings.The adequate application of recommendation presented by this study will reduce construction wastes and enhance construction workforce efficiency.

Keywords: buildability, construction workforce, design team, production information

INTRODUCTION

Construction workforce productivity is often defined as the ratio of output to input (Enshassi, Mohammed, Mustafa and Mayne, 2007). There are enormous challenges confronting construction industry. Basically, one of the most significant of these challenges is low productivity of construction labour (Jarkas and Bitar, 2012). The reason for poor performance is occasionally attributed to the complexity and dynamism involved in the construction environment (Raiden, Dainty and Neale, 2003, Enshassi, Mohammed and Abushaban, 2009). Nonetheless, Durdyev, Ismail and Abubakar, (2012) however posted that construction productivity could be improved through effective management efforts toward achieving project goals. Irrespective of

[2] fapohundaj@cput.ac.za

Adebowale, O.J. and Fapohunda,J.A. (2014) Adverse impacts of design team on construction workforce productivity *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference*, 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 111-119.

the significant number of studies undertaken towards improvement of construction workforce productivity, there is prevalent of cost and time overruns in the construction sector (Alinaitwe, Mwakali and Hansson, 2007). This becomes a momentous evidence of productivity challenge within the construction industry. Although human capital is a major resource in the construction environment, but problematic to control and therefore affect overall objectives of construction projects (Soham and Rajiv, 2013). As a result, construction projects are generally categorized by their diversity, complexity and low level of productivity compare to manufacturing industries (Sears, Sears and Clough, 2008:3, Kazaz, Manisali and Ulubeyli, 2008, Moselhi and Khan, 2012).

Labour constitutes a significant percentage of construction cost, and the quantity of labour hours in performing a task in construction is susceptible to labour control by management effort through motivation, incentives, performance assessment, and recognition (Geneva, 2001). The factors responsible for low performance of construction workforce permeate through every participant in the construction sector. Hence, considering the significance of design professionals in construction building production process, the study explores design team production information and design related factors affecting construction workforce productivity towards improvement of construction workforce in the South African construction industry. The objectives of this study are to identify design team related factors that negatively affect construction workforce efficiencies and subsequently rank the identified factors in the order of severity.

LITERATURE REVIEW

Construction workforce overview

The relevance and meaning of construction labour performance has become a long time central subject of academic concern (Drucker, White, Hegewisch, and Mayne, 2006). The study undertaken by Kazaz, Manisali, and Ulubeyli (2008) indicated that the workforce of the construction industry, especially in developing nation is not yet considered as an important input. Kazaz *et al* (2008) further opined that constructions labour represents the most significant construction variable that attracts a significant percentage of construction cost. In addition, Soham and Rajiv, (2013) buttress that construction workforce in the supreme asset of every firms rather than cost and thereby important to every organisations. In respect to extant research on construction labourproductivity, the significance of construction workforce and state of productivity is revealed. Hence, effective construction workforce management that afford improved labour productivity is essential in determining the success of any construction project (Hanna, Taylor and Sullivan, 2005).

Construction management entails the combination of better understanding of construction workforce, construction industry, changes in market and clients orientation (Bozai and Ahmed, 2011). Further, (Chen, Liaw, and Lee, 2003) posted human resource as the twenty first century most valuable asset. Also, construction workers is the only productive resource in the construction industry (Soham and Rajiv, 2013) whose effectiveness demands contributions from all stakeholders in the construction sector. Therefore, successful organisations consider construction human resource function as the main focus when planning for organisations bussiness strategies (Olomolaiye and Egbu 2004). Due to the significant contribution of construction workforce to successful production of contruction products, Kazaz and

Ulubeyli, (2007) opined that the effective utilization of construction human capital will enhance productivity of other construction production units (material and equipments) and enable organisations set objectives achievable.

Impact of design team on construction workforce productivity

"Team is defined as a group of people holding themselves collectively accountable for using complimentary skills to achieve a common purpose" (Schermernorn, Hunt, Osbon and Uhl-Bien, 2011). Apparently, the cost of construction design ranges between 2 – 5 % of the total project sum (Jarkas and Bitar, 2012). Therefore, the role of construction designers cannot be undermined in construction production process (Chan, Scott and Chan, 2004). In the construction environment, client professionals become important, transform the conception of clients to reality and provide client with necessary professional advices towards a successful delivery of construction projects. Moreover, previous study noted that design factors significantly contribute to wastage of construction resources (Osmani and Price, 2007). Therefore, much can be done during preparation of production information (Specification, schedule and construction drawings) to reduce wastage of construction resources through effective drawings and specifications. The causes of construction design related problems are pointed out by Rivas, Borcherding, Gonzalez, and Alarcon (2011) as poor construction drawings and specifications, lack of familiarity of engineers with field conditions and poor decision making. Similarly, the study undertaken by Zakeri, Olomolaiye, Holt, and Harris (1996) established the predominant design factors affecting construction productivity as, error in construction design and poor constructability of design, contradiction in architectural, mechanical, electrical, and structural engineering drawings, confliction of contract document with drawings, specification and variations.

In the construction industry, architect plays a significant role in the construction project delivery process. This necessitates the involvement of architect in construction from the conception stage of project to final handling over process (Oyedele and Tham, 2006). However, the effort of an architect to design a conceived construction project is complex, and therefore an important responsibility of a client is the ability to effectively communicate the design intension to an architect (Campbell, 2000). Besides, construction safety professionals recognise safety of construction workers to be best ensured during the design phase of construction projects (Gambatese, Behm and Rajendran, 2008). Consequently, the decisions of an architect have a significant effect on successful delivery of construction activities and impact the output of construction workforce (Oyedele and Tham, 2006). The management function of an architect is directed towards achieving the set objectives for project actualisation through effective implementation of production information. Conversely, construction projects are complex, filled with uncertainties and identify with higher level of risk (Chan et al. 2004). In building construction contractual procedure, architect mostly becomes the lead design professional (Knutson, Schexnayder, Fiori and Mayo, 2009), and sub-let part of the work such as structural frame, mechanical and electrical systems to specialist engineers. Therefore, architect set out construction project objectives that must be accomplished for the successful delivery of construction project (Murray and Langford, 2004). In addition, prior to approval of architect design for physical development by contractor, numerous set of drawings are generated, distributed for review, comment and thoroughly revised (Campbell, 2000). Oyedele and Tham (2006) further stated that the review of architectural design enhances the buildability of a construction project. Arguably, the inadequacies in designer's production information do not establish a thorough review of construction drawings and specification before construction phase. Hence, lack of adequate skill of architect or avoidance of builders input in design stage could affect constructability and impact output of construction workforce. A major consequence for lack of significant consideration for design buildability may constitute delay in construction process, building collapse during construction process, cost overruns and extension of project duration (Oyedele and Tham 2006).

Basically, structural engineers, mechanical engineers, electrical engineer and service engineer are the predominant building construction design engineers with the aim of producing project production information to achieve a viable and functional construction product. In the like manner that architect leads design team in commercial and residential building sectors, the same way engineers lead construction designers in industrial and heavy engineering projects, while architects undertake design of office space in the project (Knutson et al. 2009). Poor production quality of engineering drawings and ineffective specification significantly affects optimisation of construction project cost, quality and schedule (Gao, Walter, Edward, Jeselskis and Terry, 2006). Similarly, waiting for design interpretation and engineer information is posted by Rivas et al. (2011) as factors influencing construction workforce productivity. Engineering drawing information could be complex to interpret and thereby valuable time is spent on drawings by users (Gao et al. 2006). Gao et al. (2006) further pointed out adoption of colour drawings as a factor that will facilitate drawing communication between design engineers. Besides, Pektars and Pultar, (2005) posted that the decission made in the early stage of construction engineering design will have an unforeseen impact on construction at a later stage and therefore becomes expensive to modify since the decission affect numerous parameters. According to the study undertaken by Aibinu and Olayinka, (2006), poor structural design information, inadequate supervision of structural works and late issuance of instruction may impinge on construction productivity. Further, Toole and Gambatese, (2008) added that engineers as design professionals are required to design facilities that conforms to functional demand of construction client at the expected quality, budgeted cost that could be delivered to meet the deadline of client. Recognising the relevance of construction design on construction workforce safety, American society of Civil engineers (ASCE) posted safety and constructability as essential factors to be considered by engineers during the preparation of construction plan and specifications (Gambatese, Behm, and Rajendran, 2005).

RESEARCH METHODOLOGY

The purpose of the study is to enhance construction workers performance during construction production processes. The study was undertaken in the Western Cape Province, South Africa due to vast growth of construction activities within the city of Cape Town. The study adopts a quantitative research approach with designed closed ended questionnaire survey. The questionnaire design explored twenty prevalent construction design team related factors from the review of extant literatures. The survey repondents were required to indicate their level of agreement to each of the identified factors to allow for ranking and subsequently determine severity of each factor on construction workforce performance. The "level of agreement" of survey questionnaire adopts a four point likert scale; where 1 =strongly disagree, 2 = Disagree, 3 = Agree and 4 = strongly agree. However, the study is a preliminary investigation and an integral part of an on-going research on enhancement of construction workforce performance. The research instrument is directed towards piloting the questionnaire for the main study. Therefore limited numbers of twenty-five questionnaires were physically administered to respondents, twelve of the questionnaires were retrieved and ten were valid for the purpose of analysis. However, the study respondents are vast in construction skills with adequate work experience of minimum of ten years in the field of construction. Irrespective of low response rate, the reliability and validity of the study is upheld with satisfying work experience of the respondents. Survey respondents were randomly selected from construction firms within Cape Town, South Africa. The survey participants are; contract managers, quantity surveyors, site supervisors, site managers, and project managers as construction practitioners involved in construction production processes. The administration and retrieval of questionnaires adopts physical contacts approach. Data was analysed through descriptive SPSS statistical tool and subsequently ranked identified factors in the order of severity

RESULTS

Table 1: Design team related factors affecting construction workforce performance

S/N	Factors	Mean	Sum	%	Rank
1	Missing details in architectural working drawings	3.5000	35.00	87.5	1
2	Slow response of architect to drawing questions	3.4000	34.00	85	2
3	Non-clarity of architectural specification	3.2000	32.00	80	3
4	Complexities involved in construction drawings	3.2000	32.00	80	3
5	Buildability problem	3.1000	31.00	77.5	5
6	Contract documents conflicting construction drawings	3.1000	31.00	77.5	5
7	Architect late issuance of instruction	3.1000	31.00	77.5	5
8	Non-clarity of architectural drawings	3.1000	31.00	77.5	5
9	Revisions and changes order by architects	3.1000	31.00	77.5	5
10	Lack of co-ordination among design team	3.1000	31.00	77.5	5
11	Poor structural design information	3.0000	30.00	75	11
12	Lack of agreement between designers and clients	2.9000	29.00	72.5	12
13	Inadequate time for preparation of production information	2.8000	28.00	70	13
14	Technicalities involved in structural drawings	2.8000	28.00	70	13
15	Incomplete pages of structural drawings	2.8000	28.00	70	13
16	Incomplete pages of architectural drawings	2.8000	28.00	70	13
17	Revision and changes order by structural engineers	2.8000	28.00	70	13
18	Non-involvement of constructor in design process	2.7000	27.00	67.5	18
19	Architect delay of inspection	2.7000	27.00	67.5	18
20	Poor design concepts due to mode of payments	2.4000	24.00	60	20

DISCUSSIONS

The study identifies design team productivity factors affecting the efficiency of construction workforce as presented in table 1. The result represents the perception of construction practitioners. The survey respondents are professionals and involved in building production processes. According to the result, it was found that 87.5 % of survey respondents perceived that missing details in architectural working drawings is the most severe design factor affecting construction productivity as presented in table 1 above. Rivas *et al.* (2011) buttress that, poor construction drawings and specification is a critical design factors affecting construction performance. The finding also identifies slow response of architect to drawing questions as the second design team detrimental factor impinging on the efficiency of construction practitioners with 85 % respondents. The third most critical factors perceived by respondents with the same level of adverse impacts on construction productivity are non-clarity of architectural specification and complexities involved in construction drawings. The findings indicates buildability problem, contract documents conflicting construction drawings, architect late issuance of instruction, non-clarity of architectural drawings, revisions and changes order by architects and lack of co-ordination among design team as factors with the same degree of negative impacts on construction performance with 77.5 % respondents as shown in table 1. Oyedele and Tham (2006) however posted review of architecture design as a factor that enhances construction buildability.

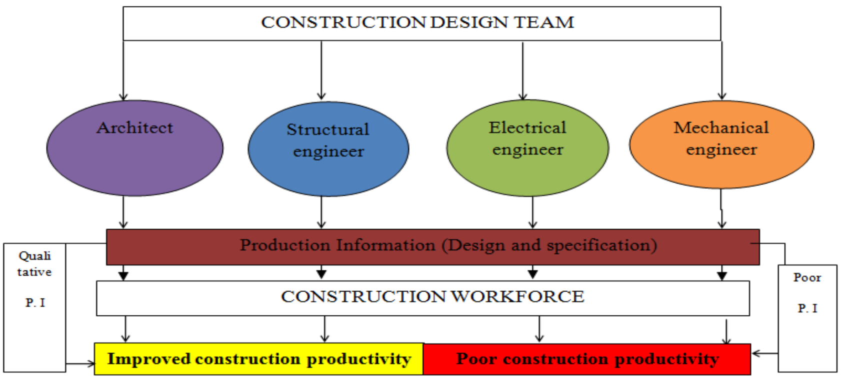


Fig. 1 *Design professionals impacts on construction workforce productivity*

The factors above represent the most critical design related factors affecting the performance of construction workforce. However, it is essential to take cognisance of the factors with minimal adverse effect on construction workforce efficiency. The finding reveals poor structural design information, lack of agreement between designers and clients as factors with minimal impacts on construction workforce performance. Inadequate time for preparation of production information, technicalities involved in structural drawings, incomplete pages of structural drawings, revision and changes order by structural engineers are identified factors with minimum level of adverse effect on construction workforce performance. Finding reveals non-involvement of constructor in design process, architect delay of inspection and poor design concepts due to mode of payments as the least designer's factors impinging on the efficiency of construction employees. Figure 1 presents the impacts of design team members on the efficiency of construction workforce.

CONCLUSION AND RECOMMENDATION

The designer's factors affecting performance of construction workforce are enormous and therefore not restricted to factors identified in this study. Nonetheless, the factors identified in this study are critical design productivity factors and substantiated in relevant literatures. Therefore, within the context of this exploratory investigation, higher percentage of the design related factors affecting construction performance are accorded to inefficiencies in designer's production information, especially the architects. Therefore, there is a greater necessity for a thorough review of architect's production information than other design professionals before and during construction processes. A thorough pre-construction and regular reviews of architect and other design team member's production information documents will help to prevent missing information, improve clarity/quality of drawings and specifications, prevent ambiguity, improve buildability and ultimately enhance efficiency of construction workforce as indicated in figure 1.

REFERENCES

Aibinu, A., and Odeyinka, H. (2006). Construction delays and their causative factors in Nigeria, journal of construction engineering and management, Vol. 132, No. 7, pp. 667-677.

Alinaitwe, H., Mwakali, A. and Hannson, B. (2007). Factors affecting the productivity of building craftsmen- Studies of Uganda. Journal of Civil Engineering and Management, Vol 13, pp. 169-176.

Boazi, G., and Ahmed, M. (2011). Human factors and competencies for effective construction management, international journal of earth science and engineering, Vol. 4, No 6SPL, pp. 752-755.

Campbell, A. (2000). Architectural construction documents on the web: VRML as a case study, journal of automation in construction, pp. 129-138.

Chan, P., Scott, D., and Chan, P. (2004). Factors affecting the success of a construction project, journal of construction engineering and management, Vol. 130, No. 1, pp.153-155.

Chen, H., Liaw, Y. and Lee, Z. (2003). Using an HRM Pattern approach to examine the Productivity of Manufacturing firms – An emperical study, International journal of manpower, vol. 24, No 3, pp. 299-317.

Drucker, J., White, G., Hegewisch, A., and Mayne, L. (2006). Between Hard and Soft Human Resource management: Human resource management in the construction industry. Journal of construction management and economics, 14:5, pp. 405-416.

Durdyev. Ismail, S. and Abu Bakar, N. (2012). Factors constraining labour productivity: Case study of Turkmenistan, Vol. 55, pp. 1-5.

Enshassi, A., Mohamed, S., and Abushaban, S. (2009). Factors affecting the performance of construction projects in the Gaza strip, Journal of civil engineering and management, 15(3), pp.269-280.

Enshassi, A., Mohamed, S., Mustafa, A. and Mayne, E. (2007). Factors Affecting Labour Productivity in Building Project in the Gaza Strip. Journal of Civil Engineering Management. Vol.8, No 4, pp. 245-254.

Gambatese, A., Behm, M. and Rajendran, S. (2005). Design role in construction accident causality and prevention: Perspective from an expert panel, journal of safety science, pp. 675-691.

Gambatese, A., Behm, M. and Rajendran, S. (2008). Viability of designing for construction worker safety, journal of construction engineering and management, Vol. 131, No. 9, pp.1029-1036.

Gao, Z., Walters, C., Jeselskis, J. and Wipf, J. (2006). Approaches to improving the quality of construction drawings from owner's perspective, journal of construction engineering and management, Vol. 132, No.11, pp. 1192-1192.

Geneva, (2001). Tripartite meeting on the Construction Industry in the Twenty First Century: Its image, employment and Skill requirement: International labour Organisation, pp. 1- 68.

Hanna, S., Taylor, S. and Sullivan, T. (2005). Impact of extended overtime on construction labour productivity, journal of construction engineering and management, pp. 734-739.

Jarkas, M., and Bitar, G. (2012). Factors affecting construction labour productivity in Kuwait, journal of construction engineering and management, Vol. 138, No. 7, pp. 811-820.

Kazaz, A., Manisali, E., and Ulubeyli, S. (2008). Effect of basic motivation factors on construction workforce productivity in Turkey, Journal of civil engineering and management, 14(2), pp. 95-106.

Kazaz, A., and Ulubeyli, S. (2007). Drivers of Productivity among Construction Workers: A case study in a developing country. Journal of Building and Environment, Vol. 42, pp. 2132-2140.

Knutson, K., Schexnayder, J., Fiori, C. and Mayo, E. (2009). Construction management fundamentals, second edition, McGraw-Hill pp. 25-50.

Moselhi, O., and Khan, Z. (2012). Significance ranking of parameters impacting construction labour productivity, construction innovation, Vol. 12, No 3, pp. 272-296.

Murray, M. and Langford, D. (2004). Architect handbook of construction project management, riba enterprises ltd. London, pp. 4-25.

Olomolaiye, A. and Egbu, C. (2004). The significance of human resource issue in knowledge management within the Construction Industry- People, Problems and Possibilities. Journal of Association of Researchers in Construction Management, vol. 1, pp. 533-540.

Osmani, M., and Price A. (2007). Architects' perspectives on construction waste reduction by design, journal of waste management, pp. 1147-1158.

Oyedele, O. and Tham, W. (2006). Client's assessment of architects' performance in building delivery process: evidence from Nigeria, journal of building and environment, pp. 2090-2099.

Pektars, S. and Pultar, M. (2005). Modelling detailed information flows in building design with the parameter-based design structure matrix, pp.99-122.

Raiden, B., Dainty, J. and Neale, H. (2003). Current Barriers and Possible Solution to Effective Project team Formation and Deployment within a large construction Organisation, international journal of project management, vol. 22, pp. 309-316.

Rivas, A., Borcherding, D., Gonzalez, V., and Alarcon, F. (2011). Analysis of factors influencing productivity using craftsmen questionnaires: Case study in a Chilean construction company, journal of construction engineering and management, pp. 312-320.

Schermernorn, Hunt, Osbon and Uhl-Bien, (2011). Organisational behaviour, eleventh edition, John Wiley and son, pp. 95-157.

Soham, M., and Rajiv, B. (2013).Critical Factors Affecting Labour Productivity in Construction Projects: A case study of South Gujarat region of India. International journal of engineering and advance technology, vol. 2, issue 4, pp. 583-591.

Toole, T. and Gambatese, J. (2008). The Trajectories of prevention through design in construction, journal of safety research, pp. 225-230.

Zakeri, M., Olomolaiye, P., Holt, G., and Harris, F. (1996). A Survey of Constraints on Various Construction Operatives "Productivity" Journal of Construction management

ANALYSIS OF THE EFFECTIVENESS OF QUALITY ASSURANCE SYSTEMS TOWARDS DELIVERING LOW-COST HOUSES IN CAPE TOWN, SOUTH AFRICA

V. Ngquba[1], J. Crowe[2] and J. Fapohunda[3]

Department of Construction Management and Quantity Surveying, Cape Peninsula University of Technology, South Africa

As an endeavor to deliver adequate social housing in Cape Town's disadvantaged and underdeveloped communities, the study aimed at ensuring that National Housing code as set by Department of Human Settlement and ensured by NHBRC concerning the overall quality of houses are adhered to. Questionnaires were used to collect data from occupants concerning structural performance of their houses, interviews conducted with building inspectors, contractors and designers involved in the construction process regarding their insight of quality assurance systems. The statistical tool SPSS was used to analyze data collected. The study examines the cause of poor quality evident in RDP house construction in Cape Town. Improving quality of houses constructed will promote healthy lifestyle as a result of planned sewerage, drainage, uncontaminated water and power. This paper is practical research and is limited to books relevant to quality of low-cost houses and data retrieved from interviews and questionnaire survey. This will develop a strategy for suc+cessful implementation of quality assurance systems in construction process.

Keywords: low cost housing , quality assurance systems, quality audits

INTRODUCTION

The government of the republic of South Africa and the Department of Human Settlements has been faced with a huge backlog in delivering adequate houses for the citizens. In fact, the provision of adequate social housing has been an issue before the current regime came into power in 1994 as continues to be a current contentious issue. This led to the growth of informal settlements evident in and around many South African cities. That tends to diminish the standards of the cities concurrently threatening low-income earners dignity, health and security (Dewar 1992). After several attempt made trying to overcome the backlog in housing and provide citizens with adequate housing, the conditions still remain unresolved in most areas in the country.

One way or the other, there is a real need for change and quick enhancement. As have been highlighted above that numerous attempts have been undertaken, which included the introduction of policies by both at national and provincial government and other enhancements initiated at municipality levels. Now, the researcher's intention is to

[1] ngqubav@cput.ac.za
[2] crowej@cput.ac.za
[3]fapohundaj@cput.ac.za

Ngquba *et al.* (2014) Analysis of the effectiveness of quality assurance systems towards delivering low-cost houses in Cape Town, South Africa *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 121-129.

ascertain the effectiveness of quality assurance systems and inform which is suitable and how should it be applied when delivering low-cost houses. This study identifies and review existing quality assurance systems used in current low-cost housing construction. Relevant literature reviewed, interviews and questionnaires conducted occupants, municipality workers who are involved in the construction process. This paper is practical research and is limited to books relevant to quality of low-cost houses. The study is focusing on promoting lives of people staying in low-cost houses thus ensuring quality in construction process.

BACKGROUND

The study is focusing at the Western Cape particularly Cape Town led by Democratic Alliance (DA) as the provincial government of the Western Cape Province with effect in 2000. The premier of the province is Helen Zille. The popular municipality is Cape Metro District Municipality with its effective local Government City of Cape Town.

According to the prolonged nature and background of crisis in South African low-cost housing particularly Cape Town, this study will find the progress, processes undergone concerning delivery of acceptable quality of adequate housing and systems in place to ensure quality going forward. The study will also look the correlation between the poor end produce and the insufficient use of Quality Assurance Systems (QAS) in the delivery of Low-Cost Housing (LCH). The resultant quality of houses constructed and structural performance has been on-going concern. The concerns include defective foundations, incorrect aggregate mixes, damp floors, chipping paint because of humid walls when wet. The walls have cracks and plumbing system is installed incorrectly. The quality concerns in housing are associated with aspects such as inadequate skill from designers and contractors workmanship.

However, some defects in a building which impact the resultant quality negatively are due from different aspects from the differential soil types and designs. There are other factors that contribute to the poor structural performance as a result of poor resultant quality. These are procurement system selected, quality of material used and effectiveness of quality assurance system implemented during the delivery of low-cost housing.

Defects impact the quality of the building this is witnessed from the different structural performances due to variations occurring in different soil types (Marshall, Worthing and Heath, 2009). The loose soil allows settlement to start earlier and is expected to end with the completion of the structure, while the compact soil settlement take time to occur. Cape Town has sandy soil and naturally is loose soil and referred to as non-cohesive soil.

Marshall, Worthing and Heath (2009) said non-cohesive soil allows settlement to start earlier and probable end simultaneously with the completion of the actual structure, while cohesive soil settlement takes time to occur. The first aspect to consider when planning the project is soil where the actual construction begins from foundations, footings and brickwork up to the roofs. The soil need to be tested for the purpose to foresee and determine the durability of the building from the soil types samples and the possible defects to be expected, this is done by Geotechnical personnel.

Basically, the building experiences load stress through its lifespan. This stress is exerted downwards to the foundations from the roofs, walls and floors to footings where the construction of the structure began (M, W, & H, 2009).

LITERATURE REVIEW

Quality Defined

Quality has been defined as the extent of conformance to the norms and standards of the use (McLaughlin, 1995). Quality is defined as a series of attributes selected on the basis of accuracy and precision of measurement. These attributes are in turn used to evaluate the effect of a breeding line or transgenic product, chemical or quarantine treatment, handling technique or system, set of storage conditions or other pre-construction variable on the construction of houses. Quality changes can be plotted as a function of time and directly related to physiological changes, such as disorientation of materials during handling and storage.

Quality Assurance

Quality assurance is considered to be a broader, more nearly all-encompassing term for the application of standards and procedures to ensure that a product meets the desired performance criteria (Barrie and Paulson 1984). Quality Assurance (QA) activities include a planned system of review procedures conducted by personnel not directly involved in the inventory development process (Ruth 2009). Reviews, preferably by independent third parties, should be performed upon a finalized inventory following the implementation of quality control procedures to verify that data quality objectives were met.

Quality Audits: For the purpose of good practice in inventory preparation, audits may be used to evaluate how effectively the inventory agency complies with the minimum quality control specifications outlined in the quality control plan. It is important that the auditor be independent of the inventory agency as much as possible so as to be able to provide an objective assessment of the processes and data evaluated. Audits may be conducted during the preparation of an inventory, following inventory preparation, or on a previous inventory.

Non-Conformance: To monitor and track quality issues and that defect are kept from the customer.

Specifications: To ensure that every work undertaken corresponds to the specification given and eliminating unintended flaws in doing so ensuring quality concurrently. Conformance

Causes of Poor Quality in Low Cost Housing construction

Many people in the country have directed the blame on designers and contractors workmanship, while overlooking client's role concerning the clear details of the project. Client should provide the designer with a clear desire, time frame and exact budget. Griffith (1990) said that most of the blame for poor building performance and low quality work is directed on the designer. The inadequate skill of workmanship is one of major problem facing the industry hence there is need for greater attention to aspects of leading and motivating the workforce in order to achieve better workmanship (Griffith, 1990). Cape Town and South Africa is faced with issues such as housing backlog, design faults, inadequate skill and client manipulation, and these factors influence low-cost housing.
The other factor as Danny, F. (2010) postulated is the incorrect practice of the National Building Regulations by the municipal representatives or the negligence aggravated by ignorance of National Building Regulations and National Housing Standards as set out by the Department of Human Settlement and other relevant bodies regarding the quality of low-cost houses. According to the responses obtained from the building inspectors, two from the effective local Government City of Cape

Town and one from Human Settlement showed that there is no quality assurance system in place during the construction process.

RESEARCH METHODOLOGIES

Questionnaires were used to collect data from occupants concerning structural performance of their houses, interviews conducted with building inspectors, contractors and designers involved in the construction process regarding their insight on quality assurance systems. An on-going quality concerns on low-cost housing as poor resultant structural performance of the buildings shows defects in design, foundation, superstructure, minor roofs problems and plumbing fittings. This has been substantiated by means of questionnaire survey sent to occupants of three locations, requesting the experience on day-to-day structural performance of the houses.

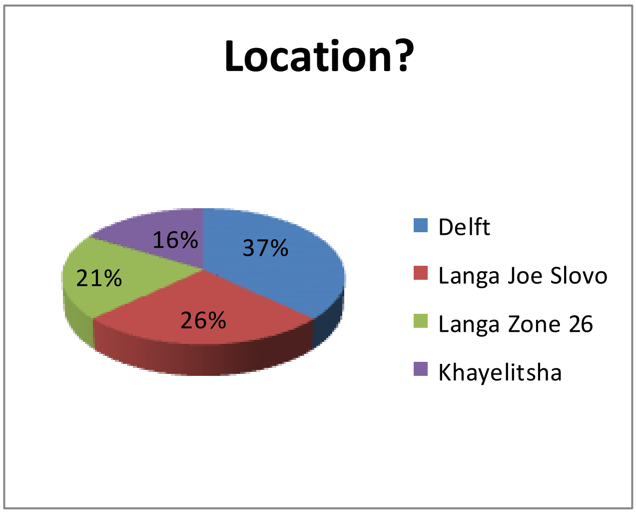


Fig 1.1 Pie chart shows the locations where questionnaires were distributed

The questionnaires were hand delivered to randomly selected occupants in these three residential areas. Where questions needed some clarity assistance was provided hence there was no need for pilot questionnaire for criticism on the type and style questions.

FINDINGS

From the 100 questionnaires which were handed out to the community members 73 were retrieved for scrutiny. In Khayelitsha 20 questionnaires were distributed of which 12 was retrieved, in Delft 40 questionnaires were distributed and 27 was retrieved and from the 40 questionnaires distributed in Langa 34 was retrieved. The total percentage of responses for these different communities is 73%.
The responses were scrutinized and they showed a high level of dissatisfaction by occupants due to poor structural performance of their houses. With an exception of the sizes and number of rooms there are greater structural defects from walls to the roofs. However, it is not the matter of ignorance from government on sending out representatives to inspect the progress on site, as shown in the chart below.

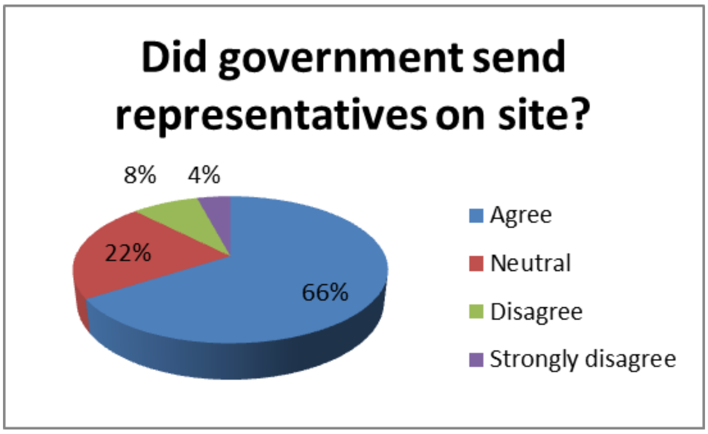


Fig 1.2 Pie chart showing the presence of building inspectors on site.

Now from what has presented, the question would be, are they doing what they should doing on site or is it there lack of knowledge of what they should be doing. In Delft, the greater concerns came from the designs of the building where the majority of occupants showed dissatisfaction in designs. There was no ventilation in the designs as shown in the chart below.

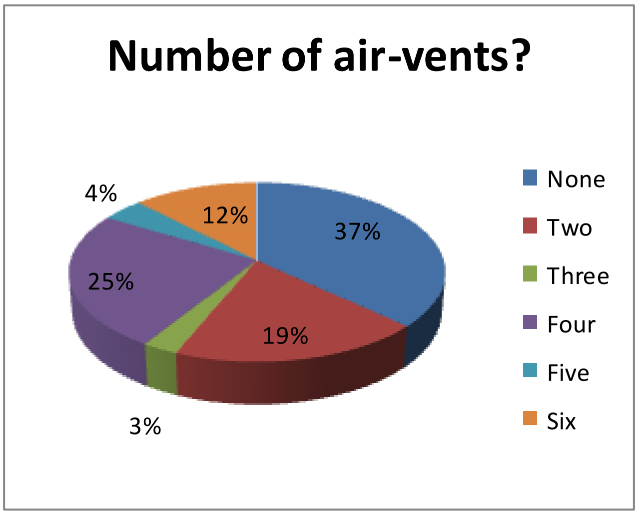


Fig 1.3 Pie-chart showing air-vents

The big percentage (37%) which no ventilation was obtained from Delft, there were other concerns that were common to all three locations such as humid walls which was associated with incorrect sand cement mix ratios, cracks in walls and unstable roof structures where steel is used as roof structure. Occupants felt that it would be a good idea if they are given a choice in design. In addition, they said should they given opportunity to improve the design it would in the areas as shown in the bar-chart below.

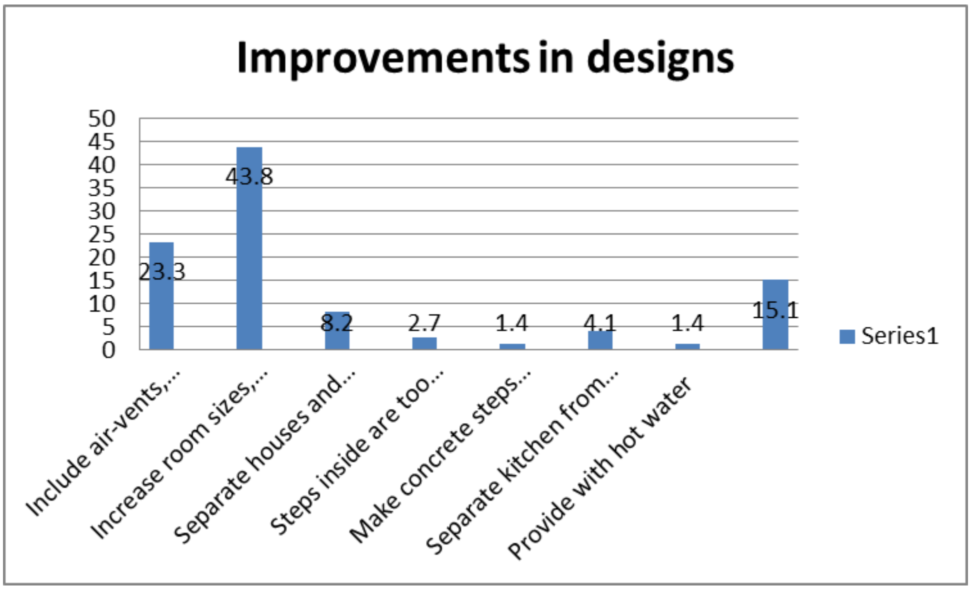


Fig 1.4

Bar-chart showing areas of improvement in designs

When asked about their confident in quality of workmanship constructed their houses, occupants showed the lack of confidence giving the reasons for their responses. The bar-chart below shows the brief reasons why they lack confidence.

Fig 1.5 Bar-chart reasons for the answers.

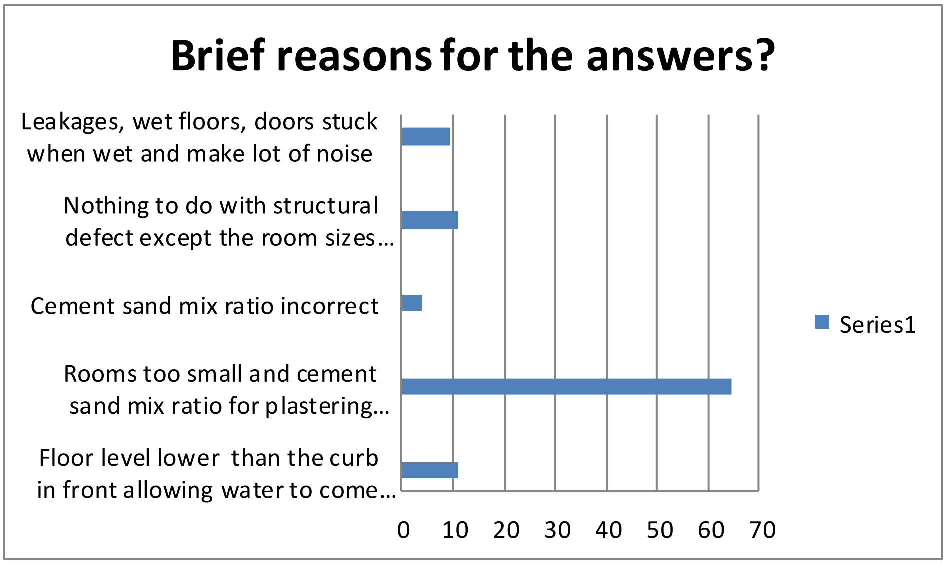


Fig 1.5 Bar-chart reasons for the answers.

As presented above, building inspectors are available on site from inception to completion; however, there is still a gap in achieving high standard of quality in the houses constructed. Perhaps introduction of quality assurance systems in delivery of low-cost houses will solve the problem associated with low quality and quality assurance. Below is a brief details of quality assurance systems that will solve the predicament in low-cost housing quality.

QUALITY ASSURANCE SYSTEM/STANDARD.

ISO 9000

Whereas ISO 9000 is an internationally recognized quality management system, its application would benefit all role players (Evans and Lindsay, 2002). Developers are likely to benefit the most as it can provide them with a competitive advantage in the market. It could also inform departmental and municipal procurement processes as ISO certification could provide quality assurance in procurement processes. Whereas it appears that the Department does not have a formalized quality management system, the ISO 9000 standards should be used to guide the development of such a system.

Benchmarking

Whereas a project management approach is typically used to coordinate and implement quality improvement initiatives, quality improvement in the Province needs to be led by an experienced project manager, supported by an appropriate multi-disciplinary team (Gryna, 2001).

Performance Management Plans

Performance management systems within all institutions should include measures on quality performance initiatives, as defined by the organization, and including all staff. Measures to monitor adherence to ethical standards should be explored, and this may also be an area for further research.

Process Management

Delivery rates (at each stage of the inspection) also need to be programmed and monitored, and communicated to all stakeholders to enhance supply chain management activities, including “just in time” principles (Evans and Lindsay, 2002). This should also apply to the Department.

BACKGROUNDS OF CASE STUDIES

Two construction sites visited in Delft and Langa in an effort to identify quality assurance system (QAS) used. The case studies aims to examine how each site practices QAS. In addition, the methods of measuring the performance of QA within each site are presented.

Site A

Site A is under the contractor who has involved in local construction projects for more than 15 years. The Management Representative, who has worked for the firm for 15 years, was interviewed for this case study. Site A has won several quality awards before. This is not surprising because the quality mission of the company has incorporated certain aspects of QA that is to: ‘‘Provide quality construction that meets customer requirements and continual improvement to enhance customer satisfaction.’’ At the time of this study, Site A was audited and awaiting certification to the ISO 9001:2000 standard. The Management Representative highlighted that the ISO

9001:2000 standard emphasizes continual improvement and is more systematic than the old ISO 9001:1994 standard which concentrated on documentation.

Site B

Site B's contractor is known for its high-quality standards in design-and-build projects. The personnel interviewed were the Quality Control Manager who has worked in the company for seven years. The firm seeks to adopt the ''do it right the first time'' approach and to strive for zero wastage and zero defects recognizable in TQM. Contractor in site B is also committed to understanding the needs of its customers to deliver quality products through a continual improvement process.
At the time of this study, contractor was expected to obtain their certification to the ISO 9001:2000 standard. It was then preparing for the ISO 9001:2000 audits. The Quality System Manager agreed that certification to the ISO 9001:2000 standard will help in facilitating continual improvement to allow contractor to respond more positively toward client needs and expectations. The quality system manager noted that the new ISO 9001:2000 standard focuses on process flow that can help to identify what needs to be controlled.

CONCLUSION

Though quality assurance practices in construction projects vary sites to site, there are some common elements of quality assurance systems that apply in most or, at least, several major types of systems. These can be identified as approaches to quality level and scope of quality review, key stakeholders involved in the process, methods and instruments, and the consequences of quality monitoring. However, the question of how effective quality assurance systems should be designed and implemented is subject to wide debate. There is, for instance, a lack of clarity about what the purpose of quality assurance should be, about the adequateness of diverse methods and instruments used by quality assurance systems. Identifying the features of effective quality assurance systems is rendered more complicated by the difficulties in measuring the effectiveness of such systems. It is also difficult to know how the quality of construction would have changed without the implementation of quality assurance processes. Moreover, it is not easy to measure the outcomes of quality in construction projects. Hence, numerous analysts seem to agree that the impact of quality assurance systems on construction is difficult to assess and is thus in need of further research.

REFERENCES

Barrie, D.S. and Paulson, B.C. (1984). "Professional Construction Management". Second Edition, The McGraw-Hill, Inc., United States of America.

Danny, F. (2010). "Social impact of poor housing". United Kingdom. London EC1Y 8NA.

Dewar, D. (1992). Urbanization and the South African city: a manifesto for change, in: D. M. Smith (Ed.) The Apartheid City and Beyond, pp. 243-254. London: Routledge.

Evans, J.R. and Lindsay, W.M. 2002. "The Management and Control of Quality". Fifth Edition. United States of America: South Western.

Griffith, A. (1990). "Quality Assurance in Building". Macmillan Education Ltd, Houndmills, Basingstoke, Hampshire.

Gryna, F. M. (2001). Quality Planning and Analysis. From product development through use. Fourth edition. New York: McGraw Hill Companies Inc.

Marshal, D, Worthing, D and Heath, R (2009): Understanding Housing Defects. Third Edition. USA, New York, NY 10017

McLaughlin, G.C. 1995. “Total Quality in Research and Development”. Florida: St Lucie Press.

Ruth, L. 2009. “Growing up in social housing in Britain”: A profile of four generations from 1946 to the present day.

Wikipedia. (2010) Quality Assurance, http://en.wikipedia.org/wiki/Quality Assurance,

10:25am, 3/02/2010.

ASSESSING AREAS AND TRENDS OF BAMBOO USAGE IN BUILDING CONSTRUCTION IN GHANA

D. Opoku[1], J. Ayarkwa and K. Agyekum
Department of Building Technology, KNUST, Kumasi, Ghana

Bamboo has gained popularity in its usage in many areas in building construction in some Asian and Latin American countries where it is grown as an alternative material to timber. However, in Ghana, bamboo usage in building construction has not been given much attention. This study focuses on identifying areas and trends of bamboo usage in building construction in Ghana and the prospect of being an alternative material to timber. The study employed structured questionnaire survey of 100 medium and small scale building contractors and 84 architects who responded to 14 areas of bamboo usage identified through a comprehensive literature review. Data was analysed by means of relative importance index to identify the possible areas in the construction industry where bamboo is mostly used. The findings showed that props, landscaping and hoarding among others are the three most significant areas in construction where bamboo is used. The findings further showed that though bamboo has received little attention in its usage in the areas of ladders, scaffolds, workers shed, roofing, ceiling, wall partitioning and flooring. Generally, the respondents agreed to the increase in the usage of bamboo as a construction material in the building industry. However, the increment is significant in the areas of props and landscaping. This study should create the required awareness of bamboo as an alternate material to timber which is dwindling in its supply to the building industry.

Keywords: bamboo, building construction, Ghana

INTRODUCTION

The increase in the population and human activities in Ghana has rapidly pulled up a high demand of buildings to house both the individuals and activities (i.e. the provision of residential, commercial, industrial or the combination of any of the building categories). However, the demand for building has beckoned the activeness of the building construction industry (BCI) to support in whinging the wheels of development especially in developing countries (Ofori, 2012; Lopes, 2012).

The BCI is characterised by three main resources; human, plant and equipment, and material resources. Notwithstanding the importance of the mentioned resources, arguably the impact of the material resource in building construction (BC) should not be undermined (Fapohunda and Stephenson, 2010). Deshwal (2011) asserts that building materials account for nearly 60% to 65% of the total cost of building construction. The demand for materials either locally obtained or imported has pulled an array of different industries to play roles in the construction industry and the list of these industries is not complete without mentioning the timber industry. To confirm the rapid demand for timber and timber products, a study by Food and Agriculture

[1]desphlex@gmail.com

Opoku *et al*. (2014) Assessing areas and trends of bamboo usage in building construction in Ghana *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 131-141.

Organisation (1997) affirms that there is an outburst demand for building construction and this is coupled with the increased demand for timber in the industry. In a study to project into the stability of the supply of timber into the market for various uses, it was anticipated by the Food and Agriculture Organization (FAO) that the demand of order for wood and wood products would increase by thirty percent (30%) by 2013 (FAO, 1997). Notwithstanding the increased demand of timber and timber products, related study outlined that, Ghana's forest timber production area is declining in an increasing manner in both size and productivity due to unecological logging practices and over utilization of the traditional timber species. The extreme exploitation of the forest has beckon on authorities to put strict regulation which has eventually reduced the quantity of timber supplied to the furniture and construction industries. (Ayarkwa, 1998; Solomon-Ayeh, 2004).

The alleviation of the problem of insufficient and extinction of the timber species allowable to the market especially to the construction industry, has called on exploitation of other forest resources comparable to timber. Bamboo is identified as a constructional material which has constructional properties comparable to that of timber (Amanda et al. 1997). Bamboo has been identified and tested by many countries and proven to have the qualities which make it a very good material for the building and construction industry. According to Gutiérrez (2000), there has been an ancient exploration of bamboo for construction and this is due to the fact that it appears to be a tailor-made material for use as a building component. Bamboo appears round, straight, smooth, strong and beautiful.

Bamboo possesses constructional properties like high tensile strength, high strength to weight ratio and high specific load bearing capacity hence, confirming its potential as a material for building construction (Tada et al. 2010; Ghavami ,2005; Van der Lugt et al. 2005; Paudel, 2003; Yao and Li, 2003; Iyer, 2002; Amada and Untao, 2001). Bamboo has the ability to grow almost everywhere in various seasons and has short rotation (Liese, 1985 and Power, 2004). Like wood bamboo also possesses high residual strength to absorb shocks and impacts–this makes it a highly suitable material for construction of houses to resist seismic and high wind forces (Shyamasundar et al., 2008)

AREAS OF BAMBOO USAGE IN BUILDING CONSTRUCTION

The uses of bamboo for building construction have metamorphosized from simple pole construction to more sophisticated construction. Bamboo can serve as a material for the whole or part of a construction of a building (Tekpertey, 2006).

Bamboo has greatly been given consideration by several countries in Asia and Latin America as an important building material not only for the construction of rural houses but also for urban private houses and public buildings (Shyamasundar and Vengala, 2008). According to Malin and Boehland (2006) the use of bamboo in building construction can be classified into temporary (Props, Scaffolding, Workers shed, Ladder, Formwork and Hoarding) and permanent uses (Bamboo Reinforcement, Trusses, Ceiling, Doors and windows, Roofing, Bamboo floor, Partition walls and Landscape).

To confirm the growing utilization of bamboo in building construction, literature outlines that bamboo tremendously has multiple uses in building construction (Table 1). Jansen (2000) asserts that the trend of bamboo usage in building construction is increasingly gaining attention and utilisation. Contractors and architects are patronising the potential of bamboo by increasing it usage and specifying it respectively.

Table 1: Summary of the areas of bamboo in building construction

No.	Areas	Reference
1	Props	Jiang, (2008), Tekpetey (2006)
2	Scaffolding	Fu, (1993), Chung, et al., (2003), Chung and Sin, (2002), Janssen, (2000), Jayaneti and Follet, (1998)
3	Workers shed	Recht et al., (2001)
4	Ladder	Chung, et al., (2003)
5	Formwork	Recht et al., (2001)
6	Hoarding	Jiang, (2008), Tekpetey (2006)
7	Bamboo Reinforcement	Iyer (2002)
8	Trusses	Paudel and Solomon-Ayeh, (2004)
9	Ceiling	Bandara, 1990
10	Doors and windows	Gangopadhyay (2003)
11	Roofing	Shyamasundar, K. (2005)
12	Bamboo floor	Xiao et al, (2009), Haregewoin, (2007), Customs General Administration of China, (2004)
13	Partition walls	Punhani and Pruthi (1992)
14	Landscape	Sta. Ana, (2006)

Although the above mentioned areas exposes extensive use of bamboo in building construction in some Asian and Latin American countries, little research has been done to popularise the potential of bamboo to make it attractive to architects and building contractors to specify and use it respectively. To confirm the areas of bamboo usage in building construction in Ghana, Tekpertey (2006) noted that the most popular areas are props and hoarding though his statement was not with any empirical evidence but by observation. This study therefore focuses on identifying other areas and trends of bamboo usage in building construction in Ghana.

RESEARCH METHODOLOGY

This study deployed a comprehensive review of related published works to identify the various areas of bamboo usage in building construction and the identified information modified to suit the situation in the Ghanaian building construction industry to help outdoor the pertaining situation of bamboo usage in Ghana. The survey instrument employed was a structured questionnaire and this was adhere to in order to reduce bias in the question and answer processes, closed-ended questions were mainly used in the survey (Roberts, 2007). However, respondents were asked to add to the areas of bamboo usage and suggest other values that will improve the use of bamboo in building construction in Ghana. The questionnaire was administered to 100 small and medium scale building contractors in the Kumasi metropolis and 72 Principal Architects of registered architectural firms in Accra and Kumasi. A face-to-face approach of questioning was used to administer the questionnaires to maximize the response rate. The questionnaire administration took place in the offices and active sites of the respondents.

The questionnaire was divided into three sections. Section one primarily focused on background information of the respondents and how often bamboo is used in building and design. The second section sought information on the possible areas and trends of bamboo usage. On the possible areas of bamboo usage respondents were asked to rank on the Likert scale of 1 to 5, which areas bamboo is highly used, where 1= less used, 2= not used, 3= neither used nor highly used, 4= used and 5=highly used. Lastly, the third section focused on the trend of bamboo usage with regards to volumes and this was evaluated on the likert scale 1 to 5, where the score '1' = highly decreased, score '2' = decreased, score '3' = stable, score '4' = increased and score '5' = highly increased. A number of sampling techniques in research were considered and the purposive sampling was decided upon due to time limitation. Out of the total of 172 questionnaires administered to the building contractors (100 questionnaires) and Architects (72 questionnaires), 138 were retrieved (85 from contractors and 53 from Architects) and used in the analysis. This represented a response rate of 85% and 73% respectively and it is considered sufficient for the study (Oladapo, 2005; Newman and Idrus, 2002; Ellhag and Boussabaine, 1999).

The Relative Importance Index (RII) method of analysis was employed to help identify the significance of the factors which influence bamboo in building construction (BC). According to Adnan et al. (2007), to analyse data on an ordinal scale (e.g. Likert scale 1-5) as used in this research, the application of Importance Index (II) is suitable and this helped in coming out with various ranking in the research. Ranking as defined by Fowler et al. (1995) is a comparison among given options, within pairs of options, by cardinal of importance (first, second, third, etc). Additionally, he asserted that, ranking is scoring items one at a time using a common scale, and it also determines the importance of factors.

RESULTS AND DISCUSSION

Uses of bamboo in building construction

Figure 1 shows that, 100% of the building contractors have used bamboo or bamboo products at least in an area in building construction. Ninety-four (94%) of architects responded they have specified bamboo for use in a building project. However, six percent (6%) of the Architects sampled responded they have not specified bamboo for use in any project. This result suggests that bamboo has a potential of gaining popularity in building construction in Ghana as majority of the respondents they have used it at least for a specific purpose in a project.

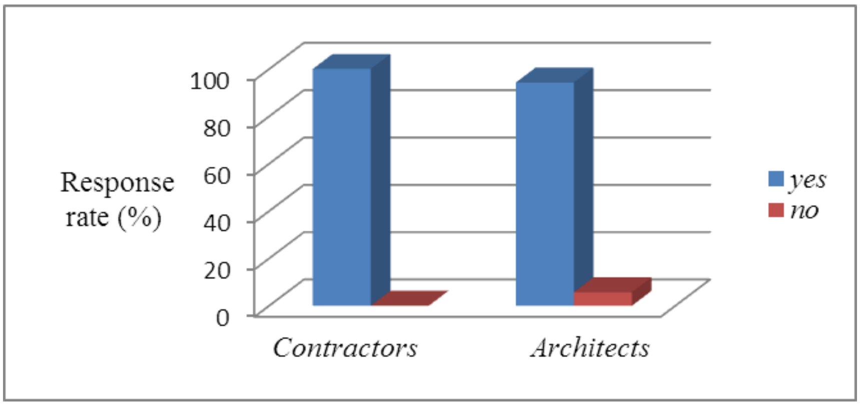


Figure 1: Response to the use of bamboo

How often bamboo is used

Respondent were asked to evaluate how often they use and specified bamboo in building construction. Figure 2 shows that thirty two percent (32%) and twenty percent (20%) of building contractors reiterated that they do not to use bamboo often and often respectively. However, eighteen percent (18%) of building contractors use bamboo very often and twelve percent (12%) using bamboo in areas in construction quiet often.
The response from the Architects as also reveal that, sixty percent (60%) of Architects do not often specify bamboo for use as a material in Building construction. twenty six percent (26%) and six percent (6%) of the Architect reiterated the specify bamboo quiet often and very often respectively. However, three percent (3%) of architects specify bamboo often.

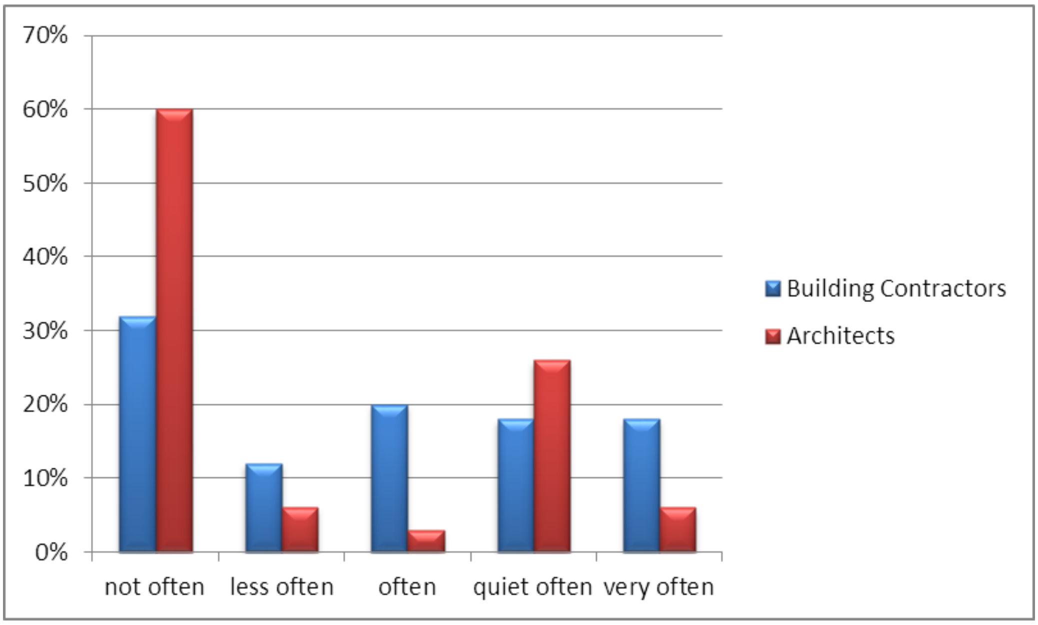


Figure 2: Response on how often bamboo is used in BC

Figure 2 above shows that majority of respondents do not often use bamboo in building construction in Ghana and this represent that, there is less attention to the frequency of it usage. This therefore calls for attention in ways of promotion of bamboo usage for it to gain popularity as in the case of other building materials especially the imported ones.

Building contractors response to the areas of bamboo usage in BC

With a Relative Importance Index (RII) score of 0.8582 which is very close to one (1) and being ranked as first means that contractors agreed that bamboo is highly used in the area of props than any other area. Building contractors emphasised that bamboo is less used in the other mentioned areas including scaffolding, workers shed, ladder, formwork, hoarding, landscaping, doors and windows, trusses and ceiling. Although building contractors agreed to have used bamboo in all the areas, its usage in all the areas except props is not significant since their RII score is less than the neutral score (0.5). Thus, with the exception of props, the uses of bamboo in BC in Ghana have not been exploited by contractors. This result is perhaps bamboo as a material has not been industrialised extensively and given the needed promotion of its properties enough as in the case of other building materials hence, the contractors do not want to go in for a material they are not sure of. This is reflected in the RII value where the temporary uses are higher.

Table 2: Response to the areas of bamboo usage

Area of usage	Building contractors		Architects	
	RII = $\Sigma W/(S * N)$	Rank	RII = $\Sigma W/(S * N)$	Rank
Props	0.8582	1st	0.8343	1st
Workers shed	0.4182	2nd	0.3714	6th
Scaffolding	0.3891	3rd	0.3771	5th
Ladder	0.3856	4th	0.2971	12th
Hoarding	0.3782	5th	0.3829	4th
Formwork	0.3236	6th	0.3143	10th
Landscape	0.3055	7th	0.5257	2nd
Doors and Windows	0.2946	8th	0.3086	11th
Bamboo Reinforcement	0.2836	9th	0.2743	14th
Trusses	0.2800	10th	0.2913	13th
Bamboo floor	0.2691	11th	0.3657	7th
Ceiling	0.2582	12th	0.3257	8th
Partition Walls	0.2546	13th	0.3886	3rd
Roofing	0.2400	14th	0.3200	9th

Architects' responses to the areas of bamboo usage in BC

Architects were asked to evaluate their bamboo usage in the various identified areas in building construction and the result is as shown in the Table 2. The Relative Important Index (RII) scores of all the areas except props (0.8343) and landscaping (0.5257) were found to be less than the neutral score (0.5). Thus, Architects were of the view that bamboo is highly used in the areas of props and landscaping whereas in the areas of scaffolding, workers shed, ladder, formwork, hoarding, flooring, doors and windows, partition wall, trusses and bamboo reinforcement were less specified. Bamboo specified for props and landscaping were ranked t first and second respectively by the respondents. The results also buttress the fact that architects have also contributed to the less exploitation of bamboo on construction site because the fail to specify them for use in the industry.

Quantity of bamboo culms per building project

With the result in table 2 showing that bamboo is mainly used for props with less attention to its usage in other areas, a further survey was conducted to identify the average bamboo culms used by contractors per building project. Figure 3 shows that thirty eight percent (38%) contractors use average bamboo culms of about 100 - 200. Twenty five percent (25%) contractors also responded that they use an average of 201-300 bamboo culms per project. However, contractors responded that, even though bamboo culms are used regularly on building sites for temporary activities, there was no contractor who had used more that 500 bamboo culms per project regardless of the size of the project. According to Tekpertey (2006), bamboo culms below 100 pieces are mainly used for activities which do not require a lot of time to complete. In relation to BC, the use of bamboo culms below 100 are for small building projects which require a very short time of execution. This result indicates that contractors embrace the temporary use of bamboo and with much insight to its advantage over other building materials will lead to high patronage; hence, bamboo will be among the common listed materials as in the case of timber.

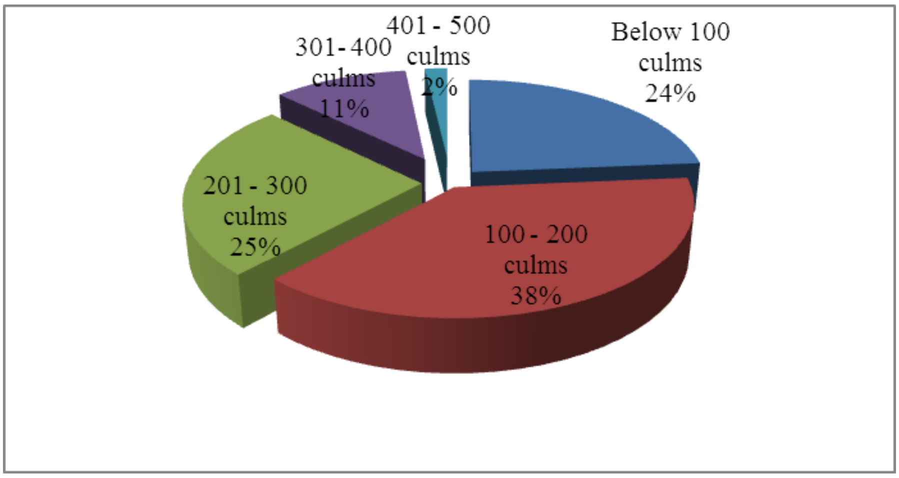


Figure 4: Contractors response on the average quantity of bamboo culms used per project

Perception of respondent on the trend of bamboo usage over the past 10year

This section was intended to ascertain the trend of bamboo usage by respondent over the last 10years for both temporary and permanent uses. From the evaluation of the perception of respondents on the trend of bamboo usage as shown in Table 3, averagely, about 62% of contractors reiterated that, their usage of bamboo generally in BC has neither seen increment nor reduction in the volumes. About 22% of contractors responded there is an increase in the use of bamboo for BC and 16% also responded there is a significant decrease in the various temporary uses of bamboo. Averagely, majority (40%) of Architects responded that the trend of bamboo usage in building construction has been stable as shown in table 3. About 31% and 29% of Architects also indicated the used of bamboo in building construction had increased and decreased respectively. The result of this section of the study is thus, in line with the fact that less attention has been given to bamboo usage over the period of the past ten (10) years hence, the need to promote the bamboo usage through diverse platform as discussed in the recommendations.

Table 3: General perception of the level of increment of bamboo usage by respondent

Perception	Building Contractors		Architects	
	Frequency	Percentage (%)	Frequency	Percentage
Decreased	14	16	15	29
Stable	52	62	21	40
Increased	19	22	17	31

Table 4: Contractors' response to the trend of volume of bamboo usage

	Building Contractors		Architects	
AREA OF USAGE	RII = $\Sigma W/_{(S*N)}$	Rank	RII = $\Sigma W/_{(S*N)}$	Rank
Props	0.8909	1st	0.8686	1st
Scaffolding	0.5636	6th	0.5486	8th
Workers shed	0.5600	7th	0.5886	3rd
Ladder	0.5673	5th	0.5543	7th
Formwork	0.5309	14th	0.4257	13th
Hoarding	0.5891	4th	0.5829	5th
Bamboo Reinforcement	0.4564	9th	0.4743	14th
Trusses	0.5927	3rd	0.5486	8th
Ceiling	0.5527	11th	0.5429	10th
Doors and Windows	0.5527	11th	0.5600	6th
Roofing	0.5455	13th	0.5429	10th
Bamboo floor	0.5600	7th	0.5314	12th
Partition Walls	0.5564	9th	0.5886	3rd
Landscape	0.6146	2nd	0.6514	2nd

The results as shown in tables 4 show that the use of bamboo in the area of props in building construction has seen significant increase (it was ranked first by both architects and building contractors) and this relate to the finding of Tekpertey (2006) which acknowledge the fact that bamboo is largely used in the area of props in building construction in Ghana. The use of bamboo in the area of landscape has also seen an appreciable increase as it is ranked second by both respondents. Averagely, respondents were indifferent (neutral) about the use of bamboo in areas such as scaffolding, workers shed, ladder, formwork, hoarding, trusses, ceiling, doors and windows, roofing, bamboo floor and partition walls. The result also shows that, the use of bamboo in the areas of reinforcement and formwork has seen a decrease in its usage over the last ten (10) year as suggested by the architects. The building contractors suggested that bamboo usage in the area of reinforcement has seen no significant increase and this decrease is as a result of the shift to urban modernity since bamboo as a reinforced material was is the thing of the traditional construction in the rural areas of Ghana. There is therefore the need to put the use of bamboo in an innovative way to make it acceptable in the peri-urban and urban areas of Ghana.

CONCLUSION AND RECOMMENDATION

The architects and building contractors -respondents agreed they have used and specified bamboo for used respectively in at least an area in building construction. Basically, bamboo is mostly used for temporary works than permanent works in building construction in Ghana, with the most popular area of usage being props. Bamboo has not gained popularity in the areas of use for permanent purposes in building construction except in the area of landscape. Nonetheless not many respondents use bamboo in that area, even though it was ranked used than any other area of usage. It can further be deduced that, bamboo has a potential to thrive in the building construction industry in Ghana but the various areas of usage have not been exploited with the exception of the area of props which even need further attention to be able to modern trend of building construction material.

The result of the research shows that, generally, over the past ten (10) years, the different areas of bamboo usage in building construction has not seen any increase with respect to the volumes of usage except in the areas of props for temporary use and landscape for permanent use. Respondents agreed that the above mentioned areas are the only two gaining popularity.

At the end of the study, the researcher found out that, indeed, bamboo as a material in the building construction has a lot of potential but has not been exploited. Hence, it needs the involvement of the various stakeholder related to bamboo in construction to spearhead the potential into feasible uses. As a matter of urgency this paper recommends that: the government should give the needed support to the bamboo sector in Ghana to promote the extension of it areas of attention further to the construction industry. Industries which will treat and produce bamboo products for use in building construction should be established. Established institutions in the building construction industry such as Department of Building Technology, KNUST, Department of Architecture, KNUST, The building and road Research Institute (BRRI) and some Non-Governmental Organisations (NGOs) could be funded to organise training programmes and workshops towards the promotion of the use of bamboo and its potential in building construction. Architects should consider bamboo as a primary material in their specification for building designs and during construction. Promotion of bamboo usage in less used areas in building construction should be giving the needed hype to create the awareness of its potential as a building material. Research into bamboo in construction should be encouraged in building construction institutions to enhance basic promotion of the potential of bamboo.

Additionally, this paper suggests that further study in the following listed bullet points could be looked at to enhance the promotion of bamboo in building construction in Ghana.

- Extend the research to identify cost benefit analysis of bamboo and other building materials in specific areas of application in Ghana.
- Factors influencing the use of bamboo in building construction.
- Studies into specific details in bamboo construction.

REFERENCES

Amad, S. and Untao, S. (2001). Fracture properties of bamboo, Trans *Tech Publication Ltd., Zurich-Uetican, CH - 8707,* Switzerland, pp. 451-459

Ayarkwa, J. (1998). New Marketable Ghanaian Timber Species for Furniture and Construction, *Wood News, Forestry Research Institute of Ghana (FORIG),* Kumasi, Ghana, pp 13-18

Bandara, D.H.M.S. (1990). Possible uses of bamboo in low cost housing, *National Building Research Organisation, Sri Lanka.*

Cardoso, R. D, Okai, E.N.A, Eshun, A.A. and Haizel, K. E (2007). Review of the domestic timber market with an emphasis on Off-Forest Reserve timber production and management in Ghana, Timber *Industry Development Division, SGS Ghana Ltd. Pp.1-3*

Chung, K.F., Chan, S.L. and Ye, W.K. (2002). Mechanical Properties and Engineering Data of Structural Bamboo:Proceedings of International Seminar on Bamboo Scaffolds in Building Construction, Hong Kong, *INBAR, pp: 3-13.*

Fu, W.Y. (1993). Bamboo Scaffolding in Hong Kong*, the Structural Engineer, Vol.71, No.11, pp. 202-204.*

Food and Agriculture Organisation (1997). State of the World's forest, *FAO publication, Rome. http:www.fao.org/docrep* [accesses 2012, May 23]

Gangopadhyay, P. B., (2003). Bamboo Resources as a Rural Livelihood Option in Madhya Pradesh, India, *Paper submitted to XII World Forestry Congress*, Quebec City, March 2003.

Ghavami, K. (2005). Bamboo: Functionally Graded Composite Material, *Asian Journal of Civil Engineering (Building and Housing) Vol. 4, No. 1 (2003) 1–10.*

Haregewoin, Y. M. (2007). Integrated Housing Development Programs for Urban Poverty Alleviation and Sustainable Urbanization (The Case of Addis Ababa). *ENHR International Conference on Sustainable Urban Areas, 2007.* Rotterdam

Iyer, S. (2002). Guidelines for Building Bamboo reinforcement masonry in Earthquake-prone Areas in India, *University Of South California, pg 75-83*

Janssen, J.J.A., (2000). Designing and Building with Bamboo*, INBAR Technical Report*

Jayanetti, D.L. and Follet, P.R. (1998). Bamboo in Construction, *INBAR Technical Report No.16. TRADA, U.K. 120pp.*

Jiang, Z. (2007). Bamboo and Rattan in the World, *China Forestry Publishing House,* China

KPMG (2008). Potential Opportunity for Investors Kumasi, Ghana, pp. 1-15.

Malin, N. and Boehland, J. (2006). Bamboo in construction: Is the Grass always Greener? *Environment Building*

Moavenzadeh, F. and Rossow, J. A. K. (1976). The Construction Industry in Developing Countries, *Technology Adaptation Program, Massachusetts Institute of Technology. pp. 1-5*

Obiri, B.D andOteng-Amoako, A.A. (2007). Sustainable Development of the Bamboo Industry in Ghana. *Ghana Journal of Forestry, Vol.* 2 *1* and 22

Oladapo, A. A. (2005). An Investigation into the Use of ICT in The Nigerian Construction Industry, *from Http://Www.Itcon.Org/Data/Works/Att/2007_18.Content.02391.Pdf*,[Assessed On 4th February, 2013]

Punhani, R.K. and Pruthi, K.S.C. (1992). Substitution of wood in buildings - alternative forest based materials and their technology,*Forest Research Institute*, Dehra Dun, India.

Recht, C. and Welterwald, M. F. (2001). Bamboos, *Timber Press*, the University of Virginia

Shyamasundar, S. K and Vengala, J. (2008), "Promotion of bamboo housing system and recent development", *pp 2*

Solomon-Ayeh, K.A. (2004). Bamboo school building. *INBAR Publication*

Tada, T. Hashimoto, K. and Shimabukuro, A. (2010). Challenges, Opportunities and Solutions in Structural Engineering and Construction: On characteristics of bamboo as structural materials, *Taylor and Francis Group, London, ISBN 978-0-415-56809-8 pg 527-532*

Tekpetey, S. L (2006). Adding the utilization of bamboo resources in Ghana through property search and enhanced processing, *ICBR*, Beijing, China.

Van der Lugt, P., van der Dobbelsteen, A.A.J.F and Janssen, J.J.A. (2005). An Environmental, Economic and practical Assessment of bamboo as a building material for supporting Structures. *Construction and Building Materials, 20: 648-656*

Xiao, Y., Shan, B., Chen, G., Zhou, Q., Yang, R.Z. and She, L.Y. (2009). Development of laminated bamboo modern structures, *Proceedings of the 11th International Conference on Non-conventional Material and Technologies (NOCMAT): Materials for sustainable and affordable construction*, Bath, UK

Yao, W. and Li, Z. (2003). Flexural behavior of bamboo-fiber reinforced mortar laminates. Cement and concrete Research 33 (2003) 15–19.

ASSESSING THE IMPLEMENTATION STRUCTURE FOR PUBLIC-PRIVATE PARTNERSHIPS IN URBAN HOUSING IN NIGERIA

Eziyi O. Ibem[1], Albert B. Adeboye [2] and Oluwole A. Alagbe[3]
[1]School of Construction Economics, University of the Witwatersrand, Johannesburg, South Africa
[2, 3]Department of Architecture, Covenant University, Ota, Nigeria

Public-Private Partnerships (PPPs) are gaining recognition as alternative procurement strategy to government-provider approach in mass housing in many countries, including Nigeria. However, there are few studies exploring their implementation structures, especially in the developing countries. This study examined the implementation structure of Public-Private Partnerships (PPPs) in housing in Nigeria using Ogun State as a case study. Qualitative research approach was used and data were derived from oral interviews with key industry stakeholders. It was observed that the implementation structure of PPPs in housing in the study area was a combination of the New National Housing and Urban Development Policy, government agencies and corporate private sector organizations, Federal Mortgage Bank of Nigeria, commercial banks, building regulations and bye-laws as well as PPP agreements. This structure influenced the assignment of roles and risks amongst the partners in housing projects; and was found to be deficient in low-cost housing. The paper explored the policy and practice implication of this development and argued for the improvement of social content of PPPs in urban housing delivery in Nigeria.

Keywords: public-private-partnership , urban area, public housing, joint venture, Ogun State.

INTRODUCTION

Public-Private-Partnership (PPP) is increasingly gaining recognition as an alternative to government-provider approach in the provision of housing, urban services and critical infrastructure in many countries. As a result, there is a growing body of knowledge and literature on the concept and practice of PPP across the world. Several authors (Miraftab, 2004; Bovaird, 2004; Moskalyk, 2008; UN-HABITAT, 2011) have observed that empirical studies are largely focused on efficiency, effectiveness and equity of PPP strategy as well as the factors that influence its operation in the different areas of development. Abd Aziz et al. (2007) however noted that most of the studies are predominantly in the areas of public infrastructure, urban services, environmental management, and housing and other related areas and appear better reported in advanced than in the developing countries. This implies that compared to the

[1] Eziyi.ibem@wits.ac.za
[2] Albert.adeboye@covenantuniversity.edu.ng
[3] oluwole.alagbe@covenantuniversity.edu.ng

Ibem *et al.* (2041) Assessing the implementation structure for public-private partnerships in urban housing in Nigeria *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference*, 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 143-178.

developed countries, there is a paucity of research on the adoption of PPP in the developing countries.
It is observed from the review of literature that there is no single definition of PPP upon which most academics and practitioners could agree. This is simply because PPP is a concept that is subject to different definitions and interpretations. In the context of this study, PPP is used to describe a working arrangement that allows both the public and private (commercial and not-for-profit) sector organizations/institutions to share responsibilities, benefits and risks in public administration and public services provision (see Bovaird, 2004; Tomlinson, 2005 (UN-HABITAT, 2006b; Abd Aziz et al. 2007; Ibem, 2011b).
Like any other construction procurement strategy, the outcome of PPP is influenced by a number of factors, which. The UN-HABITAT (2006b) pointed out that the outcomes of PPP projects are generally influenced by political, social, economic, cultural factors as well as the underlying implementation and operational frameworks. The existing literature (including Abd Aziz and Hanif, 2006; UN-HABITAT, 2006b; UN-HABITAT, 20011) also helps to understand that PPP procurement strategy is gaining currency in the housing sector in many countries because of the advantage it provides in encouraging multi-institutional participation and enhancing the capacity of the public-sector to deliver more housing and vital services at affordable cost. Consequently, several authors (Payne, 1999; Ong and Lenard 2002; Freut, 2005; UN-HABITAT, 2006b; 2011) have explored the extent to which PPP has been implemented in urban housing in several countries. For instance in Nigeria, the existing studies focus on the role of government agencies in PPP (Ibem, 2010) and the contributions of PPP in addressing urban housing challenges (Ibem, 2011a; 2011b; Adegun and Taiwo, 2011, Ibem and Aduwo, 2012). None of these studies examined the underlying implementation structures PPP in housing delivery in the country.
In view of the growing demand for innovative procurement strategies in improving urban housing supply chain management system in many developing countries, including Nigeria, there is a need for a better understanding of the implementation structures of PPPs in housing. Therefore, this study sought to better understanding of the implantation structure of PPP in urban housing in Nigeria using Ogun State as a case study with a view to assessing the suitability of the structures in delivering low-cost housing to those in critical need in urban centers in the country. The study addresses two key research questions. These are:

- What is the existing implementation structure of PPPs in housing in Ogun State, Nigeria?
- How the structure does influences the operational model of PPP; target population and cost of housing in PPP housing projects?

In the context of this study the implementation structure of PPPs encompasses the legal, regulatory and financial frameworks upon which PPP in housing operate. It is expected that this the study firstly contributes to bridging some gaps in the literature; and secondly, informs public housing policy and management strategy. The paper proceeds in four major sections. The first section is a review of related literature; followed by the research methodology of the study. The next section is the presentation study findings, while the penultimate section is the discussion of study findings.

LITERATURE ON PPP IN HOUSING PROVISION

According to Mazouz et al. (2008), authors in diverse academic disciplines have offered different definitions of PPP and used the term to describe a wide range of ideas, practices and working relationships at local, national and international levels. Even though space will not allow us to discuss the various definitions and conceptions of PPP; but one definition of PPP which has found relevance in the current study is that offered by Miraftab (2004), in which PPP was defined as a market-enabling strategy through which the private sector's role is complemented by the state, communities and non-governmental organizations in addressing societal challenges. Putting this definition into context, it can be concluded that PPP represents an organizational arrangement that allows the public, commercial and non-commercial private sectors to share responsibilities in public service delivery in mutually agreed terms and conditions.

PPPs are generally formed by a network of interdependent partners drawn from the state, market and civil society. Each partner is known to have its own ideals, skills, material resources, value, objectives and interest and differs from one another in size, financial capability, status and strategy. These enable them to play different roles according to their strengths and weaknesses as explained in the UN-HABITAT, (2006b) report on Public-Private partnerships in enabling shelter strategies. In the context of housing delivery under the PPP arrangement, the state (government) is expected to concentrate on providing an enabling policy, regulatory and financial environment; the market engages in actual provision, management and administration of housing, while the civil society plays an intermediary role between the market and the people. The implication of this is that in an ideal situation, PPP in housing should consist of partners in the public sector (government agencies), private sector (property developers, contractors, building material manufacturers and sellers, financial institutions etc.), and the community sectors (civil society organizations, communities and households). This institutional composition suggests that PPP in housing is based on the division of labour among partners. In the first instance, this appears to be in line with New Public Management (NPM) paradigm that seeks to reform the ways public sector conducts its programmes and activities (Hood, 1994; Hughes, 1998) by encouraging multi-stakeholder participation in public administration and social service delivery (Adams and Young, 2006; Yamamoto, 2007; Mazouz et al., 2008). Secondly, it is also consistent with the precepts of enabling markets to work which encourage the division of labour among stakeholders in the housing sector according to the areas of comparative advantage (see World Bank, 1993 for an exposition on enabling markets to work in housing and infrastructure provision).

Based on this understanding, four possible implementation structures of PPPs in housing can be identified. These include the following

- Partnerships between the civil society and the markets
- Partnerships between the government and the markets
- Partnerships between the government and the civil society; and
- Partnerships between the governments; the markets and civil society (UN-HABITAT, 2006b),

Each of these structures differ one from another in the number of partners, their roles and purpose of the partnerships. Their adoption also depends to a large extent on the goal of the PPP and the prevailing socio-economic, political and cultural environment. However, but the UN-HABITAT (2011) report on Public-Private Partnerships in housing and urban development made it clear that the effectiveness of PPPs in any given assignment is a function of the underlying legal, regulatory and finance structure. This simply means that among other things, the implementation structure of PPPs is very important in understanding and predicting theirs operations and the outcomes. The implication of this is that researchers can understand the efficiency and effectiveness of PPPs in housing by exploring their implementation structures.

A number of reasons have been advanced on why the adoption of PPP has evolved and appears to be increasingly gaining acceptance as a viable way of circumventing the inadequacies of government-provider approach to social service provisioning. First, is the poor performance of public sector in social delivery (Birner and Wittmer, 2006).Second is the need for an alternative to full privatization, which has been criticised for benefitting the rich at the expense of the poor in the society (Getimis and Marava, 2002). Third, is the argument that since many countries are witnessing some levels of financial constraints in extending basic social services and subsiding the provision of new ones, PPP has come to bring in private financing and managerial skills towards achieving more efficient and cost- effective social services provision (Kyvleou, 2006; Adams and Young, 2006). Furthermore, the UN-HABITAT (2011) noted that almost all countries around the world have witnessed some form of PPP investment in the provision of housing and urban infrastructure principally because when the PPP strategy is correctly implemented it offers greater value for money compared with government-provider approach. In addition, other studies (including Jamali, 2004; Brown et al., 2006; UN-HABITAT, 2011) have shown that PPP increase construction and operation efficiencies at reduced cost. Obviously, the above helps to explain why many countries are turning to the PPP strategy in a bid to address shortfalls in their housing and social infrastructure needs; suggest that PPPs seek to improve fixed infrastructure provision by promoting value for money. Despite these merits, the report by UN-HABITAT (2011) however noted that when compared with traditional procurement, PPP may involve additional costs that if not well managed can erode any economic benefits derivable from its adoption

In the housing sector, there is copious evidence in the literature showing that PPP has been successfully adopted in urban housing provision in many countries. For instance, Payne (1999) identified the role of partnerships between the government, markets and the civil society in providing the different socio-economic groups access to land and housing in Egypt, India, Pakistan and South Africa. In Kenya (Otiso, 2003) and Brazil (Freut, 2005) there are also cases of PPP in housing for the low-income people. Further, studies (Ong and Lenard 2002; Abd Aziz and Hanif, 2006; Abd Aziz et al., 2007) indicate that collaborations between public and private sectors have been instrumental to the provision of housing for the low-income earners under the PPP platform in Malaysia. The initiation of housing projects by governments and the introduction of subsidies have been identified as one of the strategies engaged in assisted the low-income earners to become homeowners in the PPP option in that country. In contrast, the existing studies in Nigeria (Ibem, 2011a, 2011b; Adegun and Taiwo, 2011; Ibem and Aduwo, 2012) suggest that PPP in housing in the country thrives on partnerships between the government and private commercial housing developers, and thus appears to be in favour of housing for the high-income people. Elsewhere, the report by the UN-HABITAT (2006b) on PPP housing in the United States, Canada, Western Europe, Japan, Australia, Turkey, India and the Philippines, indicate that despite a wide range of variations in context, some factors, including the composition of the partnerships, their roles and implementation structures were the necessary conditions for effective PPP in housing.

From the foregoing, it was possible to develop a conceptual framework for understanding the relationship between the implementation (policy, institutional, regulatory and financial) structure and the outcomes of PPP in housing (Figure 1). Based on this framework, the study posits that the outcomes of PPP in housing in terms of quantity, quality and cost of housing as well as the target population of housing provided by PPPs are determined by the implementation structure and intervening social, economic, cultural factors.

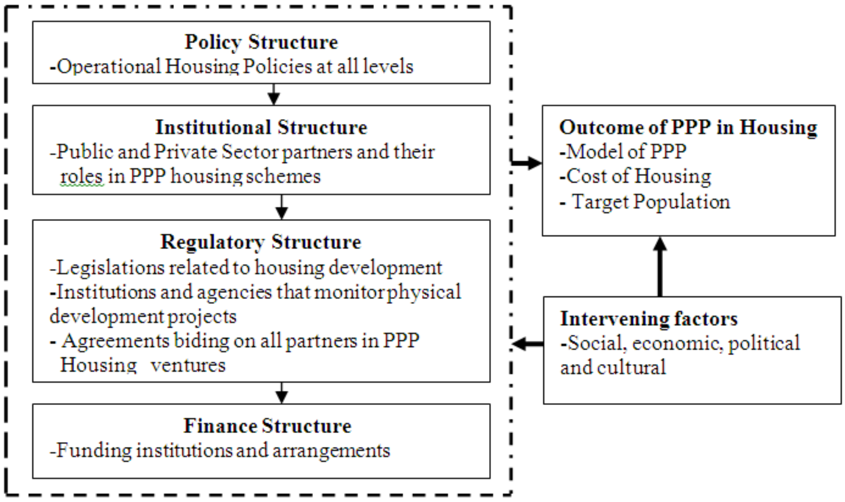


Figure 1: Conceptual Framework of the Study

RESEARCH METHOD

This is an exploratory study, which is part of the overall study conducted to assess PPP housing in Ogun State Southwest Nigeria. A qualitative research method was used and the study population was public and private sectors organization with a good record of accomplishment in PPP in housing in the study area. Data were derived through a survey conducted between June 2008 and February 2010 in the study area. Interview enquiries using an interview guide was the principal research strategy used in the collection of data. This was supplemented by data derived from archival records. Preliminary investigations by the researchers revealed that two public housing agencies: the Ogun State Ministry of Housing (OSMOH) and Gateway City Development Company Limited (GCDCL) and two private sector organizations: Sparklight Property Development Company Limited and Grants Property Limited were the key operators of PPP in housing in Ogun State. Consequently, these organizations were purposively selected for the research.

Face-to-face oral and telephone interviews were adopted in eliciting responses from the interviewees. This was based firstly on the assumption that the interviews will allow the researchers to capture the views of the key participants in PPP housing schemes in the study area. Secondly, it was also based on the notion that the perspectives of the key participants in the schemes would be meaningful, insightful and explicit in providing accurate data for the research. Due to the technical nature of the subject, the informants were selected based on job their designation, scope of professional practice and years of experience. This was to ensure that only those who are knowledgeable in the operations of PPPs in housing in their respective organizations participated in the current research. Consequently, only officers of the ranks of Head of Departments and above were selected for the interviews.

Four persons, one from each of the four organizations were interviewed; meaning that four different interview sections were held one for each of the selected officials using pre-determined questions drawn from the interview guide. The interviews took place in each of the interviewees' offices and each session lasted approximately 30 minutes. Three of them were interviewed on-one-one basis, while one was interviewed on telephone. The interviews were based on an interview guide comprising a number of questions relating to the organizational composition of the PPPs, the specific roles of each of them and cost of housing provided in the PPP housing schemes. The adoption of the interview guide was to help make the interview sessions more systematic and comprehensive and at the same time reducing the level of deviations from the subject matter under investigation. The interviews were manually recorded as the researchers took detailed notes during the interviews. The notes were expanded immediately after each interview session. Follow up interviews were also conducted to update information gathered from the initial interviews and to validate information collected from the interviewees conducted earlier on. Questions asked were mainly on the institutional composition the PPPs; the roles of different partners, and the underpinning policy and regulatory framework PPP in housing as well as the target population of the housing schemes in the study area.

In view of the fact that data collected were principally qualitative in nature, content analysis was used in the data analysis. Initially, the information from the interviews was transcribed, followed by the integration of related pieces information and idea from the different interviews; and identification of common and key themes emerging from all the interviews discussed. Attempt was made at enhancing validity of the result of the research by ensuring that only top management staff members directly involved in PPP in housing the four organizations were selected to participate in the study; and by conducting follow-up interviews.

STUDY FINDINGS

Implementation Structure of PPP in Housing

Figure 2 is a graphic illustration of the implementation structure of PPPs in urban housing identified in Ogun State at the time of the study was conducted. It is evident from Figure 2 that the policy structure of PPP in housing in the study area is the New National Housing and Urban Development Policy (NNHUDP) launched in 2002 by the Federal Government of Nigeria. This policy was designed to reform the housing sector in Nigeria by encouraging private sector participation through emphasis market principles in public housing delivery. In line with this, that policy has the ultimate goal of ensuring that all Nigerians have access to decent, safe and sanitary housing at affordable cost through private sector-led initiatives as Aribigbola (2008) explained in a study on housing policies and programmes implementation in Akure, Nigeria. To achieve this goal, the instrumentality of the NNHUDP was used to establish the Real Estate Developers Association of Nigeria (REDAN), Building Materials Producers Association of Nigeria (BUMPAN) and secondary mortgage institutions, who among other responsibilities are to form partnerships with government agencies in mass housing provision in Nigeria. This implies that the implementation of PPP in urban housing across Nigeria was made possible by the NNHUDP, hence it is considered as the policy framework for PPP in housing in Nigeria.

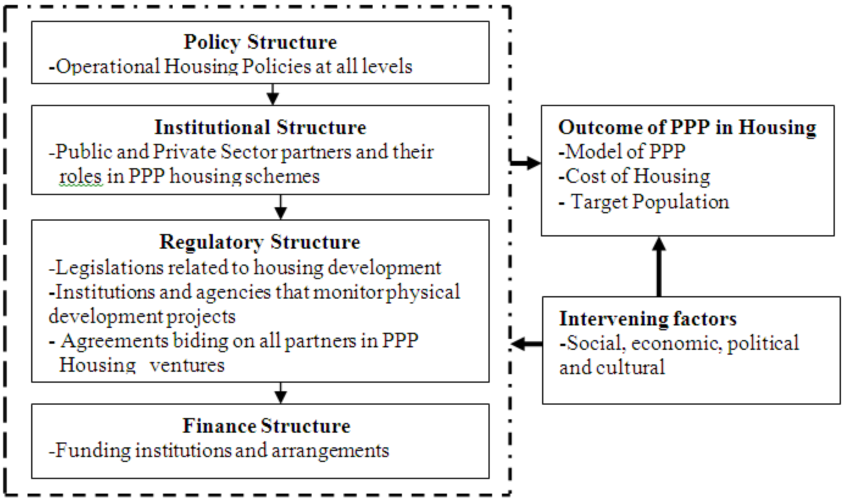


Figure 1: Conceptual Framework of the Study

RESEARCH METHOD

It is also evident from Figure 2 that the institutional framework of PPP in housing in the study comprises the following organizations: State government agencies (Ministry of Housing and the parasatals under it) and commercial private sector housing developers who are members of the Real Estate Development Association of Nigeria (REDAN), construction contractors and construction materials suppliers as well as private finance institutions, including commercial banks and secondary mortgage institutions. Consequently, the funding of PPP housing projects is the responsibility of the Federal Mortgage Bank of Nigeria, private sector operated mortgage institutions and commercial banks in form of loans or credit facilities

As regards the regulatory structure, two key regulatory instruments were identified in PPP in housing in the study. The first is the existing building regulations and byelaws. These were designed to ensure that housing provided in the PPP housing schemes is of the desired standards for human habitation and promotes social development and environmental sustainability. The responsibility of ensuring that housing provided in the PPP arrangement meets these requirements is carried out by responsible government agencies, namely physical development control agencies and public health departments. The second regulatory instrument identified was the PPP agreement that is signed by the partners in the PPP projects. The PPP agreement, which comes in the form of Memorandum of Understanding (MOU), is normally a product of negotiations between parties involved in the PPP housing projects. According to the officer in the GCDCL interviewed, the MOU is both the operational and legal document establishing the PPPs and guides their operation on each project. It among other things provides the basic information on the nature and structure of PPP housing schemes; the equity contributions and benefits of the partners and also sets the life span of PPP housing projects, including development, implementation, operational and termination stages.

The management of PPP housing projects was also found to be based the implementation structure described above. This ensures that each partner plays specific roles as outline in the MOUs. The interviews revealed that the allocation of responsibilities and risks in PPP housing projects among the partners were determined

by the implementation structure. Based on this, government agencies were found to be playing the role of providing land and title registration at subsidized cost, facilitating the process of obtaining permits and approval of housing development plans. They also select private sector partners through a competitive bidding process; provide the regulatory framework for monitoring the quality and standard of housing provided as well as provide some basic amenities such as access road, electricity to project sites. On the other hand, private sector organizations were involved in the design, actual construction, and management of the housing projects. The commercial banks and secondary mortgage institutions were involved in the provision of housing finance. Completed housing units were jointly sold and allocated to buyers by the partners. According to the officer in Sparklight Property Development Company Limited interviewed, at the operational stage of PPP housing projects, the private sector organizations were involved in the routine maintenance and management of completed housing estates and that this attracts annual maintenance from the beneficiaries and residents of the houses as agreed by the partners.
Examination of Figure 2 shows that Local Government Authorities (LGAs) and not-for-profit private sector organizations such as housing cooperatives, civil society organizations, which represent the interest of the grassroots people were conspicuously missing in the implementation structure of PPP housing schemes; and thus have no input in PPP housing projects in the study area.

Types of PPP Housing Schemes

Under the existing operational structure described in the preceding section, two types of PPP housing schemes were implemented in the study area. The first type involved the development of new housing estates: OGD-Sparklight and Havilah Villas housing estates, while the second involved the redevelopment of Ibarra Housing Estate in Abeokuta constructed in 1958 by the now defunct Western Nigeria Housing Corporation. The study also found out that between 2007 and 2010, around 552 housing units were constructed in three different housing estates in urban areas of the State. All the houses are complete-walk-in homes as no starter of shell houses were constructed. The cost of houses provided in the schemes was between ₦3.45million (US$21,563) for 2-bedroom semi-detached bungalow and ₦37.5 (US$2.358million). In all, finding of the study shows that the targeted population of PPP houses was the middle and high-income earners in the study area.

DISCUSSION

From findings of this study, a number of issues relating to the implementation structure of PPPs in housing have emerged. Firstly, from the review of literature, it is evident that PPP in housing may also include individual households, not-for-profit private sector organizations such as housing co-operatives and non-corporate private sector housing developers; but findings of this study appear to be in support of previous study by Ibem (2010) indicating that Local Government Authorities (LGAs) and NGOs were not part of PPP housing schemes in Nigeria. In fact, it was observed that only corporate private sector property developers, who are members of REDAN, construction contractors and building materials suppliers as well as private sector financial institutions, have been involved in PPP housing in Ogun State. Obviously, most of the organizations identified with PPP housing projects are profit-motivated; indicating that the joint venture model is gaining acceptability as the predominant variant of PPP the study area. Notably, this has influenced the operational structure of the PPPs and the way organizations involved share responsibilities, risks and associated benefits in PPP housing projects.

Arguably, the absence of LGAs and other grassroots organizations in the implementation structure of the PPPs in housing as observed in this study can be due to a number of factors. In the context of Nigeria, and perhaps other countries with similar three tier governance structure, the LGAs are the closet government at the grassroots and are responsible for the formation and growth of housing co-operatives and community organizations. However, it has been observed that in the last decades of existence of this tier of government in Nigeria, LGAs have not been effective in performing the statutory role assigned to them in the National Policy Housing Policy in 1991 due to age-long fiscal challenge (see Federal Republic of Nigeria, 1991). In fact, going by findings of this study, it is obvious that under the new dispensation in PPP in public housing delivery, LGAs have not performed better. Given the increasing role of local authorities and organizations at grassroots level in addressing housing needs of low-income urban residents in many countries, including Nigeria as Mabogunje (2005) and Oyewole (2010) noted in their separate studies; it is argued that the non-involvement of LGAs, and NGOs in the implementation of PPP in housing constitutes a hindrance to the chances of PPPs providing housing that is affordable to low-income people who have more critical housing needs that their high- income counterparts in Ogun State and Nigeria.

Secondly, we also found in the literature that the inability of the traditional public-sector procurement option to provide housing and basic amenities to the people in many developing countries at affordable cost, which is largely attributed to bureaucracy and funding challenges, necessitated the adoption of PPP in housing. In line with this, the study has shown that government agencies in Ogun State appear to be focusing on those areas that usually cause delays and contribute to increasing cost of production, management and administration of public housing. The private sector on the other hand seeks to improve the efficiency of public housing procurement system by curtailing bureaucracy and the financial burden on government by bringing in its business, financial and managerial acumen in the PPP procurement option. This finding appears to be in support of the precepts of the Enabling Markets Work (World Bank, 1993) and NPM (Hood, 1994; Yamamoto, 2007) in the area of sharing responsibilities and risks in public housing with the markets.

Thirdly, the study reveals that the PPPs have so far produced 552 housing units between 2004 and 2010. This is no doubt an insignificant proportion of the annual urban housing needs in the study area which has been put at 7,500 housing units; suggesting that the present operational structure of the PPPs is yet provoke a significant increase in the quantity of housing units provided under the PPP platform in the study area. In addition, in terms of the cost of housing, the result also shows that the smallest housing unit (2-bedroom terraced bungalow) constructed in the OGD-Sparklight housing estate costs about N3.45million (US$21,563). Since the cost at which houses reach the consumers in the market goes a long way in determining affordability; this simply means that going by the current minimum wage of N18, 000.00 in Nigeria, it will requires a minimum of 15 years of continuous savings of total annual income for an average worker to be able to buy a 2-bedroom terraced bungalow constructed in the OGD-Sparklight Housing Estate. This goes to suggest that housing provided by the PPPs in the study area is not affordable to an average income earner. This finding appears to be in support of the UN-HABITAT (2011) which noted that if not well managed, the PPP option to housing and infrastructure could attract high cost capable of eroding the economic benefits of its adoption. Based on the evidence produced from this study, it can be concluded that the existing implementation structure of PPP in housing in this study places emphasis on housing for high-income earners as previous studies (Ibem, 2011a; 2011b; Adegun and Taiwo, 2011) have also found in other states in Nigeria.

Relating findings of this study with those in other countries; obviously, it is evident that the outcome of the PPP joint venture housing in Ogun State, Nigeria, is not in line with that in the Philippines where similar model of PPP was found to have been very successful in housing low-income earners (see UN-HABITAT, 2006b). This goes to show that differences in the social, economic and political environment can influence the outcome of PPP in housing provision. Also, the fact that LGAs and NGOs that are supposed to represent the interest of low-income people were not involved in those PPP housing schemes may further explain the reasons why the PPPs were providing housing that is not affordable to low-income earners. This simply means that the existing structure of PPP in housing is not suitable for low-income housing in the Nigerian context. In all, findings of this study are not consistent with evidence in the literature (Bing et al., 2004) suggesting that PPP procurement makes the cost of service affordable to the majority of the people. Rather they are clear indications that PPP in housing in Ogun State is providing commercial private sector housing developers access to land at subsidized cost and other incentives in providing housing for high income earners who have the wherewithal to build or acquire houses for themselves.

CONCLUSION

This paper examined the implementation structure of PPP in urban housing in Nigeria using Ogun State as a case study. Evidence from this study shows that so far, the joint venture model involving government agencies and corporate private sector housing developers is not adequate for housing low-income people. Hence, PPP in housing is yet to make any significant contribution in increasing the supply of urban housing at affordable to average income earners in the study area. This study implies that policy actions in the form fiscal reforms or decentralization (fiscal federalism) are required to empower Local Governments Authorities (LGAs) and grassroots organizations to play active role in PPP in housing. This will promote low-cost housing under the PPP platform. The study also implies that pro-poor PPP models such as partnerships between governments, multi-nationals, and NGOs and partnerships between government and NGOs should be initiated to promote low-cost housing under the PPP arrangement. Such housing schemes can be funded using the contributory pension scheme and the National Housing Fund (NHF) with support from the multi-nationals as part of their corporate social responsibilities. In conclusion, although, PPP in housing is a recent phenomenon in Nigeria, it is evident from the study that the future of PPP in low-cost is contingent upon improving its operational structure to accommodate the interest of ordinary people.

REFERENCES

Abd Aziz, W. N. A., and Hanif, N. R. (2006). Business Partnership in Meeting Housing needs of the Urban Poor. *Global Built Environment Review*, Vol.5, No.2, Pp39–48.

Abd Aziz, W. N., Hani, N. R., and Musa, Z. N. (2007). Public–Private Partnerships approach: A success story in achieving democracy in the home ownership for urban inhabitants in Kuala Lumpur Malaysia. Reviewed paper, Real CORP 007 Proceedings, Tagungsband, Vienna, May 20–23, 2007. Available online (http://www.corp.at). Retrieved February 15, 2008.

Adams, J., Young, A., and Zhihong, W. (2006). Public–Private Partnerships in China: Rational system and constraints. *International Journal of Public Sector Management*, Vol.19, No.2, Pp 384–396.

Adegun, O.B. and Taiwo, A.A. (2011).'Contribution and Challenges of private Sector's in Housing in Nigeria: Case Study of Akure, Ondo State'. *Journal of Housing and the Built Environment*, Vol. 26, No.4, Pp 457-467

Ahmed, S.A. and Ali, M. (2004) 'Partnerships for Solid waste management in developing Countries: linking the Theories to Realities', *Habitat International*, Vol.28, Pp 467–479.

Aribigbola, A. (2008). Housing policy formulation in developing countries: Evidences of Programme Implementation from Akure, Ondo State Nigeria. *Journal of Human Ecology*, Vol.23, No.2, Pp. 125–134.

Bing, L., Akintoye, A., Edwards, P. J. And Hardcastle, C. (2004) Critical success factors for PPP/PFI projects in the UK construction industry. *Construction Management and Economics*, Vol.23, Pp. 459 – 471

Birner, R., and Wittmer, H. (2006) "Better Public Sector Governance Through partnership With the private sector and civil society: The case of Guatemala's forest Administration", *International Review of Administration Science*, .Vol.72, Pp459-472.

Bovaird, T. (2004). Public-Private Partnerships: From contested Concepts to Prevalent Practices. *International Review of Administrative Sciences*, Vol.70, No.2, Pp.199–215

Brown, A., Allison, O., and Luo, J. (2006). The suitability of Public-Private Partnership in the Provision of Sustainable Housing in China. World Review of Entrepreneurship,*Management and Sustainable Development*, Vol., No.1/2, Pp.101–124.

Federal Republic of Nigeria (1991) *National Housing Policy*, Lagos: Federal Government Press

Fruet, G.M. (2005) The low-income housing cooperatives in Porto Alegre, Brazil: a State/CommunityPartnership, *Habitat International*, Vol.29, Pp300–324.

Gruneberg, S., Hughes, W. and Ancell, D. (2007) Risk under Performance-based Contracting in the UK construction sector. *Construction Management and Economics*, Vol.25, Pp 691–9.

Hood, C. (1991) “A Public Management for all seasons?” in *Public Administration*, Vol.69, Nov.1, Pp 3-19.

Hughes, O. (1998), *Public Management and Administration. An Introduction*, London: Macmillan Press Ltd

Ibem, E.O. (2010) ‘An Assessment of the Role of Government Agencies in Public-Private Partnerships (PPPs) in Housing Delivery in Nigeria’. *Journal of Construction in Developing Countries*, Vol.15, No.2, pp 23-48.

Ibem, E.O. **(**2011a**)**. The Contribution of Public Private Partnerships (PPPs) to Improving Accessibility of Low-Income Earner to Housing in Southern Nigeria. *Journal of Housing and the Built Environment*. Vol.26, No.2, Pp201-217.

Ibem, E.O. (2011b) Public Private Partnership (PPP) in Housing Provision in Lagos Megacity Region, Nigeria. *International Journal of Housing Policy*, Vol11, No.2, Pp133-154.

Jamali, D. (2004). ‘Success and Failure Mechanisms of Public Private Partnerships (PPPs) in Developing Countries: Insights from the Lebanese Context’, *International Journal of Public Sector Management*, Vol.17, No.5, Pp 414-430

Klijn, E.H. and Koppenjan, J.M. (2000) ‘Public management and policy networks: foundation of
a Network Approach to Governance’. *Public Management*, Vol.2, No.2, Pp 135–158.

Kooiman, J. (1993), *Modern Governance: New Government-Society Interaction*, London: Sage Publications.

Mabogunje, A.(2005). ‘Cooperative Societies as Agents of Affordable Mass Housing Delivery’, *Housing Today*, Vol.1, No.9, Pp11-12

Mazouz, B., Facal, J., and Viola, J. (2008). ‘Public-Private Partnership: Elements for a project-Based Management Typology’ *Project Management Journal*. Vol.39, No.2, Pp 98–110.

Moskalyk, A.(2008). The Role of Public-Private Partnerships in Funding Social Housing in Canada, Canadian Policy Research Networks Research Report, September. Downloaded from www.shscorp.ca (10th September, 2012)

Ong, H. C. and Lenard, D. (2002). Partnerships between Stakeholders in the Provision of and Access to Affordable Housing in Malaysia. Paper presented at FIG XXII. International Congress held at Washington, D.C., USA, April 19–22, 2002.

Otiso, K.M. (2003) ‘State, Voluntary and Private sector partnerships for Slum Upgrading and Basic Service Delivery in Nairobi City Kenya’. *Cities*, Vol.20, No.4, 221–229.

Oyewole, M.O. (2010) ‘Housing Development Finance through Cooperative Societies: the Case of Ogbomosho, Nigeria’ *International Journal of Housing and Market Analysis*, Vol.3, No.3, Pp245-255.

Tomlnson, F. (2005). Idealistic and Pragmatic Versions of the Discourse of Partnership. *Organizational Studies*, Vol.26, No.8, Pp1169–1188.

Payne, G. (1999) (ed). *Making common ground: Public–Private Partnerships in Land for Housing*. London: Intermediate Technology Publications.

UN-HABITAT (2006a). *National Experiences with Shelter Delivery for the Poorest Groups*.Nairobi: UNHABITAT

UN-HABITAT (2006b). *Public–Private Partnerships in Enabling Shelter Strategies*. Nairobi:UNHABITAT

UN-HABITAT (2011). *Public–Private Partnerships in Housing and Urban Development.* Nairobi: UNHABITAT

World Bank (1993). *Housing: Enabling Market to Works with Technical Supplement*. Washington: World Bank

Yamamoto, R. (2007). Multi-Level Governance and Public–Private Partnerships: Theoretical Basis and Public Management. *Interdisciplinary Information Science* Vol.13, No.1, Pp 65–88.

ASSESSMENT OF HEALTH AND SAFETY REGULATIONS ENFORCEMENT AT BUILDING CONSTRUCTION SITES IN GHANA

Mustapha Zakari[1]
Building Technology Department, School of Engineering, Cape Coast Polytechnic, Cape Coast. Ghana

Health and safety planning and management should always be in proportion to the risks and complexity associated with each project. In compliance with these Regulations, one needs to decide on what he needs to do in order that the focus will always be on actions necessary to reduce and manage risks. In Ghana, there has been increased in human exposure to hazards in the construction industry. The study aimed to assess the regulations regarding health and safety in the Ghanaian building construction industry and the extent to which these regulations are enforced. Structured questionnaire was the method used to collect data from Building Contractors who were working under the supervision of Architectural and Engineering Services Limited (AESL) and Public Works Department (PWD) within Cape Coast Metropolis. Data collected were analysed using percentages and bar-charts. It was found that health and safety regulations were not enforced. There was also absence of regular safety education and awareness programmes. High risk of accident is the implication if the regulations are not enforced.

Keywords: health and safety, regulations

INTRODUCTION

The nature of construction work makes it vulnerable to accident leading to injury or death to a site worker. By accepting that there will always be a certain risk involved.

Little or no attention is given to safety measures and procedures that should be observed on construction site mainly because management does not realize the great losses they incur when workers or personnel are injured. Fatalities bring great losses to the individual and society as a whole. It is possible to reduce the chances of unsafe events at construction sites by enforcing safety measures. Site managers and supervisors are responsible for ensuring that the construction site is as safe as reasonably possible for those who work on it. Companies are required to comply with regulations to meet construction laws in addition to any safety policies they have created. Accidents cause distress to all concerned, and apart from loss of production time ad slowing down production. It results in loss of earning by the employer then the expenses incurred premium. Safety, health and welfare legislation has steadily increased the awareness of everyone in the inherent of risk at most workplace. Regulations, specifications, inspection requirements, and job safety programmes seek to prevent construction site accidents and promote safety awareness on the part of all

[1] zakari.mustapha@yahoo.co.uk

Zakari. (2014) Assessment of health and safety regulations enforcement at building construction sites in Ghana *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 157-163.

parties involved in a construction project. But despite these important efforts to deal with the challenge of construction site safety, accidents occur and will undoubtedly continue to occur, due to both the nature of the work itself and the variety of hazards faced by construction workers (Perecman Firm, 2012). A research conducted by Tawiah et al. in the year 2011 indicated lack of safety policies resulted in weak safety performance on construction sites and this posed a very big problem and hindered the practice of safety. Most workers in the construction industry did not see the need to wear protective clothing because majority of the supervisors and management did not ensure the adherence of these regulations.

PURPOSE OF THE STUDY

The study aimed to assess the compliance levels of safety regulations and the extent to which the enforcement agencies were ensuring its adherence.

The specific objectives of the study are as follows:

- To find out the causes of accident and the degree of compliance of health and safety.
- To determine whether health safety regulations are enforced.

LITERATURE REVIEW

Work related injuries such as occupational diseases arising from exposure to dangerous substances such as dust, chemicals, asbestos are common among construction workers. Cotton et al (2005) asserts that “a worker’s well-being depends on the provision of decent working conditions” and that “adequate health and safety measures can protect the workers from wages lost through injury”. According to Hughes and Ferrett (2008) the construction industry has world reputation for the quality of its work but remains one of the most dangerous in the UK. The International Labour Organisation (ILO) estimates at least 60,000 fatal accidents a year on construction sites around the world which is one in six of all fatal work-related accidents. It is worth knowing however that most of these accidents and fatalities could be avoided if effective safety measures were put into proper practice.

The construction industry in Ghana

The construction industry continues to be the backbone of the Ghanaian economy. This was supported by a research conducted by Tawiah et al (2011). Its contribution to the Gross Domestic Product is about 8.5% (Ghana Statistical Service, 2007) and in 2003 it employed about 2.3 % of the economically active population. The Ghanaian construction industry like many developing countries is labour intensive and will continue to be so for a long time. The characteristic of its labour intensive has increased the human exposure to increased health and safety hazards. It is in this light, that safety of construction employees assumes a colossal importance for all stakeholders in the construction industry. It is absolutely important to improve the unacceptable poor safety record of the industry by taking effective action to minimize the risk of accidents and ill-health as (Tawiah, et al 2011).

Government Regulatory Agencies for Safety in Ghana

Government regulatory agencies often enact regulations to help ensure that a construction project is safe to build, safe to use, and safe to maintain and delivers you good value. The ministry of Works and Housing in Ghana, regulates the activities of construction firms. Only firms meeting the required safety needs are given certification to proceed as an establishment (Adusei, 2009).The Factories Inspectorate is a state agency responsible for the enforcement of health and safety regulations.Laryea (2010) was of the view that health and safety requirements using contractual frameworks should be one mechanism to use to tighten regulation. Health and safety policies and procedures in the Labour Act, 2003 (Act 651) and the Factories, Offices and Shops Act, 1970 should also be clearly articulated to the parties to all construction contracts in Ghana.

Legislations Regarding Safety in the Construction Industry in Ghana

There are legislations regarding health and safety in the Ghanaian construction industry. For instance, the two main legislations regarding health and safety on construction sites include The Factories, Offices and Shops Act (1970), Act 328 and Labour Act (2003), Act 651. These acts spell out regulations to be followed by companies regarding factories and labour respectively and it is very important that construction firms comply with the regulations laid down in these acts.

Laryea(2010)reported on the current state of health and safety on construction sites in Ghana revealed that there was a serious lack of structures and procedures at all levels of the construction chain - lack of strong and appropriate health and safety legislation for governing construction work and site operations in construction. There are two Acts in Ghana (the Labour Act, 2003 and the Factories,Offices and Shops Act, 1970) that provide some form of regulatory instruments for ensuring health and safety on construction site were not strongly enforced and many contractors were not even aware of their Health and Safety obligations under these Acts. Regulatory bodies responsible for ensuring compliance were not properly resourced to carry out their statutory responsibilities under the two legislations. Laryea (2010) based on earlier work by Kheni (2008) revealed that owner/managers of construction SMEs in Ghana had little knowledge of the legal framework governing health and safety in the construction industry of Ghana. He emphasized on strengthened of government institutions such as the Factory Inspectorate Department, which is mandated to ensure a safe and healthy environment for working and to promote measures that will safeguard the health and welfare of employees, should be able and empowered.

Justification of Construction sites as factories under this Act

The Act of the Parliament of Ghana defines certain basic safety rules and requirements for factories, offices and shops (Act (1970), Act 328) not excluding construction site safety. The definition of a factory, according to section 83, sub-section 2(d) of this Act is "any premises in which articles are made or prepared incidentally to the carrying on of building operations or works of engineering construction and in which any person is employed in manual labour, not being premises in which such operations or works are being carried on". In view of this, the Act classifies construction work sites as factories.

The Parliament of Ghana enacted the Act to ensure safety at work places. The Act, which controls safety requirements passed by the government, is to be generally administered under the authority of the Ministry of Labour and co-operative, by the chief inspector of factories and staff of the Factories Inspectorate. The Act also spells out safety precautionary measures to be taken into consideration.

RESEARCH DESIGN AND METHODS

The selecting of the consultants was based on census since all the government consultancy agencies in Cape Coast were used. The sampling technique used by Stoker (1985) was used as a guideline. The construction companies selected for the study were those whom AESL and PWD serve as consultants for them. Purposive sampling technique was employed in the selection of each company. This was based on the fact that not all construction sites within the area of study were located. The total number of construction companies located for the study was found to be nineteen (19). According to Stoker (1998), if the population is less or up to twenty (20), then the percentage suggested is 100% therefore the number of respondents consisted of all construction projects which were supervised by AESL and PWD and located within Cape Coast Metropolis.The instrument used for data collection was questionnaire and questions relating to the following were asked: the establishment of the firm, the use of personal of protective equipment by workers, rate of accident and the availability of health and safety officers at the site. Both skilled and unskilled labours were involved in the answering of the questions and this as carried out during the day. Descriptive statistics was employed in the analysis of the data collected and the low response rate was caused by the change of weather on the day of the administering of the questionnaires and negligence on the some of the workers to return the questionnaires. The responses obtained are valid and reliable based on the previous research findings in Ghana.

RESULTS AND DISCUSSIONS

Nine out of the nineteen questionnaires administered were received, which represent 45%.

Table 1: Provision of Personal Protective Equipment

Provision of (PPE)	Frequency	Percent (%)
Boots	8	88.89
Helmets	8	88.89
Belts	3	33.33
Goggles	6	66.67
Face Masks	3	33.33
Overall Coats	8	88.89
Gloves	6	66.67
Ear Plugs	2	22.22

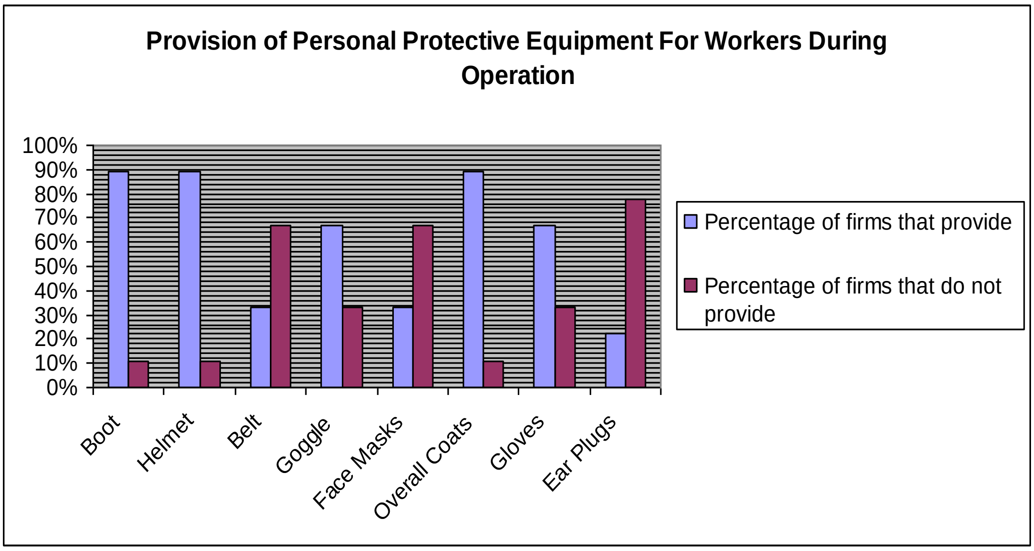


Figure 1: Provision of Personal Protective Equipment (PPE)

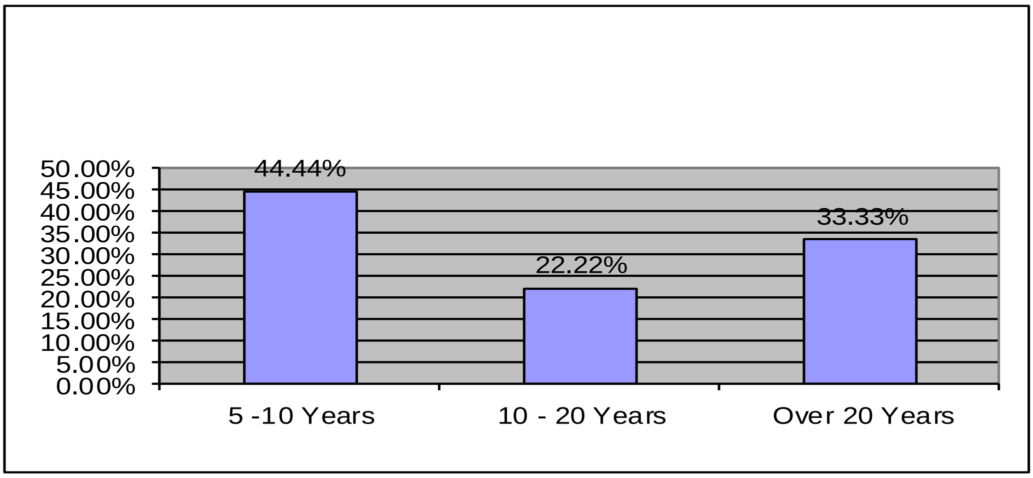


Figure 2 Period of establishment of firm Source: (Field survey (2012)

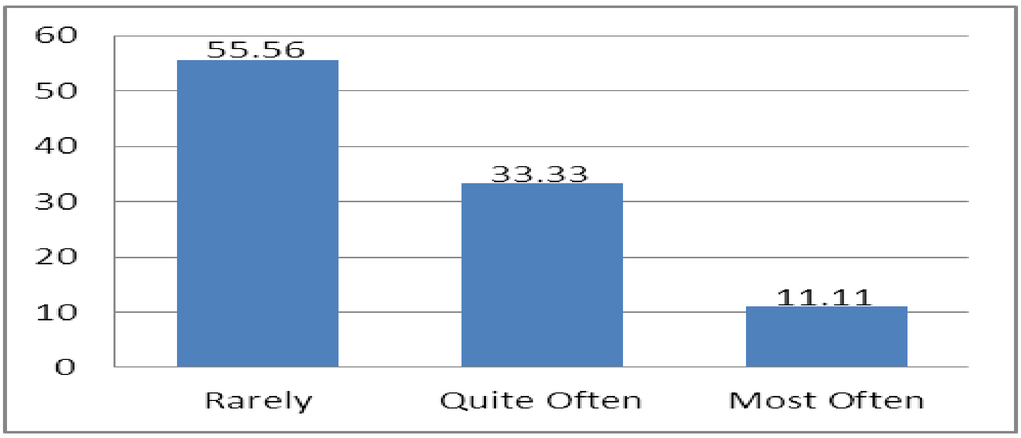


Figure 3: Rate of Accident

Figure 1 shows that majority of the firms did not provide health and safety manual to workers but have basic Personal Protective Equipment (PPE). Majority of the firms were established between 5 and 10 years as shown in figure 2. Even though, they have been in business for a long period and the rate of accident is rare, does not imply that accident do not occur at all. It does occur but not often (Figure 3).

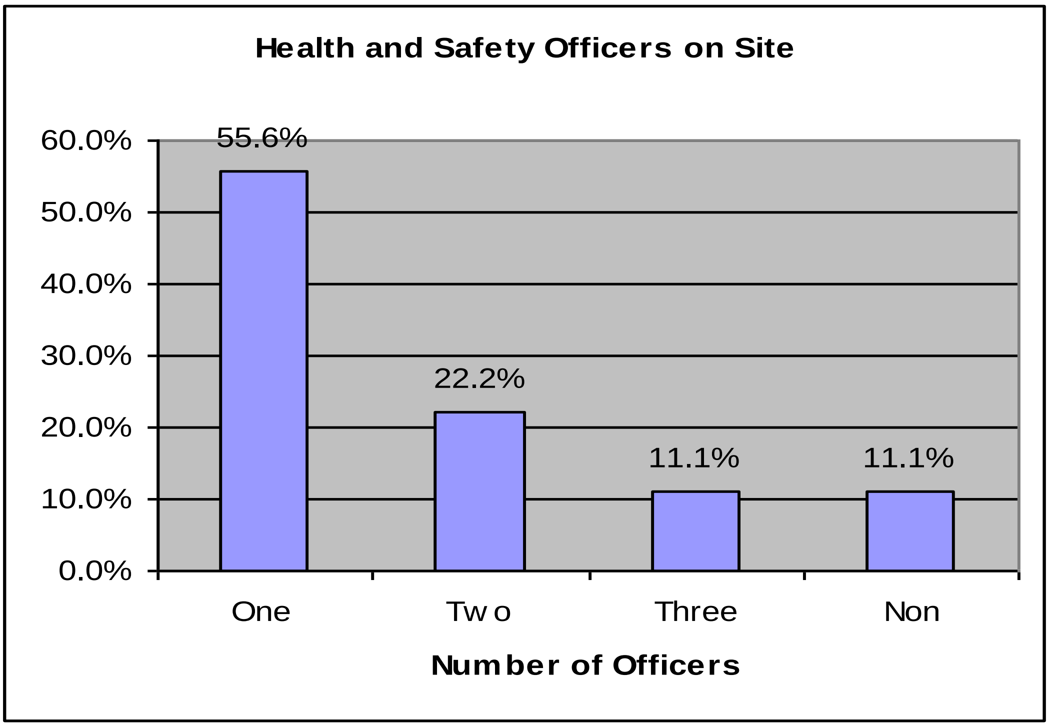


Figure 4: Health and Safety Officers on Site

Majority of the sites have at least one safety officer and were in possession of Factories, Offices and Shops Act (1970) or its abstract. Moreover, were in favour sanctions for non-adherence to safety regulations.

DISCUSSION

It was noted from the research findings that majority of the firms have basic Personal Protective Equipment (PPE) but did not provide health and safety manual to their workers. This is contrary to the Health and safety policies and procedures in the Labour Act, 2003 (Act 651) and the Factories, Offices and Shops Act, 1970 which is clearly articulated to the parties to all construction contracts in Ghana. It was also clearly stated in the literature that only firms that meet the required safety needs are given certification to proceed as an establishment.Even though, most of the firms have been in existence for a long period and have at least one safety officer,and were in possession of Factories, Offices and Shops Act (1970) or it's abstract but, yet they have failed to comply with the regulations laid down in these acts. This may be due inadequate resource to the regulatory bodies responsible for ensuring compliance to carry out their statutory responsibilities under the two legislations.

CONCLUSION

*It is recommended that health and safety regulations should be enforced. S*afety awareness programmes and regular education must be organized for all workers. The ignorance level of the enforcement has accounted greatly for the existing level of non-compliance of the regulations.

REFERENCES

Adusei, A. K. N.(2009). The Ghanaian Construction Industry and Compliance with Regulations; Safety Regulations. Unpublished (BSc.) Project, Department of Building Technology, Kwame Nkrumah University of Science and Technology (KNUST), Kumasi-Ghana.

Cotton, A. P., Sohail, M. and Scott, R. E. (2005). Towards improved labour standards for construction of minor works in low income countries. Engineering, Construction and Architectural Management..

Factories, Offices and Shops Act, 1970 (Act 328).

Ghana Statistical Service, (2007)

Hughes, P. and Ferrett, E.(2008). Introduction to Health and Safety in Construction. 3rd ed. Oxford: Elsevier.

Kheni, N.A. (2008) Impact of health and safety management on safety performance of small and medium-sized construction businesses in Ghana:

Labour Act 651(2003).

Laryea, S.(2010). Health and Safety on Construction Sites in Ghana.COBRA 2010). The Construction, Building and Real Estate Research Conference of the Royal Institution of Chartered Surveyors Held at Dauphine Université, Paris, 2-3 September 2010. Retrievedfrom http://www.academia.edu/349580/Health_and_safety_on_construction sites_in_Ghana on April 22,13.

Stoker,G.(1995) Governance as theory: five prepositions.International Social Science Journal.INT SOC SCI J.vol.50.no.155and Sampling Methods. In A.S. Devos, Research at grass roots. Van Schaik Publishers.

Perecman Firm, P.L.L.C., (2012). The Construction Industry at a Glance [online]. Bronx, New York. Retrieved from http:// www.perecman.com / Construction – Accidents _ PC / The – Construction – 1 – on May 13,2013.

Tawiah, D. D. and Adade, A. A. and Amesimeku, H.(2011). Formal Health and Safety practices on Ghanaian Construction Sites. Unpublished (BSc.) project. Department of Building Technology, Kwame Nkrumah

AWARENESS AND PROSPECTS OF AGILE PROJECT MANAGEMENT IN THE GHANAIAN CONSTRUCTION INDUSTRY

Simon Ofori Ametepey[1], Samuel Kwame Ansah[2] and Clinton Aigbavboa[3]

[1]*Faculty of Technical and Vocational Education, University of Education, Winneba, P. O. Box 1277, Kumasi –Ghana*

[2]*Department of Building Technology, Cape Coast Polytechnic, P.O. Box AD 50, Cape Coast Ghana*

[3]*Department of Construction Management and Quantity Surveying, University of Johannesburg, Doornfontein Campus, Johannesburg, 2028, South Africa*

Recent studies of the construction industry have revealed that project management has developed in the opposite direction over the past few years, towards a 'harder' and more stringent approach with an increasing degree of specialization. It has been observed that the present day construction activities require new management paradigms. Conversely, there are some new developments in the field such as Agile Project Management (APM). APM approach has gained momentum in other industries and is now being given consideration in the construction industry. Within this approach, the human aspect takes precedence over reliance on documentation. This research assessed the prospects of APM in the construction industry in Ghana using the SWOT analysis model. A mixed method approached (questionnaire and interview survey) was adopted to elicit data from respondents. Questionnaires were used to retrieve data from Construction Project Managers (CPM) whereas interview was conducted with some project management experts. The results of the survey revealed that there is a very low level of awareness of the concept of APM amongst CPMs in Ghana. Even though a small number of the respondents were aware of APM, they lack thorough knowledge of the concept as the concept has never been adopted in any of the projects managed by these professionals. However, majority of the CPMs welcomed the concept and were eager to know more about it. It is therefore recommended that more discussions, seminars, training, and workshops on APM and its importance should be initiated to enhance the level of awareness and knowledge in the Ghanaian construction industry. Likewise, further studies could also look at how both paradigms (APM and Traditional project management) can be mixed since they all have their weaknesses and strengths.

Keywords: agile project management, Ghana, mixed method

INTRODUCTION

The traditional way of managing construction projects has been around for half a century and is still the basis on which construction business relies (Johansson, 2012). Recent studies of the construction industry have revealed that project management has developed in the opposite direction over the past few years, towards a 'harder', more

[1] oforipmp@gmail.com
[2] skansah@hotmail.co.uk
[3] caigbavboa@uj.ac.za

Ametepey *et al.* (2014) Awareness and prospects of agile project management in the Ghanaian construction industry *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference*, 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 165-178.

stringent approach with an increasing degree of specialization (Everts, Pries and Nijhuis, 2011). This approach works well with relatively simple and repetitive construction projects. Nevertheless, project managers have noticed that their environment is rapidly increasing in complexity, and that this development limits their effectiveness (Karlesky and Voord, 2008). Furthermore, the traditional project management approach lays out the steps for development and stresses the importance of requirements. However, this approach is limited by the fact that projects rarely follow the sequential flow, and clients usually find it difficult to completely state all requirements early in the project, therefore change becomes inevitable. Projects change and this is not fundamentally due to lack of planning or incompetence on the part of project managers. Rather, change is an inherent characteristic of any growing entity. Traditional project management usually hinges on eliminating change and designing out uncertainty up-front (Karlesky and Voord, 2008). Today, construction projects' processes have become more complex and interconnected than ever before. They involve complex communities of alliances with strategic suppliers, outsourcing vendors, networks of customers and partnerships (Hass, 2007).

Moreover, some researchers have incessantly posited that the results of past project performance record are troubling; hence the traditional project management approach needs to be re-examined (Arras people, 2010; Onna, 2007; PMI, 2009). According to Everts et al., (2011) Traditional project management can be somewhat ineffective since project requirements are elusive, volatile and subject to change. The highly strait-jacketed management style described above is not entirely suitable for increasingly complex construction projects. Hence, identifying an optimal way of managing, controlling and coordinating construction projects has been a constant challenge (Tonnquist, 2006). Researchers have observed that the new construction project management approaches require new management paradigms.

An alternative approach, Agile Project Management (APM), has emerged in other industries such as IT (Information Technology) and manufacturing. A number of researchers have carried out studies on APM and have recommended it as an alternative to the traditional project management in the construction industry (see for examples Demir et al., 2012; Johansson, 2012; Everts et al., 2011; Hass, 2007). APM is a highly iterative and incremental process, where developers and project stakeholders actively work together to understand the domain, identify what needs to be built, and prioritise functionality (Hass, 2007). Two main concepts within the Agile methodology are adaption to change and collaboration between people (Agile Sweden, 2012). Agile project management uses an interactive process to help customers define their needs and requirements. The Agile approach is suitable for complex projects where it is difficult to specify the product in advance. It is widely used in the software industry where the customer detects their needs through means of repeated tests and improvements to a prototype. It is on this premise that this paper assessed the prospects of APM in the construction industry. This research adopted the use of SWOT analysis model developed by Havard Business School in the early 1950's (Panagiotou, 2003). It includes the strengths, weaknesses, opportunities and threats of APM in the construction industry. It is expected that the study will extend our understanding of the current issues associated with APM in the construction industry. The paper proceeds with a review of literature on APM; the description of the research method adopted for the study; analysis and discussion of study findings. It ends with some conclusion remarks and recommendations.

LITERATURE REVIEW

This section reviews related literature on APM, SWOT analysis model adopted for the study, Traditional project management and Characteristics of APM.

SWOT Analysis Model

The prospect of APM in the construction industry was assessed in this paper by the use of SWOT analysis. SWOT Analysis is a strategic planning tool used to evaluate the strengths, weaknesses, opportunities, and threats of an objective requiring a decision. SWOT analysis model is a well used and popular tool which originated from the Harvard Business School in the early 1950s (Panagiotou, 2003), although some sources attribute it to Albert Humphrey at Stanford University in the 1960s and 1970s (Scott and Sharkey, 2007). SWOT analysis is a commonly employed framework in the business world for analyzing the factors that influence a company's competitive position in the marketplace with an eye to the future. However, the SWOT framework can also be usefully applied outside the pure business domain. A quick check on literature turns up SWOT analyses for urban-renewal projects, career planning, website design, youth sports programs, evaluation of academic research centers, and it becomes obvious that it can be usefully applied to guide any organized human endeavor designed to accomplish a mission.

Generally, a SWOT analysis serves to uncover the optimal match between the internal strengths and weaknesses of a given entity and the environmental trends (opportunities and threats) that the entity must face in the marketplace. In SWOT analysis, **strength** can be viewed as a resource, a unique approach, or capacity that allows an entity to achieve its defined goals. A **weakness** is a limitation, fault, or defect in the entity that impedes progress toward defined goals. An **opportunity** pertains to internal or external forces in the entity's operating environment, such as a trend that increases demand for what the entity can provide or allows the entity to provide it more effectively. A **threat** can be any unfavorable situation in the entity's environment that impedes its strategy by presenting a barrier or constraint that limits achievement of goals.

Traditional (Waterfall) project Management

Traditional Project Management typically involves management of distinct and sequential Project Life Cycle Phases (Project Initiation Phase, Planning Phase, Execution Phase, and Closure Phase). Such a management model is referred to as "Waterfall Model" since the progress flows from the top (first phase) to the bottom (last phase), like a waterfall. It involves very disciplined and deliberate planning and control methods. In traditional project management there are distinct phases throughout the project life cycle (Hass, 2007). Tasks are completed one after the other in an orderly sequence, requiring a significant part of the project to be planned up front. For example, in a construction project, the team needs to determine requirements, design and plan for the entire building, and not just incremental components, in order to understand the full scope of the effort. In this approach, an important part is the disciplined planning and control methods which to an extent are not completely void of errors. The activities are performed in a planned and orderly sequence. In order to perform such extensive planning of projects following this approach, it is assumed that the project's future is predictable and that tools and activities are well understood (Johansson, 2012). In addition, with traditional project management, once a phase is complete, it is assumed that it will not be revisited, which at time is not the case. There are of course both strengths and limitations with this approach as there are with any other approach. On the one hand the strengths of this approach are that it lays out the steps for development and stresses the importance of requirements. On the other hand, the limitations are that projects rarely follow the sequential flow, and clients usually find it difficult to completely state all requirements early in the project.

Agile Project Management

In the 1990's, Roland Gareis in "Handbook of management by projects" stated that the number of projects conducted was increasing but at the same time the number of participants within each project was decreasing (Gustavsson, 2011). Johansson (2012) asserted that, despite these changes, project managers were still using the same traditional management methods, and were only educated on new methods that were based on trying to parallelize tasks in order to decrease the lead-time. This, however, did not have the desired effect. The same management approach of "Waterfall Model" was subsequently adopted for Software sector also. But it was soon realized that a different approach needs to be developed for management of software projects due to inherent differences in nature of Construction/Manufacturing Projects vis-à-vis software projects. The software developers responded in a different way. They considered the traditional management methods present at that time to be slow and static and felt more hindered than supported by these methods. Therefore, software developers were searching for methods that were more supportive and at the same time enable developers produce IT-systems of quality in an effective and efficient way. Thus there was a need to adopt a different management model for software projects which would be more dynamic, interactive, flexible and adaptive throughout the lifecycle of project (Johansson, 2012). During the 90's a lot of different new methods that are today found within Agile project management were developed. For instance, one of the most popular methods today is called Scrum and it was created in 1995. Before February 2001, there was no name under which all these new flexible and adapting methods could be gathered, they had up until then been called "light-weight methods'' (Hass, 2007). However, in the small ski resort Snowbird in Utah, USA, 17 prominent agile method developers who represented different Agile methods gathered because they felt they needed a common name and common values for all their methods. They also needed ways of creating software in a lighter, faster, more people-centric way. Different names were discussed and one of them was "Adaptable" but since this more or less means that actions are taken retroactively the name was rejected. The name "Agile" was considered to be a more accurate description of these methods and was hence chosen.

The common values that were discussed and agreed upon during the meeting in Snowbird became the "Agile Manifesto" and included four main values (Beck, 2001).

- over ***processes and tools***
- ***Working software*** over ***comprehensive documentation***
- ***Customer collaboration*** over ***contract negotiation***
- ***Responding to change*** over ***following a plan***

For the value of individuals and interactions over processes and tools, Johansson (2012) suggests that this idea in the Agile manifesto basically means that project team members carries a responsibility to modify and apply the best process for the specific project. The opposite would mean that the project members had a more or less standardised process and tools for every project and they could just follow that plan. This does not necessarily mean that a project cannot follow a pre-set of processes and tools within the organisation. With regards to working software over comprehensive documentation, the title indicates that this part of the Agile manifesto is very much linked to the software development industry and for good reasons it is the industry from which the Agile methods originate. However, this does not mean that it cannot be applied to any other industry (Gustavsson, 2011). This goes to suggest that it can be re-written into “Useful project outcome over comprehensive documentation” and thus makes it easier to understand what it would mean in other industries. This implies that this part of the manifesto is to right through the project delivering smaller useful results, instead of setting up a goal to deliver the result of the entire project at one point somewhere in the far future. The next value of APM is client collaboration over contract negotiation. Throughout the history of project management it is an established fact that, a good relationship between the client and the supplier is of the essence for a successful project. The reality is that before the advent of Agile management approach methods one did not really know how to achieve good relationship between clients and service suppliers in the construction industry. Since project delivery process is divided into smaller parts, in Agile, with review and presentation between each of them the client has (and should take) the opportunity to see, discuss and decide whether the present plan should continue or if something should be changed. Responding to change over following a plan is the final value of APM. One accepts the fact that within Agile management, it is a waste of time trying to predict the future. One realizes that plans created in the beginning will most likely need to be adjusted when the project grows and the market around changes. So instead of spending extra time planning every last detail, the Agile methods embrace change through the project process.

There are several key characteristics that provide the basis for APM. One of the characteristics of APM is Visual control. This is a "cards-on-the-wall" method of planning to assist a team in organising the work of projects (Hass, 2007). For example, one successful Agile project team placed different colour groups of cards that represented the features of the solution on the wall. The features that were designed, developed, tested and in production were one colour, the features that were designed, built, tested but not yet put in production (but ready to go) were in another colour. The team was able to see at a glance where they were with each feature set. The next attribute of APM is co-located high-performing teams. In Agile development, all the key team members are co-located, including the customer/end-user, preferably in a work room. This approach greatly increases the quality of co-ordination and communication. Besides, Test-driven development is the next characteristic of APM. In cases when the customer or client is having a difficult time articulating requirements, Agile teams often use test-driven development. This requires more iteration between requirements, design, development and test. Adaptive control is another major characteristic of APM. Everyone on the team is constantly adapting. Because of this dynamic environment, the project manager needs to be seen as a leader, not a taskmaster. Instead of setting rigid instructions for the team to follow, the project manager facilitates the team in establishing working relationships, setting ground rules and fostering collaboration. Collaborative development is also another attribute of APM. APM relies on collaboration among all team members to deliver results, capture candid feedback and implement lessons learned on the next iteration of the solution. Another attribute of APM is feature-driven development. This practice greatly reduces complexity and allows the team to focus on one feature at a time. For example, one team is working on Feature #4 and that's the team's only focus. They do not worry themselves about Features #1-3. It is the project manager who ensures the next feature in the backlog is truly the next priority, based on business value and risk. The other characteristic is leadership and collaboration rather than command and control. The principles of APM are timeless and links closely to leadership. It addresses a lot of the steps that facilitate leadership much more than traditional management. The final attribute of APM is lessons learned. After each cycle, the team holds a lessons learned session to determine what they can do better on the next iteration. As the team learns, it adapts how the members are working together to continuously improve team performance.

However, it’s much more challenging to implement agile methods in bigger projects involving acceptance of bids. One of the key issues is how to build up trust between clients and contractors so that both are comfortable with idea of Agile techniques. Clients will naturally be concerned over the facts that “deliverables have not been defined clearly”, “Scope may creep” and that “the contractor may use this as a tool to bleed money from him”. The next key issue is how to evaluate and compare the bid cost. Obviously, the contracts with Agile project management techniques will not be fixed price contracts since the scope and the deliverables will change during the course of work and these changes may well be quite substantial.

Flexibility, fairness and transparency in decision making system coupled with involvement of independent reputed adjudicators will help in making the APM techniques work for the larger benefit of the society. It must be appreciated by all stakeholders that with APM techniques clients will possibly spend a bit more but would most likely be a lot happier. Also, incorporating Agile management techniques into projects fosters a focus on the benefits of each feature. In traditional project management, the teams strive to finish the project on time and under budget and often lose sight of the overall benefits the entire effort is intended to bring to the organization. It is important to remember the strategy the project is expected to advance as well as the total cost of ownership and not just the project costs.

RESEARCH METHODOLOGY

This paper is an exploratory study in which concurrent mixed method was adopted. According to Ritchie and Lewis (2003), quantitative and qualitative methods should not necessarily be seen as opposing approaches to research but instead as complimentary strategies appropriate to different types of research questions. Qualitative approach was used in this research to capture the viewpoints not captured in the quantitative approach and was used to validate findings obtained through the quantitative method. The study population was construction project managers (CPMs) in the Greater Accra Region of Ghana. A multi-stage sampling technique was used in selecting the respondents. In the first instance, a systematic sampling technique was adopted in selecting every 6th organization in all the construction organizations in the study area. Where there was a single CPM within the selected organization, the CPM of the organization was automatically picked for the survey. In organizations where there were more than one CPM, random sampling technique was used in selecting a

CPM. Secondly, in organizations that have more than four CPMs, two CPMs were purposively selected to ensure adequate representation.

The main data collection instrument used was pretested questionnaire administered by the researchers and two other trained field assistants. The questionnaire was structured to capture information on the respondents' background, their current project management practices, level of awareness and knowledge of APM, and prospects of APM. Of the 156 questionnaires administered, 112 (72%) valid questionnaires were retrieved. Data collected using the questionnaire instrument was augmented by in-depth one-on-one interviews with purposively selected construction project management experts. These helped unveil a repository of relevant data needed to enhance the understanding of the issues investigated. The semi-structured interview was conducted concurrently as the questionnaire was being distributed and retrieved from the respondents. One project management expert granted the interview but did not allow it to be audio recorded as was done for the remaining experts. The interviews did not have specific time frames though on the average it took about thirty minutes. This approach was adopted to allow the interviewer to explore the views of the interviewee, allow them to explain their views on the subject matter make recommendations and suggestions and make room for the discussion of other pertinent issues not covered in the interview guide.

Data derived through the questionnaire were analyzed using the Statistical Package for Social Studies, SPSS (version 17) and descriptive statistics was the primary data analysis technique used. Interview responses were also analyzed using content analysis technique. Content analysis approach was adopted to analyse responses to the open-ended questions in order to "minimize redundancy" (Ruben et al., 1998). The result is presented in the next section of this paper.

RESULTS

Background Information of the Respondents

The result shows that of the 112 respondents in the survey, 48 (42.86%) were Project managers by profession. Analysis of the distribution of the respondents by profession reveals that around 27 (24.11%) of them were Quantity Surveyors whilst 23 (20.54%) were Architects. The result of the background information of the respondents as presented in Table1 shows that a majority (52.68%) of the respondents belong to a professional body whilst 47.32% do not belong to any professional body at the time of the survey. The greater part (41.07%) of the respondents' professional experience ranges between 11years and 15 years. Hence, it was revealed that 69.6% of the respondents had a Bachelors degree as their highest level of education. Among the respondents, about 60.71% worked with contractors, 28.57% worked with consultants whilst 8.93% worked with clients.

Awareness of APM

The result also shows that about 5.36% of the respondents were aware of and had excellent knowledge about the concept of APM, while the rest have very little or no knowledge about APM. Around 57.14% of the respondents agreed that the level of application of Agile methodology in the construction industry was very low.

As shown in Table 2, around 33.93% of the respondents indicated that they have very low awareness and knowledge of APM, 24.11% claimed to have low awareness of the concept, whilst 14.29% indicated they have a good awareness and knowledge of the concept. However, only 5.36% of the respondents said that their awareness and knowledge level of the concept was excellent.

On the issue of the level of application of Agile Project Management, the result reveals that57.14% of the respondents indicated that their level of application of Agile methodology was very low, while 38.39% stated that there was a low level of application of Agile methodologies in their projects. Of all the respondents, less than 1 % (0.89%) indicated their level of application of APM was good.

Table 1: Background information of the respondents

RESPONDENTS'CHARACTERISTICS	FREQUENCY(n=112)	PERCENTAGE (%)
Profession of Respondents		
Project Manager	48	42.86
Quantity Surveyor	27	24.11
Architect	23	20.54
Others	14	12.50
Professional body belonging to		
Project Management Institute	16	14.29
Ghana Institution of Surveyors	18	16.07
Ghana Institution of Architects	19	16.96
Others	6	5.36
None	53	47.32
Years of project management experience		
1 -5 yrs	11	9.82
6 - 10 yrs	26	23.21
11 -15 yrs	46	41.07
16 - 20 yrs	19	16.96
21 - 25 yrs	7	6.25
26 - 30 yrs	3	2.68
Category of Respondents Organisation		
Contractor	68	60.71
Consultant	32	28.57
Client	10	8.93
others	2	1.79
Educational Qualification		
Diploma/HND	12	10.71
Bachelors Degree	78	69.6
Masters Degree	14	12.5
Doctorate Degree	4	3.6
Others	4	3.6

Respondents were also asked whether they will implement APM in future projects; and the result revealed that 82.14% of them indicated that they will adopt APM in future projects, whilst 17.86% said they will not implement the concept in future projects; implying they will adhere to the traditional methodology since they are comfortable with it.

TABLE 2: Awareness of APM

	FREQUENCY(n=112)	**PERCENTAGE (%)**
Level of Awareness and Knowledge of APM		
Excellent	6	5.36
Good	16	14.29
Moderate	25	22.32
Low	27	24.11
Very Low	38	33.93
Level of Application of APM Methodology		
Excellent	0	0.00
Good	1	0.89
Moderate	4	3.57
Low	43	38.39
Very Low	64	57.14
Whether respondents will adopt APM in future Projects		
Yes	92	82.14
No	20	17.86

SWOT Analysis of Agile Project Management in the construction industry

In this section, the statements of the item pool sought the opinion of respondents in the survey on the SWOT Analysis of Agile Project Management in the construction industry.

Respondents whose level of awareness and knowledge of APM was moderate, good and excellent were asked to express their level of agreement with the SWOT analysis of APM. This section of the questionnaire was restricted to this category of respondents because the need for some knowledge of APM was required in order to express a reliable view of the SWOT analysis to APM.

Respondents were required to indicate on a four point Likert scale (why 4 Likert scale instead of 5?), their level of agreement or otherwise of the SWOT analysis. They scored by indicating their level of agreement, that is: ‘4’ - strongly agree; ‘3’ - agree; ‘2’ - disagree; and ‘1’ - strongly disagree.

For the purposes of the analysis used in this section, these connotations were approximated: 0 - 1.49 approximated as ‘1’; 1.5 – 2.49 approximated as ‘2’; 2.5 – 3.49 approximated to ‘3’; and 3.5 – 4 approximated as ‘4’.To analyze their responses, the means of all 49 responses to the various statements were calculated (Table 3). An overall mean score of 3.6, approximately 4, which connotes ‘Strongly Agree’ on the Likert scale, was obtained.

Table 3: SWOT Analysis of Agile Project Management

Item	SWOT Analysis of APM	Average Score	Percentage Score %
	Strengths		
1	High client satisfaction	3.2	80.00
2	Quick adaptation to change	3.9	97.50
3	Issues related to clients requirements are solved and answered immediately since the client is part of the team	3.8	95.00
4	There is always a continued channel of communication between team members which increases job satisfaction	3.7	92.50
5	Project team members are often more pleased since they communicate with clients and respond to their needs without informing their supervisors	3.6	90.00
6	It is based on people and their creativity	3.4	85.00
7	Progress can be viewed and measured after each iteration	3.5	87.50
8	There is constant inspection and integration since inspection is done after each iteration which means faults can be corrected regularly	3.3	82.50
9	The client can evaluate the project after each iteration and suggest plans for future	3.6	90.00
10	Its philosophy is based on the idea that projects are developed in short iterations	3.5	87.50
	Average Score	3.6	88.75
	Weaknesses		
11	Often used as a means to bleed money from clients through lack of defining a deliverable	1.9	47.50
12	Lack of structure and necessary documentation	3.8	95.00
13	Requires meetings at frequent intervals at enormous expense to clients	3.6	90.00
14	Can lead to more difficult contractual negotiations	3.8	95.00
15	Impossible to develop realistic estimates of work effort needed to provide a quote, because at the beginning of the project no one knows the entire scope/requirements	3.7	92.50
16	Can increase the risk of scope creep due to the lack of detailed requirements documentation	3.9	97.50
17	Customer interaction- not all customers can find time to spend with the team	3.8	95.00
18	Agile team and end users are supposed to be located in the same physical location for long periods which is not applicable in all situations	3.6	90.00
19	Difficulty in coordinating between teams for large projects	3.1	77.50
20	Lack of long term planning	3.8	95.00
21	Lack of enough documentation for tracking overall progress	2.9	72.50
	Average Score	3.4	86.14
	Opportunities		
21	APM methodology is successful in other industries	3.2	80.00
22	Academic and professional acceptance	2.8	70.00
23	Construction projects are incessantly being complex with the traditional method	3.2	80.00
24	High clients dissatisfaction with project deliverables	3.3	82.50
	Average Score	3.1	78.13
	Threats		
25	Lack of awareness	3.8	95.00
26	Requires too much cultural change to adopt	3.9	97.50
27	Customer Bureaucracy	3.6	90.00
28	The need for highly competent team members	3.5	87.50
29	Complexity and risks involved	3.4	85.00
	Average Score	3.6	91.00
	Overall Average Score	3.6	89.74

Respondents were asked to assess the strengths of APM in the construction industry. An average score of 3.6 was obtained, approximately Likert point ‘4’ which connotes ‘Strongly agree’. This implies that on the average, respondents strongly agreed to the strengths of APM in the construction industry in Ghana. The weaknesses of APM were also assessed by respondents and an average score of 3.4 was obtained. This approximately gives a Likert score of ‘3’ which connotes ‘Agree’ on the four point Likert scale. This goes to show that, respondents on the average agreed to the weaknesses of APM in the construction industry. Furthermore, respondents on the average agreed to the opportunities of APM in the construction industry. An average score of 3.1 was obtained, approximately Likert point ‘3’ which connotes ‘Agree’. The last part, which was the threats of Agile methodology in the construction industry was assessed by respondents. An average score of 3.6 was also obtained, approximately Likert point ‘4’ which connotes ‘Strongly Agree’. This implies that respondents on the average strongly agreed to the threats of Agile methodology. In all, an average score of 3.6 was obtained for the SWOT analysis of Agile methodology in the construction industry. This approximately gives a Likert score of ‘4’ which connotes ‘Strongly Agree’ on the four point Likert scale. This means that respondents on the average strongly agreed to the SWOT analysis of APM. It is however important to note that some respondents had reservations about some of the statements and also disagreed with some points made. They had the opportunity to indicate in a column provided on the questionnaire for any additional comments. Respondents disagreed with some of the weaknesses of APM such as APM is often used as a means to bleed money from clients through lack of defining a deliverable and also lack of enough documentation for tracking overall progress. In addition, they also disagreed with some of the opportunities of APM such as APM is academically and professionally accepted.

DISCUSSION

It is evident from this study that respondents in the survey were predominantly very experienced practitioners with enough knowledge of construction project management practices. It is not astounding that most of the respondents were not aware and had very low knowledge of APM since the concept is new to the construction industry in Ghana. Furthermore, this automatically led to a very low level of application of Agile methodology in the construction industry in Ghana. Practitioners with low level of awareness of the concept indicated their zeal and willingness to know much about the APM concept and eventually adopt the methodology in their future projects.

With regards to the SWOT analysis of the Agile methodology, the respondents strongly agreed to the entire SWOT analysis. In addition, the practitioners specifically agreed to the strengths, weaknesses, opportunities and threats of APM analyzed in this study as revealed from the findings.

There are many encouraging strengths of agile philosophy such as short development cycle, high customer satisfaction, and quick adaptation to change. No doubt that the strength of agile methodology is based on its flexibility. One of the strong points of agile methodology is that its philosophy is based on the idea that projects are developed in short iterations. At the end of each iteration, the client inspects that section and makes an input before moving ahead to the next iteration which means that the overall project will be more flexible. In traditional methodologies, if the client changes some requirement after long period such as (six-ten month) this require complete project rebuilding, but in the application of agile philosophy it can be adapted. Another strength point is that the client can evaluate the development after each iteration and suggest plans for future. Another strength point of agile methodology is the constant inspection and integration since inspection is done after each iteration which means that faults can be corrected regularly. The next strength point is that progress can be viewed and measured after each iteration. Also, agile methodology is based on people and their creativity. This means that solving emergent issues and problems is done immediately without following rigid policy and procedures. In agile methodology, the project team is often more pleased since they communicate with clients and respond to their requirements without following rigid policies in communicating with senior managers to seek approval for every simple modification. Flexibility does not mean that project team can do modifications and respond to clients' needs without telling their supervisors but they can respond to clients' modifications before reporting to senior managers. Also, one of the main strengths of agile methodology is that it is based on working with small teams. This means that there is always a continued channel for communication between team members which increases job satisfaction. Continued communication means identifying problems and mistakes earlier. Besides that, working in small teams accelerates the development process. In agile methodology customers play an important role in the working team. Agile methodology recommends having a full time customer or client working with development team. This means that any misunderstanding of clients' requirements can be resolved and answered immediately. This means the time taken to solve any emergent issue will be reduced to the minimum.

There are some weaknesses also found within the agile methodology of which the respondents agreed to. One weakness of agile methodology is customer interaction. Some Agile followers consider this point as a merit, but in fact it may become a weak point in some circumstances such as the client or customer might not find enough time to spend with the project team, or if the key customer is one of the high level managers. Another weak point is that agile methodology recommends that the agile development team and end users/client should be located in the same physical location for long periods daily which is not applicable under all situations. One of the main weaknesses in agile methodologies is difficulty in coordinating between teams for large projects. Another weak point is that agile methodology lacks long term planning. This means that when various components of the project have been assembled, definitely this will result in some problems. In agile methodology this is called "refactoring". Since agile methodology is mostly based on verbal communication with customers/clients, this usually leads to weak documentation. APM is often used as a means to bleed money from clients through lack of defining a deliverable. APM also lacks enough documentation for tracking overall progress and makes project managers face huge challenge of not delivering goals.

There are some opportunities that also exist in considering APM as an alternative method for construction project management. APM methodology has been successful in other industries such as IT and manufacturing which has increased customer satisfaction, productivity and profit. Another opportunity is that a lot of academics and professionals have accepted and advocated for APM methodology. The next opportunity for APM is that construction projects are continuously being complex with the traditional method and clients are being dissatisfied with project deliverables and therefore a new approach is being required.

Besides that, there are some threats which tend to be obstacles in considering APM as an alternative methodology for construction projects. One of the key threats of APM is that agile methodology is based on having strong and highly qualified practitioners who have the creativity and skills to work in teams and to communicate with other teams or customers. These highly qualified professionals are not easy to find and demand huge cost. A further threat which is an obstacle to APM is customer bureaucracy. Customers who have a limited understanding of development practices tend to overcompensate and swamp the development process with users and project managers who add little or no value to a project. In choosing to use agile methods for project delivery it is important to influence the customer and the project stakeholders that 'less is more'. APM also requires too much cultural change to adopt since clients and professionals have been with the traditional methodology for a very long time.

CONCLUSION

This paper assessed the prospects of Agile project management in the construction industry using the SWOT analysis model. The study showed and highlighted the strengths, weakness, opportunities and threats of agile methodology. The paper demonstrated the main strengths of agile methodologies such as its philosophy based on short development cycle, high customer satisfaction and a quick adaptation to change.

This study has shown that practitioners in the construction industry in Ghana have very low level of awareness and knowledge of APM. Therefore the level of application of the concept is also very low. However, the practitioners are willing to know much about the APM concept and eventually adopt the methodology in their future projects. Practitioners with some knowledge of the concept strongly agreed to the SWOT analysis. Even though, they agreed to the strengths of APM, they also agreed that it has some weaknesses, opportunities and threats. It is therefore recommended that more discussions, seminars, training, and workshops on APM and its importance should be initiated to enhance the level of awareness and knowledge in the construction industry in Ghana.

FURTHER RESEARCH

An immediate point for further study would be to develop a framework for implementing APM in the construction industry since the concept is being adopted from a different industry. Other studies could also look at how both paradigms (APM and Traditional project management) can be mixed since they all have their weaknesses and strengths.

REFERENCES

Agile Sweden, (2012) *Om Agile* (Author's translation: *About Agile*), retrieved from http://www.Agilesweden.com/ on 12-05-2013

Arras people, (2010) Project management Benchmark 2010

Beck, K. (2001) *Manifesto for Agile Software Development*, retrieved from http://Agilemanifesto.org/ on 04-06-2012

Demir S.T., Bryde D.J., Fearon D.J. and Ochieng E.G. (2012) Re- conceptualising agile for lean construction: The case for "agilean" project management *In*: Smith, S.D (Ed) *Procs 28th Annual ARCOM Conference*, 3-5 September 2012, Edinburgh, UK, Association of Researchers in Construction Management, 1013-1023.

Everts,P., Pries, F., and Nijhuis, S. (2011) Management and Innovation for a Sustainable Built Environment ISBN: 20 – 23 June 2011, Amsterdam, The Netherlands

Gustavsson, T., (2011) Agil projektledning. First edition. Stockholm, Sweden: Sanoma Utbildning AB. (Author's translation of the title: *Agile Project Management*)

Hass, K. B., (2007) "The Blending of Traditional and Agile Project Management". *PM World Today* Vol. IX, Issue V.

Johansson, M.Y. (2012) Agile project management in the construction industry- An inquiry of the opportunities in construction projects. Department of Real Estate and Construction Management, KTH Architecture and the Built Environment.

Karlesky, M., and Voord, M. V. (2008) Agile Project Management (or, Burining your

Gantt Charts). *Embedded Systems Conference* (pp. 1-8). Boston: Atomic Object and X-Rite.

Onna, M. V. and Koning, A. (2007) De kleine Prince 2, gids voor project management,

Academic Service, The Hague.

PMI Netherlands Chapter, (2009) A guide to the Project Management Body of Knowledge

(PMBOK Guide), PMI/van Haren Publishing, Zaltbommel.

Panagiotou, G. (2003) Bringing SWOT into focus. Business Strategy Review. 14(2) 8-10

Ritchie, J. and Lewis, J. (2003) Qualitative Research Practice: a guide for social

science students and researchers. London: SAGE Publications Ltd.

Rubin, K.H., Bukowski, W.M., and Parker, J.G. (1998) Peer interactions, relationships, and

groups. In W. Damon (Series Ed.) and N. Ei-senberg (Vol. Ed.), Handbook of child psychology: Vol. 3. Social, emotional, and personality development (5th ed., pp. 619–700). New York: Wiley

Scott, L. M. and Sharkey, C. (2007) Putting the Pieces Together: Private-Duty Home Healthcare and Geriatric Care Management: One Home Health Agency's Model. Home Healthcare Nurse. 25(3)167-172.

Tonnquist, B., (2006) Projektledning. Second edition. Stockholm, Sweden: Bonnier Utbildning AB. (Author's translation of the title: *Project Management*)

CAUSES OF DISPUTES IN CONSTRUCTION PROJECTS IN SOUTH AFRICA: A CASE OF GAUTENG PROVINCE

Miehleketo Baloyi[1] and Justus N. Agumba[2]

Department of Construction Management and Quantity Surveying, University of Johannesburg, South Africa

Disputes have become an inherent feature of the construction industry projects. However few research projects have focused on this niche area in South Africa. The purpose of this study was to unearth causes of disputes and their effects on construction projects and to further determine the methods that are used to settle the disputes. In order to determine the objectives of this study, semi-structured interviews were used. Thirty practitioners i.e. professionals in the construction industry were purposively invited to participate. Fourteen practitioners accepted to participate in the interviews which represented 47% response rate. The results of the interviews were analyzed using content analysis that is coding of reoccurring themes from the interviews. The study revealed nine factors that contribute to causes of disputes in construction projects namely; poor communication, poor contract documentation, suspension of work, failure to understand and correctly bid or price the work, bad weather, non-circulation of information, i.e. site instruction, distribution of drawings etc., incomplete tracing mechanism for request of information and delay in extension of time. Furthermore, the effects of disputes identified were; project delays, change in contract cost leading to cost overrun, deterioration of relationships or bad relationships leading to friction, parties do not get information on time and neglecting clients' needs. In order to resolve the disputes the most popular method used was arbitration. However, some respondents opted to use conciliation and mediation. The practicality of the study is that organizations that enter into construction projects should be aware that they may encounter disputes in their projects; hence they should know the methods they can use to resolve them.

Keywords: construction dispute, dispute resolution, Gauteng

INTRODUCTION

The continuing costly disputes in the construction industry has led to a common interest by researchers in different countries to identify the generic aspects of conflicts, claims, disputes and their resolution (Love et al., 2008). Allen (2011) concurs with the sentiments of Love eta al., (2008). Unlike other types of industries where the development and manufacturing of products can be standardized and tested before being purchased, the nature of projects in the construction industry are extremely diverse. Every project in the construction industry is unique. Even where identical buildings are under construction, the site conditions in each project will differ and introduce new challenges. Moreover, it is a multi-party process where numerous specialist parties are involved due to the diversity of skills required and thus

[1] miehleketob@gmail.com

[2] jagumba@uj.ac.za

Baloyi, M. and Agumba ,J. N. (2014) Causes of disputes in construction projects in South Africa: A case of Gauteng province *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference*, 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 179-187.

maintaining teamwork atmosphere and controlling potential conflicts or disputes is important (Asem et al., 2000).
Moreover, construction projects normally span for a long period between the decision to invest and the completion of works. Younis et al., (2008), states that this leads to instability of supply and demand and high sensitivity to economic fluctuation. Completing a construction project is a process and therefore requires a high level of cooperation between parties. According to Love et al., (2008) disputes have become an inherent feature of the construction industry.
This paper undertakes a comprehensive research in the field of construction industry in South Africa to identify the causes of disputes, their effects and the methods used to resolve the disputes in the construction projects.

LITERATURE REVIEW

Causes of Disputes

In every industry where people have to work together and cooperate there is a possibility of disputes to arise, and construction industry is not an exception. Often there is a lack of understanding about the reasons behind the disputes, but to avoid disputes from occurring and resolving them if they occur, it is vital to understand the causes of disputes (Love et al., 2008).

Table 1 Disputes in construction projects

Location	Factors contributing to disputes
Middle East (2012)	Failure to properly administer the contract
	Failure to make interim awards on extensions of time and compensation
	Employer imposed change
	Contract selection was not a best fit when compared to projects characteristics
	Third party or Force Majeure events
Asian (2012)	Incomplete and/ or unsubstantiated claims
	Failure to make interim awards on extensions of time and compensation
	Differing site conditions
	Failure to understand and/ or comply with its contractual obligations by the employer/contractor/subcontractor
	Failure to properly administer the contract
United States (2012)	Incomplete and/ or unsubstantiated claims
	Errors and/ or omissions in the contract document
	Failure to understand and/ or comply with its contractual obligations by the employer/contractor/subcontractor
	Differing site conditions
	Failure to make interim awards on extensions of time and compensation
United kingdom (2012)	Failure to properly administer the contract
	Failure to understand and/ or comply with its contractual obligations by the employer/contractor/subcontractor
	Employer imposed change
	Conflicting party interests
	Incomplete and/ or unsubstantiated claims
Mainland Europe (2012)	Failure to understand and/ or comply with its contractual obligations by the employer/contractor/subcontractor
	Unrealistic risk transfer from employers to contractors
	Failure to make interim awards on extensions of time and compensation
	Conflicting party interests
	Third party or Force Majeure events

Adapted from Allen, M., 2013

Construction is a very complex industry. Every project in construction is unique and most projects span for long period of time. Because of every project being unique a number of things must therefore be considered when undertaking any type of project. This includes, delivery method, type of skills required, type of contract to use and who to employ in the project. These are some of the essentials that are involved in running a successful project.
However, researchers have come up with several lists of the most common causes of disputes. Literature is replete with studies that have examined the causes of disputes and notably the findings are related. Table 1 presents a summary of causes of dispute from previous studies that have been undertaken globally.

The effects of disputes in construction projects

Younis (2008) stated that the continuing costly disputes in the construction industry has led to a common interest of researchers in different countries to identify the generic effects of conflicts, claims, disputes and their resolution.
From the statement above we acknowledge that dispute may affect the project in a negative way. Disputes are not budgeted for and when they occur may turn to be very costly. Cost is one of the parameters or factors that determine a project’s success. Clients seek to get their projects done at a lowest economical cost, while contractors seek to do the job at the lowest possible cost in order to get maximum profit.
Construction disputes, when not resolved in a timely manner, become very expensive – in terms of finances, personnel, time, and opportunity costs. The visible expenses (e.g. attorneys, expert witnesses, the dispute resolution process itself) alone are significant. The less visible costs (e.g. company resources assigned to the dispute, lost business opportunities) and the intangible costs (e.g. damage to business relationships, potential value lost due to inefficient dispute resolution) are also considerable, although difficult or impossible to quantify. It has been estimated that construction litigation expenditures in the United States have increased at an average rate of 10 percent per year over the last decade, nearly $5 billion annually (Peña-Mora et al., 2002). Disputes can be both business and personal effective. Sometimes you find yourself attaching business assets along the resolution process.
Construction disputes are not only costly but are also time consuming. According to Allen (2011) disputes in the Middle East and Asia, were found to last, on average, 9.1 months from beginning to resolution. Disputes in Asia, however, lasted the longest at 11.4 months, with the UK at 6.75 months. The dispute occurrence in projects has detrimental effect on project performance.

Dispute Resolution methods

Court processes by means of litigation is traditionally the primary means of dispute resolution in the construction industry. Australia inherited the common law of England and Wales including the English court systems. Of importance is the English Arbitration Act 1697. This Act formalized arbitration in England by providing a procedure which enabled parties to a civil action to refer their matter to arbitration to be resolved as a judgment of the court (Astor and Chinkin, 2002). Over time Australia has adapted to suit the needs of Australian industry and developed specialized courts and tribunal systems for resolving disputes (Fenn et al., 1998).
This historical development of the various strategies in relation to alternative dispute resolution processes such as mediation, arbitration, negotiation and adjudication was developed by the Australians. This method has since been adopted by other or most

counties internationally. The Act provided the first legally enforceable framework for agreements to arbitrate over any ‘controversy’ (CRC Construction Innovation, 2007).
Koh (2005) stated that dispute can be resolved using informal process such as negotiation and alternative dispute resolution method (ADR) or formal resolution methods such as litigation and arbitration. However litigation is known to be very expensive and time consuming. In line with this sentiment the increased levels of litigation experienced in the early 1980s, the U.S. construction industry looked to alternative means of resolving disputes. The different methods of resolving disputes grouped as Alternative Dispute Resolution (ADR) method, include arbitration, negotiation, mediation, mini-trials, Rent-a-Judge, and dispute review boards.

Arbitration

Arbitration is a process which is still regarded as an ADR method despite the growing dissatisfaction. According to Koh (2005) it takes too long to reach resolution, and costs too much. However, arbitration is a widely accepted form of alternative dispute resolution outside the courts (Eilenberg, 2003). It is the final process in lieu of litigation, found in most general conditions of contract.

Negotiation

Parties may appoint an attorney or a third party to assist them negotiate the dispute or try to resolve the dispute on their behalf. This is usually conducted at an earlier stage of the dispute. If parties may resolve their issues at this stage then they should save time and costs (Koh, 2005).

Mediation

According to Koh (2005) mediation is a widely used technique wherein the parties continue their negotiation with the assistance of a mediator. The mediator serves at the request of the disputing parties and facilitates, but does not dictate, the negotiation. The process may involve joint meetings as well as sequences of separate meetings with each party. The mediator undertakes to clarify each party's concept of the facts, priorities and positions; loosens rigid stances; explores alternative solutions; and seeks tradeoffs. The mediator is an agent of reality, never an advocate for either side. The outcome is either a resolution of the dispute or a step toward other recourses.

Mini-trial

A mini-trial, which can be voluntary or contractually mandated, is a structured settlement procedure, with each side presenting its case before either neutral participants or senior representatives of the disputing parties. Rules and formats have been developed for these processes, such as those prepared by the American Arbitration Association and the U.S. Army Corps of Engineers. One benefit is that the parties can often derive their relative positions without going through the long, drawn-out procedures followed in conventional litigation. The dispute can then be resolved in days or weeks rather than years.

Rent-A-Judge

The Rent-A-Judge procedure involves a judge (usually a retired state or federal magistrate) who presides over a private litigation. The parties submit their dispute to the judge, with a pre-established consensus that the decision will be binding or non-binding (Koh, 2005).

Dispute Review Boards (DRB)

Koh (2005) indicated that the objective of the DRB is to be kept abreast of the work as it progresses, through distribution of progress reports and through periodic site visits, whether there is a dispute or not. In this manner, the DRB has an opportunity to hear from all parties how the project is proceeding, and can view the site conditions under "no dispute" conditions.

One significant difference between the DRB process and other ADR methods is that the DRB is used at the beginning of the project. The existence of the board serves to encourage cooperation between the parties, and serves as a deterrent, rather than an incentive, to pursue claims.

PROBLEM STATEMENT

Construction projects are increasingly complex, resulting in complex contract documents. Complex construction can likewise result in disputes. Disputes have become an inherent feature of the construction industry. In order to determine the causes of disputes, their effect and methods used to resolve the disputes in construction projects in South Africa the following specific research questions were formulated.

- What cause(s) dispute in construction projects?
- What effect(s) do disputes have in construction projects?
- What method(s) are used to resolve construction project disputes?

RESEARCH METHODOLOGY

In order to answer the research questions. An inductive approach was used. The method used was semi-structured interview which is qualitative. In this research approach the researcher studies the phenomenon without predetermined expectations or categories and tries to understand the data from the perspective of the participant (Moustakas, 1994). The interview questions for the purpose of the semi-structured interviews were constructed and identified beforehand by using literature study, problem statement and the research questions as a guide. Three research questions were asked, namely, ‘What are the main cause(s) of dispute in your projects?’, ‘What effect(s) do these cause(s) have on your projects?’ and ‘What method(s) do you use to resolve dispute in your projects?’

The target respondents were based in Gauteng province. This was because the province is more vibrant in construction projects compared to the other nine provinces, therefore more ideal to conduct this study. Furthermore the limited time to complete the study and expenses of conducting the study in other provinces were further reasons to conduct the study in Gauteng province. Thirty respondents were therefore purposively sampled and invited to participate in the interview. Fourteen respondents accepted to take part in the study which represented a response rate of 47%. The duration of the interviews lasted approximately 30 minutes per respondent. The interviews were recorded manually on a writing pad as the interviewees did not want to be recorded using an electronic device. Furthermore, the researcher’s attitude was one of unconditional positive regard. Nondirective conversation technique for example minimal encouragement, attentive listening, clarification, paraphrasing, reflecting and summarizing, were used to gather information. A relaxed atmosphere was created to help the participant to feel at ease. This approach is in line with the study of Van Rooyen et al., (2010).

The data was then analyzed using content analysis. This included identifying recurring themes and coding them in order to analyze, quantify and interpret the research data systematically and objectively. The universe of the content to be analyzed was defined and categorized. The units of analysis, words and themes were determined by reading trough the written transcriptions of the data. The themes were coded. Coding can be seen as the process of grouping evidence and labeling ideas so that they reflect increasingly broader perspectives (Creswell and Clark, 2007).

RESULTS AND DISCUSSIONS

Causes of disputes in construction projects

Table 2 indicates nine factors that contributes to causes of disputes in construction projects namely; poor communication, poor contract documentation, suspension of work, failure to understanding and correctly bid or price the work, bad weather, non-circulation of information, i.e. site instruction, distribution of drawings etc., incomplete tracing mechanism for request of information and delay in extension of time. This finding is in line with the findings indicated by Allen (2013).

Table 2 Overall results from practitioners

Respondents	Cause(s) of dispute	Effect(s) on project	Resolution method
Interview 1	Discrepancy on contract document i.e. drawings	Causes delay on the project	Conciliation
Interview 2	Incomplete drawings and specifications	Causes delay on a project	Conciliation
Interview 3	Delay/Suspension of works	Bad relationship between parties	Arbitration
Interview 3	Delay/Suspension of works	Bad relationship between parties	Arbitration
Interview 4	Failure to understand and correctly bid or price the works.	Changes in contract amount	Arbitration
Interview 5	Lack of understanding and agreement in contract procurement. Bad weather	Delay Change in contract amount	Arbitration
Interview 6	Inadequate in open and factual communication.	Delays; parties do not get information in time	Mediation
Interview 7	Issuing instructions verbally and not in writing	Delay	Mediation
Interview 8	Non-circulation of information, i.e. distribution of drawings, site instruction etc.	Delay	Arbitration
Interview 9	Poor communication	Neglecting client’s want	Arbitration
Interview 10	Discrepancy between drawings and bills of quantity	Changes the contract cost	Conciliation
Interview 11	Design and specification oversights and errors or omissions resulting from uncoordinated civil, structural, architectural, mechanical and electrical designs.	Causes delay and friction between parties	Arbitration
Interview 12	Poor communications between and among the parties involved in the project	Delay	Mediation
Interview 13	Inadequate tracing mechanisms for RFI (Request for information).	Time delay	Arbitration
Interview 14	Delay in execution of works	Delay on a project	Arbitration

Effects of disputes on construction projects

The effects of disputes are indicated in Table 2. The effects of construction disputes were identified to be:

- Project delay;
- Changes in contract cost leading to cost overrun;
- Deterioration of relationships or bad relationships leading to friction;
- Parties do not get information on time; and
- Neglecting clients' needs.

These findings on the effects of disputes are supported by Allen (2011).

Resolution Methods to handle disputes

The findings in Table 2 revealed the methods used to resolve disputes. The respondents indicated that arbitration was commonly used. This result concurs with literature that arbitration is the most common resolution methods used around the world. Although it is costly, they are very effective. Despite arbitration being commonly used, mediation and conciliation were also used but not frequently. These findings are not identical to the findings of Allen (2013). Allens' (2013) study indicated that party to party negotiation and meditation were the preferred methods over arbitration. This study in South Africa is an indication that disputes in South Africa could be incurring higher costs. This is because according to Koh, (2005) the process of arbitration is quite expensive.

CONCLUSIONS

The study has unearthed different causes of disputes in the construction industry i.e. poor communication, poor contract documentation, suspension of work, failure to understanding and correctly bid or price the work, bad weather, non-circulation of information, i.e. site instruction, distribution of drawings etc., incomplete tracing mechanism for request of information and delay in extension of time. These causes of disputes are in line with the once noted by Allen (2013). This is an indication that South African construction industry is not unique from the global trends in terms of causes of disputes in their projects. Furthermore, the effects of disputes were identified to be; project delay, change in contract cost leading to cost overrun, deterioration of relationships or bad relationships leading to friction, parties do not get information on time and neglecting clients' needs. The effects identified in this study are not unique to the global trends as well. They are in line with the findings of Allen (2011). In order to resolve the construction disputes the most popular method used was arbitration despite literature indicating that it can be very costly when arbitration is used (Koh, 2005). Based on this argument some respondents opted to use conciliation and mediation to resolve their disputes. Allen (2013) indicated that mediation is still one of the most widely used technique to resolve disputes hence there finding is in line with the current findings in South Africa.

LIMITATIONS OF THE STUDY

The findings of this study are limited because it was mainly a qualitative study; therefore the findings cannot be applied to other contexts for example quantitative study. With regard to the sample, only those in Gauteng province were interviewed which means the results might not be applicable in other provinces.

RECOMMENDATIONS FOR FURTHER RESEARCH

This study has identified the causes of disputes, the effect it has and resolution methods used in the construction industry. A further research can be undertaken to identify methods that can be used to avoid dispute occurrence in projects. Furthermore, a quantitative research can be under taken to test the causality of the causes of disputes and the influence it has on the effects of disputes on construction projects.

REFERENCES

Allen, M. (2011). Construction disputes on the rise

http://www.building.com.uk/forum/2011_0729const_donr.pdf last date viewed 27/01/2014.

Allen, M. (2013). Global Construction Disputes: A Longer Resolution http://www.echarris.com/contractsolutions last date viewed 27/01/2014.

Asem, M., Abdul-Malak, U. and Mustafa, M. (2000). Claim Avoidance Administrative Procedures for Construction Projects. CIB, London

Astor, H. and Chinkin, C. M. (2002). Dispute resolution in Australia 2nd ed, LexisNexis Butterworths Sydney.

Creswell, J.W. and Clark, V.P. (2007). Designing and conducting mixed methods research. Thousand oaks, CA: Sage.

CRC Construction Innovation, (2007). Dispute avoidance and resolution: A literature review

Eilenberg, I. M. (2003). Dispute resolution in construction management, UNSW Press, Sydney.

Fenn, P., O'Shea, M. and Davies, E. (1998). Dispute resolution and conflict management in construction: An international review, E & FN Spon London.

Koh, C.P. (2005). The causes of construction dispute on client organizations. Masters thesis, Universiti Teknologi Malaysia, Faculty of Civil Engineering

Love, P. E. D, Davis, P, Kerry London, K. and Jasper, T. (2008). Causal modelling of construction disputes. In: Dainty, A (Ed.), Proceedings 24th Annual ARCOM Conference, 1st-3rd September 2008, Cardiff, UK. Association of Researchers in Construction Management, Vol. 2, 869–878.

Moustakas C. (1994). Phenomenological research methods. London Sage.

Peña-Mora, F., Sosa, C. and McCone, S. (2002). Dispute Avoidance and Resolution in Large Scale Civil Engineering Systems, MIT/Prentice Hall Civil and Environmental Engineering Textbook Series, USA.

Van Rooyen, L., Du Toit, D.H., Botha, E., and Rothmann, S. (2010) Artisan retention in an organization in South Africa. SA Journal of Human Resource Management/SA tydskrif vir menslikehulpbronbestuur, Vol. 8, 1, 1-8.

Younis, G., Wood, G. and Abdul Malak, M.A. (2008). Minimizing construction disputes: the relationship between risk allocation and behavioural attitudes, IN: Haigh, R. and Amaratunga, D. (eds.) Proceedings of CIB International Conference on Building Education & Research BEAR, 2008, Sri Lanka, pp.134-5.

CHALLENGES FACING EMERGING CONTRACTORS WITHIN THE CONSTRUCTION INDUSTRY IN GAUTENG PROVINCE

Dikeledi Divine Malongane[1], Alfred Atsango Talukhaba[2] and James Okumbe [3]

Faculty of Engineering and the Built Environment, Tshwane University of Technology, Private Bag X680 Pretoria, 0001 South Africa

This research project was aimed at identifying challenges facing emerging contractors around Gauteng Province. This study adopted a survey research design using questionnaire as the data collection instrument. The research targeted 100 SMME contractors (grade 2-5) identified in the CIDB database and professionals within the construction industry. A response rate of 47.8% was obtained from SMME contractors, consultants and other professionals in the construction industry in Gauteng Province. This study observed that emerging contractors in the South African construction industry are characterized by low levels of experience and formal construction related training, lack of required skills, lack of access to finance, lack of employment opportunities and lack or poor cash flows to sustain their businesses due to delays in payment. These accounted for the failure of emerging contractors to sustain their businesses in the long run. The paper concludes that government needs to address challenges and constraints faced by SMME contractors within the construction industry by assisting the contractors to increase the level of skills; enhancing their accessibility to credit facilities; access to job opportunities by SMME contractors as well as enforcing prompt payments of contractors' claims by clients.

Keywords: SMME contractors, emerging contractors, CIDB, targeted procurement.

INTRODUCTION

The construction industry is an important player in the economy of South Africa. It was reported that in March 2009 the construction industry contributed to the total gross domestic fixed investment (GDFI) and employed 458 000 employees (Stats SA, 2009) while SMMEs in the expanding sector contributed a far larger share of approximately 55 % amounting to R23 billion in 2006 (DTI,2008:96). It is indicated in the white paper for creating an enabling environment for reconstruction, growth and development in the construction industry; that the construction industry, which comprises both the building (residential and non-residential) and civil engineering sectors, plays a vital role in the South African economy, providing a physical infrastructure which is fundamental to the development of the country and its activities that affect the lives of all South Africans. The white paper further illustrates that construction contributes 35 % to the GDFI.

[1]dikeledi.malongane@me.com
[2] OkumbeJ@tut.ac.za
[3] OkumbeJ@tut.ac.za

Malongane *et al.*(2014) Challenges facing emerging contractors within the construction industry in gauteng province *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference*, 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 189-205

There is a compelling need to unlock growth constraints and to develop a sustainable contracting capacity as well as to elevate the development of previously disadvantaged individuals and enterprises (CIDB, 2008:i). However, emerging contractors have a tendency to fail to develop into sustainable enterprises due to inadequate knowledge and lack of experience (Martin, 2010:1). Hence, leadership by government is required to establish the framework for contractor development.

It was reported in the Masakhe CDP handbook that the economy of our country has undergone profound restructuring over the years to achieve growth, employment creation and poverty eradication. The NDPW and CIDB (2008:2) have identified the need to effect a redress in the interest of equity, the advancement of construction sector transformation, promotion of SMMEs and effective emerging contractor development programmes.

Emerging contracting companies in South Africa often fail to develop into sustainable businesses. Research has indicated that the companies that currently exist often face internal and external challenges. Some of these reported challenges include barriers to access finance, legal constraints, a lack of access to job opportunities, and a lack of required skills, amongst others.

The National Construction Development Programme (NCDP) states that the National Department of Public Works (NDPW) has been providing leadership in terms of contractor development since the inception of the democratic government in 1994. Initially, the NDPW established the Emerging Contractor Development Programme (ECDP) to advance entry for primarily black contractors into the construction industry through direct government contracting. The Expanded Public Works Programme (EPWP) was later conceptualised by Cabinet, primarily to enhance job creation in the public sector, but at the same time afforded government the opportunity to enhance its contractor development initiatives through the Vu'kuphile Programme.

Both the ECDP and the Vu'kuphile programmes are primarily skills development programmes based on and implemented through a learnership programme.

At the same time, the NDPW conceptualised the Contractor Incubator Programme (CIP) which is based on the principles of advanced enterprise development with the aim of shifting the focus of contractor development from small contracts to more substantial contracts as well as to higher levels of contracting.

In South Africa, contractors enter the market at the lower end in the general building contracts category thus rendering the sector extremely competitive and unsustainable (DPW, CIDB, CETA, 2005). Emerging contractor policies intended for Black Economic Empowerment (BEE) are being used as job creation opportunities which contribute to the overcrowding of emerging markets (Thwala and Mvubu, 2008:87).

Since 1995, DPW has been actively involved in conceptualising and implementing programmes to promote emerging contractors within the built environment. Through these programmes, the DPW together with the CIDB has increased the participation of Historically Disadvantaged Individuals (HDIs) in the mainstream economy.

As reported by Thwala and Phaladi (2006:3), this participation increased economic activity in an economically depressed environment. Previous contractor development programmes have focused mainly on the under R500 000 range market, which has been found not to be a sustainable market, given the number of new entrants to the market. The researchers alluded that this resulted in only a few of these businesses being sustainable and the cost of contractor development consequently being extremely high compared to that of the sustainable businesses.

Research conducted by Seeletse (2012:1) reveals that small enterprises constitute 80 % of the business sector in South Africa. However, emerging contractors find it difficult to penetrate the construction sector. As reported by the Gauteng Local Government and Housing MEC (2010:1), the boom in the construction industry during the erection of the 2010 FIFA World Cup infrastructure has benefited only big companies at the expense of emerging contractors

The aim of this study is to establish the challenges that emerging contractors are facing in terms of successfully managing their businesses; understand the cause of delays in payments by employers; Discuss challenges in accessing job opportunities by emerging contractors and to analyse government contractor development initiatives and to understand the shortcomings in implementing these programmes

LITERATURE REVIEW

According to Spenser (2005:41), small and medium sized contractors can be distinguished as those who affect small scale contractors and medium sized contractors respectively. Spencer (citing Dungwana and Rwelamila, 2003) argued that contractors can also be distinguished from each other by various variables such as the size of their annual turnover, capacity and capability.

Thwala and Phaladi (2006:87) argued that small and medium contractors face increasing competition owing to the long term real decline in demand and many contractors responded by shedding labour. However, while emerging contractor development policies were intended for black economic empowerment, capital is limited and the cost thereof is high. Moreover, while government has made some efforts to increase accessibility to finance, the targeted programmes have enjoyed limited success due to the low awareness and usage of existing promotional programmes. In addition, high interest rates also pose a threat to the growth of micro enterprises, and the effect of the recession can be felt by these contractors as the inadequacy of external finances deters enterprises with growth potential from expanding.

In his research, Ofori (2002:1) found that while small and medium contractors throughout the world face many challenges, contractors in developing countries have additional problems that differ from those experienced by their counterparts in the developed world. Research indicates that conditions in developing countries present additional challenges which include a lack of resources for training contractors, poor construction procurement systems and a lack of management capacity and resources to equip managers to operate their business enterprises efficiently and effectively.

Several researchers have analysed problems facing emerging contractors and the following barriers have been identified.

Skills-related barriers

Spencer (cited by Hauki and Engdelhl, 2001:62) contended that the Skills Development Act (Act No. 97 of 1998) provides an institutional framework for devising and implementing national sector and workplace strategies to develop and improve skills and the workforce. However, South Africa is characterised by a systematic investment in human capital (Thwala and Phaladi, 2006:89). This has resulted in a labour force with a skewed distribution of craft skills, career opportunities and workplace experience. It is noted that while the promulgation of the Skills Development Act of 1998 is commendable, micro enterprises already express concern about the administration costs of recovering levies in the form of grants for training undertaken. According to Phaladi and Thwala (cited in Kesper, 2000), the costs of designing a workplace training programme as an alternative to using external training institutions and the relatively high fees charged by private training institutions after the closure of the former industrial training board which had been subsidised through levies from industry.

The purpose of the Skills Development Act is to:

- Increase the levels of investment in the education and training of the labour force;
- Improve the employment prospects of previously disadvantaged individuals due to unfair discrimination, and;
- Redress the disadvantages through training and education.

According to Wasi, Bridge and Skitmore (2001:6), deficiencies in planning and management skills are acknowledged to be the greatest single problem for small scale contractors in general. Furthermore, in developing countries, the local construction industry lacks the capacity and capability of undertaking large construction projects which results in a continuation of colonial construction companies undertaking all major construction projects. Consequently, smaller contractors find it difficult to acquire experience in these types of projects which in turn leads to contractors with limited management and technical skills (Wasi, 2001:7).

Tlhomola (2010:49) stated that the training of small business owners and their staff members enable them to acquire the necessary skills to ensure the survival and success of their business. This researcher further cites Van Aardt et al. (2008:249) who assert that about 80 % of the problems experienced in businesses are caused by a lack of management skills. Moreover, these entrepreneurs lack the critical business skills required to run their businesses successfully.

Wasi, Bridge and Skitmore (2001:7) concluded that these deficiencies affect the ability of small scale contractors to acquire materials and manage their works successfully, thus generally contributing to poor performance. Often, these contractors resort to hiring graduates with little or no experience and assign them to oversee projects. Their lack of skills and experience at both supervisor and worker levels has, however, also been a contributing factor to poor performance.

One of the factors contributing towards the failure of contractor development is financial management skills. Wasi, Bridge and Skitmore (2001:10) further noted that financial management skills enable contractors to better manage their finances, thereby facilitating appropriate expenditures to keep their businesses operational. However, research also reveals that many contractors have cash flow problems. This could mean that money might be spent on other things rather than operating costs to keep the company operational.

Financial barriers

Baitani and Mullungu (2007:9) reported that a construction business, like any other business, requires financing both for the establishment of the basic infrastructure in terms of acquisition and expansion of capital items, and for working capital to run the business. It is also noted that the financing for the basic infrastructure and starting up a business is obtained from external sources. However, small companies are experiencing constraints resulting in little or no access to finance.

Access to finance remains a dominant constraint to construction SMMEs (Shakantu and Kajimo, 2007:6). These researchers indicated that this stems from the fact that construction SMMEs have limited access to capital markets, partly due to the perception of higher risk, information barriers and the higher costs of intermediation for smaller firms. As a result, small construction companies often cannot obtain long term finance from finance institutions as a form of debt and equity.

Though it was noted by Chilipunde as cited by Carson (2006:31) that supplier credit appears to be the most common source of external financing for equipment among SMME contractors, Shakantu (2007:7) indicated that efforts to promote SMME access to finance might have exert a greater impact on development and growth, but access is limited and the cost of capital is high.

The South African government has made some efforts to increase accessibility to finance. According to research, targeted programmes have had limited success due to limited awareness and usage of existing promotional programmes. In addition to insufficient access, high interest rates as a result of the recession pose a constraint to the growth of small enterprises. Shakantu (2007:7) also highlighted that poor financial policies make lending to construction enterprises by financial institutions more unfriendly. Most financial institutions limit lending to construction businesses as compared to trading enterprises.

Thwala and Phaladi (2006:89) indicated that efforts to promote the access of small contractors to finance might have more impact on development and growth, but access is limited and the cost of capital is high. These researchers argue that while government has made some efforts to increase accessibility to finance, the targeted programmes have had limited success due to a low awareness and usage of existing promotional programmes. Moreover, high interest rates also pose a constraint on the growth of micro enterprises. Shakantu (2007:12) reported that fundamental difficulties are evident in terms of discrimination by financial institutions against micro enterprises with little collateral, difficulties in accessing information and lack of exposure.

Lack of access to job opportunities

Access to job opportunities contributes significantly to the survival of an enterprise. Government has an important role to play by ensuring that a conducive regulatory environment prevails for emerging contractors.

Contractor development is measured by the growth in the CIDB grade of a contractor, which is one component of development (CIDB, 2009). Shakantu (2006:4) indicates that the CIDB contractor registers are filled by micro enterprises aiming to secure small contracts, which results in fierce competition between these companies. This competition then translates into desperate tenderers and unsustainable overbidding.

Government departments, local authorities and public corporations use the preferential policy as required by the Preferential Procurement Policy Framework, Act No. 5 of 2000 (PPPFA). The Act allows different public sector entities to give preference to previously disadvantaged enterprises when awarding tenders. In addition, the Act enables public entities to use an unbundling system, which is a tender process that divides construction work that can be performed by one contractor into smaller works so that they can be executed by more than one contractor (CIDB, 2004:8).

However, research reveals that although a preferential procurement system is in place, emerging contractors still face work flow problems. Once contractors have completed a project they usually have to wait for some time before receiving the next project (Mbonane, 2005:16).

Delays in payments

Mvubu and Thwala (2009:4) postulate that emerging contractors experience problems due to lack of payments by clients. The Joint Building Committee Contract 2000, clause 13.11 stipulates that the employer shall pay the contractor within 7 calendar days of the date of issue of the payment certificate. However, a study conducted by the Department of Housing (2006) reveals that problems regarding delays in the payment of contractors still exist. This study further indicates that these problems can be attributed mainly to, amongst other things, the unwieldy nature of payment processes as well as unnecessary bureaucracy in the processing of claims, lack of capacity within client departments and over-centralisation of all processes that affect payments. Other secondary contributing factors include delays such as lack of clarity on the part of contractors regarding the steps, procedures and requirements for payments (Human Settlements Concept Paper, 2006:8)

Kapulala et al (cited by Chilipunde, 2010:35) indicates that contractors suffer from erratic cash flow problems and are often forced to delay or suspend work due to delays in payment or non-payment; government being the main defaulter in this respect. Moreover, contractors fail to meet numerous contractual obligations, resulting in work costs escalating beyond their budget as a result of claims and interest. In the case of labour-based construction, delays in payment could result in strikes, unrest and serious disruptions. Delays in payment by clients can be identified as a major stumbling block that affects the growth of small contracting enterprises.

Barriers to training and mentoring of emerging contractors

International research carried out by the National Institute for Occupational Safety and Health (NIOSH, 1999:9) describes training as communication directed at a defined population for the purpose of developing skills, modifying behaviour and increasing competence.

Generally, training focuses exclusively on what needs to be known, whereas education is explained as a longer term process that incorporates the goal of training and also explains why certain information must be known. Education emphasises the scientific foundation of the material presented.

According to research, both education and training induce learning, a process that modifies knowledge and behaviour through teaching and experience.

Similarly, Moss (2007) cited Chilipunde (2010:144) observed that training is a form of teaching or education that transfers knowledge. In the process, the trainer has certain responsibilities which include: presenting, demonstrating, guiding and administration – also referred to as mentoring (CIDB, 2008). Mentorship is essential in order to accelerate the process of development.

Mentorship affords selected contractors, who are awarded contracts in terms of the programme, the benefit of exposure to the experience of those individuals who have extensive experience in the construction industry. This exposure is designed to address many of the common shortcomings encountered in such contractors while they still lack sufficient experience (Watermeyer, 2001:6).

According to the CIDB status report (2009:39), access to theoretical and practical training supported by mentoring is core to any contractor development programme. Moreover, it is vital that training should be meaningful and relevant to the target graduation level of development for contractors, and that this training is accredited. However, this requirement is compounded by the problem that the South African Qualification Authority (SAQA) accreditation does not exist for many subject areas and the Contractor Development Programmes (CDPs) are therefore often reliant on their own assessments. Contractors need these formal qualifications to be able to verify their theoretical competence in preparation for the participation in both the public and private sector construction industries. The CIDB (2009) reported that the quality of some of these mentorship programmes is unacceptable.

The CIDB (2008) addressed the challenges of skills development through its construction industry performance unit and the CIP. There is an undisputable link between the quality of projects delivered by contactors and skills. Quatey et al. (2001:15) observed that despite numerous institutions providing training and advisory services, a skills shortage still exists in the SMME sector as a whole.

Watermeyer et al. (2001:6) postulate that mentorship is essentially required to bridge the gap between the growth of an inexperienced contractor and a fully-fledged contractor, and between a contractor executing contracts with a particular value and risk profile and a contractor executing contracts with a higher value or risk profile, or both.

Moreover, mentorship is required to accelerate the development of selected contractors and in so doing overcome the impediments which they face. As such mentorship can be viewed as the 'helping hand' which assists the selected contractor to cross the divide between small contracts and larger ones.

Based on the knowledge gained through practical experience in the construction industry, mentors are able to:

- Guide and advise selected contractors regarding the area in which they need to improve their competencies;
- Develop the technical, managerial, administrative, commercial and business skills of key staff members; and
- Set up business systems within emerging contracting enterprises.

South African emerging contractors are characterised by low levels of experience and formal construction related training, lack of required skills, lack of access to finance, lack of employment opportunities and lack or poor cash flows to sustain their businesses due to delays in payment. Therefore, this contributes to the failure of emerging contractors to sustain their businesses in the long term. Access to appropriate, relevant and understandable information and advice is critical to small enterprise development. Due to past discrimination and lack of opportunities, this problem is most severe among black people, in particular, small start-up enterprises, survivalists and micro enterprises.

The acquisition of relevant technical and business skills is generally regarded as one of the critical factors for success in small enterprises. In addition, literacy and entrepreneurial awareness are particularly important to enable people to advance from survivalist activities into larger and better earning enterprises with the rapid expansion in the range and number of small enterprises all over the country. Knowledge about presently available training has to be disseminated more effectively in order to reach entrepreneurs all over the country. In parallel with additional training efforts it is necessary to expand applied research on problems, needs and development trends in South Africa's SMME sector. With increased training, there is also a need for a rapid expansion of business-mentorship systems.

In surveys among small enterprises all over the world, access to finance emerges as one of the most urgently felt needs. This remains true even though other problems (such as poor marketing, lack of technical skills, weak management) often aggravate the financial position of small enterprises and hamper their access to funds. The financial needs of different types of SMMEs vary widely, with access problems being particularly severe in rural areas, among start-up micro enterprises and among those owned or controlled by women as well as other formally disempowered groups and in other high risk business categories. As far as lack of knowledge about financing programmes or the process of application constraints is concerned, further research regarding the SMMEs in the construction industry is vital in order to identify inequalities that still exist given the role that collateral plays in securing credit from conventional banks.

Emerging contractors usually experience difficulties in accessing job opportunities and is the most serious obstacle to sustaining business and growth beyond a mere subsistence level. This perception is confirmed by many studies carried out in South Africa and internationally. Market access is viewed as a critical factor in business growth, in particular, in the case of entrepreneurs from disadvantaged communities. However, further research is required to support the quest to obtain the status quo among emerging contractors in terms of accessing job opportunities and to test the progress made in terms of re-orientating procurement towards small-enterprises.

Just like training, finance and business skills, technology is often considered to be an important factor that influences the success of small enterprises. However, entrepreneurs do not always have access to technology. This applies to both ends of the technology spectrum. Sophisticated technology is needed for small enterprises in the services sector to be competitive and appropriate technology is needed by small-enterprises operating in the labour-intensive, low-skill spheres. Both of these areas deserve to be further explored among emerging contractors.

RESEARCH METHODOLOGY

For the purpose of this study, only one type of research methodology approach was employed, namely survey research or a descriptive survey in the form of questionnaires. According to Fyvie (2010:82-83), two forms of questions prevail in questionnaires, that is, “open” and “closed” questions. Open questions allow respondents to phrase an answer in their own words, decide on the wording, the length of the answer and the matters to be raised in the answer while closed questions structure the by allowing only answers that fit into categories that have been established in advance by the researcher.

Research performed by Desta (2006) cited by Chilipunde (2010:66) demonstrated that a research design should ensure that the evidence collected addresses the research questions and is also vital to ensure coherence and rigour. This is necessary because the questionnaire provides the data to test the validity of the problem statement and in order to acquire relevant data; the appropriate questions need to be posed. The questionnaire was designed to gather information that is relevant to each sub-problem. A 5-point Likert scale was utilised in the design of the questionnaire in order to rate the responses of the respondents.

The questionnaire consisted of two sections, namely Section A and Section B. The same questionnaire was designed for SMME contractors, consultants and clients as well as for other authoritative individuals within the construction industry. Simple, clear and unambiguous language was employed and inputs from the literature review were used to design the questionnaire. Only people in positions of authority were requested to respond to these questionnaires.

The questionnaire was designed with the aim of gathering information relevant to each sub-problem. A five level likert scale was used in designing questionnaires, to scale responses from participants. The questionnaire consisted of two sections, namely A and B. Simple, clear and unambiguous language was used. Inputs from literature review were used to design the questionnaire. According to (Cidb: 2010/11) there are in total at least 2 385 registered SMME contractors (grade 2-5) within the chosen geographical area of Gauteng which made it impossible to allocate questionnaires to and expect responses from everyone. As a result, only 100 questionnaires were given to chosen SMME contractors between grade 2 and 5 to respond within a specific time. Some questionnaires were also given to consultants on data bases of identified registered professionals to complete. Only persons of positions of authority were requested to respond to these questionnaires.

RESULTS, DATA ANALYSIS AND INTERPRETATION

An analysis and interpretation of the data regarding the constraints and challenges faced by SMME contractors within the construction industry in Gauteng province was presented. The questionnaire was systematically designed to effectively evaluate data relating to the theoretical framework created for this study.

Questionnaires were administered to100 SMME contractors within the construction industry identified from the CIDB database,10 construction project managers and five consultants, that is, a total sample of 115 potential respondents.

Hence, 55 responses were received by 30 October 2012 which represented a response rate of 47.8 per cent. This positive response rate can be attributed to constant reminders, personal administration and personal collection where necessary as well as the extension of the submission date.

The data were analysed by using quantitative analysis techniques. It is imperative that the reliability and validity of the data be taken into consideration when conducting research. According to Chilipunde citing Blose (2001:39), “data reliability can be defined as whether or not data measures a representative fraction of the target group”.

Demographic background of Respondents

The demographical data collected includes average years of experience within the construction industry, management experience and highest qualification of the respondents. The study reveals that the respondents of the questionnaires were predominantly males; and few were females. Figure 1 illustrates the gender of the respondents. These results are true reflection of what is obtained in the construction industry today, which is mainly dominated by males; suggesting that a lot of transformations are needed in the South African construction industry

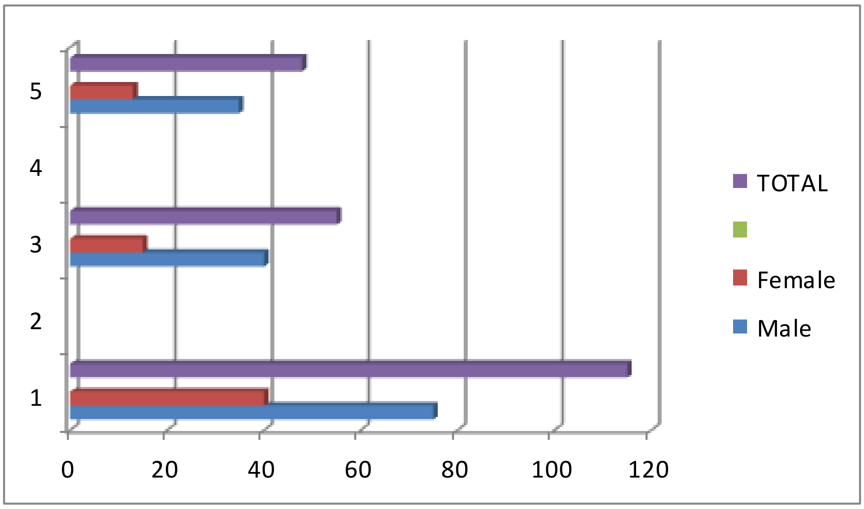


Figure 1: Gender of Respondents

Similarly, Figure 2 indicates the ages of the respondents. It is evident from this Figure that the majority of respondents were within the age group of between 35 years and 44 years age group. This is possibly due to the fact that a large number of questionnaires were sent to owners and senior staff members of companies\firms as a result this data can be proven reliable due to the fact that respondents were mature enough to answer questions

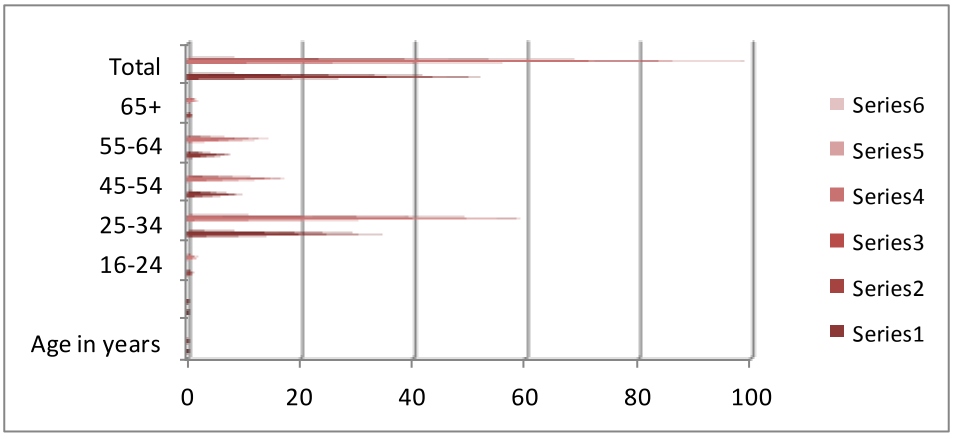


Figure 2: Age Groupings of Respondents

Challenges of Emerging Contractors

Lack collateral to access finance

Values ranged between 1(strongly disagree), and 5(strongly agree).An analysis of reveals the level of agreement by respondents to various questions: Respondents strongly agree that inflexible credit terms from Banks is a major problem with a result percentage score of 92.7 and difficulties in obtaining loans from banks is 89.1 % whilst 78.2% agree that there are difficulties in accessing finance. The majority of respondents with a percentage of 96.4 score strongly agree that late payments by clients contribute to challenges facing SMME contractors. Figure 3 indicates that SMME contractors are facing many financial problems, which in turn result in compromising quality and time on construction projects as well as disputes and unrest on site amongst others.

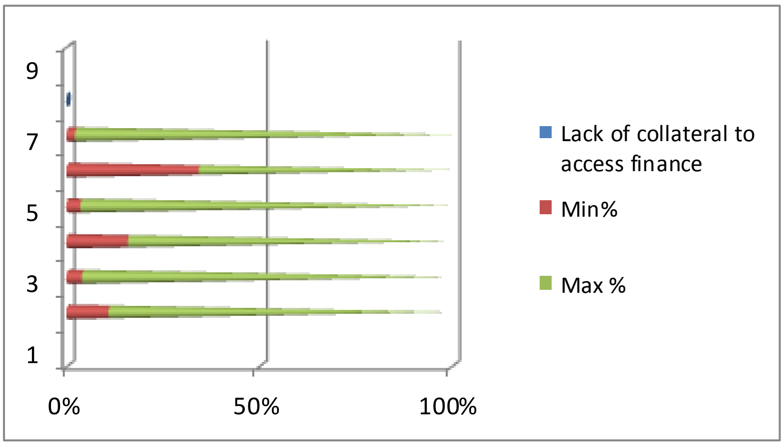


Figure 3: Lack of collateral to access finance

Delayed payments by Employers/Clients

Values ranged between 1(strongly disagree) to 5(strongly agree).An analysis of the below table shows that many SMME contractors experience late payment of their invoices by clients/employers with 89.1% maximum score strongly agreeing .The analysis also shows that the payment process by Clients are somewhat lengthy, with an overall percentage score of 87.3.

Table 1: Delayed payments by employers

Category	**Min %**	**Max %**
Progress payments to Contractors are always settled on time.	5.4	72.7
Payments to contractors are Settled within 30 days of Invoice submission	5.4	87.3
Employers always adheres to JBCC/GCC payment Clauses.	5.4	47.3
Final accounts are always settled on time	1.8	89.1
Valuation and certification of interim payments s always done on time.	9.1	47.3
Payment process by Client/employers is easy.	29.1	70.9

Limited access to employment opportunities

Values ranged between 1(strongly agree) to 5(strongly disagree).An analysis of the table below shows that fraud and corruption is a contributing factor towards difficulties in securing construction job opportunities in government with the highest percentage of 67.3. This confirms the report by CIDB (2009) that unscrupulous contractors are increasingly resorting to bribery, fraud and corruption to bypass cidb requirements for registration, especially in higher grades, in a bid to land bigger construction projects from government. Respondents also indicated that SMME contractors do not get a fair chance to compete for jobs with a total score of 65.4.Respondents also indicated that

Government Contractor Development Programmes does not make it easy for SMME Contractors to access job opportunities scoring 63.3%.5=strongly agree

Table: 2 Limited access to job opportunities

Description	**Min %**	**Max %**
SMME Contractors find it easy to access advertised jobs	41.9	58.2
Tender documents prices are reasonable/affordable	27.2	38.2
Government procurement system makes it easy for SMME contractors to get job opportunities	3.6	58.2
Government Contractor Development Programmes makes it easy for SMME contractors to access job opportunities	5.5	63.6
SMME Contractors get a fair chance to compete for job opportunities	5.5	65.5
Fraud and Corruption is a contributing factor towards difficulties in securing job opportunities in government	12.7	67.3

SUMMARY AND INTERPRETATION

This study indicates the need for training, delayed payments by employers and difficulties in accessing employment opportunities and reveals that there is lack of collateral to access finance by SMME contractors. Respondents illustrated which training needs are relevant, which business skills are lacking and the prevalence of unethical conduct which results in limited competition for job opportunities amongst SMME contractors.

The demographic data indicates that there are disparities with regard to the research participants as most of the respondents were males. This could be attributed to the construction industry still being male dominated, even 19 years into democracy in South Africa.

In terms of the research data, a need exists to train SMME contractors in the following areas: interpretation of building drawings, management and administration of building sites and financial management.

Respondents strongly agreed that invoices for work completed by SMME contractors are not settled on time whereas they agreed that contractors are faced with inflexible credit terms from suppliers and banks. The research findings reveal that respondents also agree that loans are difficult to obtain from banks while obtaining guarantees, insurance bonds and sureties are major obstacles.

In addition, respondents indicated that a lack of business management and financial management skills is a major barrier and further strongly agreed that a lack of bookkeeping, contract administration, leadership, communication and site management dominate among SMME contractors. Respondents also strongly agreed that there is an enormous deficiency in terms of financial management skills.

According to the respondents, a prevalence of unethical conduct was also evident. They strongly agreed that fraud and corruption is a contributing factor to the lack of fair competition regarding jobs among SMME contractors. Respondents also agreed that although tender documents are reasonably priced, the government procurement system and Contractor Development Programmes do not make it easy for SMME contractors to access job opportunities.

Testing of hypothesis

The literature review and the findings emanating from the survey were utilised to test the hypotheses.

Hypothesis 1

There is lack of training, and business and financial management skills among SMME contractors

The first hypothesis is supported by the following findings:
The need for training in terms of financial management (96.4 %) is the highest with, indicating a great need for training. The need for training in the interpretation of building drawings and construction programmes (74.5 %) is also highlighted. There is a very strong need for training in the management and administration of building sites (80 %).

Hypothesis 2

SMME contractors lack collateral to access finance.

The second hypothesis is supported by the following findings: Inflexible credit terms from suppliers and banks are rated very high (92.7 %).This indicates that suppliers and banks make conditions difficult for SMME contractors to access credit facilities to finance their businesses. Respondents also agree that late payments by clients or employers make it difficult for SMME contractors to sustain their businesses. Difficulties in obtaining guarantee bonds, sureties and insurance bonds also allude to some of the challenges facing SMME contractors.

Hypothesis 3

SMME contractors experience late payments of their invoices by employers and clients.

The third hypothesis is supported by the following findings:

Late payments of invoices and final accounts by employers are ranked high (96.4).

The findings indicate that 89.1 % of the final accounts are not settled on time.

Hypothesis 4

SMME contractors find it difficult to access job opportunities.

The fourth hypothesis is supported by the following findings:

Fraud and corruption ranked as the highest (67 %) contributing factors the lack of competition for job opportunities. SMME contractors not being afforded a fair chance to compete for jobs ranked second highest (65.4 %).Respondents also agreed that the government procurement system and Contractor Development Programmes do not make it easy for SMME contractors to access job opportunities; this item scored 63.6 %.

Although the hypotheses were well supported by the findings emanating from the survey, there is a great concern with regard to the late payment of invoices by employers as shown in the testing of Hypothesis 3, the inflexible credit solutions presented in the testing of

Hypothesis 2 and the lack of business, technical and financial management skills among SMME contractors as reflected in the testing of Hypotheses 1.

CONCLUSION AND RECOMMENDATIONS

From the findings of the survey, the following conclusions can be drawn regarding the need for training, and the lack of business and financial management skills:

- Training in terms of reading and writing skills was rated the lowest by respondents. Although such a need exists; there are other aspects that should take priority.
- All other aspects requiring training were rated high, with the need for technical and financial management training being rated the highest.

It can therefore be concluded that the need for training is enormous and that all aspects in terms of training should be considered to be of equal importance. It can also be concluded that SMME contractors lack business management skills. Therefore, training for SMME contractors in terms of business and financial management skills is a requirement to ensure competence and sustainable business enterprises.

In terms of "investigating financing challenges", the following conclusions can be drawn:

- Each aspect of investigating financial challenges was rated high, including inflexible credit terms from suppliers and financial institutions.
- Delays by clients in settling invoices is rated the highest.
- Difficulties in obtaining guarantee bonds, sureties and insurance bonds as well as the cost of tender documents were rated the lowest.

In summary, it can be concluded that SMME contractors face financing problems. This is mostly due to delayed payments by employers; this has a negative impact on sustaining their businesses and results in a lack of collateral to access finance. This problem must be addressed as it hampers the growth and development of SMME contractors. In terms of delays in payment by employers, it can be concluded that:
SMME contractors experience delays in the payment of their claims, as this aspect was scored the highest by respondents.
In conclusion, although claims are mostly certified on time by consultants, delays in payments by employers pose a risk to SMME contractors with regard to sustaining their businesses and keeping up with payments to creditors in order to maintain a healthy credit record which in turn will assist contractors to access finance from financial institutions.
Lastly, in terms of limited access to job opportunities, the following conclusions can be drawn:

- There is insufficient competition for SMME contractors to compete for jobs mainly due to fraud and corruption. This aspect scored the highest.
- It is difficult for SMME contractors to access job opportunities; this aspect was scored second highest by respondents

It can therefore be summarised that a need exists for government to implement new strategies in order to offer all contractors an equal opportunity to access job opportunities and to facilitate fair competition for all those who tender.

From the findings of the survey, the following conclusions can be made regarding a need for training, lack of business and financial management skills:

- Training in terms of reading and writing skills was rated the lowest by respondents. .Although the need exists; there are other aspects that should take priority.

- All other aspects requiring training were rated high, with the need for technical and financial management training being rated the highest.

It can therefore be concluded that the need for training is enormous and that all aspects in terms of training should be considered to be of equal importance. It can also be concluded that that SMME contractors lack business management skills. Therefore, training for SMME contractors in terms of business and financial management skills is a requirement to ensure competence and sustainable business enterprises.

In terms of 'investigating financing challenges', the following conclusions can be made:

- Each aspect of investigation financial challenges rated high including inflexible credit terms from suppliers and financial institutions.
- Delays by clients in settling invoices rated the highest
- Difficulties in obtaining guarantee bonds, sureties and insurance and cost of tender documents rated the least high.

In summary, it can be concluded that SMME contractors face financing problems .This is mostly due to delayed payments by employers which a have a negative impact on sustaining their businesses and lack of collateral to access finance. This problem must be addressed as this hampers growth and development of SMME contractors.

In terms of delays in payment by employers it can be concluded that:

- SMME contractors experience delays for payment of their claims, as this scored the highest by respondents.

In conclusion, although claims are mostly certified on time by consultants, delays in payments by employers pose a risk on SMME contractors in sustaining their businesses, and keeping up with payments to creditors in order to maintain a healthy credit record which in turn will assist contractors to access finance from financial institutions.

Lastly, in terms of limited access to job opportunities, the following conclusions can be made:

- There is not enough competition for SMME contractors to compete for jobs mainly due to fraud and corruption scored the highest.
- It is difficult for SMME contractors to access job opportunities; this aspect scored second highest by respondents

It can be summarised that there is a need for government to implement new strategies in order to give everyone an equal opportunity in accessing job opportunities and fair competition within tenderers.

From the research findings from Gauteng Province, it is clear that government needs to address challenges and constraints faced by SMME contractors within the construction industry. The treatise recommends that although there are Contractor Development Programmes in place, proper monitoring and control mechanisms must be put in place in order to monitor progress on initiatives by government. The outcome of the study reveals that there is a gap in terms of required skills among SMME contractors. This is an indication that there is enormous need for training especially in business, technical and financial management skills. Lack of these skills results in incompetence and failure among SMME contractors. The following recommendations are therefore suggested in order to address challenges facing SMME contractors within the construction industry:

- Legislation to create an enabling environment for SMME contractors should be periodically reviewed to address the challenges from lessons learnt in implementing contractor development programmes to support contractor development and growth.
- Results from Contractor Development Programmes need to be recorded and a data base established in order to monitor progress.
- CIDB should revisit the framework and strategies on contractor development and introduce new approaches in consultation with SMME contractors and get their inputs to bridge the gaps.
- Contractor Development Programmes should instil a culture of continuous learning, knowledge creation and knowledge sharing through education among SMME contractors.
- Government should set aside funding for SMME contractors to access after being awarded a contract to kick-start the project without requiring collateral but just some form of insurance and increase the percentage of retention money to recover the money lent.
- Government must also implement strict measures to employees who do not comply with a 30 day payment period of invoices in order to assist SMME contractors to sustain their businesses.
- Department of Public Works should partner with CIDB to ensure proper rotation of awarding contracts to eligible SMME contractors and put strict monitoring and evaluation measures in place.
- Fraud and corruption including any other unethical behaviour should not be tolerated at any point and must be dealt with accordingly.

REFERENCES

CIDB (2010), National Contractor Development Programme Framework.

CIDB Status Quo Report (2009) , South African Contractor Development Programme.

CIDB(2005)South African Contractor Development Programmes, status quo report.

CIDB(2011) Assessing supply and demand for emerging contractor National Contractor Development Programme.

Department of Human Settlement report, 2009

Dlungwana ,S and Rwelamila P.D (2002) Development and Implementation of the South African Construction Excellence Model,

Dlungwana ,S and Rwelamila P.D (2005) Contractor development models for promoting sustainable building.

Dlungwana, S. and Rwelamila, P.D. (2003).Contractor Development Models for promoting sustainable communities – a case for developing management capabilities of SMMEs.

Dlungwana, S.and Rwelamila, P.D. (2004) Contractor Development Models that meet the challenges of Globalisation: A case for developing Management capability of local contractors. Cidb.

Dlungwana, W.S. and Rwelamila, P.D. (2003). The role of performance assessment tools in measuring contractor performance in developing countries.

ECDP(2006) National Department of Public Works,ECDP,Vuk'uzenzele.

Edmonds,G and Miles D(1984)Factors affecting the performance of small indigenous contractors in Papua.

Emerging contractors in South Africa,Lugwig Martin,2009

Gasa(2012)Measuring the competitiveness of small, medium and micro enterprise contractors through the use of the register of contractors

Hauptfleisch,D,Lazarus S,Knoetze,T (2007) An integrated emerging contractor development model for the construction industry;

Hidle,R.D and Muller M.H (1997) The role of Education as an agent of change.

Masakhe ECDP Handbook,KZN Department of Public Works

Ofori G(1993)Managing construction industry development,

Ofori G,(1991)Programmes for improving the performance of contracting firms in developing countries,

Ofori, G. (2002). Current issues in small construction contractor development.

Ofori, G. and Han, S.L. (2000). Foundations of change: Aspects of the construction industry in Developing Countries.

Preferential Procurement Policy Framework Act(No 5 of 2000)

Pretoria Contractor Incubator Programme Management Plan, NDPW.

Qongqo and Milfred (2008) Paper No 39 Development programs,

Report for the Provincial Emerging Contractor Conference (2010), The Australian journal of construction economics and building KZN Human Settlement

Rwelamila P.D (2002) Creating an effective construction industry strategy in South Africa. Phaladi and Thwala, CIDB 2008 Critical Success factors for small and medium sized contractors in the North West Province.

Shakantu W.M (2007). The south African construction Micro Enterprise Development challenge

Solly Matshonisa Seeletse(2012),Common causes of small business failure in the townships of West Rand district municipality in Gauteng Province of South Africa.

Spencer Lazarus(2005) An integrated skills development model for Emerging Construction contractor in the Eastern Cape,

The constitution of the Republic of South Africa (No 108 of 1996)

Wasi, D.; Bridge, A. and Skitmore, R.M. (2001). Growth paths of construction enterprises in Singapore. Volume 3, Engineering, Construction and Architectural Management Journal, Singapore(Guinea).

White Paper (1997). creating an enabling environment for Reconstruction, Growth and Development in the Construction Industry.

COMPETITIVE STRATEGY, DECISION-MAKING STYLE AND ORGANISATIONAL PERFORMANCE: A CONTINGENCY APPROACH

Luqman O. Oyewobi[1], Abimbola O. Windapo[2] and Keith S. Cattell[3]
Department of Construction Economics and ManagementUniversity of Cape Town, South Africa

The choice of decision-making style and the competitive strategy of an organisation play a significant role in gaining competitive advantage and achieving superior performance. The relationship between strategy and organisational performance is a central issue that essentially determines organisation's decision-making processes. The objective of this paper is to examine and analyse the influence of strategic decision-making style and the competitive strategy on organisational performance based on contingency theory. The study focuses on large construction organisations in South Africa using a quantitative questionnaire survey to elicit information. Competitive strategy and decision-making style attributes cannot be measured objectively, thus subjective data were used using opinion scales. The data collected were analysed using regression, correlation and descriptive statistics. The results indicate that organisations adopted decision-making style in their day-to-day operational activities. The findings also show thatdirective style of decision-making shows negative but significant association with the overall performance of organisation while differentiation strategy is negatively but significantly associated with objective performance measure. The findings cannot be generalised to other smaller construction organisations as it was limited to large organisations. Knowledge of the relationship among the variables measured in this paper will be beneficial to both owners and managers of construction organisations because it provides necessary information on how strategic decision-making influences strategy adopted and in turn organisational performance.

Keywords: competitive strategy, contingency approach, decision-making style, organisational performance.

INTRODUCTION

Managements of organisations are expected to make strategic decisions that have significant influence on their organisation's performance, the style and speed of decision-making has been reported to be strongly related to organisational performance (Goll and Rasheed, 1997; Baum and Wally, 2003). Contingency approach holds that, decision-making structure are chosen based on the competitive strategy employed by an organisation, and assumes that organisations that carefully select their strategy with adequate attention on decision-making structure outperform their competitors that do not (Chung, 2008; Chung, Wang and Hang, 2012). Part of

[1] oywluq001@myuct.ac.za
[2] abimbola.windapo@uct.ac.za
[3] Keith.Cattell@uct.ac.za

Oyewobi *et al.* (2014) Competitive strategy, decision-making style and organisational performance: a contingency approach *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 207-221

the key issues in the strategic management field is the clarification of the developmental process of strategy so as to provide a plan for decision-making that will lead to effective formulation of strategy (Panagiotou, 2008). Competitive strategy of an organisation and its structural relationship are vital in improving organisational performance and enhance its competitive advantage. Organisational strategic decision making and competitive strategy have been topical issues of great concern among scholars from diverse background most especially amongst researchers in both strategic management field and organisational theory (Dean and Sharfman, 1996; Pertusa-Ortega, Molina-Azorin and Claver-Cortes, 2010; Amzat and Idris, 2012). It is believed that, the quality of decisions is dependent upon the organisations strategic process and posture. This exerts pressure on organisations to identify their strengths, weaknesses and device mechanism to recognise pertinent business opportunities, and adapt to the dynamic construction business environment in a way that will reduce or eliminate business threats. The identification of these factors will not only enable organisations gain competitive advantage over their industry rivals but guarantee the needed survival to remain in business by obtaining the anticipated strategic fit (Panagiotou, 2008).

Rowe and Mason (1987) view decision-making style from a psychological viewpoint and contend that, it is a cognitive process that characterises how an individual solves a problem and make use of available information to formulate decisions. The cognitive viewpoint considers organisation and its external environment to be interrelated while the industry environment and market margins are constructed socially through the development of competitive depiction (Porac et al., 1995). The cognitive process assists an individual to adopt analogous postures and behaviours in different spheres of influence (Raffaldi, Iannello, Vittani and Antonietti, 2012). Despite the significance of decision-making style as self-assessment tools that require organisations to evaluate its modus operandi inertly, there is a lack of understanding on how the decision-making style influences organisational performance taking into cognisance the competitive strategy. The contingent relationship between structure and competitive strategy, and their effects on organisation performance has been researched using contingency theory (Pertusa-Ortega, Molina-Azorin and Claver-Cortes, 2010). However, there is far less empirical or theoretical research devoted to investigate how competitive strategy and decision-making style affects organisation performance in construction context save (Lansley, 1987; Shirazi, Langford and Rowlinson, 1996).

Lansley’s (1987) study focuses on corporate strategy and survival of organisations in the UK construction industry, but not on competitive strategy whichis the focus of this paper. Lansley establish the relationship between construction industry environment, the strategies of construction organisations and the implication of these on structure and management styles of the firms. Though Lansley explained corporate strategy may be studied using contingency theory, hedid not acknowledge that if an organisation desires to diversify, it requires changing its structure from functional to division structure (Pertusa-Ortega, Molina-Azorin and Claver-Cortes, 2010). The attention of Shirazi et al. (1996) was on the linkages between theoretical issues that influence the structure of construction project organisations with respect to their environment and technological complexities. This paper is aligned to the view of

Chew, Yan and Cheah (2008) who posit thattechnology is a strategic resource required by construction organisations to obtain competitive advantage and performance excellence.

This paper examines and analyses the influence of the strategic decision-making style and the competitive strategy on organisational performance based on contingency theory and would therefore, contribute to the current discourse on the impact of strategy, decision-making style and organisational performance in the construction context using the contingency approach. Against this background, the paper investigates how the decision-making styles with respect to competitive strategy influence organisational performance. The paper also examines the relationship between different types of decision-making styles, competitive strategy and organisational performance.

THEORETICAL BACKGROUND AND CONCEPTUAL FRAMEWORK

The theoretical framework of this study is founded on the contingency theory. Strategic contingency theory upholds that a beneficial strategy should obtain a strategic fit with the dimensions of the environment in which it is implemented; this suggests that different strategies are required in different environments in which organisations operate (Baack and Boggs, 2008). The competitive strategies and the strategic decision-making styles of construction organisations will therefore,be measured based on the contingent variables identified in the literature. The linkages amongst the constructs: strategy-structure-performance trilogy, as it affects organisational performance will be its focus. Thus, the study investigates the underlying theoretical foundation of priorstudies in this subject area.

Although, strategic contingency theory can be traced back to the structure-strategy-performance paradigm linked to the early institutional economists (such as Mason, 1939 and Bain, 1956), the idiom 'contingency theory' was first introduced in organisational studies lexicon in 1967 by Lawrence and Lorsch. Lawrence and Lorsch (1967) conduct an empirical research to show the influence of organisational structure on economic performance of organisations and argue that organisational performance is contingent upon environmental dimensions. Since that period, contingency theory continues with its dominance in strategic organisational management literature as one of the central approachesto the study of organisational design and remains the most extensively adopted present-day theoretical approach to organisational studies (Scott, 2003). The theory focuses more on strategy than structure and its concern is on the strategic fit or match between strategy and environment (Lee and Miller, 1996). Porter (1980, p. 3), unequivocally states that "The essence of formulating competitive strategy is relating a company to its environment." The theory proposes that the most sustainable strategic posture of an organisation is the one that obtains a beneficial strategic fit with the business environment (Parnell, 2013). The main concern of contingency theory is on how organisation achieves strategic fit with the environment to enhance performance with respect to its structure. However, the contingency theorist, argue that no single ideal style or kind of organisation exists for all potential types of environment; each organisation must obtain a beneficial fit between circumstantial elements- business environment, the organisational structural attributes,

and the competitive strategy (Parnell, 2013; Pertusa-Ortega, Molina-Azorin and Claver-Cortes, 2008).
The perception 'fit' explains the strategic linkages between organisations and theircontextual components to enhance organisational performance. The concept 'fit', as used in contingency theory, is described in Pertusa-Ortega et al., (2008: 141) "as the degree of internal coherence among a set of theoretical attributes (for instance, certain strategies will most probably be associated with specific organizational structures and environments)". Mile and Snow (2003) posit that the most effective and efficient organisation is the one that develop mechanisms that permit organisation's to achieve strategic fit and complement the market strategy. The strategic fit being referred to in this paper is the competitive strategy and decision-making style used inenhancing organisational performance/excellence and this is conceptualised in Figure 1.

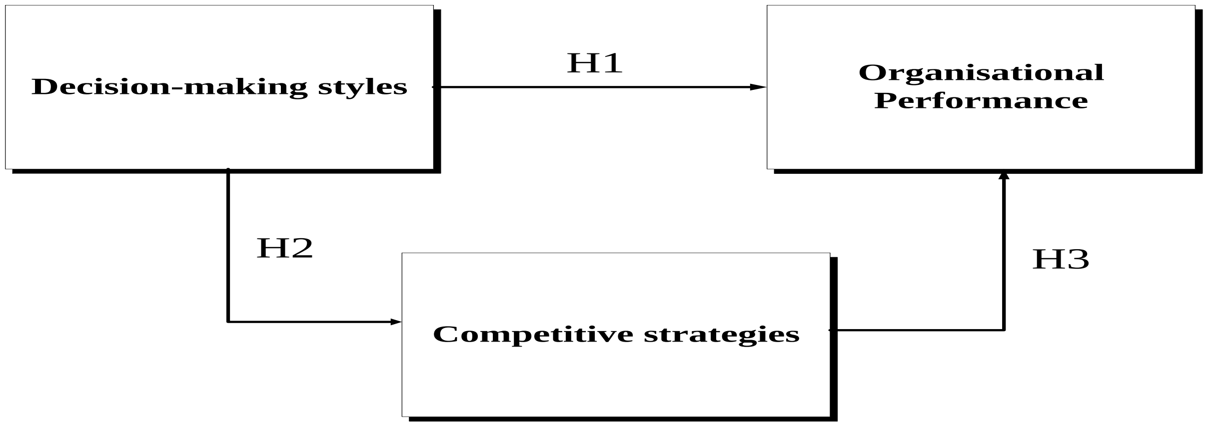


Figure 1: Conceptual framework for moderating effects of decision-making styles in the relationship between strategies and corporate performance

It is essential to delimit the fit used in this paper because many of the previous studies that focused on contingency approach failed to unambiguously delimit the description of fit that they use, which often lead to confusion when putting forward the influence of organisational fit on the performance of an organisation (Roca-Puig and Bou-Llusar, 2007). This is considered to be one of the reasons for incongruence in the results of empirical research theorising on the impact of fit on organisational performance (Pertusa-Ortega et al., 2008). Pertusa-Ortega et al. (2008) argue that within the construction of contingency concept, organisational performance is dependent on the fit that exists between organisational background, its structure (this is conceptualised as decision-making style) and the strategic processes of the organisation. Findings from previous studies indicate that different decision-making styles exhibit different impacts on organisational performance which may be positive or negative (Rehman, 2012; Amzat and Idris, 2012). Govindarajan (1989) also found that problem-solving style among other factors have influence on the competitive strategies of business units.

Decision-making

Due to the turbulent and hyper-competitive nature of construction business environment, especially in South Africa, where no entry barriers exist (Construction Industry Development Board(cidb), 2012), construction organisations receive pressure to think fast and be ahead of their competitors in the market place so as to capture business opportunities. Robbins and Coulter (2005) argue that decision-making is an integral part of managerial functions and as such decision making is central in a managerial functioning system. Hence, decision-making is one of the most vital function performed by the management of an organisation. In fact, the primary responsibility of managers is decision-making upon which the success or failure of any organisation is hinged (Yukl, 1994; Nooraie, 2012).

Decision-making styles

Asaari and Razak (2007) view strategic decision-making as those decisions that give overall direction to an organisation and its eventual sustainability in the face of expectable, changeable and unforeseen events that may likely ensue in an organisation's vital business environment. Decision makers are influenced by the unpredictable nature of the business environment and as such managers are saddled with the responsibility of making everyday decisions on issues that affect their organisations and provide solutions to problems (Tatum, Eberlin, Kotttraba and Bradberry, 2003). Tatum et al. (2003) posit that decision-making style has been discussed in extant literature from various viewpoints and one size fits all solution does not exist, as there is no unanimously accepted categorisation of decision-making style. Tatum et al. (2003) contend that decision-making style vary with regard to the quantity of information available at the disposal of decision makers, the amount of alternatives that presents itself, and the degree to which decision makers strive to put together and coordinate several sources of input (information). This supports the earlier position of Eisenhardt (1989) who argues that the larger the amount of information available to a decision maker, the quicker the decision-making even when various sources of information are put into consideration. Eisenhardt's theory is contrary to traditional decision theory which acknowledges that the speed of decision making slows down when dealing with large and multiple sources of information.

However, Asaari and Razaki (2007) positthat decision making style may be categorised based on the approach used by decision makers in solving organisational problems and that these styles are grounded on the individual manager's perspective toward decision making. Bartol and Martin, cited in Asaari and Razaki(2007) contend that multiple models of decision-making style exist in literature and these include: rational style, non-rational style, satisficing style, incremental style, and garbage-can style. Scott and Bruce (1995) also, categorised decision-making style into five different groups which they tagged General Decision Making Style (GDMS). These classifications include: rational, intuitive, dependent, avoidant, and spontaneous decision-making style. Rational decision-making style denotes that individual engrossed in rational decision processes anticipate the need for it, and adequately equipped with all necessary information suitable to make an effective decision. Intuitive decision-making suggests that managers rely solely on premonitions and feelings without adequate information to make optimal decisions. This may be from any of these sources; innate response, general experience or focused learning (Patton, 2003). Dependant style describes managers that rely heavily on direction and support of subordinates or other individuals to make vital decisions. This type of manager always search for advice and direction from others to arrive at decisions. Avoidant decision-maker, try to avoid decision-making or perhaps postpone making of vital decisions either for fear of failure or any other reasons. Spontaneous decision makers are known for making sudden and impulsive decisions. They are quick in making

decisions and always eager to come through the decision making process as rapidly as possible (Omotola, 2012).
In contrast, Miller, Hickson and Wilson (1996) argue that decision-making is satisficing rather than maximising. They contend that decisions cannot be made wholly in a rational way considering the constraints of organisational sophistication and the cognitive abilities of managers. As a result of this, this paper considers decision-making style from the four forces that determine how decisions are made as argued by Rowe, cited in Amzat and Idris, (2012). This is because it is essential to explore individuals' decision within background of their set of needs, predisposition and the desired values taking into accounts apparent individual differences that manifest and become stable overtime. These styles are as follows:(i) **Analytic style**- this possesses the distinctive feature that is challenge-based achievement with complex reasoning attained through a methodical and slow decision making process; (b) **Behavioural style**- which promotes effortless reasoning, individual orientation and make employees feel valued within the organisation by creating an enabling environment that allows compromise to be reached and enhance better communication; (c)**Conceptual style**- the achievement of the organisation is based on the intrinsic rewards which are psychological, usually non-financial rewards that workers receive from performing their task meaningfully and doing it successfully. This includes rewards such as praises and recognition, which Thomas (2009) regards as the reinforcements that keep workers actively self-encouraging and enhances their work engagement. This style improves the employee's orientation and encourages creativity and idealistic environment; and (d)**Directive style**- the characteristics of this include authoritative power and dominant behaviour by the superior with clarity of purpose and simple reasoning or rational thinking.

Competitive strategy

Ansoff (1984) argues that the strategic management science as a field of study became prominent in the late 1950's, when organisations needed to develop a methodical approach in deciding where and how organisation will carry on with its future business. This assertion was corroborated by researchers that the key reasons of strategic management research is to assist organisations identify and decide ways of improving their performance (Crook, Ketchen, and Snow, 2003). Competitive strategy involves a series of methodical and linked decisions that put business organisation in a vantage point to compete favourably with its business rivals. The concept of competitive strategy originates from Porter's (1980; 1985), 'competitive advantage theory' which turned intoan axiom towards the end of the 20th century. Competitive advantage was developed by Porter to enable organisations sustain their ability to improve performance and be more innovative in their approaches to enhance quality of their products.
The essence of competitive strategy is to enjoy superior profit margin and remain competitively relevant in the marketplace to attain success (Porter, 1985). Therefore, competitive strategies that are used mostly in business organisation including construction business as categorised generically by Porter are to either (1) strive to be the industry low-cost producer through cost-based business strategy, (2) practice different strategy based on quality, superior performance or technological dominance, and (3) concentrate on a market segment using focus strategy to achieve competitive advantage by performing more than the competitors in providing more value to the product required by the buyers. These strategies are adopted within the construction industry as a result of the proliferation of construction organisations on a yearly basis, which forces the existing construction firms, to eliminate the potential barriers of new

entrants to the business (Isik Arditi, Dilmen, and Birgonul, 2010). This is achieved by adopting more proactive and competitive strategies: focus, low-cost or differentiation, to undertake or secure construction works that are beyond the capability of the new entrants (Isik et al., 2010). Hence, alignment of these strategies to the five competitive forces: threat of new entrants; threat of substitute products or services; bargaining power of suppliers; bargaining power of buyers; and rivalry amongst existing firms, as given by Porter, will provide organisations with the opportunity to identify and develop core competence skills required to achieve sustainable competitive advantage and performance excellence.

Pearce and Robinson (2007) contend that in an ideal strategic management setting, decision makers must come from all the three decision-making hierarchy levels of an organisation: Corporate, Business or Competitive, Functional levels. This is because strategic decision-making exhibit an immense influence on organisations and demand huge commitment of organisation resources to align decision makers with the type of strategic goals and strategies they are more often than not responsible (Pearce and Robinson, 2007). The focus of this paper is on competitive strategy and as such decisions at business-level is of more importance. At this level, decision-making moves beyond conceptualisation and tends to be more effective in bridging the gaps between corporate and functional decision-making levels (Pearce and Robinson, 2007). Here, the manager translates strategic direction statements and intent into concrete objectives and strategies, and determine how organisation will compete in theindustry (Pearce and Robinson, 2007).

Organisational performance

The continuous increase in the number of construction organisations denotes fierce competition, most especially in the South African context, where over 30 Acts relating to the construction industry have been enacted in nearly two decades to balance the inequality of the past and give preference to black owned organisations (cidb, 2004). Consequent upon this, construction organisations are confronting many issues of how to continuously exist in the industry by formulating strategies and making viable and feasible business decisions. Decision makers within an organisation require multiple sources of information to make quick decision on the ways to achieve the strategic goals of their organisation (Eisenhardt, 1989; Tatum et al., 2003). In making these decisions, considerable amount of information are needed, thus it becomes necessary for organisation decision makers to reappraise past decisions and evaluate their strategies to ensure the organisations objectives are being realised (David, 2011). This requires measuring the performance of the organisation. The measures of performance may be subjective or objective; this has generated heated arguments within the performance literature (Allen, Dawson, Wheatley and White, 2008). The two categories of performance measures have their own inherent merits and demerits. According to Allen et al. (2008), objective measures of performance such as return on investment, return on asset or return on capital appears to be more concrete in explaining organisations performance, but they are often limited in scope to financial or accounting data.

However, the inappropriateness of objective measures as insufficient for planning and making decisions for the healthy growth of organisations has been identified byWongrassmee, Gardiner and Simmons (2003) and Jusoh, Ibrahim and Zainuddin (2008). This is considered unsuitable for this studybecause their focus is limited to easily measurable standards such as profitability and do not consider other norms essential to competitive success (Liviu, Sorina, and Radu, 2008). The Subjective measures as argued by Allen et al. (2008), are leading indicators but indeterminate. Subjective measures by and large offer the researcher a comprehensive description of how effective an organisation is with respect to their industry or market competitors (Allen et al., 2008). Subjective measures of organisational performance permit a wider range of organisations to be contrasted unlike the objective measures that frequently constraint the breadth and scope of organisations that can be involved within a single study (Allen et al., 2008). Therefore, this paper views organisational performance from both perspective in relation to their competitiveness from multiple organisational standpoints and this comprises of accounting data, objective fulfilment and overall performance of the organisation. Therefore, effective managerial decision-making style can be assumed to exhibit a higher influence on organisational performance and as such, the paper hypothesised that:

Hypothesis 1: There is a positive and direct relationship between overall organisational performance and decision-making styles

Hypothesis 2: Decision-making styles moderate the relationship between competitive strategies and organisational performance.

Hypothesis 3: There is significant relationship between different measures of organisational performance with competitive strategy as moderated by decision-making style.

RESEARCH METHOD

The sample used in this study comprises of 277 large construction organisations functioning in the South African construction industry and listed inGrade 7 to 9 of the cidb Contractor Register. These categories are selected because the study intends to investigate the impact of the organisation decision-making styles and competitive strategy on performance which may not be uniformly distributed amongst small andmedium sized construction organisations due to their size. Small or medium organisations are considered to be more centralised than large organisations, thus decision-making iscentralised (Pertusa-Ortega et al., 2010). The research adopted an internet-based survey approach to administer questionnaires to top management staff of the sampled companies. This approach eliminates the barriers ofpostal surveys and allows the researcher to build in dynamic error tracking mechanism for consistency of response throughout the survey (Easterby-Smith, Thorpe and Jackson, 2012). The target respondents are the chief executive officers and senior management employees that have deep and broad knowledge of the organisation philosophy and its processes (Goll and Rasheed, 1997). They are considered to be the most suitable respondents for the research so as to explain the decision-making structure and strategic postures of their organisations (Pertusa-Ortega et al., 2010). A total of 72 (approximately 26%) valid responses were obtained and analysed. The constructs used for the questionnaire are derived from extensive review of extant literature as discussed in the following subheadings.

Operationalization of constructs

Decision-making style- The decision-making styles in this study is synonymous with problem-solving skills of managers or leaders of organisation identified by Lansley (1987). Although, the styles of decision-making used in this paper are based on

Rowe's classification, which made it easy to understand the cognitive aspect of managers in decisions making. The styles also assist in having full knowledge of how individuals view and approach problems within an organisation. Hence, the variables used in measuring the decision-making styles were adopted from Amzat and Idris (2012). This study measures the styles of decision-making- analytic, behavioural, conceptual and directive on a five point likert scale.

Competitive strategy- This paper considers the three generic strategy as classified by Porter (1980; 1985) and the generic strategies are measured with multi-item five-point likert scales. The study combines previously adopted items of measurement used by earlier researchers both within and outside construction management research, and adapts same to measure competitive strategy used by organisations (Kale and Arditi, 2002; Nandakumar, Ghobadian and O'Regan, 2010).

Organisational performance- This study analyses the performance of organisations from both subjective and objective perspectives. Some authors' view that subjective measures of performance are more suitable in measuring organisational performance because it strengthens generalizability of the findings (Allen et al., 2008; Pertusa-Ortega et al., 2010). Therefore, organisational performance wasmeasured subjectively using overall objective fulfilment scale used in Nandakumar et al. (2011) on a multi-item five-point likert scale. The objective measure of performance used is the Return on Capital Employed (ROCE), this is because it indicates the level of effectiveness of organisational management of financial resources in the growth of its business. ROCE has been used in previous studies to measure performance in construction context, because it offers concrete evidence in the explanation of organisations performance (Ibrahim, Ibrahim, Kabir, 2009; Oyewobi, Windapo, Cattell, 2013).

Control variables- This paper adopts the size of organisation and number of years in business as a control variable to remove any potential influence it might pose on organisational performance (Pertusa-Ortega et al., 2010). This is because organisation size is a contingent variable that is capable of influencing the decision-making style due to the structure and design of the organisation (Pertusa-Ortega et al., 2010). Therefore, size of organisation was measured by the natural logarithm of organisation's employee's number; this will eliminate any potential effects on organisational performance due to the heterogeneity in the size of organisations considered.

Data analysis, Presentation and Discussion

The data were analysed using descriptive, parametric and multiple regression method of data analysis to establish the relationship and determine the impact of the variables on one another. The analysis follows the method used by Goll and Rasheed (1997), Baum and Wally (2003) and Huang (2001) for identifying moderating variables.

Table 1 shows the descriptive statistics (means and standard deviations) and Pearson product-moment correlation. The correlations between competitive strategies, decision-making styles and measures of performance show that all the four types of decision-making styles are present within the organisations considered and are being used whether knowingly or without attention. Directive style of decision-making shows negative but significant association with the overall performance of organisation while differentiation strategy is negatively but significantly associated with objective performance measure (ROCE). However, this does not support hypothesis 1, because the relationship is negative, it thus proposes the need to explore the role of related variables as potential moderators of the association.

Regression analysis was conducted to examine whether there is a significant relationship between the constructs stated in the hypotheses. Table 2 shows the direct relationship among the variables with the measures of organisational performance, while Table 3 shows the moderated effect of decision-making styles controlled with organisational size and years of existence in the construction business. Model 2 indicates that the main effect was significant on objective performance measures (financial) and also shows that differentiation strategy is significantly related to objective performance. This is consistent with the findings of Spencer, Joiner and Salmon (2009) and Teeratansirikool, Siengthai, Badir and Charoenngam (2013), who assert that differentiation strategy influence organisational performance through financial measures. Direct but negative relationship exists between analytical decision-making style and overall organisational performance (Goll and Rasheed, 1997).

Table 1: Means, standard deviations, and correlations

	Mean	Std. Deviation	Directive style	Analytical style	Conceptual style	Behavioural style	Differentiation strategy	Cost-leadership strategy	Focus strategy	Subjective measures	Objective measures	Overall performance
Directive style	4.0694	0.75669	1									
Analytical sytle	4.25	0.74588	.343**	1								
Conceptual style	3.9167	0.83497	0.21	.328**	1							
Behavioural style	3.8194	0.89327	.352**	0.005	.319**	1						
Differentiation strategy	4.1157	0.39425	0.067	-0.02	-0.17	0.034	1					
Cost-leadership strategy	4.0972	0.43583	-0.135	0.105	-0.068	-0.081	0.209	1				
Focus strategy	4.0382	0.45706	0.043	0.106	-0.01	0.043	0.109	0.111	1			
Subjective measures	4.1574	0.33822	0.021	0.073	-0.061	-0.192	0.146	0.185	0.091	1		
Objective measures	503.3556	1732.97741	-0.182	0.141	0.196	-0.165	-.345**	0.12	-0.007	-0.077	1	
Overall performance	3.9583	0.86297	-.276*	-0.137	-0.083	-0.028	0.194	0.192	0.12	0.022	-0.131	1

**p<0.01:

This also supports the assertion of Amzat and Idris (2012) in a research conducted among research universities in Malaysia, it was found that analytical style is dominant and decision-making style influence job satisfaction of the group studied.

The moderated regression results (model 5) indicate that decision-making style moderates the relationship between cost-leadership and differentiation strategies and objective performance, this corroborates hypothesis 2 and 3 earlier stated. These findings is in line with the results of Dess and Davis (1984), Power and Hahn (2004) and Allen and Helms (2006), who found that a positive relationship between cost-leadership and organisational performance. The results are also in harmony with the findings of Goll and Rasheed (1997) and Baum and Wally (2003), who established that decision-making is a strong predicator of organisational performance when used as moderators. Hence, these results provide evidence to support the three hypotheses stated in the paper.

Table 2: Results of regressing of organisational performance on decision-making styles and strategies

	overall performance		Objective		subjective	
	Model 1		Model 2		Model 3	
Independent variables	Beta	t	Beta	t	Beta	t
(Constant)		1.426		1.008		4.357**
Directive style	0.062	0.424	-0.005	-0.032	-0.167	-1.089
Analytical style	-0.304**	-2.302	-0.176	-1.372	0.074	0.535
Conceptual style	-0.055	-0.436	0.124	1.014	0.06	0.452
Behavioural style	0.001	0.008	0.11	0.834	-0.018	-0.126
Differentiation strategy	0.18	1.488	-0.349**	-2.977	0.08	0.631
Focus strategy	0.098	0.817	0.012	0.101	0.087	0.693
Cost-leadership strategy	0.113	0.933	0.16	1.364	0.146	1.152
R2		0.158		0.204		0.075
F-Model		1.716		2.35**		0.741

Table 3: The moderating effects of decision-making styles on strategies and organisational performance

	overall performance		Objective		subjective	
	Model 4		Model 5		Model 6	
	Beta	t	Beta	t	Beta	t
(Constant)		5.495***		1.036		13.457***
Differentiation strategy x Dms	-0.01	-0.052	-0.571	-3.191***	-0.024	-0.124
Cost-leadership strategy x Dms	-0.019	-0.107	0.373	2.188**	0.115	0.626
Focus strategy x Dms	-0.058	-0.329	0.109	0.658	0.01	0.055
Organisation size(log)	-0.371	-1.757	-0.065	-0.328	-0.099	-0.46
Organisation's years of existence (log)	0.23	1.089	-0.015	-0.077	0.177	0.828
R2		0.05		0.15		0.02
F-model		0.671		2.264*		0.258

CONCLUSIONS AND IMPLICATIONS

The findings from the analyses give support to the role of decision-making styles as a mediator in the association between competitive strategies and organisational performance. The empirical findings lend support to the hypotheses stated in the paper that direct association exists between decision-making style but negatively related and also moderate the relationship between objective measures of performance and competitive strategies. Based on these findings, it can be concluded that the lesser the differentiation strategies used by construction company management in South Africa, the better their performance financially. Implying that organisations can adopt differentiation strategy to achieve high market share and then adopt cost-leadership to improve their objective performance. However, the results of this study have to be made clear considering the limitations ranging from research design, choice of data sourced and unavoidable trade-offs involved in the interpretation procedures.Competitive strategy and decision-making style attributes cannot be measured objectively, thus subjective data using opinion scales were employed. The sample used was limited to large construction organisations based in South Africa and depend on a respondent per each organisation, hence the results cannot be generalised to other smaller construction and service organisations in the industry.

However, the research findings present some implication for future research. It makes explicit the need to have a better understanding of the moderating role of different decision-making styles and their influence on organisational performance through competitive strategies. It is also essential to study these effects in relation to the dimensions of the environment concurrently so that content specificity of the different styles can be ascertained. Although, this study did not consider this, but there is a need to take cognisance of how organisational core capabilities influence these variables. In summary, this research made the need to consider different decision-making styles being practiced within an organisation as it affects its performance beyond rational processes apparent.Abetter understanding of this will enable organisations achieve superior corporate performance.

ACKNOWLEDGEMENT

The financial assistance of the National Research Foundation (NRF) towards this research is hereby acknowledged. Opinions expressed or conclusions arrived at, are those of the authors and are not necessarily to be attributed to the NRF.

REFERENCES

Allen, R. S. and M. M. Helms (2006), ‘Linking Strategic Practices and Organizational Performance to Porter’s Generic Strategies’, Business Process Management, 12(4), pp. 433-454.

Allen, R.S., Dawson, G. Wheatley, K. and White, C.S. (2008). Perceived Diversity and Organizational and correlates. Journal of Employee Relations, 30(1): 20-33.

Amzat, I. H. and Idris, A. R. (2012) Structural equation models of management and decision making styles with job satisfaction of academic staff in Malaysian Research University. International Journal of Educational Management, 26(7), 616-645

Ansoff, H.I. (1984). Implanting Strategic Management. Englewood Cliff: Prentice Hall N.J.

Asari, M. H. A. H. and Razak, R. C. (2007) Strategic decision making practices and organization performance: a conceptual perspective of malaysian organizations. In the proceeding of Oxford Business and Economic Conference, June 24-26: Oxford University, UK. 0-14.

Baack, D. W. and Boggs, D. J. (2008) The difficulties in using a cost leadership strategy in emerging markets. International Journal of Emerging Markets Vol. 3 No. 2, pp. 125-139

Bain, J.S. (1956), Barriers to New Competition, Harvard University Press, Cambridge, MA.

Baum, J.R. and Wally, S. (2003), "Strategic decision speed and firm performance", Strategic Management Journal, Vol. 24, pp. 1107-29.

Chew, D. A. S., Yan, S. and Cheah, C. Y. J. (2008) Core capability and competitive strategy for construction SMEs in China. Chinese Management Studies, 2(3), 203-214.

Chung, H. F. L. (2008) The impact of a centralised organisational structure on marketing standardisation strategy and performance: the experience of price, place and management processes. Journal of Global Marketing, 21(2), 83-107.

Chung, H. F. L., Wang, C. L. and Huang, P-h (2012) A contingency approach to international marketing strategy and decision-making structure among exporting firms. International Marketing Review, 29(1), 54-87.

Construction Industry Development Board (2012), Construction industry indicators, March 2012, South Africa

Crook, T.R., Ketchen, D.J. Jr., and Snow, C.C. (2003), "Competitive edge: A strategic management model," Cornell Hotel and Restaurant Administration Quarterly, 44(3), 44-53.

David, F. R. (2011) Strategic Management: concepts and cases. 13th ed. New Jersey, Prentice Hall.

Dean, Jr. J. W. and Sharfman, M. P. (1996) Does Decision Process Matter? A Study of Strategic Decision-Making Effectiveness. The Academy of Management Journal, 39(2), 368-396

Dess, G. G. and P. S. Davis (1984), 'Porter's (1980) Generic Strategies as Determinants of Strategic Group Membership and Organizational Performance', Academy of Management Journal, 27(3), pp. 467-488.

Easterby-Smith, M., Thorpe, R. and Jackson, P., (2012) Management Research. London: Sage Publications

Eisenhardt, K. M. (1989) Making Fast Strategic Decisions in High-Velocity Environments. Academy of Management Journal, 32(3), 543-576

Goll, I. and Rasheed, A.M.A. (1997), "Rational decision-making and firm performance: themoderating role of environment", Strategic Management Journal, Vol. 18 No. 7, pp. 583-91.

Govindarajan, V. (1989) Implementing Competitive Strategies at the Business Unit Level: Implications of Matching Managers to Strategies. Strategic Management Journal, 10, 251-269.

Huang, T-C, (2001) The effects of linkages between business and human resources management strategies. Personnel Review, 30(2), 132-151

Ibrahim, Y. M., Ibrahim, A. M., Kabir, B. (2009), Geographic diversification, performance, and the risk profile of UK construction firms, Journal of Engineering, Design and Technology, 7(2), 171 – 185

Isik, Z., Arditi, D., Dilmen, I. and Birgonul, M. T. (2010), The role of exogenous factors in the strategic performance of construction companies, Journal of Engineering, Construction and Architectural Management, 17(2), 119-134

Jusoh, R., Ibrahim, D. N. and Zainuddin, Y. (2008). The performance consequence of multiple performance measures usage: Evidence from the Malaysian manufacturers. International Journal of Productivity and Performance Management, 57(2), 119-136

Kale, S. and Arditi, D. (2002) Competitive Positioning in United States Construction Industry, Journal of Construction Engineering and Management, 128(3), 238–247.

Lansley, P. (1987) Corporate strategy and survival in the UK construction industry, Construction Economics and Management, 5, 141-155

Lawrence, P. R., and Lorsch, J. W. (1967) Differentiation and integration in complex organisations. Administrative Science Quarterly, 12(1), 1-47.

Lee, J. and D. Miller (1996), 'Strategy, Environment and Performance in Two Technological Contexts: Contingency Theory in Korea', Organization Studies, 17(5), pp. 729-750.

Liviu, C., Sorina, G. and Radu, O. (2008), Strategic control and the performance Measurement systems. Management and Marketing, Journal of Faculty of Economics and Business Administration, University of Craiova, Romania, Stiinţe Economice Tom xvii, 4, 189-194.

Mason, E.S. (1939), "Price and production policies of large scale enterprises", American Economic Review, Vol. 29 No. 1, pp. 61-74.

Miles, R. E., & Snow, C. C. (2003) Organizational strategy, structure, and process (2nd ed.). Stanford, CA: Stanford University Press

Miller, S.J., Hickson, D.J., and Wilson, D.C. (1996). Decision making in organizations. In S.R. Clegg, C. Hardy, & W.R. Nord (Eds.), Managing Organizations: Current Issues (pp.43-62). London: Sage Publications.

Nandakumar, M K, Ghobadian, A and O'Regan, N (2010) Business-level strategy and performance: The moderating effects of environment and structure. Management Decision, 48(6), 907-939

Nooraie, M. (2012) Factors Influencing Strategic Decision-Making Processes International Journal of Academic Research in Business and Social Sciences, 2(7), 405-429

Omotola, O. (2012) An investigation into Decision Making Styles practices and preferences of human resource managers in the Banking Industry in South-western Nigeria. European Journal of Business and Management, 4(11), 1-6.

Oyewobi, L. O., Windapo, A. O. and Cattell, K. S. (2013) Impact of business diversification on South African construction companies' corporate performance. Journal of Financial Management of Property and Construction. 18(2), 110-127

Panagiotou, G. (2008) Conjoining prescriptive and descriptive approaches: Towards an integrative framework of decision making. A conceptual note. Management Decision Vol. 46 No. 4, pp. 553-564

Parnell, J. A (2013). Strategic management: Theory and practice, 4th ed, Sage Publications.

Patton, J.R.,(2003) Intuition in Decisions. Journal of Decision Making, 43(10):989-996.

Pearce II, J. A., Robinson, Jr. & Richard B. (2007).Strategic Management, Formulation, Implementation, and Control Tenth Edition. Boston, MA. McGraw-Hill/Irwin

Pertusa-Ortega, E. M., Molina-Azorin, J. F. and Claver-Cortes, E. (2008) A comparative analysis of the influence that different fit perspectives have on firm performance. Management Research, 6(2), 139–150.

Pertusa-Ortega, E. M., Molina-Azorin, J. F. and Claver-Cortes, E. (2010) Competitive strategy, structure and firm performance: a comparison of the resource-based view and the contingency approach. Management Decision, 48(8), 1282-1303.

Porac, F.J., Thomas, H., Wilson, F., Paton, D. and Kanfer, A. (1995), "Rivalry and the industrymodel of scottish knitwear producers", Administrative Science Quarterly, Vol. 40 No. 2, pp. 203-20.

Porter, M. E. (1980). Competitive advantage: creating and sustaining superior performance. New York: Free Press.

Porter, M. E. (1980). Competitive advantage: creating and sustaining superior performance. New York: Free Press.

Porter, M. E. (1985) Competitive Advantage: Creating and Sustaining Superior Performance (Free Press, New York).

Power, T.L. and Hahn, W. (2004), "Critical competitive methods, generic strategy and firm performance", International Journal of Bank Marketing, Vol. 22 No. 1, pp. 43-64.

Raffaldi, S., Iannello, P., Vittani, L. and Antonietti, A. (2012) Decision-Making Styles in the Workplace: Relationships between Self-Report Questionnaires and a Contextualized Measure of the Analytical-Systematic Versus Global-Intuitive Approach. Sage Open Journal, 2, 1-11

Rehman, R. R. (2012) Impact of Employee Decision Making Styles on Organizational Performance: In the Moderating Role of Emotional Intelligence. World Applied Sciences Journal 17 (10), 1308-1315.

Robbins, S.P. and Coulter, M. (2005). Management, 8ed., NJ: Pearson Education, Inc.

Roca-Puig, V., & Bou-Llusar, J.C. (2007) Organizational fit andperformance in Miles and Snow's configurational theory.Management Research, 5 (1), 17–28.

Scott, W. (2003) Organisations: rational, natural and open systems. Englewood Cliff, NJ: Prentice Hall.

Shirazi, B., Langford, D. A. and Rowlinson, S. M. (1996), Organisational structure in the construction industry, Construction Management and Economics, 14(3), 199-212

Shirazi, B., Langford, D. A. and Rowlinson, S. M. (1996), Organisational structure in the construction industry, Construction Management and Economics, 14(3), 199-212

Spencer, X., Sarah, Y., Joiner, T.A. and Salmon, S. (2009), "Differentiation strategy, performance measurement systems and firm performance: evidence from Australia", International Journal of Business, Vol. 14 No. 1, pp. 1-22.

Tatum, B.C., Eberlin, R., Kotttraba, C., and Bradberry, T. (2003). "Leadership, decision making, and organizational justice," Management Decision, 41(10), pp. 1006-1016.

Teeratansirikool, L. Siengthai, S. and Badir, Y. (2013) Competitive strategies and firm performance: the mediating role of performance measurement. International Journal of Productivity, Vol. 62 No. 2, 2013, pp. 168-184

Thomas, K. (2009). The four intrinsic rewards that drive employee engagement, retrieved on 15/04/2013 from http://www.iveybusinessjournal.com/topics/the-workplace/the-four-intrinsic-rewards-that-drive-employee-engagement#.UWsruUpquKk.

Wongrassamee, S., Gardiner, P.D and Simmons, J.E.L (2003), Performance measurement tools: the balanced scorecard and EFQM excellence model, Measuring Business Excellence, 7(1), 14-29

Yukl G. (1994) Leadership in Organizations, (3rd ed). Englewood Cliffs, NJ: Prentice-Hall

CORRELATES OF CLIENTS' PAYMENT PATTERNS AND CONSTRUCTION PROJECT PERFORMANCE

Akinsiku Olusegun Emmanuel[1] and Olubunmi Atinuke Johnson
Department of Building, University of Lagos, Nigeria.

Construction projects all over the world are infamous with the occurrence of time overruns and non-performance. The non-performance in this sector of the economy has been a source of concern to stakeholders in the industry. Studies have identified several factors responsible for this. The effect of client's payment pattern on construction project delivery and performance was examined in this study with a view to identifying the various payment patterns utilised in a construction project, discover the major effects imposed on the project by these payment patterns, and the most suitable payment pattern for effective project delivery. To achieve these objectives, a survey was undertaken to obtained data from 120 respondents who practice as project consultants, contractors, project management organisations and financiers. The respondents were selected from construction practitioners in Lagos State, Nigeria, being a core area of construction activities. Six payment patterns were used during the course of the research; cost-reimbursement, incentives, open-book pricing approach, advance payments, milestone payments, and direct payments. Advance payment was found to be the most acknowledged payment while claims and extension of time was established to be the major effects of client's payment patterns on construction project delivery. The study also presents a relationship between clients' payment pattern and project performance. Key implication of the study to construction practitioners is that prompt payment by clients to contractors will make the construction industry less litigious and prevents contractors from factoring risks of delayed payment into bids.

Keywords: cost, delivery, payment pattern, performance, time

INTRODUCTION

The construction industry plays a key role in satisfying a wide range of physical, economic, and social needs. Its delivery involves systematic planning and implementation of the client's requirements (Idoro, 2008). Construction encompasses series of activities that the project stakeholders perform from inception to completion. However, these tasks do not always come easily as series of projects compete for limited resources (Walker, 2007). Funding-related matters in construction have been identified to be one of the main causes of non-performance of construction projects, with payment related issues accounting for the majority of these. Researchers in construction management ranked clients' cash flow and payment problems a major factor in the delay of projects (Abdul-Rahman *et al.*, 2009; Dlakwa and Culpin, 1990; Odeyinka and Yusif, 1997). The degree of financial solvency of construction clients has been investigated to have a strong relationship with project performance (Lim and Ling, 2002).

[1] eoakinsiku@yahoo.com

Akinsiku, O.E. and Olubunmi, A.J. (2014) Correlates of clients' payment patterns and construction project performance *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference*, 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 223-232

The complex structure of the contracting and sub-contracting makes the construction industry a unique one. The industry is also known to be labour-intensive, as such contractors need regular and prompt working capital to be able to settle payments for labours, sub-contractors, materials, supplies, equipment rentals, overhead, and similar expenses. A general contractor sometimes require the inputs of specialise sub-contractors to undertake some specific aspect of the work. These sub-contractors are generally small and medium-sized entrepreneur business (SME), as such access to bank credit is limited and dependence on cash-flow from the general contractor is high to guarantee continuous performance. Understanding the effects of client's payment patterns on project delivery is necessary for all project stakeholders on a construction project. Delays in payments to contractors may affect their programmes and plans, thereby impeding the progress of work and affecting performance (Odusami and Olusanya, 2002; Sweis *et al*. (2007).

Previous researchers' have identified delay of payment by clients as one of the common risk affecting time overruns of projects (Ameh and Osegbo, 2011; Durdyev, Ismail and Abu Babar, 2012; Mahamid, 2013). The Department for Business, Innovation and Skills (DBIS), (2013) in a related study of UK construction, identified factors that determine successful delivery of a construction project to include equitable financial arrangements and certainty of payment. It was reported that late payment portends problem for construction businesses, and construction contracting SMEs rely on trade credit to smooth cash flow during the period between doing the work and receiving payment. In a related study by Dlakwa and Culpin (1990), lack of prompt payment to contractor was identified to be the major underlying problem affecting performance. This was substantiated by Sambasivan and Soon (2007), who identified the finance and payment for completed works as the major causes of delay caused by the client.

This paper therefore seek to identify the type of payment pattern that can best suit construction projects, examine the effects of different payment patterns on the delivery of a construction project and identify the effects of clients' payment patterns on construction performance in a bid to achieve optimum project delivery.

PROJECT PERFORMANCE

The performance of construction projects has always been an area of concern in the construction industry. Performance of a project has been described as the degree of achievement of certain effort or undertaking. It relates to the prescribed goals or objectives which form the project parameters and that strategically aligns with the set goals of the organisation (Shenhar, Gordon and Alexander, 1996). From project management perspective, it is all about meeting or exceeding stakeholders' needs and expectations of a project. However, Rad (2003) noted that the perception of success or failure of a project is usually based on some factual evidence which may be personal. Rad (2003) therefore suggested the need for a set of performance indices that formalize the process and make explicit what is implicit in these seemingly subjective evaluations.

Chitkara (2005) opines that project performance measurement involves placing consideration on three major project elements of time, cost and quality. Pinto and

Slevin (1988) identified the successful implementation of a project as one which comes in on-schedule, comes in on-budget, and achieves basically all the goals originally set for it, and, is accepted and used by the clients for whom the project is intended. Among these industry accepted project success metrics; cost is perceived in high esteem. Odusami and Olusanya (2002) pointed out that there exists a high positive correlation between the time performance and the cost performance of a project. This implies that the variable of cost is related to time; hence the effect of the former is often the same with that of the latter (Idoro, 2008).

According to Odusami and Olusanya (2002), and Njie *et al.* (2006), certain effects that were imposed as a result of the use of a client's payment pattern on construction project delivery. These include:

- The use of undesirable techniques/terms by one party to protect its own interest
- Slow execution of work
- Claims
- Adversarial attitudes
- The impartiality of the contract administrator being compromised resulting in conflict of interest.
- The imposition of unfair terms on the contractors and sub-contractors
- Extension of time
- Accumulation of interest charges
- Late return of income
- Insolvency of contractor
- Additional interest charges
- Extra taxes and duties
- Abandonment of project

For the performance of construction projects, availability of working capital in terms of payment by the client to the contractor, and the general contractor to its sub-contractors is very important.

RESEARCH METHODS

The research being quantitative made use of a well-structured questionnaire to elicit information from respondents to achieve its objectives. The research involves a cross-sectional survey of construction professionals doing business in Lagos State, the commercial hub of Nigeria. A location that boasts to have the highest number of registered construction, contracting and consultancy organizations with the various professional institutions, and a high professional concentration. This is evident by the high volume of construction workload and activities in the last decade.

The study was restricted to the construction stakeholders and firms. The target population for this study comprised core building industry professionals who are involved in the procurement of building projects, and have a wide knowledge in practice of building construction delivery. These include architects, builders, construction managers, structural engineers, quantity surveyors, and services engineers. The population sample was drawn from professionals in client organizations, consulting and contracting organizations in operating in Lagos State. A

total of 120 professionals were purposively selected. This is buttressed by Babbie (1995) which states that with purposive sampling it will be possible to do more intensive study by focusing on the key stakeholders in the industry with adequate knowledge on the issues pertaining to the study. The questionnaire was divided into two sections; the first section attempted to obtain information with respect to the designation of the respondents, professions, educational qualification and job experience. These are called moderating variables. The other section elicited information pertaining to the study.
Personal distributions of the questionnaires were done by the researchers, with personal interviews and in some occasions. The data were processed and analysed using SPSS statistical analysis software. Descriptive statistics, using percentages (%) were applied to collect data where applicable, from variables in the study.

RESULTS OF ANALYSIS

Of the 120 questionnaires that were administered to the population, analysis was done based on the 90 returned showing a 75% response rate which is encouraging and sufficient for generalisation. The results of this analysis can thus be said to be unbiased as the result of any survey is biased and is of little importance, if the return rate is lower than 30 - 40% (Moser and Kalton, 1971).

Table 1: Respondent's information

Respondents information	Frequency	Percentage of respondents
Gender		
Male	75	83.3
Female	15	16.7
Profession		
Architecture	15	16.7
Building	12	13.3
Civil/Structural Engineering	15	16.7
Quantity Surveying	48	53.3
Highest Qualification		
OND	9	10.0
HND	15	16.7
B.Sc/B.Tech	48	53.3
M.Sc/M.Tech	18	20.0
Years of Experience		
Under 5 years	30	33.3
6-10 years	54	60.0
11-15 years	6	6.7

Table 1 shows the general information of the respondents in the population sample. It is divided into sections; gender, profession, highest qualification and years of experience.

The gender information of the respondents shows that 83.3% are males and 16.7% are females. This is as a result of the high number of males in the construction industry as compared to females. The professional background of the respondents shows; 53.3% are quantity surveyors, 16.7% of the respondents are architects, 16.7% are civil/structural engineers, and 13.3% of the respondents are builders. This shows that a greater percentage of the respondents are quantity surveyors, thereby creating a greater prospect of validity to the research as quantity surveyors deal directly with the payment issues.

Table 1 further depicts a majority of the respondents being university graduates with 53.3% of the population having a Bachelor degree. Around 20% are holders of a Masters degree, 16.7% are Higher National Diploma holders, and 10% have Ordinary National Diploma. This adds to the validity of the research as a result of the adequacy of the educational qualification of the respondents. The associated professional body is also portrayed in the table, with NIQS having 46.7% of the respondents, 16.7% belonging to Nigeria Society of Engineers, 13.3% are members of Nigeria Institute of Architect, 10% belonging to Nigeria Institute of Building, while four (4) respondents have no affiliation with any professional body. This indicates that quite a lot of the respondents are registered professionals in the industry.

The years of experience of the respondents are shown; 60% having 6-10 years of professional experience in the field, 33.3% of the respondents have less than 5 years of experience, and 6.7% have 11-15 years of experience. These are indications that the respondents' experience and levels are adequate, thereby adding to the validity of the research.

Table 2: Nature of services rendered by the firm

Services	Frequency	Percentage
Consultancy	57	63.3
Contracting	24	26.7
Project Management	9	10.0

Table 2 shows the nature of services rendered by the respondents' firms. 63.3% of the respondents offer consultancy services, 26.7% are under contracting organisations, and 10% of the respondent offer project management services.

Most used payment pattern in the construction industry

The respondents were asked to identify the payment pattern which is frequently used by their organisations. Mobilisation by advance payment was mostly chosen with 43.3% of the total amount of respondents, 33.3% stated that milestone payments were often, 6.7% of the respondents declared the use of open-book pricing approach; another 6.7% stated they use direct payments, and 10% of the respondents chose cost-reimbursable methods. This analysis is shown on table 3.

Table 3: Most used payment pattern

Payment pattern	Frequency	Percentage
Mobilisation by advance payment	30	33.3
Cost reimbursable	9	10.0
Open book pricing approach	6	6.70
Mile stone payment	30	33.3
Direct payment	6	6.70

Performance of payment pattern

Respondents were asked to rate the performance of payment patterns used based on a five (5) point Likert scale, ranging from excellent to poor. After analysis was carried out, mobilisation by advance payments was adjudged best with a mean score of 4.07, this was followed by milestone payment with a mean of 3.73. Others such as, direct payment, cost-reimbursable, incentives and open-book pricing followed and ranked 3rd, 4th, 5th, 6th respectively. Details of the analysis are provided in Table 4.

Table 4: Types of payment pattern used in the construction industry

Types	Frequency	Mean	Rank
Mobilisation by advance payments	87	4.07	1
Milestone payments	90	3.73	2
Direct payments	90	3.40	3
Cost-reimbursable	90	3.23	4
Incentives	90	3.17	5
Open-book pricing approach	90	3.10	6

Effects of payment pattern on project performance

Respondents were asked to rate the effects of payment patterns on the delivery of construction project, using a five (5) point Likert scale ranging from extremely high to very low. Of the 12 identified factors, claims and extension of time was chosen by the majority as a major effect imposed by payment patterns on project performance with a mean of 3.90, accumulation of interest charges and late return of interest, and insolvency if contractor followed with means of 3.63, 3.57 and ranked 3rd and 4th respectively. Insolvency of contractor and abandonment of project were both ranked 5th with mean of 3.53. The least ranked factors affecting payment delivery were extra taxes and duties, conflict of interest and adversarial attitudes with mean of 3.21, 3.13, 3.07 and ranked 10th, 11th and 12th respectively. Details are as seen on Table 5.

Table 5: Effects of payment pattern on the delivery of a construction project

Effects	Frequency	Mean	Rank
Claims	90	3.90	1
Extension of Time	90	3.90	1
Accumulation of interest charges	90	3.63	3
Late Return of Income	90	3.57	4
Insolvency of the contractor	90	3.53	5
Abandonment of Project	87	3.53	5
The use of undesirable techniques/terms by one party to protect its own interests	90	3.47	7
Slow execution of work	90	3.43	8
Additional interest charges	90	3.43	8
Extra taxes and duties	87	3.21	10
Conflict of interest	90	3.13	11
Adversarial Attitudes	90	3.07	12

Strategies to minimize effects imposed by client's payment pattern

Using a five (5) point Likert scale ranging from very important to unimportant, the respondents were asked to rate strategies to minimize the effects of client's payment patterns on project performance. Result as presented in table 6 reveals that, most respondent were of the opinion that ensuring project monitoring and proper evaluation of the project is the best strategy and was ranked 1st with a mean of 4.43. Project schedule plans was ranked 2nd with a mean of 4.30. The use of project objectives as a criterion in decision making, following due process and the selection of appropriate delivery system followed with a mean of 4.20, 4.10, and 2.50 and were ranked 3rd, 4th and 5th respectively.

Table 6: Strategies to minimize effects of client's payment pattern on performance

Strategies	Frequency	Mean	Rank
Ensuring project monitoring and evaluation	90	4.43	1
Project schedule plans	90	4.30	2
Using project objectives a criterion in decision making	90	4.20	3
Following Due Process Policy	90	4.10	4
Selection of appropriate delivery method	90	2.50	5

Relationship of payment patterns and project performance

In an attempt to evaluate the relationship that exists between construction client's payment pattern and construction project performance, a hypothesis was postulated for the study. The statement of the hypothesis is:

Null hypothesis ($H_{0)}$: There is no significant relationship between client's payment patterns and the project performance

Alternate hypothesis ($H_{1)}$: There is significant relationship between client's payment patterns and the project performance.

The result of the one way analysis of variance (ANOVA) of the hypothesis is as presented in Table 7. The final analysis indicates that there is a statistically significant relationship ($p<0.05$) between clients payment pattern and project performance. Hence the null hypothesis which states there is no significant relationship between client's payment patterns and the project performance is rejected. Hence it can be postulated that there is significance in the patterns of clients' payment and construction project performance. Any payment plan that does not go along with the progress of construction or the schedule of work by the contractor may jeopardize the construction process.

Table 7: ANOVA test results of client's payment patterns and project performance

	Sum of squares	df	Mean square	F	Sig.
Between Groups	1550.157	30	155.016	5.104	.002
Within Groups	485.917	48	30.370		
Total	2036.074	78			

SUMMARY OF FINDINGS

The result of the research has been presented and analysed in the previous section. Attempts shall be made to formulate realistic and logical statements, as well as deriving reasonable conclusions. From the result presented:

- Mobilisation by advance payments is the most used payment pattern as evident from this study.

- Most firms /organisations are satisfied with the payment pattern primarily utilised by them.
- When assessed against each other, mobilisation by advance payments is the most preferred of the payment patterns.
- Claims and extension of time were ranked as the major effects imposed by payment patterns.
- Extra taxes and duties, conflict of interest and adversarial attitudes were identified as the least effects imposed by payment pattern.
- Project monitoring and evaluation, as well as project schedule plan is paramount in curbing the effects imposed by payment patterns.
- There is significant relationship between clients payment pattern and construction performance.

In conclusion, this study aimed at finding the effects of client's payment pattern on construction project performance. Any payment pattern utilized in the construction industry should be able to be aligned with the contractor's workflow. Contractors, most especially medium sized contractors have challenges in accessing finance, in cases where this can be accessed; it is done with high interest rate. This limits the profitability of the company and can also be a factor that favours compromise in quality of construction. However, the management of payment

RECOMMENDATIONS

To ensure optimum project delivery and its subsequent performance, the following are hereby recommended

- Adequate supervision of construction processes and transparency in cost regulation and project lifecycle should be ensured.
- Adequate monitoring of every stage in a project lifecycle is the foundation of minimizing the effect imposed on a project as a result of payment patterns utilized in the project.
- Complete understanding of the project to be embarked upon should be observed, coupled with proper and sound advice to the client from all relevant stakeholders in the project team.
- Construction clients should try to understand project delivery methods and the forms of payment that will enable optimum performance of projects.
- Proper education and comprehension of the various payment patterns that can be utilized in the construction industry should be a paramount knowledge to all construction professionals.
- Review of the current payment patterns and development of new ones should be carried out by professional bodies, in a bid to improve the construction industry.
- Contractors should devise means of managing the risks of late payments by clients as this is critical to their survival in business.
- Construction clients should have a well-structured cash-flow forecast; late payment to contractors may make contractors to factor late payment risk into bids.
- Prompt payment will make the construction industry less litigious.

The above recommendations may not be all the possible factors that could minimize the effect imposed by client's payment patterns, but it is a strong belief that if these are well implemented, it will go a long way in curbing the effects of by client's payment patterns on construction performance.

REFERENCES

Abdul-Rahman, H., Takim, R., and Wong, S.M. (2009). Financial-related causes contributing to project delays. *Journal of Retail and Leisure Property*, *8*(3), 225–238.

Ameh, O.J., and Osegbo, E.E. (2011). Study of relationship between time overrun and productivity on construction sites. *International Journal of Construction Supply Chain Management, 1*(1), 56-67.

Bowen, P.A., Cattel, K.S., Hall, K.A., Edwards, P.G., and Pearl, R.G. (2002). Perceptions of time, cost and quality management on building projects. *Australasian Journal of Construction Economics and Building, 2*(2), 48-56.

Chitkara, K.K. (2005) *Construction project management: Planning, scheduling and controlling.* Tata McGraw Hill Publishing

Department for Business, Innovation and Skills. (2013). *UK construction: An economic analysis of the sector.* Retrieved from https://www.gov.uk/government/uploads/system/uploads/attachment_data\file/210060/bis-13-958-uk-construction-an-economic-analysis-of-sector.pdf

Dlakwa, M.M., and Culpin, M.F. (1990). Reasons for overrun in public sector projects in Nigeria. *International Journal of Project Management, 8*(4), 237-241.

Durdyev, S., Ismail, S., and Abu Bakar, N. (2012). Factors causing cost overruns in construction of residential projects; case study of Turkey. *International Journal of Science and Management, 1*(1),: 3-12.

Idoro, G.I. (2008). The state of project planning in the Nigerian construction industry. *The Lagos Journal of Environmental Studies*, *6*(2), 20-29.

Lim, E.H., and Ling, F.Y.Y. (2002). Model for predicting clients' contribution to project success. *Engineering, Construction and Architectural Management, 9* (5/6), 388–395.

Mahamid, I. (2013). Common risk affecting time overrun in road construction project in Palestine: Contractors' perspective. *Australasian Journal of Construction Economics and Building 13*(2) 45-53.

Moser, C.A., and Kalton, G. (1971). *Survey Methods in Social Investigation*. UK: Heinemann Educational.

Njie, G., Langford, D., Kaka, A., and Fortune, C. (2006). *Collaborative working via innovative payment systems.* In J.V. Torrance, H. Adman, and R. Takim (Eds.), Proceedings of the International Conference in the Built environment in the 21st Century (ICiBE2006), 169-180. Edinburgh, UK.

Odusami, K.T., and Olusanya, O.O. (2002). Client's contribution to delays on building projects. *The Quantity Surveyor, 38*(1), 30-34.

Pinto, J. K. and Slevin, D. P (1988). *Critical success factors in effective project implementation*, In Project Management Handbook, Cleland, D.I, King, W.R. (Eds.), Princeton, Van Nostrand Reinhold.

Rad, P.F. (2003). Project success attributes. *Cost Engineering, 45*(4), 23-29.

Sambasivan, M., and Soon, Y. W. (2007). Causes and effects of delays in Malaysian construction industry. *International Journal of Project Management, 25*(5), 517–526.

Shenhar, J., Gordon, R.D., and Alexander, L. (1996). Simultaneous management: The key to excellence in capital projects. *International Journal of Project Management, 14* (4), 189-99.

Sweis, G., Sweis, R., Hammad, A. and Shboul, A. (2007) Delays in construction projects: The case of Jordan. *International Journal of Project Management, 26*, 665–674.

Walker, A. (2007). *Project management in construction*, Fifth edition. Oxford: Blackwell.

DELIVERING AFFORDABLE DWELLINGS FOR KEY WORKERS: THE SHARED-OWNERSHIP OPTION IN SUB-SAHARAN AFRICA

C. O Adeokun[1] and F. Isaacs-Sodeye[2]

Covenant University, College of Science and Technology, Department of Architecture, Km 10, Idiroko Road, Ota, Ogun State, Nigeria

The NHS Estates Design and Technical Services Department St Marks Hospital, Maidenhead, Berkshire, UK. SL6 6ES.

Achieving 'value for money' is a main concern on housing construction projects particularly for average income earners employed in key sectors such as the police force, education, and healthcare. This paper reviews a yet uncommon way of delivering dwelling units for this category of 'Key workers'. The scheme-Shared-Ownership- allows the end user to engage in a staged (gradual) process of ownership (Stair-casing), and has proved to be a viable option for providing housing units in the United Kingdom mainly via housing associations. The scheme can be a viable option in the urban African affordable housing market, with a main proviso; that its adaptation must be compatible with the operation of small scale property developers. Its success rests on the premises that a) Governments motivate financing institutions to develop mortgages more suited to the financial capability of this range of salaried workers and b) Maintenance programmes via the use of service charges are incorporated into the legal documentation for the sale/rental of such units. This paper argues that the shared-ownership model has real potential and can be suitably adapted to various scales of housing developers, and significantly, facilitates a gradual ownership process.

Keywords: shared-ownership, affordable housing, key workers.

INTRODUCTION

The housing needs of average income earners are often overlooked because they do not always qualify for low-income housing schemes, yet renting in the private housing sector is often a challenge because they do not possess sufficient disposable income to access many options on the open housing market. The Nigerian context for example is such that aspirations to home ownership are deeply ingrained within the culture of various ethnicities, and the urban dweller increasingly, has to choose between buying land and building in phases, or purchase completed dwellings from the private housing developers that are springing up. This situation is slowly becoming the urban housing reality in other Sub-Saharan countries such as Ghana, Gambia, Kenya, and South Africa. Key workers are invariably salaried income earners hence have a stable though modest income working in jobs or careers like the armed forces, education, healthcare, fire department, and non-managerial civil service that are in intermediate

[1] lola.adeokun@yahoo.co.uk

[2] folake.isaacs@live.co.uk

Adeokun, C.O. and Isaacs-Sodeye, F. (2014) Delivering affordable dwellings for key workers: the shared-ownership option in sub-Saharan africa *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 233-246

roles outside of management levels. These jobs usually fall within an income bracket sandwiched between professional workers and low-income earners and urban poor. According to Olotuah (2010), these workers in the Nigerian context often struggle to afford to buy ‘low-cost’ housing schemes or to rent on estates that are targeted at the middle professional classes/workers. Key workers sometimes qualify for subsidized accommodation provided by employers, but these are often limited, and assistance to buy rarely exists.

Many key workers who live in large urban areas are renters but still possess home ownership aspirations, and this peculiar catch-22 situation is also recognised in literature (Clarke, Fenton, Markkanen, Monk & Whitehead, 2008). Several solutions have been sought or designed to provide affordable housing that meet the demands of average income earners, recognising that whilst they do not require full subsidies, they nonetheless require a subsidy or a structure that allows them to afford home ownership in stages or at prices that are lower than open market prices. The Shared Ownership scheme in the United Kingdom provides housing units via housing associations, local government councils or medium scale housing developers (Clarke, et al., 2008; Cook, 2006; and UK Government website, 2013), and is an affordable scheme that allows the key worker to buy a property in stages. This invariably means that the initial cost of construction has to be borne by public or private developers who then recoup their investment by selling on the units. It is a scheme that is subsidised by the government in the UK context (Perry, 2012) and brings the government indirectly into the home sale sector, to provide a coordinated construction programme.

Shared ownership schemes have been operating for over 30 years in the United Kingdom (Clarke et al, 2008; Graham, 2010;), and the format is designed to make more housing units available and affordable, and can be adapted for key workers in cities such as Lagos, Nairobi, and Johannesburg. This paper presents the key features of the shared-ownership scheme, reviews two housing associations that are major shared-ownership providers in the United Kingdom, outlines the main benefits of the scheme that can offer lessons for the Sub-Saharan context, and discusses its shortcomings particularly within the context of developing nations. Ultimately, the scheme offers real benefits that can be suitably adapted to various scales of housing developers, and the potential pitfalls can be tackled and minimised provided a level of political will is present. The government, property developers, commercial banks, mortgage and finance institutions need to invest capital and significantly, transform their conceptualisation of the end-user from ‘consumer’ to ‘stakeholder’.

INTRODUCING SHARED-OWNERSHIP; PROVIDING AFFORDABLE HOUSING

Shared ownership is a way of buying a stake in a property with a second owner, in this case, an institution who can contribute toward the purchase of the property. Shared ownership is also known as New Build Homebuy (Graham, 2010; UK Government website, 2013). The prospective shared owner buyer (the first owner) purchases a share of the property (between 25% and 75% of the home’s value) typically from a housing association (the second owner) and pays subsidized rent on the remaining share to the housing association (Clarke, et al, 2008; UK Government website, 2013), however, the first owner (the buyer) will have sole occupancy rights to the property.

The shared ownership format was introduced in the 1980s in England to provide affordable good quality homes for those who could not afford to buy on the open market (Graham, 2010). In order to be eligible, the purchaser must have a combined household income of less than £60,000 per year (for a 1 or 2 bedroom flat)[3] and be unable to purchase an appropriate home on the open market without assistance (Council of Mortgage Lenders, Homes and Communities Agency, National Housing Federation, 2011; and UK Government website, 2013). At present, there are 135,200 shared ownership properties in England (Council of Mortgage Lenders, Homes and Communities Agency, National Housing Federation, 2011), but the mean household income bracket in the UK of £28,200[4] is far less than the upper limit of the scheme, which opens up the scheme to other professionals who could prove inability to purchase on the open market.

Shared ownership units constitute just 2.5% of the affordable housing stock, but comprises over 30% of new-build affordable housing units according to Clarke, et al. (2008); demonstrating its increasingly significant role in the affordable housing sector. Although the property is not owned outright initially, the shared owner has the normal rights and responsibilities of a full owner-occupier. All providers must offer flexibility within the 25% - 75% share range for initial purchase, and additional shares can be bought up to outright ownership.

The relevance of the scheme stems partly from the fact that people usually work during their lifetime to obtain a property to live in for their retirement which is a common phenomenon in many countries; Nigeria inclusive, and then pass it on to their children as inheritance. Whilst building their home, they tend to live in rented accommodation and pay rent to a landlord. This means that they pay twice for their homes because they pay rent and at the same time put money aside to build a home. An option is to purchase an already built home from a developer. For this option, the individual needs to have all the funds to purchase the property outright which is not realistic for most salary earners.

A second option which is relatively common in many African countries is to raise funds privately for the purchase of land and then to build in stages. Oftentimes, people move into uncompleted buildings and then continue the completion process, as their access to additional funds permits. This usually involves using the informal network of friends, and relatives (CAHF (2010), EFInA and FinMark (2010) and Mutero (2007), or taking out small loans from banks.

A third option that is slowly gaining ground in Nigeria and is the more common route in the UK, is to obtain a mortgage (loan) to pay for the property (www.helptobuy.org.uk; Clarke, et al., 2008) , and then repay the loan over a period of up to 20 years. While a stable economy and relative job security typically makes the lender reasonably confident of the buyer's ability to repay the loan, the property being purchased also serves as security or collateral as it can be repossessed in the case of protracted default on repayments. What the shared ownership scheme does is to provide assistance for people to be able to live in their completed house from the very start and not need to wait until when they have paid off the loan to take possession and occupancy.

KEY FEATURES OF SHARED-OWNERSHIP HOUSING

In the UK, housing associations (or private registered providers of social housing), according to the UK Government website (2013) provide shared ownership schemes

[3]An income limit of £77,200 was set for the purchase of a 3-bedroom property (http://www.santander.co.uk).
[4] Source of median household income is (http://www.ons.gov.uk), based on 2011/2012 figures.

utilising certain eligibility criteria. There are housing associations that also provide accommodation for lone parents, ethnic minorities, disabled people, elderly people, ex-service men and women etc. based on variants of the standard shared ownership model described below, but the basic eligibility criteria all stem from the premise of affordability for the average income earner. Hence, the initial valuation of the 100% cost of the housing unit, on which the percentage purchases is based, is usually below the market price of an equivalent unit. As mentioned previously, the shared owner initially buys a proportion of the home (minimum of 25%) which is available for immediate occupation, but pays subsidised rent on the un-owned share. Nonetheless, the shared owner has normal rights and responsibilities of a full owner-occupier.

Shared ownership homes may be new or renovated flats or houses, and are sold as leaseholds, with a 99 or 125 year lease on the property (www.helptobuy.org.uk; The Leasehold Advisory Service, 2011), which can be extended by the shared owner for a fee[5]. Importantly, all Agency funded schemes according to Council of Mortgage Lenders, Homes and Communities Agency, National Housing Federation (2011) must allow for the leaseholder to staircase to 100% and own the property outright.

You can buy more shares in your home any time after you become the owner in a process known as *Staircasing*. Staircasing is the process whereby the buyer can buy further shares (in 10% minimum lots according to the Council of Mortgage Lenders, Homes and Communities Agency, National Housing Federation, 2011) until the property is owned outright; a metaphor of going up rungs or steps in a staircase until you get to the top; which translates to outright ownership. The cost of the new share depends on how much the home is worth at the time you want to buy the share. If property prices in the property's area have gone up, the subsequent share will cost more than the first share, but the opposite is also true (Clarke, et al., 2008), though less likely to happen. The housing association gets the property valued but the homeowner pays the estate valuer's fee.

A key feature of the shared ownership scheme is that 100% ownership of the housing unit means that the unit is no longer 'shared ownership' and the owner can sell it themselves, but when the unit is put up for sale, the housing association has the right to buy the property back first. This is known as 'first refusal' and the housing association has this right for 21 years after full ownership of the home (www.helptobuy.org.uk and UK Government website, 2013). However, the housing association has the right to find a buyer for the housing unit when the shared owner owns only a share of the property. Finally, any home owner in the UK has to pay a nominal ground rent for a leasehold property (usually £1 per year), and a one-off stamp duty to the government which is for homes above a price threshold that is often more than shared-ownership property values.

ELIGIBILITY CRITERIA

Housing associations typically follow key criteria in assessing people to benefit from the scheme. The first eligibility criterion is that the purchaser is usually a "key worker", i.e. a teacher, police officer, civil servant working in the public sector although this is not strictly the case. Units are usually set aside for key workers' applications whilst other units may be offered to the wider populace. The second

[5] Information obtained from https://www.gov.uk/leasehold-property/extending-changing-or-ending-a-lease accessed on 14/01/14.

criterion is that only households with a combined income of less than 60,000 will qualify (Council of Mortgage Lenders, Homes and Communities Agency, National Housing Federation, 2011), to ensure that richer public sector workers do not use the government grant as a means to purchase multiple properties to then sell or rent out to low-income or the middle-income workers. At the other end of the scale, there will be a minimum threshold, to ensure that the mortgagee can afford to pay the mortgage to the banks and the rent on the remainder. The third criterion is that it can only be used to purchase a first property, that is a first-time buyer, and the property is for the individual to live in, and there must be evidence that they work within the property location area and within reasonable travel distance to their place of work. The fourth criterion is that the property is not to be sublet to a third party, to avoid individuals turning this into a commercial venture. The fifth criterion is that if for some reason, an individual can no longer live in the property the shared owner has to sell it back to the housing association or the government agency, to ensure that it stays within the public sector so that it is available for future eligible key workers to purchase (www.helptobuy.org.uk; Council of Mortgage Lenders, Homes and Communities Agency, National Housing Federation, 2011). These eligibility criteria have been employed over the years by most shared ownership providers, and two of the main shared ownership providers are outlined below.

CASE STUDIES: NOTTING HILL HOUSING TRUST AND THAMES VALLEY HOUSING

Over 2000 housing associations operate across the UK (www.housingnet.co.uk), but the majority of shared ownership properties are in South-East England, so the two examples are taken from this region. Notting Hill Housing (NHH), London, was founded in 1963 with 5 houses and 30 flats by Rev. Bruce Kenrick, which has grown to a current portfolio of over 27,000 properties (Notting Hill Housing, 2014a, 2014b), including over 4500 shared ownership units.[6] NHH built the first ever shared ownership scheme in West London in 1980. The association offers a varied range of accommodation from studio flats to 4 bedroom houses and is one of the most financially robust housing associations. They provide advice about choosing conveyance solicitors during the buying process, and on debt management in cases where buyers are struggling with rent repayments.

Thames Valley Housing (TVH), London, also has a long involvement in social housing going back to 1966, and presently has a property portfolio of over 14,000 housing units (www.tvha.co.uk/about/) which includes rental units, shared ownership, key workers and student accommodation. TVH raises additional funds on the open market by operating a rental market, and a joint venture to build houses for direct sale and to provide better services to the affordable sector. Whilst both housing associations get most of their funding from the government, internally generated revenue is also an important strategy to increase funds coming into the social housing sector.

PROCUREMENT AND PURCHASE OF SHARED-OWNERSHIP HOUSING IN THE UK

The typical method of financing shared-ownership construction is through government funds, with the housing associations taking responsibility for organizing

[6] From communications@nhhg.org.uk received on 14/01/14.

the design and construction process, and also acting as the management company to handle on-going maintenance and care for the development. Funding the purchase of a housing unit in the UK is typically by the end-user taking out a mortgage to pay for the share of the home's purchase price, or a combination of cash deposits and a mortgage. The value of the mortgage that an individual is allowed to borrow is a multiple of the single income, or a multiple of the combined income of a couple, and the mortgage companies try to limit risk by demanding a deposit from the mortgagee as a percentage of the loan required. The incentive for the mortgagee is that the higher the deposit paid, the lower the interest payable or charged. If property prices rise to an extent that the multiple value of the person's income will still be insufficient to obtain a mortgage, the shared ownership scheme becomes a useful route into home ownership.

The first owner (shared owner) contributes a percentage of the deposit required, thereby reducing the loan to value (LTV) ratio of the mortgage, as most lenders have a limit of the loan that they are willing to pay. For instance, Santander Bank, one of the largest banks operating in the UK and Europe offers shared ownership mortgages up to 90% LTV ratio of the value of the share that the shared owner buys (information from www.santander.co.uk). This means the prospective shared owner contributes 10% of the LTV ratio based on the initial shares. However, if the shared owner is buying a new build property, different LTV limits apply.

TYPICAL MORTGAGE SCENARIO

A typical mortgage arrangement adapted from www.santander.co.uk works as follows. For a property value of £100,000, the owner puts down a 10% deposit, which is £10,000, and the value of the mortgage required will be £90,000. If the multiple of the income of the first owner will qualify for a mortgage of £60,000 (individual banks determine the multiplier used in calculating the loan amount), there is a shortfall of £30,000 that the first owner has to provide, to makes it possible for the mortgage company to lend the £60,000 mortgage.

With regards to shared ownership units however, if the first owner (shared owner) wants to purchase 70% of the property outlined above (that is £70,000 of the £100,000), the second owner (housing association or development company) owns the remaining 30% (£30,000). The first owner needs to qualify for a mortgage of £70,000 from the mortgage company, based on their current salary, and also pay rent on the remaining £30,000 to the second owner. Shared ownership mortgages can either be a repayment or an interest-only mortgage but a detailed description of these products is beyond the scope of this paper.

If the first owner wishes to sell the property after some time, based on the example above, the value of the property may have increased to £120,000 resulting in a positive equity of £20,000 which is shared using the 70:30 ratio of ownership. However, if the property is now worth £80k, there is a negative equity of £20,000, and the loss share is also calculated on the same 70:30 basis. However, the second owner will not wish to lose their £30,000 investment, and may seek to repossess the property and sell it off to make up for their loss. Typically, if the shared ownership has been in place for at least a period of 5-7 years, and no additional monies have been borrowed against the value of the property, it is more likely that there will be positive equity which the shared owner or 100% owner can benefit from on sale.

MANAGEMENT OF A SHARED-OWNERSHIP DEVELOPMENT

The housing stock usually consists of one to two-bedroom flats, and three-bedroom houses. Shared ownership properties (flats and houses) are leasehold tenures instead of freehold tenure. By law in the UK, freehold tenure is owned in perpetuity and the freeholder owns the property and the land on which the property stands. Leasehold tenure on the other hand belongs to a leaseholder for 99/125 years (www.lease-advice.org, 2013), and then reverts to the freeholder at the end of the period, although the lease can be extended for a fee. Leaseholders can come together and buy the collective freehold after they have paid off the second owner's share, and each one of them will have a share of the freehold of the property. However, according to The Leasehold Advisory Service (2011), shared ownership leases are different in an important respect as it does not allow the shared owners to collectively manage the building or buy the freehold. All shared owners pay full rate service charges for the management of communal infrastructure in the estate, and are fully responsible for repairing the internal aspects of their flat/house.

The management of the housing organisation will consist of two main departments, namely, personnel managing the money, and personnel managing the property. The money managers ensure that eligible people purchase the property, collect rents and service charges and deposit it in funds to pay staff wages, property maintenance, loans or any other expenditure. If rents are not forthcoming from the owners, the money managers are responsible for evicting them and finding other people to take over the property. The property managers manage the property, and are usually construction related professionals such as architects, building surveyors, maintenance surveyors, and estate valuers. Condition surveys are regularly carried out on the property and infrastructure, and a periodic maintenance plan is set up based on the life cycle of the different building components. The estate valuers ensure that the property retains its value relative to the open market. As such, if the owner wants to sell their share of the property, it will be at the market rates, and equity values will be accurate.

THE PROVISION OF MAINTENANCE VIA THE USE OF SERVICE CHARGES

Since many shared-ownership housing units are usually built as small or medium sized estates or housing blocks that are part of estates, a service charge is also paid by the shared owner for the building communal areas, road and utilities provision, maintenance, repair and replacement of components. Service charge is required for all tenure (tenants, shared owners and full owners), for day-to-day reactive maintenance, planned maintenance, capital repairs and renewals and major investments for the benefit of the overall development. In order to safeguard against the housing developer diverting the service charges paid into other ventures which may be risky and would not benefit the development in the long run, it is a typical requirement that the funds be invested in an annual sinking fund or account that is stable and will retain the capital invested within the accounts registered for the development. In order to adapt the system in Sub-Saharan Africa, similar charges need to be paid for maintenance and such funds need to be managed by the management company, with yearly account statements made available to all shared owners and renters for a measure of financial transparency.

FINANCING HOUSING CONSTRUCTION IN AFRICA

State intervention in the form of (public) housing construction in many African nations evolved during the period of colonial occupation, with the provision of housing for the white colonial population "settled" in specially developed areas. The post-independence period for many countries saw the development and extension of the middle income government housing areas for the indigenous elites who filled the positions vacated by the colonial staff.

Olayiwola, Adeleye and Ogunshakin (2005) report a huge decline in Nigerian government's intervention through direct housing construction for lower income earners since the 1970s. The Federal Mortgage Bank of Nigeria (FMBN) was created in 1977 but its subsequent struggles to reduce the shortage of housing led to the promulgation of the National Housing Policy of 1991 and the National Housing Fund in 1992. Recent efforts to supply affordable housing in Nigeria according to Makinde (2013) have made little impact on the deficit to date. The largest housing provider in Nigeria is the private sector mostly in form of small landlords (CAHF, 2010; and EFInA & FinMark, 2010). Whilst the government via the FMBN and the NHF has spent a lot of money in financing, the bulk of the financing is from the private formal sector (developers, mortgage institutions, corporate bodies and finance institutions) and the informal sector (friends, families, cooperatives, and community action).

South Africa's housing sector according to AUHF (2012) can be divided into three sectors, with 20-25% falling into the category of those that earn too much to qualify for a housing subsidy and too little to afford the cheapest newly built house. This affordable housing market has become a serious concern for the government and in 2012 the South African President introduced a new housing subsidy to address the needs of this market. This new subsidy is part of interventions which include a tax incentive to build less expensive housing, and a mortgage guarantee instrument targeted at the lower-income market. Some efforts are being made to address the needs of this category, but the current situation is that one third of South African mortgage holders cannot afford their monthly mortgage repayments as reported by AUHF (2012).

AUHF (2012) and Malhotra (2002) also report some difficulties for low income property buyers in Kenya to access funding in the midst of the interest rate hikes, but fuelled by a growing middle class, the Kenyan housing sector has been one of the fastest growing over the last decade (AUHF, 2012). Despite the rise in inflation rates in Kenya during 2011 and the current, high interest rate levels, the results show evidence of a solid housing sales market, but with real difficulties in the affordable sector.

The building and construction industry is an important driver of the Ghanaian economy, and a few Ghana-based developers such as Blue Rose Limited are focused on building quality and affordable residential facilities for average income earners. Blue Rose had a turnover of approximately US$10,000,000 during the period from 2009 to 2011 which makes it one of the most successful low-cost housing developers in Africa (AUHF, 2012). Hopefully, other developers can be motivated to follow through if success is achieved by Blue Rose.

Overall, difficulties with funding housing units for average income workers including key workers is not unique, and lessons from one country may benefit another.

THE USE OF MORTGAGES IN SUB-SAHARAN AFRICA

Rust (2012) states that only 3% of Africa's population can currently support a mortgage although there is some variation across various countries. Mortgage banking development in Nigeria can be traced to the establishment of the Nigeria Building Society in 1956, but this collapsed and was not really revived until the formation of Federal Mortgage Bank of Nigeria (FMBN) in 1977, which has been unable to keep up with demand according to Adebamowo, Odewaye and Oduwaye (2012).

Adebamowo, Odewaye and Oduwaye (2012) also emphasise the need to significantly increase the contribution of the entire mortgage banking/housing finance sector to the Nation's Gross Domestic Product (GDP) which is currently put at 0.38%, compared to other countries such as South Africa and Malaysia with an average rate of 40%. A significant challenge of the Nigerian economy is that of developing a sustainable housing and mortgage finance system, which would be enhanced by the creation of mortgage pay back periods of longer tenure and lower interest rate structures. Omotoso K (2011) echoes a similar concern, stating that the ratio of mortgage loans & advances to gross domestic product (GDP) in Nigeria needs to increase from the current 0.38% progressively in the years ahead. Mutero (2007) highlights a similar plight of the poor in Kenya stating that for them, direct access to finance from banks is extremely difficult as they cannot provide security, administration costs of small loans are high and profit margins are perceived by lenders to be low. Moreover, interest rates, although they have reduced in recent years from 26% in 1999 (but are now rising again) still make borrowing expensive. This low uptake of mortgages in Africa with the notable exception of Botswana, Mauritius, Namibia and South Africa according to CAHF (2010) reinforces the need for funding solutions based on the reality of actual funding patterns.

DISCUSSION: SHARE-OWNERSHIP HOUSING AS AN OPTION IN THE DELIVERY OF HOUSING PROJECTS IN URBAN AFRICA

A discussion about the viability of shared ownership in the African context must review some peculiarities. While the record of government interventions in the housing sector in countries such as Kenya, South Africa, and Ghana, looks quite impressive, the policies are often not fully implemented, or need to be reviewed. The Nigerian scenario for instance seems to be long on policy, but very short on implementation. Under Nigeria's National Housing Fund (NHF) program, initiated in 1994 to produce 121,000 housing units, Ademiluyi (2010) reported that less than 5% was achieved, perhaps due to a lack of 'political will'.

ACCRUED BENEFITS OF SHARED-OWNERSHIP HOUSING

The key benefits of this method of home-ownership are that it involves the end user in the funding process and most importantly is a process of ownership which allows gradual purchase of the property up to 100% private ownership (Cook, 2006 and UK Government website, 2013). It provides a less onerous way of getting onto the property ladder which may otherwise have been out of the reach of many average income earners. Because shared ownership properties are typically new or refurbished the average income earner is able to access a reasonable quality of housing in terms of construction, services, and material finishes as stated on www.mortgages-remortgages.com. Also, it can be a form of investment if property values have increased significantly at the time of sale (Cook, 2006).

The emphasis on reasonable quality within the scheme can be adopted in the African context. By paying specific attention to key workers, those who work in sectors that provide essential services to the nation may be able to access this benefit in recognition of the vital role they play in local communities. It may well be that incorporating a scheme to assist key workers to own their own homes, will draw better qualified people into these services in developing nations. Finally, the rent paid on the part of the housing unit that is yet to be owned, provides some on-going profit/income for the housing association hence reducing the need to make all the profit at the front end of the transaction, and also enables the housing association to take advantage of any expansion in the rental market.

POSSIBLE SHORTCOMINGS AND MITIGATING STRATEGIES

The shared ownership scheme has been criticized as an equity trap for owners in the sense that if they wish to move away to another town, say for a new job, they may have difficulty selling the property because it may be in negative equity and it will not be sensible to sell. Also, availability is an issue (Cook, 2006), as waiting lists can be quite long (up to 1 year). The shared owner may also require permission for home improvements and in some housing associations in the UK; the shared owner does not have the option of buying 100%.

Also, whilst the opportunity to staircase is an attractive feature, it is perhaps less important to prospective buyers according to a report by Clarke and Heywood (2012a). This study of housing associations, focus groups with shared owners, and mortgage lenders states that since 2001, only 27,908 (19%) of the 145,000 homes bought through a shared ownership scheme have 'staircased' up to 100% ownership (Graham, 2010 stated that 25% of shared owners have gone on to 100% ownership). The quality of practice also varied between different associations, although according to Clarke and Heywood (2012b) '*many of the difficulties associated with second-hand shared ownership sales are in common with those of the wider housing market, e.g. 'problems of securing mortgage finance, lack of affordability, poor demand, negative equity..' p2*.

Clarke and Heywood (2012b) findings on staircasing indicate real obstacles. Shared owners stated that for most, the initial share purchased had been the maximum they could afford, and many had experienced insufficient growth in their incomes and were unable to buy any more, particularly if property prices also rose sharply (Cook, 2006). The shared owners were also deterred by the costs associated with staircasing such as the valuation, though most were keen to achieve 100% ownership. Clarke and Heywood (2012b), as well as Cook (2006) concluded on the merit of the format, albeit with a real need for the shortcomings to be updated, and Clarke and Heywood (2012b) provided some recommendations to improve on the scheme's performance. A) Mobility should be improved by considering whether it is sensible for shared owners to gain access to the tenure without paying a deposit big enough to afford them some protection during a housing market downturn or stagnancy. B) Staircasing protocols should be improved to function more effectively as a stepping stone into full ownership by reviewing the minimum level of shares sold at inception. C) The sales process should also be improved by housing associations possibly contributing towards the costs associated with staircasing. Finally, there is a need to revise leases to eliminate restrictions that affect owners wishing to sell, and to provide a more flexible approach and advisory service to shared-owners in financial distress.

The comments of Peaker (2013) suggests that shared ownership currently presents some significant legal flaws for the purchaser, citing the ruling of a 2007 court case Richardson v Midland Heart, UK (housing association), where the shared owner had a 50% share and was in arrears on the rent. The court ruled, reluctantly, that the shared owner did not have a lease that could be protected, as it was not for the whole of the property and she had no right to the return of the £29,950 she had paid. In practice, states Peaker (2012), the landlord or housing association remains the owner of the property up to the point of the 100% buyout and the shared owner can be evicted for rent arrears without being recompensed for all the payments. However, as Graham (2010) noted, repossession rates in the shared ownership sector for 2008/09 was slightly lower than the rate for all homeowners (0.385% to 0.42% respectively). Clarke and Heywood (2012b) conclude that while shared ownership may be the most promising route into home ownership for many, there are substantial risks for those taking that route, which would require some changes to legislation to amend.

Kelly (2013) highlights another issue in the UK sector: - the problem that shared ownership is not a model that suits the needs of the young people at whom it is marketed, because they are often in short-term employment and need to be mobile. Kelly (2013) also states that subletting is not permitted so shared owners cannot rent out their property should their circumstances change, though it is noted here that this is not the case with all housing associations. These problems combined with the low percentage of shared owners that have completed outright purchase, and the fact that shared ownership is less than 1% of UK households are cited as real drawbacks of the scheme, although it is a fast growing contributor to housing provision as stated earlier.

RECOMMENDATIONS: KEY STRATEGIES FOR A SUCCESSFUL ADAPTATION OF SHARED-OWNERSHIP DELIVERY SYSTEM.

Shared ownership constitutes a cultural paradigm shift in in most countries in Africa, in the sense that people own and occupy a completed house before they have fully paid for it. Secondly, a mortgage is a debt, and one that has significant responsibilities and serious consequences in case of default. In the West, mortgagees are required take out life insurance, unemployment insurance, buildings and contents insurance etc, to safeguard their assets. Sometimes, they are required to have a will. These are topics that tend to make people uncomfortable as they are confronted with their mortality.

For the scheme to work within the African context, the length of the mortgage has to balance the need to make repayments affordable, and at the same time cannot be too long that people feel uncomfortable with committing to such a long loan because of cultural conditioning.

Some improvements need to be made from the investors end. Governments need to motivate banks and microfinance organizations to provide smaller loans and less onerous collaterals for key workers to purchase their home. Governments also need to encourage financing institutions to develop mortgages more suited to the financial capability of this range of salaried workers. Reactive and planned maintenance programmes via the use of service charges, need to be incorporated into the legal documentation for the sale/rental of such units. The existing formats of housing co-operations and cooperatives can be used to pilot shared ownership schemes in countries like Nigeria and South Africa, in much the same manner as housing associations play that role in the United Kingdom. The governments should also vigorously pursue housing delivery strategies that are 'user-driven' through the use of cooperatives, development agents, and public-private sector participation (PPP).

Several of the shortcomings of the scheme cited above can be reasonably avoided in its adaptation in an African context: - The scheme may not be suitable for all in the affordable sector based on some of the shortcomings/criticisms outlined above, but it is equally clear that thousands have benefitted from the scheme, and it remains an option for those unable to buy property on the open market (Clarke & Heywood, 2012b; and Peaker, 2013). It is clear that there are serious consequences if the shared owner falls into arrears on rent (or mortgage), and this is not peculiar to the shared-ownership sector, however, adequate regulation of housing associations with clear legislative backing is vital. Housing associations or cooperatives need to provide explicit explanations of the benefits and shortcomings to the prospective shared owner, offer debt counselling where needed, and assist the shared owner as much as possible to come to an arrangement to pay off any rent arrears before resorting to court proceedings.

Certainly an adaptation of the system in a developing nation must allow for clauses that protect the buyer from exploitation by the industry, and ultimately, aiming for 100% ownership must be the target goal from the onset to fully benefit from being able to get on the property ladder in stages. This is very compatible with many cultures in Africa that place premium value on outright ownership and many certainly will consider 100% ownership a near compulsory goal. The concept of a lease is likely to be contentious in many African countries where traditionally land is owned in perpetuity. Perhaps the solution will be to offer the option of buying a share of the freehold, within clearly established conditions. Finally, the challenge posed by low levels of staircasing is a serious concern. It is suggested that perhaps a 25% initial entry point is too low, and such a buyer may be unable to afford 100% shares in the long run. Within the context of the African nations referred to in this paper, perhaps an entry point of at least 40% would mean that the shared owner over time is able to afford the remaining shares of the property. The conclusion here is consistent with Clarke and Heywood (2012b) conclusion that shared-ownership schemes despite their current shortcomings provide a real alternative to getting on the property ladder, and the advantage would be to learn from the mistakes of its practice in other countries and adapt accordingly.

REFERENCES

Adedeji, Y. D., & Olotuah, A. O. (2012). An Evaluation of Accessibility of Low-Income Earners to Housing Finance in Nigeria. *American-Eurasian Journal of Scientific Research*: 7 (1): 23-31

African Union for Housing Finance, AUHF. (2012). *Financing Housing in Africa*. A monthly Newsletter. Issue 14: May 2012: 1-6

Centre for Affordable Housing Finance (CAHF). (2010). *2010 Yearbook. Housing Finance in Africa, A review of some of Africa's housing finance markets*. South Africa: Centre for Affordable Housing Finance in Africa, A division of the FinMark Trust.

Clarke, A. and A. Heywood (2012a). *Understanding the second-hand market for shared ownership properties*. Report for Cambridge Centre for Housing and Planning Research. Department of Land economy, University of Cambridge. Cambridge.

Clarke, A. and A. Heywood (2012b). *Understanding the second-hand market for shared ownership properties*. Executive Summary for Cambridge Centre for Housing and Planning Research. Department of Land economy, University of Cambridge. Cambridge.

Council of Mortgage Lenders; Homes and Communities Agency; National Housing Federation (2011). Shared Ownership: Joint Guidance for England.

EFInA and FinMark Trust (2010). *Overview of the housing finance sector in Nigeria.* A report commissioned by EFInA and FinMark Trust.

Housingnet website. http://www.housingnet.co.uk/housing_association_data.php accessed 14/01/14.

Kelly, L. (2013) *Shared ownership flaws reveal void in young people's housing options*. Article in Guardian Professional.

http://www.theguardian.com/housing-network/editors-blog/2013/sep/06/shared-ownership-home-ownership-young-people Accessed 061213.

Makinde, O. O. (2013). Housing delivery system, need and demand. *Environ Dev Sustain*: 16, 49-69

Malhotra, M. (2002). The enabling environment for housing microfinance in kenya. *Cities alliance shelter finance for the poor series*. Washington, DC. USA.

Mutero, J. G. (2007). *Access to housing finance in Africa: exploring the issues*. A Report by Matrix Development Consultants for FinMark Trust.

Mortgages-remortgages website accessed 041213.

http://www.mortgages-remortgages.com/shared-ownership-mortgages.php

Notting Hill Housing website (2014a). Downloaded from: - http://www.nottinghillhousing.org.uk/sales/about-shared-ownership/what-is-shared-ownership accessed on 11/01/14

Notting Hill Housing website (2014b) downloaded from: -

http://www.nottinghillhousing.org.uk/about-us accessed on 11/01/14

Notting Hill Housing website (2014c) downloaded from: -

http://www.nhh50.com/?post_type=fifty-things accessed on 14/01/14.

Office of National Statistics (UK) website on http://www.ons.gov.uk/ons/rel/household-income/middle-income-households/1977---2011-12/sty-middle-income-households.html Accessed on 14/01/14

Olayiwola, L. M., O. Adeleye and L. Ogunshakin (2005, September). *Public Housing Delivery In Nigeria: Problems And Challenges*. XXXIII IAHS World congress on Housing Transforming Housing Environments through the Design, Pretoria South Africa.

Olotuah, A. O. (2010). Housing Development and Environmental Degeneration in Nigeria. *The Built & Human Environment Review:* 3, 42-48

Peaker, G. (2013). *The Hidden Dangers of Shared Ownership.* Article in Guardian Professional.http://www.theguardian.com/housing-network/2013/sep/03/hidden-dangers-shared-ownership?commentpage=2 Accessed 061213.

Santander Bank Plc. website accessed 041213.

http://www.santander.co.uk/csgs/Satellite?canal=CABBEYCOM&cid=1237894294915&empr=Abbeycom&leng=en_GB&pagename=Abbeycom%2FPage%2FWC_ACOM_TemplateW2

UK Government website (2013). From: - https://www.gov.uk/affordable-home-ownership-schemes/shared-ownership-schemes accessed 061213

DEVELOPMENT OF A FRAMEWORK FOR ETHICAL SOURCING SUPPLY CHAIN IN THE NIGERIAN CONSTRUCTION INDUSTRY

Ibrahim Kabir[1], Mbamali Ikem[2] and Ahmed Doko Ibrahim[3]
Department of Building, Ahmadu Bello University Zaria, Nigeria.

Governments world over have recognised the necessity for a sustainable built environment since the construction industry has been adjudged to use large amount of materials and energy and to also generate huge volume of waste. There are concerns with the ways developing nations seek to catch up with development trends considering the numerous challenges of sustainable development. Responsible sourcing of products and materials for construction which meets industrial certification provide an avenue for pursuing sustainable agenda. Consequently, ethical sourcing of construction inputs which meets the required standards and certification have started to become a matter of great interest to governments that aims to achieve sustainability. This paper reviews important aspects of ethical sourcing supply chain management with the aim of articulating a framework for ethical sourcing of construction inputs for the Nigerian construction industry. It was carried out by critical review, synthesis and contextualisation of relevant literature from academic, industry and legislative sources. From the findings it was discovered that Nigeria is lagging behind in pursuing sustainable agenda and the global awareness for ethical sourcing is little even in the United Kingdom.

Keywords: certification, ethical sourcing, materials, supply chain, sustainability.

BACKGROUND

There has been more attention in the last decades towards achieving sustainable development in all the sectors (Williams and Dair, 2007). This can be attributed to the fact that various human activities and particularly the construction industry have been adjudged to have serious impact on the environment. According to Uthman (2010), the construction industry contributes to the Gross Domestic Product (GDP), helps other sector to grow and helps to create jobs. These positive contributions notwithstanding, has also posed a serious challenge on the ecosystem by contributing to about half of all the greenhouse gas emission (UNEP, 2009; Greenwood et al., 2011). The construction sector is important in the sustainability debate as it acts as

[1] *brokb@yahoo.com*
[2] *mbamalikem@yahoo.com*
[3] *adibrahim2@yahoo.com*

Kabir *et al.* (2014) Development of a framework for ethical sourcing supply chain in the Nigerian construction industry *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference*, 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 247-256

vehicle for realising the dreams of developmental projects such as oil and gas installation, roads and bridges and other infrastructure projects that meet the needs and fulfill the desire of a nation. The provision of these facilities consume large amount of non-renewable resources and also generate large amount of waste (USEPA, 2009). This has directed more attention from government, society, interest groups and other relevant stakeholders for the construction industry to change from the traditionally based practice to more green practices (Azzone and Noci, 1998; Bansal and Roth, 2000; Conceicao et al., 2006). This includes revision of methods of material sourcing, strategies, methods of production and distribution. This is achievable through sustainable supply chain vis-à-vis ethical or responsible sourcing (ES) which considers social, economic and environmental factors in the materials and services flow that occurs between the suppliers, manufacturers and customers. According to Glass *et al.* (2011) ethical or responsible sourcing (ES) can be viewed as the management of all the objectives of sustainability through the construction supply chain management of products and materials.

Supply chain activities help in the conversion of natural resources, raw materials into a finished product that is delivered to the end customer. There is the need to know the sources of materials to be used for construction. According to Livesey and Hughes (2013) materials traceability has started to become the hallmark for ethical performance because of the potential risk involved in reputation since supply chain is multifaceted.

The manner in which the developing nations intend to catch up with advanced and developed nations or even developing nations calls for a rethink of the ways they want to pursue this especially with respect to sustainability. Kibert (1999) opined that the construction industry is presently at an efficient and wasteful state that create human habitat in a way that focuses on profitability only without consideration of its long-term impacts on the society at large.

The nature of challenges currently faced by developing nations is quite different from the ones faced by developed countries because in the developed world they already have the basic infrastructure in place and their concern is just the management of sustainability objectives. There is the need for greater urgency to make sustainability intervention now to avoid the issue of technology lock as witnessed by the advanced and developed world.

According to Glass (2013) United Kingdom a developed nation has managed its sustainability agenda by setting up responsible sourcing standard for product and materials in the supply chain for construction materials. In the developing countries like Nigeria, problems inherent here is the provision of development infrastructure such as road, dams, health care facilities, and refinery. There is also the need to take sustainability into account in order to address emergent challenges beyond our past experiences and to build an operation structure that is suitable for both current and future infrastructure since the construction of the infrastructure will require huge materials inputs such as stones, sands and even human resources among others.

Some authors have observed the lack of model based research that deals with sustainable supply chains (Benjaafar et al., 2010). Again, Cities Alliance et al (2007) advocated for institutional development, legal and market-policy framework or model that will include legal and political regulations, management instruments, technical consultancies, private sector involvement, citizen participation and public relations, introduction of cooperation arrangements. Thus, based on critical literature review this paper aims to articulate a frame work for ethical sourcing in the Nigeria construction industry supply chain. Accordingly the objectives of this paper includes an overview of the peculiarity of construction in Nigeria, the study of ethical sourcing practice in the advanced country and synthesis of what will form appropriate frame work for ethical sourcing in Nigeria.

RESEARCH METHODOLOGY

To achieve aforementioned goal, literature review of academic papers from journals, reports and books were conducted. Literature review method allows identification and evaluation of existing academic research and therefore could be perceived as initial stage of theory building process (Mentzer and Kahn 1995).

THE NIGERIA CONSTRUCTION INDUSTRY

Nigeria currently has a population of above 160 million and it ranked among one of the fastest growing economy in the world. According to the Oxford Business Group (2011) Nigeria is currently experiencing rapid urbanization as a result of continuous macroeconomic growth and also rapidly expanding citizens in the middle class. The construction industry is one of the key sectors to the Nigerian economy as it is also obtained in other parts of the world as a major provider of jobs and also providing the needed infrastructure for development thus contributing to the GDP (Anyawu et al., 2008). This sector has shown steady growth rates of over ten per cent in the last few years (Federal Republic of Nigeria, 2010; Central Bank of Nigeria, 2011). According to Adebayo (2002) and Oxford Business Group (2011) Nigeria has witnessed rapid population growth, high rural-urban migration, an expanding middle class and sustained macroeconomic expansion has resulted in housing deficit of about 16 million units.

The construction industries globally due to its nature have a negative impact on the environment. Such negative impact includes: changing the balance of nature, habitat destruction, generating a lot of waste, and altering the balance of natural systems. The importance of sustainability cannot be over emphasised because the construction industry is a medium for achieving any development be it human or even infrastructure. According to Adebayo (2002) one of the area that requires serious attention in sustainable development debate is the construction industry this is because most projects and development are mainly focused on the economic benefit rather than environment.

Surely, the way forward is to embrace sustainability in the construction industry. The construction companies in the developed countries due to their proactive nature have embraced the concept of sustainability in other to gain competitive advantage. Sadly this is not the case in the developing countries like Nigeria where the clamor for sustainability is just of recent since the country's independence in 1960 which was triggered in 1989 by the detection of a foreign firm dumping toxic wastes in southern Nigeria (Ajayi and Ilporukpo, 2005). Ethical sourcing awareness and practice will be lesser in developing countries due the various challenges they constantly face. Ofori (1998) and du Plessis (2007) noted that developing countries face a lot of challenges ranging from huge infrastructure and housing deficit, weak institutions of government, rapidly rising population, skills shortage, social inequity and relative unstable political climate. This is even worrisome as illustrated by Oborien (2005) that extraction of quarry is creating negative social, environmental and economic impacts on the Iyuku community in Edo state Nigeria. Similar problem occurs to communities that have body of rocks as illustrated by Mbamali (2005) that there is no evidence of consideration for quarrying in the most cities development plan in Nigeria. It can be concluded that impact of quarrying activities on communities needs serious and urgent attention because the occurrence of this natural stone is not infinite no matter how hugely the deposit may be, its formation usually take thousands of years.

The forestry subsector has played a major role in the socio-economic development in the world. It has provided revenue and generated high employment opportunity for the general population. Timber is a product of the forestry subsector and has been used in the construction of houses, barns, fences, bridges and furniture in the building industry. In fact, wood use to be the predominantly used material for construction and energy generation but changed in the 19th century (Douglas, 1995). The global demand for wood has put more pressure on the forestry sub sector. Fuwape (2009) affirmed that the various activities in the forest industry such as tree felling, transportation, conversion and processing have some negative impacts on the environment. These impacts are not limited to loss of biodiversity, destruction of forest cover. Thus, exploitation of these natural resources for the aforementioned purpose if not planned and managed will have a devastating effect on the ecosystem. This was further affirmed by Corus (2005) in Kuroshi and Achenu (2005) that the consumption of natural resources thought the world is exceeding the capacity of the natural environment. Hence, the need to apply the concept of ethical sourcing which will go a long way in reducing the various impacts discussed above.

According to Alabi (2012) the following reasons are responsible for the poor implementation of sustainability practice in the Nigeria construction industry by practitioners:

i. The lack of basic understanding of sustainable construction in the industry.
ii. Lack of political will and awareness to construct sustainably.
iii. Individual commitment is lacking.
iv. Lack of educational/institutional framework.
v. Economic benefits of sustainability are not communicated.
vi. Developers are not convinced of the value added nature of sustainability and the need for them to prepare for additional cost.
vii. There is no bye-law or regulation by the government to enforce the concept.

ETHICAL SOURCING SUPPLY CHAIN MANAGEMENT IN THE DEVELOPED WORLD

It has been know that business rely on supply from customers and also customers to purchase goods produced. Materials flow from supplier to user across the supply chain is constantly needed to keep the production line moving. Recently, there has been increase in environmental awareness were customers have started to demand from their various supplier the source of their product (Hsu and Hu, 2007; Sheu et al, 2005; Ofori, 2002). Responsible sourcing of construction inputs is an increasing discussed sustainability issue globally. The awareness has really changed and has gone along way of reshaping the supplying chain management making it an awareness driven system. Here stakeholders are concerned on the sources of materials from their various suppliers whether is ethical sourced or not. Government in developing countries like United Kingdom and Canada has started to increase their focus on sustainability through ethical sourcing in the construction industry. In the UK, concept of ethical sourcing is new which evolved as a result of recent government sustainability strategy for the construction industry which encourages the patronage of suppliers who are able to demonstrate that their product are ethically sourced (HM Government, 2008). Glass et al. (2012) further affirmed that the global awareness for ethical sourcing is little even in the United Kingdom with larger manufacturers and major contractors not being well-informed, but only few small and medium scale enterprises engaging in ethical sourcing. Ethical sourcing integrates human rights, health, safety and environmental considerations in a company's supply chains. It has now been imbibed in the standard and code of practice such as the BSI British Standards (2010) which encourages great consideration of the environment, economic and social development goals. According to Glass (2012) the use of ethical sourcing varies, which are interchangeable as responsible sourcing, sustainable procurement and also sustainable supply chain management in various literature. To clear off this ambiguity, the UK standards BS8902 (2009) and BES6001 (2009) all agreed that ethical sourcing should be towards the management of objectives relating to sustainability in the life-cycle of a product, including the key the pillars of sustainability which are environmental, social and economic objectives and include the effective auditing of the supply-chain of any constituent materials used for construction (Glass, 2011a). Ethical sourcing fully encompasses issue such as corporate social responsibility, sustainable procurement practice and stewardship of resources.

Organisation have now discovered that introducing ethical sourcing in to their business activities is not only beneficial to the environment but also enhances the quality of product delivered, reduces risk in the supply chain process or reputation damage and on the long run enhancing overall productivity level (Lippmann, 1999). However, Ballou et al. (2000) had a contrary opinion that for organization who embraces ethical sourcing, the believe of gaining a competitive advantage against other organizations is not easily achievable.

To fully implement idea of ethical sourcing the United Kingdom government has set a target that 25% of all construction products should be procured through ethical sourcing schemes by 2012 (HM Government, 2008). To facilitate this, standards has being developed to serve as guide toward ensuring ethical sourcing of products and materials. The standard is aimed at ensuring that certified construction inputs are ethically sourced and the inclusion of products and materials that are not wholly covered under current available standards and codes.

The main objectives of the standard are:

i. To promote responsible sourcing of construction products through the provision of a set of requirements.
ii. To give clear guidance on the sustainability aspects that should be addressed.
iii. To provide confidence that materials and products are being ethically sourced.
iv. To provide a route to obtaining credits within the materials sections of the code for sustainable homes and the BREEAM family of certification schemes.

The standard developed are

1. BES 6001
2. BS 8902

BES 6001 (Framework standard for the responsible sourcing of construction product BRE Global). This covers:

i. Organizational management requirements: This has to do with ethical sourcing policy, legal compliance, and quality management system and supplier chain management.
ii. Supply chain management requirements. Items included are material traceability, environmental management systems, and health and safety management systems.
iii. Environmental and social requirements. They are: waste management, water extraction, greenhouse gas emissions, life-cycle assessment; transport impacts, employment and skills, local communities.

For each item listed, a specific criteria is set against scored achieved

BS 8902 (Responsible Sourcing Sector Certification Schemes for Construction Products specification).

This is similar to the BES 6001 standard which also set standards for product certification. BS 8902 contains a useful list of headings or issues that should be addressed in any ethical sourcing scheme. It was established after the launch of BS 6001, it sought to harmonize the views of stakeholders on factors that constitute ethical sourcing standard. BS 8902 was established as an assessment standard to certify products and also act as a frame work which allows other sectors to develop their certification scheme. Certification bodies will have to develop their schemes that interpret the criteria with respect to their sector.

Synthesis of elements for a feasible and applicable frame work in Nigeria

The natures of challenges in developing countries are different from that of developed countries. This was affirmed by Adebayo (2002) that developing countries like Nigeria are faced with extreme survival issues due to poverty, war and economic problems, this make environment a less priority. For the general adoptability of responsible sourcing in the Nigeria construction industry the following should be considered due to the nature of this sector.

Stakeholders in responsible sourcing implementation. These are people directly or individually affected by any decision in the industry. They include; the professionals, material manufacturer merchants, contractors, public and private clients. The stakeholder’s perceptions are therefore key to this study.

Organizational Management Requirements

Responsible sourcing policy: There should be policy relating to responsible sourcing

Legal compliance: Relevant law that is given a statutory backing will have to be enacted.

Quality management system that is applicable to Nigeria should be made.

Supplier management system guide which can be referred to is needed.

Supply Chain Management Requirements

1. Material traceability in the supply chain
2. Environmental management systems in the supply chain
3. Health and safety management systems in the supply chain

Environmental

1. General: This includes

a. Establishing a policy and metrics b. setting of objectives and targets and also review performance c. Reporting to stakeholders d. External verification by third party

2. Greenhouse gas emissions
3. Resource use
4. Waste management
5. Lifecycle assessment (LCA)
6. Transport impacts on the environment

Social Requirements

1. Employment and skills
2. Compensation
3. Remuneration
4. Royalties
5. Community development
6. Contribution to the built environment

CONCLUSION

In recent the times the need for sustainability practices in the every aspect of the world and particularly the construction industry has begun to evolve. Nowadays, construction companies must handle manifold challenges like growing public interest on sustainability. The study has taken a broad look at ethical sourcing supply chain management and the issues emerging in this field. It shows the effort by a developed country (United Kingdom) and a developing country (Nigeria) in achieving sustainability. This paper has also highlighted the components needed for a feasible and applicable frame work in Nigeria. This paper discovered that Nigeria is lagging behind in pursuing sustainable agenda and the global awareness for ethical sourcing is little even in the United Kingdom.

REFERENCES

Adebayo, A. A. (2002): Architecture and Cities for Tourism, Paper Presented in Conference for Tourism for Architecture: Mauritius

Ajayi, D. and Ikporukpo, C. 2005. An analysis of Nigeria`s Environmental Vision 2010. Journal of Environmental Policy and Planning 7, 341-365

Alabi, A. A (2012) Comparative Study of Environmental Sustainability in Building Construction in Nigeria and Malaysia. Journal of Emerging Trends in Economics and Management Sciences 3(6): pp 951-961

Azzone, G. and Noci, G. (1998), “Seeing ecology and ‘green’ innovations as a source of change”, Journal of Organizational Change Management, 11 (2), pp. 94-111.

Ayanwu, J.C., Oyefusi, A., Oaikhenan, H. and Dimowo, F.A. (2008) The Structure of the Nigeria Economy (1990-1997), Joannee Education Publishers, Onitsha, Nigeria

Ballou, H., Gilbert, M. and Mukherjee, A. (2000) 'New Managerial Challenges from Supply Chain Opportunities', *Industrial Marketing Management*, 29, pp. 7-18.

Bansal, P. and Roth, K. (2000), Why Companies go Green: A Model of Ecological Responsiveness, Academy of Management Journal, 43 (4), pp. 717-36.

Benjaafar, S., Li, Y. and Daskin, M., 2010. Carbon Footprint and the Management of Supply

BSI British Standards (2010) *Guidance on Social Responsibility*, BSI, London, BS ISO 26000. Chains: Insights from Simple Models. Working paper. University of Minnesota.

Building Research Establishment, *BES 6001*(2009)*:* Framework standard for the responsible sourcing of construction products, Building Research Establishment, Watford,

British Standards Institution, *BS 8902(2009)* Responsible sourcing sector certification schemes for construction products – *Specification*, British Standards Institution, London.

Central Bank of Nigeria (2011), *Annual report 2011*. Central Bank of Nigeria, Abuja.

Cities Alliance, ICLEI and UNEP (2007). Liveable Cities-The Benefits of Urban Environment Planning, Washington DC.

Conceicao, P., Heitor, M.V. and Vieira, P.S. (2006) Are environmental concerns drivers of innovation Interpreting Portuguese innovation data to foster environmental foresight”, Technological Forecasting and Social Change, Vol. 73 No. 3, pp. 266-76.

Du Plessis, C., (2007). A Strategic Framework for Sustainable Construction in Developing Countries. *Construction Management and Economics*, 25, 67-76.

Federal Republic of Nigeria (2010) 2009 Annual collaborative survey of socio-economic activities in Nigeria: main statistical report, National bureau of statistics central bank of Nigeria and national communications commission.

Fuwape, J.A. (2009) “The Impacts of Forest industries and Wood utilization on the Environment” [Online] Available from http//www.fao.org/docrep/ARTICLE/WFC/XII/0122-A2.HTM [accessed 10 November, 2013]

Greenwood, D., Alwan, Z., Hudson, G., Siddall, M., Walker, P. (2011). A process model for sustainable design of buildings compliance. Built and Natural Environment Research Papers, 4(1), 11-19.

Glass, J. (2013) Envisioning the Future Pathways for Responsible Sourcing in the UK Construction Industry, In *Soetanto* R, (eds.), 13th Sustainable Building Conference, 110-1173 Coventry, England organised by Coventry University United Kingdom.,

Glass, J. Achour, N. Parry, T. and Nicholson, I. (2012), Engaging small firms in sustainable supply chains: responsible sourcing practices in the UK construction industry, International Journal of Agile Systems and Management, Special Issue: Sustainable supply chain design and practice, 5**(**1), 29-58

Glass J., Achour N., T. Parry and Nicholson I. (2011), The role of responsible sourcing in creating a sustainable construction supply chain, CIB W65 Supply Chain integration workshop, Amsterdam, Netherlands.

Glass, J. (2011a). Briefing: Responsible sourcing of construction products, Proceedings of The Institution of Civil Engineers: Engineering Sustainability, 164 (3), 164-175

H M Government, (2008) Strategy for sustainable construction, Department of Business, Enterprise and Regulatory Reform, London

Hsu, C. W.; Hu, A. H., (2007).Green supply chain management in the electronic industry. Int.J. Environ.Sci.Tec., 5(2), 205-216.

Kibert C. (1999). Reshaping the Built Environment, Island Press Washington D.C

Livesey K. and Hughes D. (2013), *Responsible sourcing of materials in construction*, BRE IP 4/13, Building Research Establishment, Watford.

Kuroshi, P.A. and Achenu, E. (2005) Building Research and Development in Nigeria in the Context of Sustainability. *In:* Mbamali, I. (Ed) *Proceedings of the 2nd National Conference: Towards a Sustainable Built Environment.* 21st-23rd September, 2005. Department of Building, Ahmadu Bello University, Zaria pp 159-169

Lippmann, S. (1999) 'Supply Chain Environmental Management: Elements for Success' Environmental Management, 6 (2), pp. 175-176.

Mbamali, I. (2005) Stone Quarrying in Nigeria: An Overview of Necessary Initiatives towards a Sustainable Built Environment . *In:* Mbamali, I. (Ed) *Proceedings of the 2nd National Conference: Towards a Sustainable Built Environment.* 21st-23rd September, 2005. Department of Building, Ahmadu Bello University, Zaria pp 54-62

Mentzer, J. and K. Kahn (1995). "A framework of logistics research." Journal of Business Logistics 16(1) pp. 231-251.

Uthman, A.A.E. (2010) Incorporating innovation and sustainability for achieving competitive advantage in construction. In: Wallis., Bilan, L., Smith, M. and Kazi, A.S. (eds) industrialised, integrated, intelligent sustainable construction ICON Handbook 2, .pp13 -42.

Oboirien, M.O. (2005) Impact of Granite on the Environment: A Case Study of Iyuku community, Edo State, Nigeria. *In:* Mbamali, I. (Ed) *Proceedings of the 2nd National Conference: Towards a Sustainable Built Environment.* 21st-23rd September, 2005. Department of Building, Ahmadu Bello University, Zaria pp 8-21

Ofori. G. (2000) 'Greening the construction supply chain in Singapore'*European Journal of Purchasing and Supply Management*, 6: 195-206 International Cement Review (ICR) 2003 *Global Cement Report, 5th Edition*. ICR, pp 342

Ofori, G. (1998). Sustainability construction: principles and a framework for attainment- comment. *Construction Management and Economics*, 16, pp141-145.

Oxford Business Group (2011) "Real estate and construction", *The Report: Nigeria 201*, Oxford Business Group

USEPA. 2009. Municipal Solid Waste in the United States [Online]. USEPA. Available: http://www.epa.gov/osw/nonhaz/municipal/pubs/msw2009rpt.pdf [Accessed 07-10-2013.

United Nations Environmental Programme (UNEP) 2009. Building and Climate Change, Paris,

Williams K. and Dair C. (2006). *What is stopping sustainable building in England? Barriers experienced by stakeholders in delivering sustainable developments,* Sustainable Development DOI: 10.1002/sd.308

Sheu, J.B.; Chou, Y. H.; Hu, C.C.,Z (2005): An integrated logistics operational model for green-supply chain management. Trans. Res., 41(4), 287-313.

ECONOMIC CHARACTERISTICS OF COMPRESSED LATERITE BRICKS IN HOUSING CONSTRUCTION IN NIGERIA

Pearl Akunnaya Opoko[1] **and Eziyi Offia Ibem**[2]**.**
Department of Architecture, Covenant University, Ota, Ogun State, Nigeria
School of Construction Economic and Management, University of the Witwatersrand, Johannesburg, South Africa.

The need to improve the supply of housing calls for research into the use of alternative construction materials in Nigeria and other developing countries with similar housing challenge. This paper examined the economic characteristics of the cement stabilised laterite block/bricks (CSLBs) in order to identify factors responsible for its limited use as walling material in housing construction in Nigeria. Data were derived via qualitative research method, including market surveys, through which prices of four building materials were obtained and used to compute the cost of walling a two bedroom prototype house. In addition, oral interviews of 26 purposively selected industry stakeholders were conducted to elicit their views on why there is low usage of CSLBs as walling material in housing construction in Nigeria. Result shows that despite the cost reduction and potentials in employment generation offered by the use of CSLBs, the social stigma against the materials appears to be overwhelming. Other factors militating against widespread use of CSLBs as an alternative to sandcrete blocks as walling materials include unavailability and dearth of skills required to use the material. The paper concludes that the prospects of using CSLBs as walling materials and benefits associated with it can be enhanced in Nigeria by encouraging the production of the material at cottage level and public enlightenment campaigns on the benefits of its use as well as training and re-training of artisans and tradesmen in the art of production and usage of the building material.

Keywords: laterick brick, housing construction, Nigeria

INTRODUCTION

Housing is universally recognised as a major necessity of life. Consequently, the United Nations Habitat Agenda has promoted adequate housing as a fundamental

[1] pearl.opoko@covenantuniversity.edu.ng
[2] Eziyi.Ibem@wits.ac.za

human right. Adequate housing has been described as housing that is safe, secure, accessible, affordable and sanitary (Federal Republic of Nigeria, 2012); and many countries have in the last few decades pursued the provision of adequate housing as a constitutional right, with complementing policies. Although there are several components of housing, including the physical component that is the house or building and associated services and infrastructure; the appearance of the physical component stands out as one of the key parameters for assessing the quality of housing. In fact, in a study on the comprehensive strength and costs of sandcrete blocks and blocks made with quarry dust in Abakiliki, Nigeria, Ikechukwu (2012) noted that the most significant element of the house is the wall. This is not only because it is the largest and most visible part of the building but also more importantly because it constitutes a major cost element in a modest house as the Nigerian Building and Road Research Institute (NBRRI), 1988) explained. The implication of this is that any research effort aimed at identifying appropriate walling material is a step in the right direction in the quest to achieving affordable housing development initiatives.

Access to adequate housing has continued to elude many Nigerians for obvious reasons. In a position paper on the way forward to facilitating low-cost housing in Nigeria, Chukwujekwu (2006) made it clear that one of the main reasons for inadequate supply of decent and low-cost housing was the high cost of building materials in the country. It is no longer news that many of the building materials in Nigeria are imported and when produced locally are usually conventional and imitations of foreign made ones. Due to the use of scarce foreign exchange in the importation of these materials, high technology and expatriate personnel involved in their applications, there is always a hike in unit cost of the materials. This partly accounts for why the cost of houses constructed with conventional and imported building materials are beyond the reach an average worker in Nigeria.

In an attempt to increase the availability of local building materials and promote their usage in the construction of low-cost houses, there have been calls for the development of alternative building materials from the abundant local resources in Nigeria like laterite, timber and stones. It is in line this that cement stabilised laterite bricks (CSLBs) was developed as an alternative walling material to the sandcrete blocks widely used in the country. It is however observed that despite the good physical and structural properties of the CSLB, the material has failed to gain wider acceptance in the last few decades of its existence in Nigeria.

This paper examined the economic characteristics of the CSLBs in order to identify factors which may be responsible for its low usage in the construction of houses. The paper seeks to further bring to the fore issues related to the development and use of local construction materials in Nigeria and other developing countries that share similar developmental and economic experiences. Discussions on alternative building materials in recent times have made sustainability a current issue (see Reddy 2004; Wekesa, Steyn and Otieno, 2010). Athough many authors such as Wekesa, Steyn and Otieno (2010) have focussed on environmental issues, little attention appears to have been given to economic issues associated with the use of local building materials. This paper is designed to increase the volume of literature and perhaps trigger more research on the subject matter.

LITERATURE REVIEW

The United Nations Centre for Human Settlements, UNCHS (1993a) revealed that building materials account for between 5% and 8% of the total value of imports in developing countries representing annual value of between 3% and 5% of Gross Domestic Product (GDP) of these countries. Although several scholars have investigated the properties of building materials in Nigeria, but many of the existing studies appear to have focused on the technical properties and cost of these materials. Research on clay bricks and blocks as an alternative walling materials got underway in Nigeria in 1985 when the Nigerian Building and Road Research Institute organised a seminar on the use of clay bricks and blocks in the provision of low cost housing in Zaria, Northern Nigeria. According to Omange (1985), the outcome of that seminar was a proceeding containing 27 papers on different properties of clay and its applications in the construction of housing. Since then, research efforts aimed at improving understanding of the various technical properties of clay bricks and blocks as walling materials have been on the increase.

The survey of literature reveals that several studies on alternative building materials have been carried out in Nigeria. These include among others studies on the:

- Application of alternative building materials for rural housing in Yankatsari village, Kano, Northern Nigeria by Opoko (1988);
- Technical characteristics of various alternative building materials in the country, including clay bricks by Dirisu, Asaolu and Olabiran (1988);
- Energy impacts of alternative building technologies on energy and environment by Reddy (2004);
- Physical properties of CSLB and their acceptability for housing construction in South West Nigeria by Alagbe (2010); and
- Use of indigenous composite building materials for housing by Taiwo and Adeboye (2013).

These studies help to understand that the different alternative walling materials have various advantages and disadvantages in terms of their physical, thermal, structural properties as well as cost.

From the review of literature and anecdotal evidence, we also understand that the role of building materials in promoting sustainable housing initiatives cannot be overemphasized. In a study on building materials production and use in housing development and management in Nigeria, Ifesanya (2007) contended that building materials contribute between 40% and 80 % of the total cost of procuring a house; while Fadairo and Olotuah (2013) explained in their study of materials and techniques of construction in low-cost housing for the urban poor in Akure, Nigeria, were of the view that building materials contribute the largest input in construction. Therefore, adequate supply of building materials is considered to be a critical factor in meeting the existing housing backlog put at about 17 million units in Nigeria (see Ayedun and Oluwatobi, 2011).

The building materials sub-sector has been recognised as vital component to the economic development of any nation as explained by Ramachandran and Ramphal (1989) and (2012). This is particularly very important in developing countries like Nigeria where the demand for adequate housing and infrastructure is astronomically high. Unfortunately, the building materials industry in many developing countries like

Nigeria can best be described as precarious. While Murrison (1979) strongly opined that the major challenges associated with inadequate building materials supply are socio-economic and not technical in nature, Opoko (1998) argued that these constraints are multifaceted being institutional, political, technical, socio-economic and cultural in nature. On its part, the National Housing Policy identified the collapse of a formally thriving building material sub-sector in Nigeria as being responsible for the current poor state of this sub-sector (see FRN, 2012). The current situation shows that the building material sub-sector in Nigeria is heavily dependent on importation as Ayedun and Oluwatobi (2012) explained. Consequently, the sub-sector is characterised by importation of finished building components and elements, raw materials, technology, machineries and even personnel. This development has a number of far-reaching economic and environmental implications.

It is against this background that Hansen and Williams (1987), in a theoretical paper on economic issues and the progressive housing development model, argued for the replacement of imported building materials with cheaper local substitutes. Gansen (1995) in a study on employment generation through investments in housing construction reported that substitution of imported building materials by local alternatives can result to increase the employment prospects by 20%. Further, in a study on jobs from housing Spence, Wells and Dudley (1993) asserted that creation of local employment has important multiplier effects on the local economy, while Ifesanya (2007) concluded that the production and use of local building materials is relevant to the economic, social, cultural and environmental sustainability of the nation. From the works reviewed so far, it is clear that the development and use of local building materials have multiplier effort on the housing sector, job creation.

Also in a paper on the problems and solutions of affordable mass housing delivery in Nigeria, Hemuka (2000) argued that over reliance on imported building materials was due to unavailability of local substitutes that are comparable in terms of quality including aesthetics in Nigeria. In view of this, the FRN (2012) identified the improvement of local capacity as vital step to stemming the over-dependence on importation of building materials in Nigeria. This is against the proposition by Chukwujekwu (2006) that governments in Nigeria have not generally done much to promote use of locally sourced building materials. Chukwujekwu (2006) further explained that poor funding of research and development has been the clog in the wheel of process in the development and usage of local building materials in the housing sector in the country. Inadequate funding of research suggests that governments in Nigeria are not doing much to promote the development and usage of local building material in the country.

Again, in recognition of the role local building materials play in the development of the housing sector, the Commonwealth Science Council and UNCHS (Habitat) in the 1980s initiated programmes aimed at promoting local capacity in building materials development as explained by Ramachandran and Ramphal (1989). In Nigeria, the new National Housing Policy (FRN, 2012), which has the overriding objective of repositioning the housing sector to serve as a catalyst for rapid socio-economic development, identified the promotion of the use of alternative building materials as a key priority. Earlier, in 2004, the Building Materials Producers Association of Nigeria (BUMPAN) was established with the objectives of identifying, mobilising and sensitizing of domestic small and medium scale producers of building materials and associated components (FRN, 2012). Chukwujekwu (2006) however lamented on the inability of BUMPAN to secure public acceptance of their products in housing development. A major reason adduced for low public acceptance of BUMPAN products is the lack of confidence in the quality of such products. The UNCHS (1993a) observed that although a lot of work has been done in developing building materials from local raw materials, such efforts has remain locked away from the supposed benefiting public in research and development organizations. On the one hand Mahgoub (1997) in a review paper on past and present efforts in achieving sustainable architecture in the United Arab Emirates argued that the use of local materials has been limited because of the perception that such local materials are incapable of meeting the demands of modern building forms and functions. Alagbe (2010) on the other hand revealed that apathy on the use of local building materials such as the CSLB could be attributed to ignorance on their physical and structural properties. It was on this premise that Cather (2001) concluded that the use of such materials be based on better understanding of their peculiar characteristics; meaning that adequate knowledge of the peculiar characteristics of local building materials can contribute to promoting their usage in construction activities.

In addition, other reasons have been advanced for low uptake of alternative building materials. In Nigeria for instance, there appears to be lack of political will on the part of government as the FRN (2002) indicated. Ramachandran and Ramphal (1989) identified the absence of sufficient know-how for the commercialization of local production of such materials. Although such local materials are cheaper than conventional materials as Fadairo and Olotuah (2013) explained, Ayedun and Oluwatobi (2011) contended that the cost advantage of alternative materials is reduced by uncompetitive production costs due to technology as well as dearth of skilled manpower. Alternative materials are also considered to be inferior and second class as Adam and Agib (2001) pointed out in their study of compressed stabilized earth block in Sudan. This view was corroborated by Zami and Lee (2008) in their study on the use of earth as a building material for sustainable low-cost housing in Zimbabwe, which they attributed this development to the misconception of indigenously sourced materials as being for the poor and therefore undesirable.

Despite the fact that conventional building materials such as sandcrete blocks are not suited to the socio-economic, climatic and technological peculiarities of many developing countries, such materials are often considered superior to local alternative walling materials. The principal reason for this is linked to the general perception that the use of sandcrete blocks as walling material is a measure of social status, prestige and economic well being (Fadairo and Olotuah, 2013). Hence it often concluded that it is degrading to build one's house with alternative building materials like stabilized bricks as explained by Alagbe (2010).

RESEARCH DESIGN AND METHODS

Data used in this paper were obtained via qualitative research method. Secondary data were obtained through extensive literature review, while primary data were collected through interview with 26 purposively selected industry stakeholders. An interview guide comprising structured and open-ended questions on the subject matter prepared by the researchers used for the interviews. This was to streamline responses while providing opportunity for respondents to give more information where necessary. Additional data were obtained through market surveys, which were used to obtain prices of walling materials such as vibrated sandcrete blocks, ordinary sandcrete blocks, NBRRI Interlocking Blocks and NBRRI cement stabilised laterite brick. This was to allow for comparative analysis of the cost of using these walling materials in housing construction.

Table 1 shows the number of stakeholders who participated in the research, which took place between July and September 2013 in Southwest Nigeria. Questions posed to the interviewees were related to the different characteristics of CSLBs produced by the NBRRI. The interviews were recorded manually and analysed using content analysis. This involved coding and organising information derived from the interviews into common themes in order to highlight patterns and crucial issues expressed by the informants. The analysis also help in identifying trends and common key aspects of the subject matter expressed by the participants, upon which inferences are drawn from and conclusions made.

Table 1: breakdown of those interviewed

S/No	**Organizations**	**No of Participants**
1	BUMPAN	1
2	NBRRI	2
3	Building Industry professionals	8
4	Others(prospective home owners)	15
	Total	**26**

It is important to state that stabilised brick is a mixture of cement and laterite and produced using a manually operated brick making machine. The machine which has dimensions of 290x140x100mm produces a compactive strength of 3kN/m. On the other hand, the interlocking blocks are made from a similar mix to the bricks but produced using a specially designed electric operated machine of dimensions 230x230x225mm. The sandcrete block is the main walling material in the Nigeria and has been included in this study for comparative purpose

To effectively carry out a comparative analysis of the cost of the different walling materials mentioned in this paper, a prototype a two bedroom house was chosen as shown in Figure 1. Use of a prototype for cost analysis instead of the unit cost of individual products was adopted to take into consideration dimensional differences and varying labour costs involved in constructing the wall elements of the house.

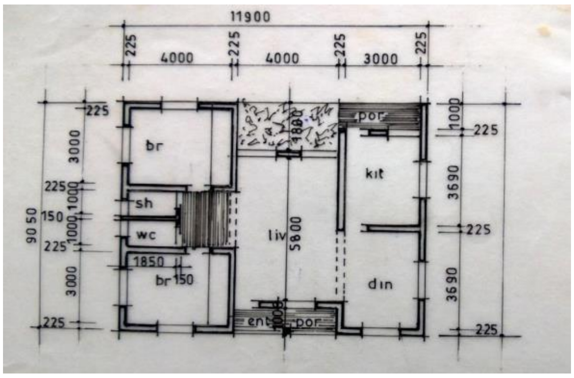


Figure 1: Plan of a Prototype Two Bedroom House Used For Analysis

FINDINGS AND DISCUSSIONS

The findings of this study are presented and discussed in this section of the paper. The economic characteristics of the materials are discussed under cost of the materials; labour cost involved in block/brick work and rendering; availability and accessibility of the materials as well as aesthetic quality of the finished work.

Comparative Cost of the Different Walling Materials

Cost analysis of the different walling materials considered in construction of prototype two-bedroom house (Figure 1) is presented in Table 2. Examination of data in Table 2 shows that the CSLB is cheaper than the sandcrete block as walling material. It is evident from the data (Table 2) that the main area of cost saving when using the CSLBs comes from their external finish as the CSLBs do not require both internal and external plastering and painting. For the interlocking CSLBs, cost saving is also achieved in the dry construction method which eliminates mortar for jointing of the walling units (blocks). However, cement-based mortar is only required at critical areas like the base course.

Table 2: Cost of the different walling materials for the prototype house in naira

S/NO	ITEMS	Cost of ordinary 230mm thick Sandcrete Block	Cost of Vibrated 230mm thick Sandcrete Block	NBRRI Interlocking Block	NBRRI Stabilized Brick
1	Bricks/Blocks	265,540.00	390,500.00	276,900.00	130,711.00
2	Mortar	178,068.00	178,068.00	15,930.00	279,826.00
3	Labour	60,000.00	60,000.00	87,500.00	90,000.00
4	Internal Plaster	122,230.00	122,230.00	122,230.00	122,230.00
5	Internal painting	74,942.00	74,942.00	74,942.00	74,942.00
6	External Plastering	122,230.00	122,230.00	Nil	Nil
7	External Painting	74,942.00	74,942.00	Nil	Nil
	TOTAL	**₦897,952.00**	**₦1,022,412.00**	**₦577,502.00**	**₦697,709.00**

In contrast, the labour costs for constructing walls using sandcrete blocks was found to be cheaper than the labour cost for the CSLBS (see Table 3) . This was due to the longer time it took to construct the walls using the CSLBS as masons and other workers involved appeared to be more familiar with the sandcrete blocks than the CSLBS. Besides, in the event that there are errors in workmanship with sandcrete blocks, they could be hidden by plastering. This is not the case with the CSLBS. It is generally believed that one of the major advantages of the interlocking CSLBS is the ease and speed of construction. Information gathered from the interviewees reveals that in practice, this is was not the case. For instance, to ensure the bricks are not damaged and achieve the desired level of aesthetics, stacking the blocks requires painstaking eye and precision for details; and thus construction tools like spirit levels must be used as appropriate. Also when the need arises, cutting of the CSLBs is very difficult and requires extra care to avoid damaging the bricks. In addition, any mistake may necessitate the wall being dismantled and reworked. All these account for the higher labour cost of CSLBs when compared to the sandcrete block as walling materials.

Table 3: Labour cost for setting blocks/bricks for the prototype

S/ NO	Type of Material	Dimensions (mm)	No. Set/Day (Nos.)	Daily Labour Rate (₦)	Total Wall Area (m^2)	Total No. of Blocks/ Bricks Prototype	Time Required to set Prototype (Days)	Cost of Labour (₦)
1	Sandcrete Blocks (9'')	225x225x450	80	3,000.00	142	1562	19.53 (20)	60,000.00
2	Vibrated Sandcrete Block (9'')	225x225x450	80	3,000.00	142	1562	19.53 (20)	60,000.00
3	NBRRI Interlocking Bricks	230x230x225	160	3,000.00	142	5538	34.61 (35)	105,000.00
4	NBRRI Stabilized Bricks	290x140x100	140	3,000.00	142	4970	35.50 (36)	108,000.00

Availability and Accessibility

A major of those interviewed identified non-availability of CSLBs in the open market as one of the factors militating against that their use as walling materials. They noted that unlike the sandcrete blocks that can be purchased with ease from blocks making industries in urban and rural areas of Nigeria; the CSLBs are not easily available in commercial quantity. Presently, CSLBs cannot be purchased on demand from either marketers or producers. The process of having access to CSLBs is somewhat cumbersome as orders have to be placed with payments and adequate time allowed for production. On the alternative, prospective users will buy the machines and produce their own blocks. This option was considered a waste of money for those who want to build their own houses. These obviously suggest that CSLBs are scarce building materials, and thus their use in housing construction is limited to few people in Nigeria. Resolving these issues will enhance wider utilisation of the CSLBs.

Aesthetic Quality

Some of those interviewed were of the view that buildings constructed of sandcrete blocks were aesthetically more appealing as there was room to correct or hide construction errors. Painting in different colours also enhances their aesthetic appeal. However for CSLBs-constructed walls, there was only one colour available. It was also revealed that poor workmanship often negatively affect the aesthetics of finished walls constructed with CSLBs. Consequently, home builders show apathy in using the CSBLs as walling material in Nigeria.

The study also found out that although people generally consider the CSLBs technically adequate and cheaper (see Table2) than the sandcrete blocks, they were very reluctant to use them in their own buildings because of social stigmatization. Majority of the homeowners interviewed felt that using such materials will lower their social standing among their peers and neighbours, because the material is believed to be for the poor. Generally speaking, anecdotal evidence shows that in Nigeria, the perception and opinion of people about building materials, to a large extent, influence how the materials are used. The general view is that if a product is cheap, then it must be inferior and vice versa. Since the advent of modern building materials in Nigeria, earth has been regarded as a material lacking in glamour and prestige required in contemporary house construction. Hence, CSLBs is considered to be synonymous with poverty and retrogression.

On the other hand, sandcrete block is considered modern and acceptable, even though they are often produced through processes that are harmful to the ecosystem. Over the years, the Nigerian society has become very materialistic as people are measured by the perceived value of what they have. Consequently, to the average Nigerian, social standing is very important and is usually a very decisive factor in decision making. In line with this, building materials that are considered modern, progressive and capable of projecting the desired status is preferred despite of their shortcomings. This explains why, there appears to be very low patronage of the CSLBs as walling material in housing construction in Nigeria.

CONCLUSION AND RECOMMENDATIONS

This study examined the economic characteristics of CSLBs and the reasons for its low uptake in housing construction in Nigeria. Evidence from the study reveals that there is a significant cost reduction in the use of CSLBs as walling material, and that massive use if the material in housing construction can result in employment generation and should stimulate the construction of low-cost housing in Nigeria. However, a number of factors identified in this paper are militating against the uptake of CSLBs by a critical mass; and by extension preventing the maximization of the benefits associated with the use of CSLBs in Nigeria.

In order to improve the level of uptake of CSLBs as an alternative to sandcrete blocks as walling materials, there is a need to improve access to, and availability of CSLBs. It is therefore suggested that research and development into the use of CSLBs be intensified. This should be followed by commercialisation production of the material at cottage level and aggressive public enlightenment campaigns on the use and benefits of using CSLBs. Notably, mass production of CSLBs in locations closer to potential markets will on one hand result in a reduction in transport cost. On the other hand, there is a higher prospect in employment generation in the production and supply chain management as well as use of the product.

It is evident from the study that one of the key challenges militating against the wide spread usage of alternative building materials such as the CSLBs is the social prejudice. It does appears that this challenge must be removed for any significant progress to be made towards wide spread use of the material. At this juncture, it is for government to demonstrate enough political will to support the uptake of CSLBs by a critical mass of Nigerians by not only facilitating the formulation of appropriate standards for the material but also using them in public housing projects in the country. Under the current public private partnership housing programme, it would be ideal for a reasonable proportion of houses be constructed with the CSLBs. These can serve as models upon which other developers can learn from.

In promoting the use of CSLBs, the need for technical training and retraining of artisans and tradesmen in the art of producing and using these materials cannot be overemphasised. Such training should be broad-based taking into cognisance the need to include those currently considered skilled in block making and laying and those who are not. In such trainings, attention may be focused on the peculiarities of the new materials especially the need for more precision and care in workmanship among tradesmen in the building construction industry. This will increase the human resource base in the production and application of CSLBs, and by extension improve the level of uptake of the material in housing construction in Nigeria.

REFERENCES

Adam E. A. and Agib A. R. A. (2007): Compressed Stabilized Earth Block Manufacture in Sudan. Paris: UNESCO.

Adedeji, Y. M. D. (2012): Sustainable Housing Provision - Preference for the Use of Interlocking Masonry in housing delivery in Nigeria. *Architecture Research* 2(5);81-86.

Alagbe, O. A. (2010)Prospects and Challenges of Compressed Stabilized Laterite Bricks in Enhancing Sustainable Housing Development in Nigeria. International Conference on Sustainable development and Environmental Protection: Strategies and Procedures for Developing Nations at Bells University of Technology, Ota, Nigeria, 21-23 September, 2010.

Anand, K. B. and Ramamurthy K. (2003): Development and Performance Evaluation of Interlocking Block Masonry. *Journal of Architectural Engineering* 6 (2); 45-51.

Ayedun C. A. and Oluwatobi A. O. (2011): Issues and Challenges Militating against the sustainability of affordable housing provision in Nigeria. *Business Management Dynamics*. 1 (4);1 - 8.

Cather, B. (2001): What's New in Construction Materials? The Challenges of the imagination. *Construction Management and Economics*. 19: 335-336

Chukwujekwu I. E. (2006): Facilitating Low Cost Housing Scheme which way forward? *The Journal of Housing Today*. 1 (10).

Dirisu, A. O., Asaolu, E. O. and Olabiran, E. O. (1988): Building Materials Research Activities at NBRRI. In Omange, G. N. (ed.). Ten Years of Building and Road Research. NBRRI, Lagos. p13-30.

Fadairo G. and Olotuah A. O. (2013): Low-cost Housing for the Urban Poor in Akure, Nigeria: materials and techniques of construction. *Journal of Environment and Earth Science*. 3 (9);135-142.

Federal Republic of Nigeria (FRN) (2012): National Housing Policy. Abuja, FRN.

Federal Republic of Nigeria (2002): The Report of the Presidential Committee on Urban Development and Housing, Abuja.

Ganesan S. (1995): Employment Generation Through Investments in Housing Construction. PhD thesis submitted to the University College, London.

Hansen E. and Willian J. (1987): Economic Issues and the Progressive Housing Development Model. Pathon, C. V. (ed) Spontaneous Shelter. Philadelphia, Philadelphia Temple University Press.

Hemuka N. N. (2000): Affordable mass housing delivery in Nigeria: problems and solutions. National Workshop on Housing Delivery Organized by the Obasanjo Collective in Lagos. 22-26 October 2000.

Ifesanya S. O. (2007) Building Materials Production and Use in Housing Development and Management (eds). Agbola T. Egunjobi L. and Olatubara C. O. Department of Urban and Regional Planning, University of Ibadan.

Ikechukwu U. F. (2012): Comprehensive Strength and Costs of Sandcrete Blocks and Blocks Made with Quarry Dust in Nigeria: a case study of Abakaliki quarry. *Journal of Chemical, Mechanical and Engineering Practice*. 2 (3) p 9-17.

Mahgoub,Y. (1997) Sustainable Architecture in the United Arab Emirates: Past and Present. In: Proceedings of the CAA-IIA International Conference on Urbanisation and Housing. 2-5 October, 1997. GOA, India.

Murrison, H. (1979): Indigenous Building Materials. Murison, H. S. and Lea, J. P. (eds). Housing in Third World Countries: Perspectives on Policy and Practice, p 126-130. Brisbane, MICE.

Nigerian Building and Road research Institute,(NBRRI) (1988): Building Construction Digest vol1, no.1. NBRRI, Lagos.

Omange, G. N. (1985): Research Development and Current Practice in Nigeria- Proceedings of the Seminar on the Use of Clay Bricks and Blocks for the Provision of Cheaper and Durable Housing Held in Zaria, October, 1985.NBRRI, Lagos.

Opoko, A.P. (1988**):** Use of Alternative Building Materials in Rural Housing: NBRRI demonstration project, Yankatsari village, Kano. In NBRRI 10th Year Commemorative Magazine, Lagos; NBRRI Publication. pp 31-33.

Opoko, A.P. (1998): Framework for Widespread Utilisation of Alternative Building Materials. In DPBHD 1998 Memorandum to the National Council on Works- proceedings of the 13th National Conference of Chief Architects of the Federation of Nigeria at Federal Secretariat, Uyo.

Ramachandran, a. And ramphal, s. (1989) foreword. *Journal of the network of african countries on local building materials and technologies*. 1(1),3

Reddy, B.V.V. (2004): Sustainable Building Technologies *Current Science*. 87(7) 899-907.

Spence, R. Wells J. and Dudley E. (1993): Jobs from Housing: employment, building materials and enabling strategies for urban development. Report prepared by Cambridge Architectural Resources Ltd. for the Overseas Development Administration of the United Kingdom.

Taiwo, A. and Adeboye, A. (2013): Sustainable Housing Supply in Nigeria Through the Use of Indigenous and Composite Building Materials. *Civil and Environmental Research* (Online) 3(1),79-84.

Thiedeke G. (1979): Manpower, Skills and Materials. Murison, H. S. and Lea, J. P. (eds). Housing in Third World Countries: Perspectives on Policy and Practice, p 118-125. Brisbane, MICE.

Tipple, A. G. (1993): *Shelter Provision and Employment Generation. Report* prepared for UNCHS (Habitat) Nairobi and The International Labour Organization, Geneva.

UNCHS (1993a): The Relationship between Underemployment and Unemployment and Shelter. Progress report of the Executive Director to the fourteenth session Nairobi 26 April- 5 May 1993.

UNCHS (1993b): *National Trends in Housing Production Practces*: Vol. 4, Nigeria. Nairobi, UNCHS.

Wekesa, B.W., Steyn, G.S. and Otieno, F.A.O. (2010): The Response of Common Building Construction Technologies to The Urban Poor and Their Environment *Building and Environment.* 45 :.2327-2335.

Zami M. S. and Lee A. (2008) Using Earth as a Building Material for Sustainable Low-cost Housing in Zimbabwe. *The Built and Human Environment Review*. 1: 40 - 55.

EMPLOYEE-DRIVEN INNOVATION IN LARGE PROJECT ORGANISATIONS

Henrik Sorensen[1] and Søren Wandah[2] and Randi Muff Christensen[3]

1Aalborg University, Dept. of Mechanical and Manufacturing Engineering, Fibigerstraede 16, 9220 Aalborg, Denmark

2Aarhus University, Dept. of Engineering, Dalgas Avenue 2, 8000 Aarhus, Denmark

3Danish Installation Management Command, Arsenalvej 55, 9800 Hjorring, Denmark

In the built environment there is considered to be a great potential for innovation and continuous improvement based on the employees' tacit as well as spoken knowledge. Through a case study the aim of this research was to challenge the theoretical approach to conduct employee-driven innovation (EDI). The case was a group of employees in a large governmental client organisation. The EDI framework was based on a theoretical approach to conduct EDI, derived from a previous literature study. The case study was conducted as an exploratory case study with outset in a gaming approach that challenged the participants with discussions on obstacles and solutions for EDI. The game approach was undertaken to facilitate discussions on specific EDI topics carefully selected to stimulate both group and plenum discussions. The themes of the theoretical framework were challenged through the participants' discussions and perceptions of the applicability in the organisation. The findings were discussed in relation to the theoretical approach and findings from a comparable case study. It identified overall methods that had the higher robustness and applicability to incorporate in a practical EDI framework. The findings further emphasise that when approaching EDI in large project organisations in the built environment, the theoretical approach is often more sophisticated than the organisational needs to be successful.

Keywords: built environment, case study, employee-driven innovation, governmental clients, project organisation.

INTRODUCTION

The built environment has long been known for its conservatism and for being traditional to a degree that has caused the industry to fall behind other industries in terms of innovation, technology, new processes, and development in general (Manley and McFallan, 2006; Wandahl et al., 2011). The rate of innovation lags behind most other sectors, and appears to be falling further and further behind. Moreover, innovation efforts in the industry are disproportionately orientated towards product enhancement rather than process improvement (Winch, 1998; Wandahl et al., 2014). The contextual conditions which characterise the industry can largely be defined as a low-tech industry (below 2 percent annual investment in R and D), with low levels of expenditure on activities associated with innovation (Seaden and Manseau, 2001;

[1] hensor@mil.dk
[2] swa@iha.dk
[3] fbe-bus02@mil.dk

Sorenson *et al*. (2014) Employee-driven innovation in large project organisations *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 269-280

Reichstein et al., 2005). The large project organisation in the built environment can be categorised as based on new bonds and relations in drifting systems, as defined by Christensen and Kreiner (1991), who also argue that the employees are an important and effective source of innovation that are often ignored or unseen in innovative approaches. In terms of their experience-based and up-to date knowledge about the projects, employees possess the newest and most valuable knowledge about materials, markets, customers, processes and customers/users. Hence, it is an obvious source of information and knowledge within the organisation, who can share their practical experiences and know-how in informal networks or forums (Høyrup, 2010).

More recently tendencies in knowledge-sharing emphasise the importance of complementing the technological investment with management practices that motivate employees to share knowledge on a continuous basis, in the quest of sustaining and improving organisation profitability and enhanced employee morale (Prusak and Davenport, 2000). This is further emphasized by O'Dell and Hubert (2011), who states that knowledge management (KM) is driven by people not technology, therefore elements such as social activities, culture, sharing and learning are keys to apply KM. However, understanding what makes employees with higher skills and knowledge motivated to share knowledge and innovate in organisation, has been a managerial issue for some time (Amar, 2004). KM involves the creation, sharing, validation, utilization, and management of tacit and explicit organisational knowledge (Bonnie and Monica, 2007; Thite, 2004). When implementing innovation, the quality of knowledge and information sharing is more comprehensive than the static quantity of information and knowledge. Further when implementing process innovation initiatives, managers should combine technical skills with skills on both knowledge-sharing qualities and team culture. (Lee et al., 2011)

Prior to this research a literature review was undertaken to investigate the theoretical field of research. The output and main purpose of the literature review was to identify the key themes on conduction EDI in large project organisations and to discover a theoretical approach or framework to conduct EDI (Sorensen and Wandahl, 2013).

The aim of this research was to challenge the theoretical approach to conduct employee-driven innovation. This is elaborated more in the two research objectives. First the collected data should give a broader view on:

- Which tools and methods in the field of EDI can be customised in a theoretical framework to fit a governmental client organised as a project organisation?

Further, the data analysis should provide input to:

- How can strategies, management control systems and organisational changes generate and support an EDI process in a governmental client organisation?

METHODS

This research is conducted as a part of an Industrial PhD research, this entails there are some relations between the case organisation and the research group. However as Patton (1990) emphasizes, in general it is difficult to ensure real objectivity, since the intrusion of the researcher's biases is inevitable in qualitative research. This further enhances this research's priority in addressing Guba (1981)'s criteria for trustworthiness of qualitative research; credibility, transferability, dependability, and confirmability. The precautions to ensure these criteria are described in this methodology section.

This research is a part of a larger case study research process. The overall case study is based on a single case and multiple unites, hence on embedded designs (Yin, 2009). The approach to the research presented in this paper is an exploratory case study with a single case and a multiple units approach, but in the perspective of this is one of several units of analysis. The strength of exploratory research is to investigate distinct phenomena with no preliminary research conducted (Yin, 2009). The exploratory approach was chosen based on the character of the research objectives and lack of prior knowledge on the case. The case study was conducted with a gaming approach. The main purpose of the game was to present some of the most essential theoretical EDI themes and challenges discovered in the literature for a representative sample of the employees in the organisation, and have them discuss possible obstacles and solutions to those issues.

The case organisation was a large Danish governmental client organisation with a project based organisational architecture. The unit of analysis was the employees of this organisation. The organisation has several offices located all over the country with various types of employees. The total number of participants in the case study was 24 out of a total number of 191 employees in the organisation. They were randomly selected based on geographical and organisational location and type of employment to ensure the broadest source of data as possible. The variations in participants and types of employment were; project managers (9), construction managers (6), project assistants (2), technical employees (4), case workers (2), and legal advisers (1). The game was designed based on the themes from the literature study and the phases in a generic innovation process model (Tidd and Bessant, 2009). The key elements of interest were consistent patterns of phenomena and themes reoccurring in the dataset. Within the themes the main interests was tendencies on drivers and obstacles in using EDI-practices in the organisation, input to tool and methods, and cultural and managerial challenges.

The case study was conducted through a gaming approach to facilitate discussions between participants and to ensure that the process was going forward. The conditions presented to the participants were that they should act and think as if the theme occurred in their everyday working environment and problem-solving processes. Likewise the participants were urged to think 'out-of-the-box' and not be restricted by the historical and cultural history of and historical events in the organisation. When designing the game, the point of departure was the exploratory case study approach, hence achieving as much data as possible exploring the phenomena, with the participants forced to brainstorm, think 'out-of-the-box' and discuss within relatively strict time limitations. The game master facilitating the gaming process was the researcher with no relations to the case organisation. To avoid the form of bias this could cause the researcher with direct relations to the case organisation was only observing, and was not in dialogue with the participants during the three games. One more member of the research group, who also has some relations to the organisation, was only observing the discussions as well.

The gaming approach

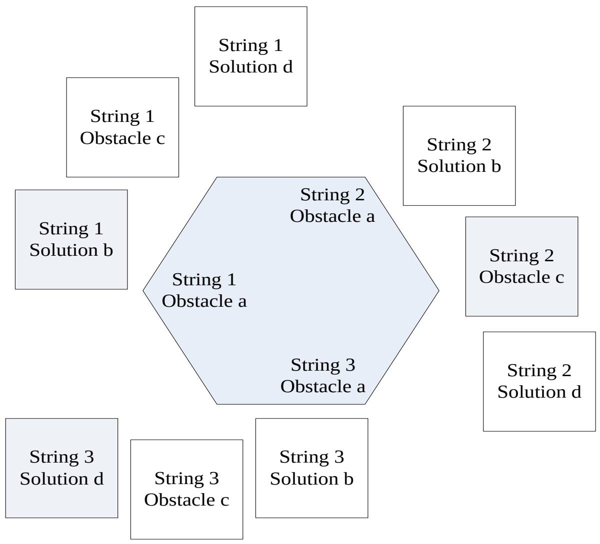
The procedure of the game was that each play consisted of two rounds with each three theme strings, see Figure 2. Each theme string took its departure in three different predefined obstacles formed by the research group. The obstacles was defined from the theoretical studies on EDI and transformed into everyday scenarios from within the organisation. As mentioned the participants was randomly selected and divided into three groups.

After an introduction by the game master, the game passed through the following steps:

1. Each group discussed separate predefined obstacles (a), during the discussion each group should agree on one solution (b) to how the obstacle could be handled.
2. The group shortly presented their result in plenum and the other groups could ask short clarifying questions to ensure that it was interpreted correctly.
3. The groups rotated to the next string.
4. Each group now discussed the former group's solution (b) and should agree on one primary obstacle (c), to why the solution (b) would not work in practice.
5. Again the groups presented in plenum and rotated to the next string.
6. The groups now discussed the obstacle (c) from the former groups, and should agree on a final solution (d).
7. Finally the participants gathered round the game board and shortly discussed the obstacles, solutions and the overall gaming process.

Round two was identical to the first but with new set of predefined obstacles and participants was divided into new groups to ensure dynamic discussions. Each round of play lasted for 45 minutes.

Figure 2: Graphical presentation of the game board and process



This process allowed all three groups to contribute in each of the three strings. All obstacles and solutions were written down on game theme cards, and placed on the game board attached to the string, they were related to. If the group had more than one solution or obstacle they could write the secondary ones on a parking place scheme. From the parking place schemes the parked obstacles and solutions could be related to the strings on the game board. During all the games played, researchers from the research group made observations on the discussions and plenum presentations to see, how and if the acting, talking, behaviour, etc. of the participants would provide some secondary input or add some information the phenomena investigated.

DATA ANALYSIS

The total amount of data was theme cards, parking place schemes and observations from three games, which means that each string of the games had three group perspectives with outset in the same predefined obstacle. During the analysis the data was divided into primary and secondary data. The primary data was the theme cards that the participants agreed on during the group discussions, and the secondary data was the data written on the parking schemes supported by the observations made by the researchers. Data was labelled so it was possible to track the relations on each theme card and the themes on the parking schemes. The data was exposed to a thematic analysis with the purpose of mapping the landscape of conducting EDI in the case organisation, and further to allow discussions on the area of tension between the practical readiness and the theoretical approach to EDI.

The amount of data was 54 from theme cards, 70 from parking schemes, and 25 from observations, this add up to a total amount of data on 149 divided on 54 primary data and 95 secondary data. There was some convergence in the data set, in the sense that some groups used the parking schemes for brainstorm notes, and then decided one of the ideas on the parking schemes. Hence the data could figure as both primary data on theme card and secondary data on parking scheme. Likewise some of the observations could be from same discussions or phenomena on to different times, whereas the data could figure in two different observations.

Table 2: Themes coded from primary data

Theme	Number of data entries
Management focus and support	10
Communication of strategy, possibilities and priorities	5
Seminars and workshops in both ideation and evaluation phases	4
Knowledge-sharing groups	4
Decision-making committees (to evaluate ideas)	4
Resistance against change	4
Employee empowerment	4
Lacking resources	4
EDI focus on a strategic level	3
Education and professionalising of employees	3
Employment of passionate and committed employees (fireballs)	3
Development of process description, guidelines and paradigms	3
Dynamic work assignments	2
Telling good stories – best cases	1

The data was exposed to first a theme analysis, in which the themes from primary data were rated higher, compared to the themes from secondary data. The primary method used in the analysis, was coding the data into overall themes. The coding was approached with no predefined themes from literature or organisational and cultural knowledge. This allowed the researchers to identify and reflect on unexpected phenomena and to avoid the influence from the bias from theory and organisational relations from the researchers. The amount of data sufficient to define a theme was by the research group considered to be at least three data entries.

RESULT

In this chapter the themes coded from the two data sources are presented. The themes that emerged from the coding of the primary data are shown in

Table 2

As shown, the number of themes matching the criteria with at least three data entries was twelve, and further there were two sub themes that didn't match any other theme. They are still presented, since the coding of the secondary data could enhance the focus on these two. In Table 3 the themes that emerged from the coding of the secondary data are listed.

Table 3: Themes coded from secondary data

Theme	Number of data entries
Management focus and support	13
Organisational culture	13
Decision-making meetings	9
Employee motivation	8
Knowledge-sharing	8
Professional process facilitator/moderator	7
Communication of strategy, possibilities and priorities	7
Employee empowerment, recognition and trust	7
System/technical challenges	7
Process description	6
Resistance against change	4
Support teams and reference groups	3
Strategic focus	2
Lean Management as KPI	1

As the two tables illustrates, there are some themes that are repeated in the two set of data. As in the coding of primary data, two themes with less than three data entries appeared in the secondary data, and again the themes are presented, as they could play some part in the later discussions.

DISCUSSION

In this section the findings from the exploratory case study are interpreted and discussed in the perspective of the theoretical approach to conduct EDI presented in Sorensen and Wandahl (2013). From the discussions the different perspectives are highlighted to indentify the challenges that should be addressed when approaching EDI in the case organisation. Likewise some perspectives are drawn to findings from similar research on EDI. The final remarks and conclusions on the discussions and the research objectives are presented in the conclusion section.

The discussions take outset in similarities and variations of the theme coding. The themes that were rated more or less similar in both primary and secondary data were:

- *Management focus and support;* the theme that had the most data entries in both primary and secondary data. This indicates that the managerial aspect plays an important role in the employees' perspective, when discussion EDI related topics, both in the data prioritised by employees as well as in observations and on the parking place schemes.
- *Seminars, workshop, meetings, and committees;* these themes were also highly prioritised according to data entries, both in relation to ideation and evaluation and selection of ideas. This could be due to the fact that in large organisations, it is important to involve a broader number of people, both employee and managers, and is apparently a well known activity in the case organisation.
- *Knowledge-sharing;* this theme was likewise rated in the top four in both primary and secondary data. This rating emphasise one of the most important elements of EDI, and indicates that most of the employees did recognise the fact that sharing knowledge is an important issue in development and innovation.

The theme where the rating diverged the most was:

- *Organisational culture*; this theme is probably the most significant, since the derivation from the primary data to secondary data is from zero to the top rated theme in the secondary data. This result was quite unexpected, but could be an indicator on the fact that the employees doesn't rate softer values directly related to organisational culture as high, as the harder values such as paradigms, management systems and meetings.

The remaining themes are more or less rated in the same way, whereas it is more difficult to deduce or interpret some general tendencies from the coding. In the following the themes from the case study is discussed in terms of both the literature study conducted on this field of research earlier in the research process and with findings from similar research and field work on the topic. The main purpose of this final discussion is to provide input to the research objectives presented in the introduction chapter.

Management

The probably most significant element in EDI and like the findings in this case study implies is the management. Management is related to many of the aspects of EDI such as innovation management, human resource management, knowledge management (Sorensen and Wandahl, 2013). If the focus is put on the managerial skills and areas that management should prioritise, the attention is drawn towards; communication, decision-making, support, recognition and empowerment of employees. The managerial skill of communication that were top-rated along with management focus and support, are also emphasised by Kesting and Ulhøi (2010) as one of the main drivers of EDI. Through a case study research on EDI in Norway Aasen et al. (2012) identified that top management should share genuine conviction in EDI on both strategic level and in communication. One more observation Aasen et al. (2012) derived from their case study was that management practices should be more of conversation and coaching based.

One of the main conclusions in (Kesting and Ulhøi, 2010) is to loosen up on the traditional corporate decision-making in the lower managerial levels and begin involving ordinary employees in decision-making, with the purpose of bringing in creativeness, networks and exclusive process knowledge. Hence, in general management should begin liberating some of the traditional control mechanisms, which often are more significant in the older tradition bound organisations. As discovered through the coding the elements of decision-making, and involvement and empowerment of employees were also themes that were rated in both primary and secondary data. Aasen et al. (2012) further rate involvement and recognition of employees as one of the main managerial obstacles in implementing successful innovation. Another obstacle they discovered was the fact, that EDI is not measurable on short term basis, which emphasise that EDI is not a quick fix solution for an organisations quest to improve turnover and profit. Naturally this will increase the challenges of implementing EDI in organisations that focus on short term investments and profit. Likewise this challenges the balance of on one side playing with creativity and development and on the other focus on turnover, profit and production. Thus an important skill of managing innovation is to know when to leave organisation hierarchy out of the process, and when to bring it back again (Leavy, 2005).

Knowledge-sharing

As mentioned in the introduction, the employees' knowledge are often emphasised as the main driver of innovation and development, since they possess the specialist knowledge and hands-on experience with the daily working processes. Innovation arises from ongoing processes of exchange, where information is not just accumulated or stored, but also created. This potentially means that knowledge is generated from connections or relations that weren't present earlier and that features on all levels of the organisation (de Sousa et al., 2012; Evans, 2012). These observations are similar to the result from coding of the data which indicated that knowledge-sharing through; groups, meetings, seminar, workshops, etc., had a high priority during the theme discussions. This could indicate that the organisation or at least the employees realise that gathering employees in some form is an ideal forum for sharing information and knowledge. A point of interest in the future research could be, to discover the obstacles that keep the employees from sharing knowledge already.

Organisational culture

The organisational role and culture were top-rate in the secondary data, but both Kesting and Ulhøi (2010) and Aasen et al. (2012) stress the importance of the cultural aspects to achieve a successful innovation. Innovative organisations were also one of the most significant themes in the literature study of research topic (Sorensen and Wandahl, 2013). Compared to the findings based on the primary data, there could be some derivation of the findings in this research and the theory and other case studies on EDI. As mentioned, this was one of the unexpected findings of the research. It could be due to the fact, that the participants were very practical in their mindsets during the discussions, and tended to focus on the harder values and tool and methods, instead of softer values such as culture and organisational values.

Employees; motivation and education

The findings in this research pointed out that employee motivation and education both are relevant in the case organisation, when discussion the themes of EDI. Motivation are in some research closely related to incentives, in this research they are valued equally as elements of affecting the behaviour of the employees. Motivation of employees is likewise regarded as an important factor of EDI in both the literature and in similar research (Sorensen and Wandahl, 2013; Kesting and Ulhøi, 2010; Aasen et al., 2012). One of the challenges in motivation and incentives is, the employees are individuals and will be motivated by many different incentives, and that some employees could be satisfied with the current working conditions.

Process

Another unexpected finding in this research was the deemphasising of process descriptions and the missing focus on an overall innovative process model. This is challenged in the literature study. Here the innovative processes to facilitate EDI-practices were discovered as a key element to ensure a successful EDI approach (Sorensen and Wandahl, 2013). According to Aasen et al. (2012), there must be a clear definition on the three interrelated elements; roles, tools, and culture, when designing an EDI process. One explanation of this observation could be that the data entries that are related process thinking were formulated in a more practical way, whereas they are coded in other themes, or simply that it wasn't rated that high during the participant.

CONCLUSION

The implications of this research and in the gaming approach were that some of the names and keywords used to define the phenomena are ambiguous, hence seminar, meetings, workshops, committee evaluation are somewhat related. A similar example is the wordings employee motivation and incentives. Thus when discussing the field of tension between the theoretical and practical approaches to EDI, this issue is handled with respect to the field of research and the researchers' background knowledge. Another condition that needs to be addressed is the rating of themes based on data entries. One must be careful to put too much emphasis on the hierarchical level of the themes separated by only one data entry due to two aspects; ambiguous words, and emotional expressions or wordings to emphasise the statements. Even though the coding and the interpretation were conducted as objectively as possible by the researchers, these two aspects could move a data entry from one theme to another. As an example; the difference between EDI focus on a strategic level and communication of strategy. In general though, the gaming approach accomplished its purpose of exploring the employees' and the organisational perspectives on EDI, and provided the possibilities of highlighting key themes and aspects to the future research.

The findings didn't provide enough input to answer the first research objective satisfactory. Nevertheless some conclusion can be drawn from the coding. In the primary data, the most significant findings were management focus and support with 19 percent, communication 9 percent. When coding the secondary data, the most significant findings were management focus and support with 14 percent, culture with 14 percent, decision-making meetings with 9 percent of the data points. The roles, tools and methods that could be derived from the findings are, in relation to the themes identified:

- *Management*: Communication, support and coaching, delegating responsibilities, involvement of employees in decision-making, identify adequate incentives
- *Knowledge-sharing*: formal and informal knowledge-sharing groups, meetings, workshops, etc., employees should be willing to share knowledge and ideas with colleagues.
- *Organisational culture*: More open culture with less bureaucratic elements and focus on using the internal knowledge by involving employees in planning and development of organisational changes. Give the employees room to grow ideas, try thing and learn from their mistakes.
- *Employees*: Allow employees to develop their skills according to the challenges and strategy of the organisation. Managers should integrate the new skills in the problem-

solving processes and allow employees to utilise the new skill for innovative purposes.

- *Process*: Formalised innovation process that allows employees to step out of the basic organisation and focus on development and innovation. Appointment of prioritised facilitator/moderator, who can ensures that the innovation process is going forward with a defined scope of work.

These topics should be elaborated in the future research to develop a framework of tools and methods to conduct EDI, both with outset in the case organisation and in similar organisations or industries.

According to the second research objective the following perspectives emerged during the discussions: When customising a framework of tools and methods to fit a governmental client organisation especially the management skills and cultural changes towards an open and more employee-oriented organisation are important. The organisational culture of the case organisation must be revised according to best practice elements from successful innovative organisations and the theoretical aspects in the research literature. Management should be more supportive and focus on communicating the innovation strategy from upper management to employees and on planning for innovation in the production routines. The employees should be more involved in both decision-making in general but also in development of the organisation, where they should be encouraged to bring in new ideas and suggestions for optimisation. To motivate employees, they should always be in a development circle enhancing their skills according to the organisations challenges and strategy.

This case study should be extended with a similar study of the management level to include their perspective in the field of tension in the practical landscape of conducting EDI in the case organisation. Further the data should be subject to triangulation with more units of analysis such as; organisational documents, internal problem-solving processes and additional employee of expert interviews.

ACKNOWLEDGEMENTS

The main author wishes to send a special thanks to the participants from case organisation, who participated in the gaming approach, and the management for prioritising time and resources. Without their contribution, this research would not have been possible to complete.

REFERENCES

Amar, A. D. (2004). *Motivating knowledge workers to innovate: a model integrating motivation dynamics and antecedents*. European Journal of Innovation Management, **7** (2) 89-101.

Bonnie, S. O. N. and Monica, A. (2007). *Knowledge sharing and the psychological contract: Managing knowledge workers across different stages of employment*. Journal of Managerial Psychology, **22** (4) 411-436.

Christensen, S. and Kreiner, K. (1991). *Projektledelse i løst koblede systemer*, Jurist- og Økonomforbundets forlag.

De Sousa, F. C., Pellissier, R. and Monteiro, I. P. (2012). *CREATIVITY, INNOVATION AND COLLABORATIVE ORGANIZATIONS*. International Journal of Organizational Innovation (Online), **5** (1) 26-64.

Evans, K. (2012). *Employee-driven innovation and workplace learning: Exploring present realities, future possibilities and enduring challenges*. Lifelong Learning in Europe, (4) 1-6.

Guba, E. G. (1981). *Criteria for assessing the trustworthiness of naturalistic inquiries*. Education and Technology Journal, **29** 75-91.

Høyrup, S. (2010). *Employee-driven innovation and workplace learning: basic concepts, approaches and themes*. European Review of Labour and Research, **16** (2) 143-154.

Kesting, P. and Ulhøi, J. P. (2010). *Employee-driven innovation: extending the license to foster innovation*. Management Decision, **48** (1) 65-84.

Leavy, B. (2005). *A leader's guide to creating an innovation culture*. Strategy and Leadership, **33** (4) 38-45.

Lee, J. Y., Swink, M. and Pandejpong, T. (2011). *The Roles of Worker Expertise, Information Sharing Quality, and Psychological Safety in Manufacturing Process Innovation: An Intellectual Capital Perspective*. Production and Operations Management, **20** (4) 556-570.

Manley, K. and Mcfallan, S. (2006). *Exploring the drivers of firm-level innovation in the construction industry*. Construction Management and Economics, **24** (9) 911-920.

O'dell, C. and Hubert, C. (2011). *Building a Knowledge-Sharing Culture*. The Journal for Quality and Participation, **34** (2) 22-26.

Patton, M. Q. (1990). *Qualitative evaluation and research methods*, Sage.

Prusak, L. and Davenport, T. H. (2000). *Working Knowledge: How Organizations Manage What They Know*. Harvard Business School Press Books, 1.

Reichstein, T., Salter, A. J. and Gann, D. M. (2005). *Last among equals: a comparison of innovation in construction, service and manufacturing in the UK*. Construction Management and Economics, **23** (6) 631-644.

Seaden, G. and Manseau, A. (2001). *Public policy and construction innovation*. Building Research and Information, **29** (3) 182-196.

Sorensen, H. and Wandahl, S. (2013) *Employee-driven innovation: A brave new world in the build environment's project organisations* IPGRC 2013 - 11th International Postgraduate Research Conference, 2013, International Council for Research and Innovation in Building and Construction, Manchester, UK.

Thite, M. (2004). *Strategic positioning of HRM in knowledge-based organizations*. The Learning Organization, **11** (1) 28-44.

Tidd, J. and Bessant, J. (2009). *Managing Innovation - Integrating Technological, Market and Organizational Change*, John Wiley and Sons, Ltd, West Sussex.

Wandahl, S., Jacobsen, A., Lassen, A. H., Poulsen, S. B. and Sørensen, H. (2011). *User-driven innovation in a construction material supply network*. Construction Innovation, **11** (4) 399-415.

Wandahl, S., Lassen, A. H., Jacobsen, A. and Poulsen, S. B. (2014). Enablers of innovation in the construction material industry. MCPC 2014: World Conference on Mass Customization, Personalization, and Co-creation.

Winch, G. (1998). *Zephyrs of creative destruction: understanding the management of innovation in construction*. Building Research and Information, **26** (5) 268-279.

Yin, R. K. (2009). *Case Study Research - Design and Methods*, Sage.

Aasen, T. M., Amundsen, O., Gressgård, L. J. and Hansen, K. (2012). *Employee-driven innovation in practice - Promoting learning and collaborative innovation by tapping into diverse knowledge sources*. Lifelong Learning in Europe, (4) 1-10.

EVALUATING CAUSES OF WORKERS FATALITY ON CONSTRUCTION SITES IN THE CITY OF TSHWANE METROPOLITAN MUNICIPALITY

Oladele S Opaleye[1] and Alfred A Talukhaba

Department of Building Sciences, Faculty of Engineering and the Built Environment, Tshwane University of Technology, Private Bag X680, Pretoria 0001, Staatsartillerie Road, Pretoria West, Pretoria, South Africa

The aim of the study was to evaluate the major risks faced by semi-skilled labourers on building sites in Tshwane metropolitan municipality which mostly lead to serious fatality. Recommendations are made to mitigate the adverse impact thereof. This study explored these elements of risk by using interview and observation approach to collect data from 83 semi-skilled labourers from five different construction companies; semi-skilled labourers in construction are more prone to risks especially falling from building heights which is basically the motive of this study. This could be classified as a safety risk which this particular grouping is exposed to. Labour risks in building industry are one of the issues that cannot be envisaged at the commencement of projects, labour risks differ from one project to another. Based on the data collected during compilation of this study, it was observed that incompetency of safety personnel employed by the main-contractors who are supposed to ensure that all stakeholders on the project comply with the safety regulations. Poor communication among the project team was also observed as one of causes of workers accidents on site, workers nonchalant attitude towards safety contributed to workers fatality on site. Poor erection of scaffolding or ladders used on site which mostly expose the workers to fall was also evaluated as cause of this risk. One of the suggested recommendations was that main contractors should employ competent safety personnel that will enforce safety regulations on sites.

Keywords: risks, semi skilled labourers, accidents, construction sites.

INTRODUCTION

Workers` fatality on construction sites could be defined as the result of risky activities construction workers embarked upon in the course of carrying out their obligated duties on site.

Workers` fatality on construction sites could be defined as the result of risky activities construction workers embarked upon in the course of carrying out their obligated duties on site. Workers` fatality could also be defined as future events or conditions that have some probability of occurrence that has impact on the workers (Mitullah and Wachira, 2003: 24). There is high probability of risk on construction sites which result in accidents and the consequences of such accidents, often affect the workers used in the construction activities of such projects (Taylor, 2007:36). The need to evaluate

[1] Oladele.opaleye@gmail.com,

Opaleye, O.S. and Talukhaba, A.A. (2014) Evaluating Causes of Workers Fatality on Construction Sites in the City of Tshwane Metropolitan Municipality *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference*, 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 281-292

these risks and suggest solutions that will minimise them, will improve safety of workers on site (Taylor et al., 2004:5). Construction sites are considered the most potentially risky and accident-prone parts of any working environment. Moreover, deaths, permanent disabilities and severe injuries have been on the increase for construction workers through major accidents (Phoya, 2012). To prevent these, main contractors should know how to identify and be aware of all possible dangers that can be encountered by workers during normal construction operations (Hunter, 2011:1). The below are top six labour risks that workers encountered on construction sites:

- Falls – Falling from scaffolding over 1.80m or a fixed ladder over 6m is the most dangerous and common construction site risk. Falling from high places such as a ladder, scaffolding and roofs account for more than fifty per cent of the accidents that happen at the construction sites. The usual cause of this incident is slipping, tripping and using unstable ladders. There are thousands of reasons for fall risks and to eliminate such risks, employers must have a fall protection program as part of any overall construction site health and safety program. Workers should be trained to identify and evaluate fall risks and be fully aware of how to control exposure to such risks as well as know how to use fall protection equipment properly (Hunter, 2011:1).
- Stairways and Ladder – According to OSHA's construction safety and health standards (2006), stairways and ladders are major sources of injuries and fatalities among construction workers. These recorded injuries are serious enough to put a worker out on sick leave. In the 2010 alone OSHA registered approximately 24,882 injuries and 36 fatalities yearly that are related to falling from stairways and ladders used at the construction site. To prevent such accidents and injuries, employers and workers must comply with OSHA's general rule for the safe use of ladders and stairways.
- Scaffolding – Every year, approximately 60 workers die by falling from scaffolding; one out of five construction site falls are fatal (Hunter, 2011:1). The most potential risk of scaffolding is due to moving scaffold components; scaffold failure related to damage to its components; loss of load; being struck by suspended materials; and improper set-up. Construction workers who assemble and dismantle scaffolding and work platforms at construction sites face the risk of serious injuries due to falls.
- Heavy Construction Equipment – Approximately 100 construction site workers die each year due to heavy construction equipment. The main causes of such accidents includes: ground workers struck when a vehicle is backing up or changing direction; equipment rollovers that injure the operator; mechanics run over when brakes are not properly set; and ground workers crushed by falling equipment from backhoes, buckets, and other moving construction vehicles (Hunter, 2011:1).

LITERATURE REVIEW

Construction industry is an important player in the economy of South Africa. It contributes 35% of the total gross domestic fixed investment and employs approximately 240,000 workers. Despite its pivotal role in social and economic development, the construction industry is considered a risky business and poses more danger than any other industry (Brace et al, 2005:18). It also plays an important role in the economy of South Africa. In spite of the numerous constraints facing the industry in developing countries, it makes significant contributions to economic growth. It is a challenging work environment which is associated with high risk to workers. Workers are exposed to harsh and dangerous tools and situations, for instance, workers have to work with dangerous machines and equipment (James, Rust and Kingma, 2012:1554). The industry stands out from other industries as having the highest worker injury and fatality rates (Cooper et al., 2010: 1). The construction industry can be interlinked to the economy of a country and it often shows how healthy the state of that economy is. If the construction sector and the economy of a country are interweaving, then it is appropriate to effectively see to the welfare of the workers in that industry (James, 2012:1555). This is because construction, to a large extent, is a labour intensive industry and depends on the availability and safety of workers to complete current and future projects. Despite sophisticated health and safety regulations in most countries, high rates of injury and fatality persist (Haupt and Massyn (2002).

Table 4 Construction fatalities compared to the other main industries

Industry	No.of fatalities (2007/08)	Fatality rate (per 100,000 workers)
Construction	72	3.4
Agriculture	39	9.7
Manufacturing	35	1.1
Transport, Storage and Communications	20	1.1
Wholesale and Retail	17	0.3
Business and Finance	12	
Public administration	10	0.7
Extractive and Utility	9	5.5
Hotels and Restaurants	1	0.1
Education	1	

Source: CIOB (2009)

Construction industry is considered to be one of the most dangerous industries worldwide, many workers have died, been injured or made handicapped as a result of risky operations in construction (Chi et. al, 2004:1). According to Phoya (2012) construction sites have been regarded as very risky areas where construction workers are subject to fatalities. Many building construction activities are inherently risky to workers safety such as working at height, are a leading cause of fatalities in construction operations. According to Pérez-Alonso et al. (2011) in their research, evaluated the labour risks of different construction phases and concluded that the management of labour risk is very poor, no internationally recognized work-risk prevention programmes being adopted reduces workers fall risk in building construction sites. According to the United Kingdom Health and Safety Executive (CIOB, 2009:6), in the last twenty-five years alone over 2,800 construction workers have died, even more workers suffer from serious injuries. ''This is an unacceptably high figure and the industry needs to device proper solution to these problems" (CIOB, 2009:2). Seventy two fatal injuries were recorded in the UK in the construction industry between the period of 2007/08 (31% of all fatal injuries across the main industries), which could be interpreted as 3.4 fatalities per 100,000 workers (CIOB, 2009:4). At this period 3,764 major injuries were also reported thereby signifying a high rise in labour risks (CIOB, 2009:12). Table 1 compares the fatalities in the construction industry to other industries.The construction industry`s safety record is unenviable, since the incidence rate of fatal accidents is higher than any other industry in most countries. Moreover, with the recognition of the significance to prevent accidents at an early stage, some major efforts have been made on the prediction of accidents in construction. However, existing precision of prediction on safety risks is inadequate and far from satisfactory (Wu, 2010:134).

In theory, most construction injuries can either be prevented or controlled. Unfortunately, achieving this goal has been very slow in practice (Hallowell et al., 2009: 24). Risk prevention and control in construction is a persistent and global challenge, with construction having one of the worst safety records among diverse economic sectors, including high-risk industries, in addition to the loss of life and reduction in the quality construction workers` life, construction incidents lead to project delays, increased project costs, medical burden, and other negative consequences.

According to Loewenson (2002:2) world Health Organisation estimates that Sub-Saharan Africa has about one tenth of the world's occupational injuries and fatalities, and about 7.5% of the world's population. The rates are twice that of the established market economies, and the resources to manage the risks and their impact are far less than half those available in established market economies. This means that Southern African Development Communities (SADC) countries need to adopt paths that can improve occupational health and safety reach high risk groups and areas in an efficient and cost effective manner (Loewenson, 2002:4). The academicians and professionals within the construction industry believed that regulations and legislation on its own cannot achieve the desired goal of zero accidents and incidents on construction sites but with the involvement of the stakeholders in the industry (Centre to Protect Workers' Rights, and Ratay, 1999 cited in Haupt (2001:2)). However, adherence to them alone does demonstrably improve site safety. If reasonable in philosophy, adequate in detail, and worded without ambiguity, legislation and regulations provide a basis for the employment and enforcement of good construction practices.

At a glance, many health and safety legislations and regulatory frameworks specify in a clear terms, how the employer must address any given conditions (Taylor et al, 2004:12). Additionally, these standards and regulations tend to support the traditional command-and-control, deemed-to-comply, or prescriptive approach of addressing unsafe conditions, existing and potential hazards while ignoring their responsibility of addressing unsafe workers behaviour. Little has been done in providing and enforcing prescriptive rules and procedures which are not good enough to promote workers safe behaviour on construction sites (Reason 2000, cited in Haupt (2001:3)). Legislative frameworks effectively address the building site environment and procedures. It is the role of main contractors to interpret how the provisions of such legislative frameworks will be implemented on construction sites relative to working practices. If unsafe worker behaviour were addressed by legislation, construction professionals might regard themselves as being exonerated from their health and safety responsibilities to their workers. For instance, if the law specified that construction workers had to come to work wearing their personal protective equipment (PPE), it becomes a problem on who should provide PPE? More so, who should enforce implement the law and who should bear the costs involved in provision of the PPE? The focus of implementation and enforcement has consequently been on compliance rather than strict preventive measures. Punitive measures for noncompliance are usually in the form of fines (Haupt, 2001:3).

Each year, occupational injuries (traumatic, ergonomic, and/or exposure) and fatalities temporarily or permanently disable many workers and even claim their lives in the construction industry. The staggering statistics made available and disseminated by occupational health and safety concerned organizations (NIOSH, 2012) confirm the impact and importance of this menace. With increase attention on safety, company-wide safety programs became the norm. These programs are in place but the industry still remains dangerous (Adbelhamid, Narang and Schafer, 2011:18). Recent research (Hale et al., 2012:2) results indicate that the dynamic nature of construction work and the transient nature of the workforce makes it difficult to prevent accident on site the measures on how to prevent or reduce this accident has to be put in place, but improvement on present measures are not curtailing this menace. Construction still kills or injures more than eight percent of its workforce each year, and 23 % of fatalities and 10.5 % of all construction injuries are also recorded. Considering that construction workforce accounts only for 6% of the South Africa workforce, the disparity in the proportion of construction workforce and the accidents related to it is a clear indication of the serious problem in the construction industry (NIOSH, 2009:12). To analyse construction worker safety on construction sites, it is important to understand the workability of safety implementation efforts. If we take any construction jobsite as an example, there are myriad of conditions that could lead to accidents. Of course there are gaps between the accident occurrence, and an existing condition, that is potential for an accident (Adbelhamid, 2011:16).

How wide or narrow are these gaps, depending upon how well the management and workers are prepared to handle a dangerous situation (OSHA, 2010:24). The first point of contact is the worker, who is performing his/her job and often needs to make a decision that would result in the potential condition transforming into a dangerous one and eventually into an accident(HSE, 2004:8). The worker's action simply would release the risk, or create one for another worker. Consequently, risk evaluation, or the lack thereof, by workers is a most critical aspect in successfully implemention safety regulations and guidelines (Adbelhamid, 2011:17). The primary cause of this risk that affected the workers by analysis model of (Adbelhamid, 2011: 19), could be identified as three of the followings: management deficiencies, training, and workers' attitude. Eight major causes are proposed, namely: lack of proper training, safety equipment not provided lack of enforcement of safety regulations, unsafe equipment, method, or condition, poor safety attitude, and isolated deviation from prescribed behaviour. Despite the contributions of building construction accident causation models to understanding the accident process, non-explained in details the underlying causes of construction accidents (Adbelhamid, 2011: 22). The difficulty in explaining construction accidents may be attributable to the dynamic nature of construction work and the different ways in which accidents occur from site-to-site especially when it comes to fall from height on building sites. Moreover, following preset rules applied in a well-structured environment where changes are predictable and controllable. But this is not possible in dynamic conditions and environments such as those characteristic of building construction. In a new model proposed for construction accidents by providing a link between all the above-mentioned models and uniting them under Rasmussen's model. In his theory of "Cognitive System Engineering", Rasmussen argues that there are no objective stop rules for tracing the cause of labour risks on site (Adbelhamid, 2011: 23).

Coming back to the major aim of this study, workers falling from heights are common accident among the workers on construction sites in the City of Tshwane municipality that amounted to high risk; it even constitutes a considerable financial burden: workers' compensation and medical costs associated with occupational fall incidents have been estimated at approximately R50 billion annually (Hsiao, 2012:6). Fall accidents in construction projects, particularly building works, are the most frequent accidents. Those accidents may results in death. Robust accident prevention is required through improving continuously health and safety in construction Navon and Kolton, (2006:3). In recognising the gravity of fall accident in construction industry, this study was able to suggest an effective remedy that can arrest fall accidents on construction sites in City of Tshwane metropolitan municipality. Therefore, understanding triggering events and their factors leading to fall accidents are of important input (Latief et al., 2011:1). South Africa safety and health legislative and regulatory frameworks are prescriptive. That specify in exacting terms, how the employer must address any given conditions. Additionally, these standards and regulations tend to support the traditional command-and-control, deemed-to-comply, or prescriptive approach of addressing unsafe conditions, existing and potential hazards while placing little, if any, emphasis on addressing unsafe worker behaviour. Legislative frameworks in occupational health and safety act and regulation of south Africa effectively address risk as means of evaluating and documentation of existing or expected hazards to the health and safety of workers, which are normally associated with the type of construction work being executed or to be executed; the work environment and procedures (Mothiba, 2010:3). Construction health and safety (H and S) has long been the focus of attention of many industry stakeholders and role players in South Africa, while it is acknowledged that many industry associations and professional societies, contracting organisations and others have made significant efforts to improve H and S within the construction industry, overall construction H and S is not improving commensurately. Notably, construction continues to contribute a disproportionate number of fatalities and injuries relative to other industrial sectors, there are continual increment in non-compliance with H and S legislation generally. According to Smallwood et al., (2010:2). Workers falls on construction sites in South Africa still persist with all safety regulations that are in place and it is well known that this country has shortage of technical trade workers like semi-skill labour such as Bricklayers, painters, scaffolders, roof carpenters and Aluminium roof Installers that this study used as participant in the compilation of this study (Haupt, 2001:83).

It is clear from the above mentioned legislations that risk assessment related prescriptions provide certain legal minimum requirements. In practice however, it actually offers little guidance on the way compliance with the requirements should be achieved. In the past, risk management in the industry was also focused on financial risk, not properly addressing the desired need. While this lack of prescription has the potential benefit of allowing a company to tailor risk assessment to its specific needs, it has the major disadvantage of providing little structure in an extremely wide, diverse and often apparently intangible field. This lack of prescription has led to the development of a vast range of procedures and processes by a wide range of researchers and consultants (Boshoff, 2011:1). According to Deacon (2003:34), researched that construction Regulations to be published in South Africa, were based on South. In these Regulations, the principal contractor must provide a documented health and safety programme, which is applicable for the duration of the construction work based on the client’s health and safety specification and the risks identified on site.

RESEARCH METHODOLOGY

Interview and observation are the methods used in obtaining information in this study. 83 semi-skilled labourers are the participants engaged interviewed, the researcher also observed some unsafe attitude of the workers while carrying out their duties on site. The photos below taken by the researcher confirmed the findings derived from the study. The interviews were tape-recorded to secure an accurate account of conversations in other to avoid losing data. Five construction companies were involved in the study, participants were assured that all information taken from them will be used strictly for academic purpose and that their employer will not have access to report of this study. The researcher was able to get information from these targeted participants due to the assurance given to them earlier, the participants confirmed that main contractors are only interested in providing safety harness to their workers only and they are less concerned about the sub contractors` workers, several sub contractors` workers confirmed that the safety personnel employed by the main contractors are less concerned about their safety welfare. What had been observed by the researcher was related to the physical setting and environment within which the construction activities took place. The observation generated insight and better understanding on the phenomenon in the study (Noor, 2008:1604). This research was directed to evaluate labour risks on building sites in City of Tshwane Metropolitan Municipality (CTMM) of Gauteng as it will emphasizing the risk that workers do face in respect of fall from building heights on construction sites. CTMM was used as the research area due to the easy access to the on-going construction of massive buildings. The risks in construction project may be derived from two sources. The first consists of the environmental impacts, which are called external risks. The second consists of the uncertainties existing in the project itself, which are called internal risks.

SUMMARY OF RESEARCH FINDINGS

The findings of this study indicated that most risks that construction workers are exposed to are due to contractor`s neglect on workers safety, employment of incompetent safety personnel by the main contractors, unsafe behaviour of workers on site, inadequate provision of PPE to workers on site. If what the South Africa safety regulations and the Act. Says is to be taken into consideration, the responsibility of the main contractors is to make sure that the workplace is risk free environment then they are supposed to employ qualify safety personnel that will identify hazards and risks on construction sites and enforce compliance of safety regulations on site.

If the main contractor employed competent safety personnel the Hammanskraal incident that claim the worker`s life would not have occurred because the safety personnel would have identified and discuss the risk of fall with the workers and the stakeholders on site. Jonckie (2010:1) said that development of a safety culture within a construction company or contractor involves the embedding of a safety approach to all activities. A positive safety culture requires participation by all contractors and the building construction workers, and is shown through each worker`s safety-related knowledge, attitude, belief, behaviour and practice. It must be supported by the top management of both the regulatory body and the construction company.

It was noted that most of the participant in this study took advantage of lapses mentioned above to ignore their responsibilities spelt out in the South Africa health and safety regulation and Act. By not using the safety harness provided for them or not using them improperly, the pictures below in figure 1and 2 confirms this submission. The workers did not take their personal safety important but rather felt that those safety harnesses will hinder the speed required of them to carry out their duties on site. It was also noted that some workers do take alcohol during lunch time or some even has hangover when resuming working on Monday due to excess intake of alcohol on weekend. These correlates with the research conducted by Evans (2006, p.34) that confirm the use of alcohol are common among the semi-skilled and unskilled labourers in most of our sites in South Africa (Ramutloa, 2010:1); which stipulates that contractors should prevent intoxicated workers from entering construction site or remaining on such site because most of alcohol related fall on construction sites leads to death.

Figure 1 Subcontractor`s workers without safety belt while carrying out their task
Note: Photo taking by researcher – 3rd April 2012 in Pretoria site.

As shown in figure 1 above, it was observed that these workers are exposed to fall from the elevated areas of their work activities as a result of non-provision of protective safety gear that could prevent them from fall. The subcontractors are more negligible to workers safety but were only concerned with work schedule of the project they are handling by not providing necessary safety gear to their workers. The main contractors mostly do not enforce safety compliance on subcontractor’s workers because they want the workers to accelerate the pace of the work so as to meet deadline of the project delivery. The inadequate provision of these equipments contributed to workers fall from height said by one the participants.

As shown in figure 2, the worker is prone to fall for not using safety belt and safety element on this very tall area where the task is being carried out by the worker. The task is being carried out on the ladder that is not properly tied to a fixed element that can prevent the ladder from slippery. It is glaring in the picture above that the workers shown are going about their daily activities without using safety harness that was supposed to be anchored the ladder and the ladder anchored to a stable and fixed element so as to protect the worker from fall. The safety officer on this site does not take cognisance of this risky act and this is one of the safety risks that could result into fall accident on this particular site.

Figure 2 Worker Attitude to safety harness (non-use of *safe*ty belt on the ladder) (Photo taking by researcher– 5th July 2012 in centurion site).

CONCLUSION AND RECOMMENDATIONS

Based on the above findings, it appears that the major stakeholders in relations to semiskilled labour risk of falls on building sites in the City of Tshwane Metropolitan Municipality has to address their lapses in workers safety on construction sites if workers fatality on site is to be addressed. It can be concluded that risk of serious injuries and death among the semi-skilled labourers is caused by a number of factors. The most significant causes of workers fall from height include the following:

- Poor supervision of the workers on site.
- Unsafe behaviour of workers on site.
- Improper use of personal protective equipment (PPE) by the workers.
- Improper erection of scaffolds
- Improper use of construction equipment (Ladder) by the workers.

To address this problem the following are recommended, that the construction companies or contractors must provide and make sure that they are able to identify the hazard on the site prior to mobilisation of materials and workers to site, they should engage in the initial design of the project through their input to the design before the final production of the drawing by the designer so that envisaged hazards can be eliminated through the nature of the building plan; the main contractor should prepare and distribute the safety regulations to all workers including other stakeholders in the project; safety gears and harnesses should be provided by the main contractor to all workers on site in respective of the workers status as they will have to embed the cost of these safety equipment in the contract of their subcontractors; the main contractors should employs competent personnel (s) that will see to day to day safety activities of the workers on site. These personnel should be on permanent employment in other to forestall any lapses in safety enforcement. The main contractor should take responsibility of the total welfare of all workers on site by making sure that all workers are insured and they are entitled to compensation if any eventuality occurs. Training should often be given to all workers on site and explain the implications attached to non-compliant of safety rules governing the site. During the training both local and English language should be used so that there will be no workers left out as this is one of the observation made in this study. Workers audit should be done to ascertain the numbers of workers tribes on site.

In addition, the safety officers must make sure that all workers roll call are made on every Mondays and all workers inspected to be sure that none of them has hangover due to excess consumption of alcohol over the weekend before such worker is allow to work on site, he should also remind them all the safety rules on the site and make sure that all the safety gear provided to the workers are used properly. He should engage on random site safety supervision to ensure that all workers comply with safety rules. The safety officer should always convey regular site meeting where all stakeholders on the project attends. The safety officer should quickly report any incident or accident that might occur on site to department of labour no matter how negligible the incident/accident may be. He should inspect the entire scaffold and ladders that are being used on site and ensure it conform to SABS standard.

REFERENCES

Abdelhamid, T.S., Narang, P. and Schafer, D. (2011) 'Quantifying workers' hazard identification using fuzzy signal detection theory', *The Open Occupational Health and Safety Journal*, Vol. 3, Suppl. 1-M3, pp.18–30, 1876-2166/11.

Boshoff, T. (2011) Construction Work and the Responsibilities of the Client, 'Draft Amendment to the Construction Regulations, 2003', South Africa Labour Guide, Government Gazette, Notice 391 of 2010.

Brace, C.L. and Gibb, A.G.F. (2005) 'A health management process for the construction industry', in Haupt, T. and Smallwood, J. (Eds.): *Rethinking and Revitalizing Construction Safety, Health and Quality*, Port Elizabeth, South Africa.

Chartered Institute of Building (CIOB) (2009) *Health and Safety in the Construction Industry*, Health and Safety Executive [online] http://www.hse.gov.uk/humanfactors/comah/common (accessed 9 August 2012).

Chi, F.C., Chang, T. and Ting, H. (2004) 'Accident patterns and prevention measures for fatal

occupational falls in the construction industry', *Applied Ergonomics*, Vol. 36, No. 2005,

pp.391–400.

Cooper, B. and Schaffer, J. (2010) *Construction Site Falls, Pennsylvania or New Jersey*

Construction Accident, Cooper and Schaffer, USA, LLC 2012.

Davies, V.J. and Tomasin, K. (1996) *Construction Safety Handbook*, Thomas Telford, ISBN 0-7277-2519-X.

Deacon, C.H. (2003) *The Health Status of Construction Workers*, Dissertation work submitted in Fulfilment of The Requirements for Master Degree in Curationis, Faculty of Health Sciences, The University of Port Elizabeth.

Eppenberger, M. (2012) South Africa Deprtment of Labour Paper presentation on Road to Zero Accident on Site Bursbok, March 2012.

Evans, D. (2006) *OH and S Risk Management*, Article on intoxication: construction companies.

Flanagan, R. and Norman, G. (2001) *Risk Management and Construction*, 1st ed., Wiley-Blackwell.

Gee, A.F. and Saito, K. (1997) 'Construction loads and other safety measures specified by U.S., U.K. and Japanese bridge standards', in Ratay, R.T. (Ed.): *Construction Safety Affected by Codes and Standards,* Proceedings of a session sponsored by the Design Loads on Structures during Construction Standards Committee and the Performance of Structures during Construction Technical Committee of The Structural Engineering Institute, Minneapolis, 5–8 October, pp.8–15.

Hale, A., Walker, D., Walters, N. and Bolt, H. (2012) 'Developing the understanding of underlying causes of construction fatal accidents', *Journal of Safety Science*, Vol. 50, No. 10, pp.2020–2027.

Hallowell, M.R. and Gambatese, J.A. (2009) 'Activity-based safety and health risk quantification for formwork construction', *J. Constr. Eng. Manage.*, Vol. 135, No. 10, pp.990–998, ASCE.

Haupt, T.C. (2001) *The Performance Approach to Construction Worker Safety and Health*, PhD dissertation, University of Florida, Florida.

Health and Safety Executive (HSE) (2011) *Top Tips for Ladder and Stepladder Safety: An Employers' Guide*, Loughborough University, Loughborough, Leicestershire, UK.

Hinze, J. (2005) 'Construction accidents', *Journal of Construction Engineering and Management*, May/June, Vol. 131, No. 7, pp.765–771, ASCE.

Hinze, J. and Huang, X. (2003) 'Analysis of construction worker fall accidents', *Journal of Construction Engineering and Management*, May/June, Vol. IX, No. 1, pp.262–271, ASCE.

Hsiao, H. and Armstrong, T.J. (2012) 'Preface to the special section on occupational fall prevention and protection', *Hum. Factors*, June, Vol. 54, No. 3, pp.301–302, National Institute for Occupational Safety and Health (NIOSH).

Hunter, C.M. (2011) *Six Construction Site Hazards, Construction Induction, Construction Safety*, Construction safety images, Riskex.

James, P.M., Braam Rust, A.A. and Kingma, L. (2012) 'The well-being of workers in the South African construction industry: a model for employment assistance', *African Journal of Business Management*, Vol. 6, No. 4, pp.1553–1558.

Jonckie, M. (2010) *Safety for the Mining Industry: Mining Safety.co.za*, 21 July [online] http://www.accidents.co.za accessed (accessed 5 October 2012).

Latief, Y., Suraji, A., Nugroho, Y.S. and Arifuddin, R. (2011) 'The nature of fall accidents in construction projects: a case of Indonesia', *International Journal of Civil and Environmental*[2] *Engineering IJCEE-IJENS*, Vol. 11, No. 5, pp.92–97.

Loewenson, R. and ILO/SAMAT (2002) *Occupational Health and Safety in Southern Africa: Trends and Policy Issues*.

Mitullah, W.V. and Wachira, I.N. (2003) *Informal Labour in The Construction Industry in Kenya: A Case Study of Nairobi*, Working papers are preliminary documents circulated to stimulate discussion and obtain comments in International Labour Office Geneva May 2003.

Mothiba, G. (2010) South Africa Department of Labour, a Construction Health and Safety Accord to help stem casualty list.

National Institute for Occupational Safety and Health (NIOSH) (2009) 'Fall injuries prevent ion in the workplace', *Special Issue on Occupational Fall Prevention and Protection* [online]

http://www.cdc.gov/niosh/topics.

Navon, R. and Kolton, O. (2006) 'Model for automated monitoring of fall hazards in building

construction', *Journal of Construction Engineering and Management*, July, Vol. 132, No. 7, pp.733–740, ASCE.

Noor, K.B.M. (2008) 'A strategic research methodology', *American Journal of Applied Sciences*, Vol. 5, No. 11, pp.1602–1604, 2008 ISSN 1546-9239.

Occupational Safety and Health Administration (OSHA) (2010) *Construction Safety and Health,Fall Hazard Participant Guide*, US Department of Labour, SH-16586-07-06-F-36.

Ramutloa, L. (2010) Department of Labour Republic of South Africa, Amended Occupational Health and Safety Act.

Ratay, R.T. (2001) *Structural Condition Assessment, Construction Safety Affected by Codes and Standards*, 3rd ed., Bridge Management, Wiley, Hoboken, NJ.

Taylor, F. (2007) 'General model of accident rate growth in the construction industry', *Journal of Civil Engineering and Management*, Vol. 13, No. 4, pp.255–264.

Taylor, G., Easter, K. and Hegney, R. (2004) *Enhancing Occupational Safety and Health*, Elsevier Butterworth-Heinemann, Amsterdam, Boston.

Pérez-Alonso, J., Carreño-Ortega, Á., Vázquez-Cabrera, F., Callejón-Ferre, Á. (2011) *Accidents in the greenhouse-construction industry*, Elsevier Applied Ergonomics 43 (2012) 69-80.

FRAMEWORK FOR MODELING SUSTAINABLE CONSTRUCTION PRACTICES TOWARDS LOW CARBON CONSTRUCTION

Sarfo Mensah[1], Joshua Ayarkwa[2] and Gabriel Nani[3]
[1]*Department of Building Technology, Kumasi Polytechnic, Kumasi, Ghana*
[2, 3]*Department of Building Technology, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana*

Carbon is progressively regarded as a measure of the performance of building environmental and energy efficiency especially in advanced economies in view of the growing trend of subscription to sustainability in the construction industry. However, there is low level of awareness of the concept of sustainability in the construction industry in the developing economies and hence most of the practices carried out in the execution of construction activities are not based on the principles of sustainability. The question therefore is, what is the state of sustainable practices carried out in construction and how can some of these practices be modelled to engender low level of carbon emissions in construction? The ultimate goal of this research is to develop a model for sustainable practices in construction to achieve low-carbon emissions. In this paper, the objectives are: 1) to expose some of the sustainable construction practices in construction; and, 2) to describe the approach that is to be used for modeling sustainable construction practices in execution of low-carbon construction. Narrative review of relevant literature was carried out in order to examine the models developed for the purpose of reducing carbon emissions levels in construction as well as sustainable practices being used as new developments for reducing carbon emissions in construction. The process for developing the model will involve ranking of practices, categorizing the practices using factor analysis and determining the relationship between them and computed carbon emission levels using correlation and multiple regression techniques. The model, upon development, is expected to yield a practical benefit of prescribing how sustainable construction practices from both theory and practices can be effectively leveraged by construction practitioners to achieve low level of carbon emissions in the construction of mass house building projects in Ghana. The model is expected to be developed and validated through an ongoing PhD project work.

Keywords: carbon emissions, low-carbon construction, modeling, sustainable construction

INTRODUCTION

In view of its importance, environmental sustainability is captured under goal number 7 of the Millennium Development Goals (MDG) for attainment in the year 2015 (United Nations Conference on Sustainable Development (UNCSD), 2012). However,

[1] sarfmen@yahoo.com
[2] gabrielnani@yahoo.com
[3] joshayarkwa@yahoo.com

Mensah *et al.* (2014) framework for modeling sustainable construction practices towards low carbon construction *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 293-303.

achievement of this target seems far from possible. For instance, according to UN Department of Public Information, UNDPI (2013),global carbon dioxide emissions have increased bymore than 46 per cent since 1990, with a five per cent increase between 2009 and 2010."The physical environment and the construction sector are linked principally by the demands made by the latter on global natural resources, and this assumes huge environmental significance with the rapid growth in global population and the attendant implications for natural resources" (Ebohon and Rwelamila, 2001:3). The implication is that the construction industry feeds on the environment but also gives back a lot of waste, most detrimentally carbon, to the environment and thus, destroys air quality (Hajibabai*et al.*, 2011) and also contributes to the global greenhouse effect due to inefficiencies and high energy consumption (Lehmann, 2013).

The construction industry and the environment can therefore be said to be symbiotic. Construction practices are therefore important to environmental sustainability. In order to have a sustainable environment, the construction industry has a significant role to play through effective practicing of sustainable construction. However, little progress has been made in achieving sustainable infrastructure construction (Bates-Eamer*et al.* 2012). Managing construction activities well to obtain green building is very essential but very little research has been conducted in this direction (Robichaud and Anantatmula, 2010).Corbera*et al.* (2010) reveals that little research has been conducted on the tendency of construction methods and practices used for carrying out construction activities, especially developing economies, to minimize greenhouse gases emissions.In like manner, not much is known about how to manage construction activities/processes well in order to obtain green building (Robichaud and Anantatmula, 2010).

Although green building requires efficient use of the limited resources used for executing construction activities,Bates-Eamer*et al.*(2012) remarks that little progress has been made in handling the limited resources needed to achieve sustainable infrastructure.It is clear that in theory, efforts being made towards improvement of sustainable construction practices are at the embryonic stage(Royal Institute of Chartered Surveyors (RICS), 2012). Construction practices and methods being carried out have remained unsustainable for long (Lehmann, 2013).Therefore, research efforts need to be intensified in the areas of sustainable construction and environmental sustainability.

There is also the need to have innovative sustainable construction practices that will stimulate significant improvement in sustainability in the management of construction activities.Hence, ensuring efficiency of construction practices would facilitate the achievement of sustainability within the construction industry. In Ghana, a developing country, it has been identified thatenvironmental impact is a significant potential critical success factor for construction activities of mass housing buildings in urban areas (Ahadzie*et al.* 2008).Carbon is also progressively being regarded as a measure of the performance of buildings' environmental and energy efficiency for the purpose of driving home the agenda of sustainable development.Therefore,a more focused direction on carbon reduction has been taken in this research project.

The questions to be answered in this paper are: 1)what sustainable construction practicesare carried out in construction; and 2)how can some of these practices be modeled to engender low level of carbon emissions in construction?Therefore, theobjectives of this paper are to: 1)expose some of the sustainable construction practices in construction; and,2)describe the approachthat will be usedto modelsustainable construction practicesin construction forthe purpose of executing low-carbon construction.

LITERATURE REVIEW

Sustainable development is normally conceptualized as that which thrives on three important pillars: Environmental Sustainability, Economic Sustainability and Social Sustainability (Borland, 2009). Du Plessis (2009) stated that environmental sustainability is foundational to the other pillars of sustainability: social, economic, technical or institutional sustainability, and not just another pillar. The challenge is thrown to the construction industry to conform to requirements of sustainable development and it is therefore highly necessary that systematic steps are put in place to change or improve existing construction practices that are not geared towards achievement of sustainable development goals.

However, most construction industry practitioners are not familiar with sustainable practices that engender sustainable development. For instance Mensah and Ameyaw (2012) identified that there is low level of awareness of the concept of sustainability in the Ghanaian construction industry. There are alsochallenging perceptions of clients in the industry and these do not auger well for achievement of sustainable development.For instance, Opoku and Fortune (2011) found out that sustainable practices in construction organizations have not been promoted due to increased capital cost or the perceived cost associated with sustainability and lack of client demand for sustainability due to the wrong perception that sustainability costs more.

Arthur and Mensah (2006) have also stressed that in order to achieve sustainable development, which is lacking in Africa, it is important to build capacity of local human resources. These findings are a representation of situation where most of the practices carried out for execution of construction activities are not based on the principles of sustainability. There is therefore a strong need to use innovative ways such as applying sustainability delivery models, to achieve sustainability in construction especially in the area of carbon emission reduction, which is a current global concern.

The contributions of both embodied and operational carbon in buildings is estimated at 30% and 70% respectively (UK Business, Innovation and SkillsDepartment, 2010). Construction activities have been found to generate more carbon than expected. In a study carried out by Ren *et al.*(2012) it was identified thatof the total carbon emitted during construction activities, materials delivery, operational activities and plant operation account for more than 90 per cent.

The development of methods for estimating the amounts of carbon attributable to a building design, construction and operation are still at sprouting stage and hence justifies further research. RICS (2012) acknowledges and admits that computing embodied carbon is a complex and relatively new area of research and therefore a number of assumptions have to be made, which affect the accuracy of the outcome.Ren *etal.* (2012), in looking at how contractors can reduce CO_2 emissions during construction, confirmed from a single construction project that carbon emissions can be directly mapped on to the components of construction activities. Otherstudies conductedwith the purpose of measuring or reducing carbon emissionsin construction and buildingshave emerged and are described below:

- Heinonen*et al.* (2011) developed a framework, where both the construction and use phases are analysed together, taking into account the time perspective of the emissions.

The authors demonstrated the danger in concentrating on the carbon emissions during operation of a building at the expense of the emissions during construction. The utilization of the framework in a residential development in southern Finland shows that the carbon barb from construction can be so high that the overall emissions of a residential area can be dominated by the construction phase. For instance, the overall emissions during 25-year life cycle for residential buildings and infrastructure resulted in carbon emissions due to the construction phase only being little less than 50 per cent.

- Civil Engineering Contractors Association (CECA) Carbon Emissions Working Group (2011) also measured the carbon emissions of a contractor based on: purchased quantities of gas oil for site generators, gas and heating systems; diesel fuel for commercial vehicles; gas oil for site plant and total recorded mileage of contractors' cars; metered electricity consumption and energy used to create heat; and air travel business mileage reported by employees; embodied CO_2 in materials depot or office; subcontractors and waste sent to landfill, including greenhouse gas (GhG) emissions in the disposal.

- Nacap (2010) measured carbon emissions from equipment usage during pipe-laying construction activities such as the pipe transportation, welding and coating processes and administration. They found out that,the largest emitter group is the earth moving (47.7 per cent), followed by lifting (15.4 per cent), pipe laying (10.7 per cent),transportation (14.7 per cent) and others (11.5 per cent). The emphasis of this work was on emissions coming out of some selected construction equipment only. However, our research work focuses on finding out the how carbon emissions from construction activities can be reduced through application of sustainable practices.

- Skanska (2010) conducted case studies in Finland, Norway, Sweden, the UK and the USA, with different locally validated carbon estimating tools. For example, they reported that 651 tons of CO_2 emission including 73 per cent from electricity and 27 per cent from fuel was produced on-site during the construction process of a 13-storey office building project in London. This emphasizes the need to take a closer look at the carbon emissions that occur during the construction phase of a building as this research sets out to examine.

- Wilkinson and Reed (2006) also conducted a study in Melbourn, Australia, to find out the relationship between carbon emissions and building variables such as size, age and occupancy. The carbon emissions were measured using an industry accepted rating tool that converted consumptions into carbon emissions. They found out that a relationship actually existed between measured carbon emissions and the building variables. This current research intends to study the relationship that exists between carbon emissions and sustainable practices during the construction phase of a building project to aid development of the low-carbon construction model.

Carrying out practices that engender low carbon emissions in construction can be a major step towards achievement of sustainableconstruction.For instance, putting up buildings that enable people to be less dependent onair-conditioning; or, using construction processes that ensureless use of car driving could significantly reduce GhG emissions(Lehmann and Crocker, 2012). However, little evidence exists to show that construction practices are sustainable enough to cause reduction in carbon emissions from construction activities.Somepractices that could aid achieving sustainability in constructionhave been identified and described in the following research works:

- Zhou and Smith (2013) conducted a study into sustainability best practice in PPP in a case study of a hospital project in the UK and found out that in order to achieve sustainable development the best practice across different strands of sustainability through contribution to local employment and the local economy include a high percentage of waste recycling, dust and noise reduction and technical innovations such as green roofs, natural ventilation and a focus on occupant comfort. These practices are generally linked to sustainable development. In thecurrent research, the focus will be on finding the direct link between sustainable practices and carbon emissions specifically. It is believed that this specificity will improve upon the effectiveness efforts being made to achieve sustainable development.

- Pitt *et al.* (2009) in their work on finding out the state of current practices in sustainable development,suggested that the practice of having fiscal incentives/penalties and regulations in place helps to drive sustainable construction. Although majority of respondents contacted for the study believed that the construction industry is taking some account of sustainability issues, it was identified that more needed to be achieved in this area. Hence the need to pursue research into sustainable construction practices that will lead to reduction in carbon emissions cannot be over-emphasized.

- Robichaud and Anantatmula (2010) also conducted a study on greening project management practices. Upon a detailed analysis, using matrix, they found out that if there is the practice of involving cross-discipline team at the earliest stages and throughout, there would be project specific adjustments to traditional project management practices. This will come with a premise that a green project improves its chances for financial success. They also suggested that their recommendations for green construction could be validated by a research. This smacks off a study into sustainable construction practices with low-carbon construction in perspective. The result of such a study can eventually lead to an overall low-carbon economy.

- Zainul Abidin (2010) investigated the awareness and application of sustainable construction concept/practices by Malaysian developers and found out that, there are limited understanding and high concern about cost; only large developers are beginning to take heed towards sustainable implementation in their projects. Hence many developers are still reluctant and uncertain concerning pursuit of sustainability in their projects. To enhance the drive towards applying sustainable practices in the construction industry, it was suggested that actions should be directed towards improving knowledge of developers in sustainability. It is expected that the ultimate output of the current research will bring improvement in the knowledge of construction practitioners about sustainable practices that can lead to low-carbon construction when implemented.

RESEARCH METHOD

Desk-based study was used as a method to employ tools such as digitalized library and search engines for reviewing literature. Narrative review was used to:

a) describe the current level of practices and science in the focused areas of carbon emission reduction in construction in order to enable adding other dimensions of insight; and,

b) provide critical analyses of relevant works.

The narrative review of relevant literature was done to identify research efforts or works that have been carried out with a more focused direction on reducing carbon emissions in construction.

The narrative review also allowed description of the latest developments in the field especially relating to models and frameworks being developed as new perspectives important to emerging issues. Also, existing methods that have been used in research works with the objective of reducing carbon emissions were examined to form a basis for describing the appropriate methodology for developing a low-carbon construction model, which is the ultimate aim of the current research. Hence, findings in literature on development of the low-carbon or "zero-carbon" models were examined and described to provide basis for distinguishing the process for development of the model in this research.

The general guidelinesgiven by Rumrill and Fitzgerald(2008) were adopted for the conduct of narrative literature reviewi.e.,identifying a research area;identifying inclusion criteria for studies;selecting studies that meet the inclusion criteria;identifying themes that emerge from the set of studies; and,drawing conclusions.

CONCEPTUAL FRAMEWORK FOR DEVELOPMENT OF MODEL

Based on the literature reviewed, a conceptual framework that will guide further exploration of literature to aid development of the model was established.

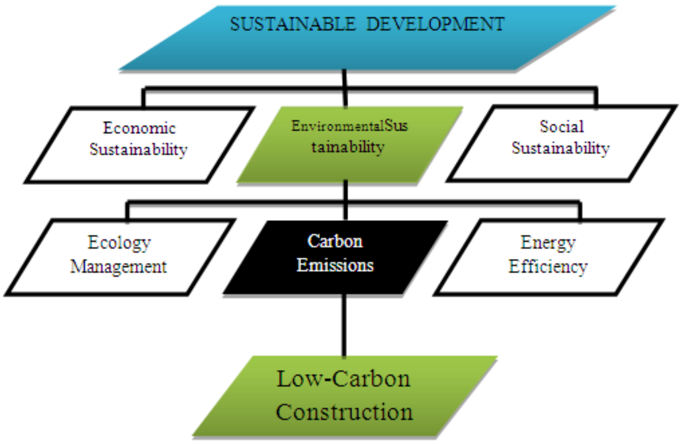


Fig. 1 - Conceptual framework
(*Source: authors' construction*)

Since the research project focuses on finding out the sustainable construction practices carried out in the management of activities that occur during the construction phase of a project life-cycle,the conceptualization, designing and planning phases of construction project management are excluded from the core area of the research. The research zeros in onthe carbon emission issuesunder environmental sustainability. Fig. 1 depicts the major conceptsthat will provide basis development of the model.

Just as Daniels *et al*. (2010) and Zurayk (2012) highlights on the importance of asking the right questions in order to carry out successful research, the process of developing the model requires that a couple of questions are asked. It is expected that obtaining answers to these questions through further research will aid effective development of the model. The main research question that would need to be answered for the development of the model is:

How can low levels of carbon emission from construction activities be achieved in Ghana?

Other research questions to underpin the model development are:

1. What are the theories and concepts that prescribe sustainable construction practices required to achieve low-carbon construction?
2. What should construction practitioners do in order to minimize carbon emission levels?
3. How can sustainable construction practices that significantly relate to low-carbon construction be determined?
4. What is the appropriate form of model required for the achievement of low-carbon construction?
5. What are the significant sustainable construction practices that can be prescribed for the achievement of low-carbon construction in Ghana?

DESCRIPTION OFMETHODOLOGYTO BE USED FOR MODEL DEVELOPMENT

In the process of outlining the systematic steps that will be adopted for the model development, a sample of low-carbon related models have been examined:

- The Green Supply Chain Operational Reference (GreenSCOR) model, developed by the Supply Chain Council (2008), provides a generic guideline for planning and defining the carbon and environmental footprint monitoring framework. The model to be developed in this research will focus on the construction activities that occur during the construction stage.
- The UK's Department for Environment, Food and Rural Affairs (DEFRA) (2009) model also provides guidelines for computation of the carbon footprint that employs a conversion factor (specified in the DEFRA model guidelines). For instance the carbon footprint from the energy consumption can be calculated as:
  Carbon Footprint =Energy consumption × Conversion factor
- In the study conducted by Cheng and Law (2011), in which they employed the guidelines in the aforementioned models, a conceptual model was implemented using web services technology that enhances system flexibility and customizability of the carbon foot print monitoring framework. Information sources and software functionalities are delivered as individual web service units that are distributed over a network through a standard protocol. The service units can be reused and combined by other services residing on a network.

Thesemodels examined puts emphasis on monitoring the carbon footprint occurring in supply chain of a given product, such as steel, before delivery to the construction site. The model to be developed in this research puts emphasis on carbon foot prints during the construction phase, after product is delivered. However it is anticipated that the guidelines provided in these models, especially methods for computing carbon footprints, will be leveraged for the development of the low-carbon construction model in the ongoing research.A proposition of thesystematic steps that can be used for development of the model is generally described below. This narration is independent of the processes through which the above models were developed.

The research approach for the development of the modelis inductive (Turkson, 2011).Apart from identifying sustainable construction practices from literature, theories and concepts,empirical data on sustainable construction practices are obtained for development of themodel.Qualitative data on the sustainable construction practices arecollected from construction practitioners with values assigned to each one to enable use of further quantitative analysis on them.This raises the need for triangulation of qualitative and quantitative methods. Thus, through desk based study the sustainable construction practices prescribed in theory areidentified whilstqualitative data on the practices carried out by construction practitioners are obtained through content analysis ofrelevant construction documents, face-to-face interviews andfield observation (Bell, 2010; Kumekpor, 2002). This enablesthe sustainable practices carried out by construction practitioners for the purpose of executing low-carbon construction to be ascertained. Through desk-based study, critical examination ofvarious forms of modelswould be carried out to enable adaptation of the most suitablemodel that could be used to prescribe the kind of sustainable practices to be carried out by construction practitioners in order to achieve low-carbon construction.The quantitative aspect of the triangulation involves application of theoretically established carbon emission conversion ratesfor plant, materials, componentsas well as building elements within selected constructions activities for the determination ofcorresponding carbon emission values.Based on Leedy and Ormond (2010), anappropriate correlation method would thenbe applied to ascertain the existence of arelationship between the practices and emission levels. To boostthe rigour of the data analysis process, multiple regression analysis technique is furtherused to establish the relationship between the *significant sustainable construction practices*and *carbon emission levels*. Eventually, such relationship facilitates selection of the practices that are relevant to the model development.Factor analysis technique would also be used to categorize the sustainable practices into appropriate groups to facilitate the model development. The final step in the development of the modelinvolves validation through assessment of construction industry practitioners who are experts in sustainable construction practices.

EXPECTED PRACTICAL BENEFITS OF PROPOSED MODEL

It is expected that the model will point out effective sustainable practices thatconstruction practitioners need to carry out to reduce carbon emissions during construction. With application of the model, a construction professional would be able to know what to do in terms of:

- Identifying any inefficiency in use of construction designs and programmes in order to recommend the needed change required to yield low-carbon construction.
- Seeing any weaknesses in adhering of specifications and recommending the best alternative practices
- Observing organization of site activities to identify carbon-emitting tendencies so as to recommend the needed changes
- Observing the delivery patterns, usage and fixing of construction materials and components to prescribe the best routes and methods for minimizing carbon emissions
- Observing the kinds and usage of construction plants and controlling any carbon-emitting tendencies

With the application of guidelines and practices prescribed by the model, construction industry practitioners desiring to achieve low-carbon construction will be able to plan, monitor and control construction activities in order to achieve low-carbon construction.

CONCLUSION

The objectives of thispaper were to expose some of the sustainable practices in construction anddescribe the process for modeling sustainable construction practicesto aid achievement of low-carbon construction.Narrative review of various relevant literature carried out has affirmed the importance of driving home a more focused efforts to reduce carbon emissions in construction through sustainable practices in order to achieve the overall goal of environmental sustainability. However, little evidence exists in the literature reviewed that point out the direct relationship between carbon emissions and sustainable practices in construction. The need to model sustainable construction practices for achieving low-carbon construction has therefore become moreindispensable.Therefore theapproachrequired for developing such a model has been described to involve a triangulation of qualitative and quantitative methodsfor identification of sustainable construction practices in theory and practice andfordetermination of significant practices relevant for the model development.The detailed process for developing the model involves ranking practices, categorizing the practices using factor analysis technique and determining the relationship between them and computed carbon emission levels using correlation and multiple regression techniques. Upon validation, the model is expected to yield practical benefits that will enable construction practitioners plan, monitor and control construction activities in order to achieve low-carbon construction.

REFERENCES

Ahadzie, D K, Proverbs, D G, and Olomolaiye, P O (2008), Critical success criteria for mass *Project Management*, 26(6), 675-687

Arthur, S N A J and Mensah, V (2006), "Urban management and heritage tourism for sustainable development: The case of Elmina Cultural Heritage and Management Programme in Ghana", *Management of Environmental Quality: An International Journal* Vol. 17 Iss: 3,pp.299 – 312.

Bates-Eamer, N, Carin, B,Lee, M and Lim, W (2012), Post 2015-Development Agenda: “Goals Targets and indicators”,CIGI Special Report, www.cigionline.org;retrieved 25th August 2013.

Bell, J. (2010) *Doing Your Research Project: A guide for first-time researchers in education, health and social sciences*. McGraw Hill Companies, England.

Borland, Helen (2009) "Conceptualising global strategic sustainability and corporate transformational change", *International Marketing Review*, Vol. 26 Iss: 4/5, pp.554 - 572

Business, Innovation and Skills (2010) annual report, (www.bis.gov.org)

CECA (2011) “Carbon in construction”Carbon Emissions Working Group, available at: www.ceca.co.uk.

Cheng, J. C. and Law, K. H. (2011) A Web Service Framework for Environmental and Carbon Footprint Monitoring inConstruction Supply Chains, *Journal of Civil Engineering andArchitecture*, Jan. 2011, Volume 5, No.1 (Serial No. 38),pp. 1-12

Corbera, E, Estrada, M, and Brown, K (2010), Reducing greenhouse gas emissions from deforestation and forest degradation in developing countries: revisiting the assumptions, *Climatic change*, 100(3-4), 355-388.

Daniels, A E, Bagstad, K, Esposito, V, Moulaert, A, and Rodriguez, C M (2010), Understanding the impacts of Costa Rica's PES: Are we asking the rightquestions? *Ecological economics*, 69(11), 2116-2126.

DEFRA (2009), *Guidelines to Defra / DECC's GhG Conversion Factors for Company Reporting*, UK Department for Environment, Food and Rural Affairs, London.

Du Plessis, C. (2009). Ecological worldview perspective on urban sustainability, *ELECS 2009, Recife*, Brazil, 28-30 October 2009

Ebohon, O J, and Rwelamila, P M D (2001), Sustainable construction in Sub-Saharan Africa relevance, rhetoric, and the reality,*Agenda 21*, 16.

Hajibabai, L, Aziz, Z, and Peña-Mora, F (2011),Visualizing greenhouse gas emissions from construction activities, *Construction Innovation*: *Information, Process, Management*, 11(3), 356-370.

Heinonen, J, Sa¨yna¨joki, A and Junnila, S (2011), "A longitudinal study on the carbon emissions of a new residential development", *Sustainability*, Vol. 3 No. 8, pp. 1170-89.

Leedy, P D and Ormond, JE (2010),*Practical Research*, Pearson Education Limited, London

Kumekpor, T. K. B. (2002). *Research Methods and Techniques of Social Research.*Sonlife Printing and Press.ISBN: 9988-640-69-2

Lehmann, S (2013), Low carbon construction systems using prefabricated engineered solid wood panels for urban infill to significantly reduce, greenhouse gas emissions. *Sustainable Cities and Society* 6, 57-67

Lehmann, S and Crocker, R (Eds.) (2012),*Designing for zero waste. Consumption, technologies and the built environment*, Earth scan series on sustainable design. London: Rutledge.

Mensah, Sand Ameyaw, C (2012), Sustainable procurement: the challenges of practice in the Ghanaian construction industry *In:* Laryea, S., Agyepong, S.A., Leiringer, R. and Hughes, W. (Eds)Procs 4th *West Africa Built Environment Research (WABER) Conference*, 24-26 July 2012, Abuja, Nigeria, 871-880.

Nacap (2010), "Carbon footprint of pipeline projects",*44th Annual IPLOCA Convention*, Venice, September 27-October 1, 2010: www.nacap.com/media/CO_2.

Opoku, A and Fortune, C (2011), The implementation of sustainable practices through leadership inconstruction organizations *In:* Egbu, C. and Lou, E.C.W. (Eds.) Procs 27th Annual *ARCOM Conference*, 5-7 September 2011, Bristol, UK, Association of Researchers in ConstructionManagement, 1145-1154.

Ren, Z., Chrysostomou, V, and Price, T (2012),The measurement of carbon performance of construction activities: A case study of a hotel construction project in South Wales. *Smart and Sustainable Built Environment*, *1*(2), 153-171.

Robichaud, L B, andAnantatmula, V S (2010), Greening project management practices for sustainable construction. *Journal of Management in Engineering*,27(1), 48-57.

Rumrill, P D Jr. and Fitzgerald, S M (2008), Using Narrative Literature reviews to build a Scientific Knowledge Base, available: www.doresearch.wordpress.com/category/literature-review, accessed on: 05, November, 2013.

Skanska, A B (2010), "Carbon foot printing in construction – examples from Finland, Norway, Sweden, UK and US", Case Study 76, *Skanska*.

Supply Chain Council, (2008) *Supply Chain Operations Reference (SCOR) Model*, Version 9.0 Therivel, R. (2012).*Strategic environmental assessment in action*.Routledge.

Turkson, E (2011).*Student research project: How to obtain Top Grade*. T.M. Global logistics

UNCSD (2012), Press release of United Nations Division for Sustainable Development, *UN conference on Sustainable Development Goals*, 20 -22 June, 2012, Rio de Janeiro Brazil, www.uncsd2012.org, retrieved 26 February 2013.

UNDPI(2013), Millennium Development Goals and Beyond 2015 Fact Sheet, available at: http://www.un.org/milleniumgoals/pdf/Goal_7_fs.pdf, accessed on: November 7, 2013

Wilkinson Sara J. and Reed Richard G. (2006)Office building characteristics and the links with carbonemissions, *Structural Survey*Vol. 24 No. 3, 2006pp. 240-251

Zhou, L, and Smith, A J (2013), Sustainability best practice in PPP-Case study of a hospital project in the UK: available at www.klon.uclan.ac.uk

Zurayk, R (2012) Asking the right questions. *Journal of Agriculture, Food Systems, and Community Development*: 17

GEOGRAPHIC DIVERSIFICATION OF LISTED SOUTH AFRICAN PROPERTY COMPANIES INTO AFRICA

Omokolade Akinsomi[1], Radiyya Pahad[2], Lebogang Nape [3]and Joshua Margolis[4].

School of Construction Economics and Management University of the Witwatersrand. Johannesburg, South Africa.

The Purpose of this paper is to establish the reasons behind the lack of real estate investment by listed property companies on the Johannesburg Stock Exchange into the rest of Africa. Questionnaires were administered to a total of 12 listed property companies out of 36 on Johannesburg Stock Exchange and data on diversification strategies was gathered from the annual reports. Through an analysis of data gathered, the study established the most significant barriers to entry and the market selection criteria of South African listed property companies when it comes to investing in real estate in the African continent. The research found that property rights are the most substantial market selection criteria that listed real estate companies consider and the main barrier to entry into the African markets is legal and title risk. The study also found out that geographic diversification within South Africa was a strategy mostly adopted by listed real estate companies. This study concludes that for African countries to attract real estate investment from South Africa, they need to improve their legal and property rights regulations.

Keywords: real estate investment decisions, real estate portfolio management, real estate African markets, real estate diversification

INTRODUCTION

Real estate portfolio diversification is described as the means by which investors minimise their exposure to company-specific risk and systematic risk as well as moderating the short-term effects of individual asset class performance on portfolio value (Valley Vista Enterprises, LLC, 2007). Research into real estate portfolio diversification began with the aim of analysing how illiquidity and immobility issues that were intrinsic in real estate could be overcome (Muller, 2013).

[1] Kola.Akinsomi@wits.ac.za
[2] radiyyapahad@yahoo.com,
[3]law.nape@gmail.com
[4] joshuamargolis@hotmail.com

Akinsomi *et al.* (2014) Geographic diversification of listed South African property companies into Africa *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 305-323.

Traditionally, property companies looked at diversifying their real estate portfolio diversification by optimising the returns of property companies generally either geographically or through property type diversification. This is achieved by spreading the risk of a property portfolio either amongst different locations, both locally and internationally, or different property sectors, namely industrial, retail, office or residential. As property markets are driven by local factors, property portfolio diversification into foreign property markets will ensure that it will yield great returns as the markets would not be positively correlated (Eichholtz, 2001). Property markets provide lesser degrees of international correlation than other asset class markets, namely bond and stock markets (Eichholtz, 2001).

Diversification of property portfolios into emerging markets like those found in Africa, has not been explored to great depth by authors. Recorded historical performance of emerging markets has resulted in the gross generalisation that these markets, overall, are volatile in isolation but the only advantage is that they offer diversification prospects for global investors. With regards to real estate investment performance, diminutive knowledge exists as to whether these investments in emerging markets do offer significant diversification prospects for international investors (Barry and Rodriguez, 2004).

The South African listed property sector has been the best performing sector in comparison to other asset classes. The sector in 2012, delivered a total return of 36% and this enabled the sector to outperform cash, bonds and equities to be South Africa's top performing asset class for four years in a row (Swart and Kettles, 2013). The sector has grown immensely over the past five years despite the 2008 recession. The market capitalisation in 2007 was just R92 billion as noted by Buchner (2008), but as at January 2013, the market capitalisation of the sector was just above R210 billion and this shows the exceptional performance of the sector (Muller, 2013).

With regards to the African investment environment, the area of international diversification is opening up to a large scale within Africa. Many global players out there are highly interested in emerging markets arising from the untapped potential inherent in these markets and therefore Africa serves as a perfect example. Although this market is still at its starting stages in achieving international status due to the many risks from investment within, major changes are being undertaken within the business institutional environment, making it attractive for investment (Luiz, et.al, 2009). In order for Africa to achieve prosperity and to maintain sustainable growth, international investment from foreign companies is crucial. An area of particular importance is the alignment of local and foreign property investment into Africa. This paper aims to highlight the risks associated with geographic diversification of listed South African property companies into Africa (apart from South Africa).

Despite the benefits achieved on a global scale, diversification into Africa has not been favoured by SA listed property companies, as they are sceptical to invest in Africa, as quoted from an interview with the CEO of Growthpoint properties, Norbert Sasse, (Loo, 2009). This is a problem for investors and listed property companies because an aim of an investor and company is to maximize wealth. By not diversifying their portfolios they may be missing out on potential income. This will also influence African countries growth potential.

With the lack of literature on the subject matter of real estate in Africa and in particular, diversification into emerging markets like those found in Africa (Rushin, 2006), conclusive knowledge with regards to factors that may be impacting the growth of these markets, or lack thereof in some cases, is minimal or non-existent at all. In general, there is an absence of empirical research for identifying market selection criteria for international real estate investments (Falkenbach, 2009). The barriers to real estate investment in most African countries have not only disheartened investment from South African firms but substantial investments in Africa by investors from developed countries are less common because of these barriers amongst other things (Falkenbach, 2009).

This study proposes to investigate the deterring factors that have led to the lack of diversification by South African listed property companies into Africa and establish if the same factors that have been identified by international investors, are the same for property companies in South Africa. Our research intends to do this through understanding the market selection criteria of listed property companies in South Africa. This study will be able to assist African countries that have not been receiving direct investment in their property sector especially from South African property companies. The study will highlight the specific areas that the listed property companies find to be deterring them from investing in these countries and this will enable such countries to change these dissuading aspects in order to attract more investment from South African property companies. This is especially useful since South Africa is one of the "world's fastest growing sources of foreign direct investment in Africa" (Luiz and Charalambous, 2009).

Another purpose of this study is to develop an understanding of whether investment in property in Africa is a viable option for investors and to highlight the opportunities in this untapped market to drive South African listed property companies to invest in the other parts of Africa. If South African companies restore their faith in the continent it will maybe attract other foreign investors to invest in Africa and this will help our continent grow. The aims of this research are to provide knowledge to listed property companies and other investors in South Africa who may or may not have been contemplating a global diversification strategy. The research also aims to provide a clear perspective of the risks associated with such an investment, in order to assist sound investment making decisions regarding the diversification into emerging markets.

This paper seeks to investigate a main research question- within the African context, what the market selection criteria by listed South African property companies when making an investment decision to diversify their portfolios into other parts of Africa and also what are the factors that serve as main barriers to entry in these African markets?

Hypotheses

- Property rights are the most substantial market selection criteria of listed South African property companies looking to diversify their portfolios into Africa.
- Political risk is the main barrier to entry for listed South African property companies looking to diversify their portfolios into Africa.

LITERATURE REVIEW

(De Wit, 2010), obtained real estate data of 25 countries in 5 regions for 4 different property types which was analysed to determine whether diversification by region or property type is more efficient and effective in reducing the erratic nature of a global real estate portfolio. (Lim, et al., 2006), also developed a survey which was mailed to

1,068 major U.S. and European financial institutions and property companies. The nature of their foreign real estate investment was explored. The main considerations and motivations were ranked on a scale from 1-5 (1 being the highest and 5 being the lowest) of their real estate investments as well as their perceptions of risk and returns.

(Olaleye, et al., 2007) collected data through the use of questionnaires and interviews on twenty-eight institutional property investors and one hundred and twenty-eight real estate practitioners on what they considered as the factors that were prompting their selection of diversification evaluation techniques. In (Olaleye, 2008) study, data on the characteristics of the sampled population, which consisted of property investors and practitioners, was collected using questionnaires in conjunction with interviews.

In a survey study done by (Falkenbach H. , 2009), the 5 most important factors in the market selection process are: safety of property rights/title, expected return on property investments, liquidity of property market, and market size and taxation.

(Han, 1996), found the most significant investment factors to be economic factors, real estate opportunities and demographic attributes such as market size.(Ho, et al., 2006), also found economic growth to be key selection criteria of companies looking to diversify their portfolios internationally. The strategies behind the key selection criteria of companies looking to diversify their portfolios into Africa are real estate potential, individual market sector (retail, office, and industrial) potential and the investment process (Lee, 2005).

There is a pattern that that has developed between (Han, 1996), (Chin, et al., 2006) and (Ho, et al., 2006). Financial and economic strength and structure is the most significant factor in each case. This infers that the relatively weak African economy may link to the lack of investment by South African companies into Africa. Restrictions and regulations on foreign investors, political stability and legal regulations were also found to be important considerations.

Market size appears to be a major factor to take into consideration. (Webb and O'Keefe, 2002), propose that worldwide, there are just 14 countries that have real estate markets of sufficient size for investment, none of which are in Africa. (Liang and McIntosh, 2000), approximate the size of market available for investment.(Han, 1996), and (Falkenbach H. , 2009) also found market size to be an integral outcome of their individual surveys.

When property companies wish to expand their portfolios, the diversification strategy which is often undertaken is either property type or geographic diversification. This has led to quite a large number of studies that focus on property type and geographic diversification (Olaleye, 2008). Cheng and Roulac (2007) looked at the effectiveness of geographic diversification across metropolitan areas in the United States of America, and found that diversification across the different regions of a country may be ineffective because markets in these large Metropolitan Statistical Areas (MSA) tend to be more positively correlated. Heyndrich (2010) conducted a study on economic diversification and its relative superiority to the traditional geographic diversification strategy. The findings show that "economic diversification strategy based on industry specialization does lead to advantageous risk-return profiles compared to a traditional geographic diversification approach".

De Wit (2010) looked into the investment strategy that would be more effective in decreasing the instability of real estate returns, and found that geographic factors played the biggest role. This implies that investing across regions will result in the maximum diversification benefits. However, the author also notes that in comparison to the property type effects, regional effects are less constant over time. With regards to the returns, property type effect seems to be more important and, particularly, for returns expressed in the local currency. Olaleye (2008) who also conducted a study on the benefits of both types of diversification strategies within an African context, adds to the statement made by De Wit (2010), by stating that the adoption of a property type efficient portfolio strategy will be most beneficial to an investor if they combine real estate assets into portfolios and that increased portfolio returns can be achieved sooner if a geographic/economic diversification strategy is used. Thus the choice of either the property type or geographic diversification will depend on the time scale in which the potential investor would like to receive their return on the investment and whether or not they plan to hold that particular asset/portfolio in the long-run.

Only a limited number of journal papers exist that have explored the real estate funds in Africa and an even less number has investigated the diversification strategies that have been adopted in most of the other key African markets (apart from South Africa). This dearth in the body of knowledge will limit our research into this area as more studies will have to be undertaken to establish a larger sample size of markets in Africa. Majority of the studies that do exist, mainly focus on the Nigerian property market. Olaleye (2008) evaluated the benefits derived from different real estate portfolio diversification options in underdeveloped property markets with Nigeria being their case study, and found that investors often diversified through either property type or geographic diversification. They also found that common portfolio strategies which were adopted were either portfolio strategy or naïve portfolio strategy and that they are both efficient, even though minimal.

Olaleye and Aluko (2007) who looked at whether diversification by managers and property type would result in better performance of a portfolio also adds to the study by Olaleye (2008), through highlighting the common usage of either the naïve or efficient portfolio diversification strategy in emerging markets like those in Africa, specifically, Nigeria. Olaleye (2008), through looking at the factors which could potentially be impacting on the decision makers' diversification strategy in emerging real estate markets, notes the dominance in the use/adoption of the naïve diversification strategy.

The potential reasons behind the choice of portfolio diversification strategy are noted by Olaleye (2008). These reasons hold that; firstly, the efficient portfolio diversification strategy, namely the Modern Portfolio Theory (MPT), involves complex mathematics whereas the decision makers' such as practitioners and investors might not have been trained in the techniques required for these strategies; and secondly, investors are not willing to invest on the bases of tradition and allocation system which they do not understand and therefore, are more inclined to choose the naïve strategy over the efficient strategy.

With much of the property investments into African countries (apart from South Africa) being primarily towards direct real estate assets given to the lack of uniform property market structure like the Real Estate Investment Trusts (REITs) (Olaleye, 2008), barriers to diversification into these emerging markets are limiting the growth potential that these markets could be achieving. Few papers such as those by (Asiedu, 2006) and (Dupasquier and Osakwe, 2005) have looked into the deterrents to foreign direct investment (FDI) into Africa and have both highlighted similar deterrents that have hindered FDI into Africa.

Asiedu (2006) evaluated the level of FDI that flowed into the Sub-Saharan Africa region. The results showed that only three out of all the countries in Sub-Saharan Africa received a combined percentage of 65% of the FDI into the region with South Africa being the largest benefactor. Results were extracted from four different surveys that looked at the factors that are constraining FDI into Africa which resulted in two important findings; firstly, corruption was the highest factor which was considered an obstacle in all four surveys; and secondly, factors that were deterring FDI into Africa were: political instability, FDI regulations, weak infrastructure, financing constraints and macroeconomic instability.

Dupasquier and Osakwe (2005) conducted an investigation into the possible strategies that could be employed to promote FDI into Africa. This study adds to the body of knowledge by not only highlighting the key areas to look into for promoting FDI into, but also through providing practical solutions per constraint which could be applied in order to remedy the solution. The paper also cements the later work by (Asiedu, 2006), through noting that uncertainty in the region, which manifests itself by: political instability; macroeconomic instability; and the lack of policy transparency, is to be blamed for the dismal FDI. The paper however identifies other factors such as gross domestic product (GDP) growth and market size; high protectionism; high dependence on commodities; increased competition; and poor and ineffective marketing strategies are also contributing to the low level of FDI.

The paper identified three formal barriers: firstly, restrictions to capital accounts which affect the ability of investors to repatriate their investments; secondly, legal barriers which could take the form of ownership restrictions and as such foreign investors would be forced to find local partners in order to invest in that country; and thirdly, taxes and cost where taxation on capital gain has been seen as deterring long-term investment and cost which take the form of information costs, transaction costs, and differential taxes.

The paper has also identified eight informal barriers, namely; institutions, the rule of law and corruption, political risk, currency risk, economic stability, liquidity risk, geographical barriers, cultural barriers, and lastly legal and title risk. The analysis of both the formal and the informal barriers is crucial in determining the cross-border real estate investment flows. An analysis of the papers by (Asiedu, 2006), (Baum and Murray, 2011) and(Dupasquier and Osakwe, 2005) does shed some light on the potential factors that have deterred real estate diversification into other African markets by South African listed property companies.

The general sense about the condition of infrastructure development in most SSA countries, excluding South Africa, is that it is poor or in some cases insufficient to accommodate the need of foreign investors (Nnadozie, et al., 2008). The report also highlighted some of the critical factors which are required for economic growth and development, and infrastructure, such as, telecommunication; electricity; and transportation, amongst others, that are critical for attracting private investments which real estate investments would in most likelihood fall under. For firms wishing to diversify into emerging countries, like those in Africa, economic infrastructure in most of these countries would have to be assessed at great depth as it will ultimately have an effect on the returns that can be realized from the diversification into these markets.

Luiz (2010) who carried out a study on long-term trends in the development of economic infrastructure and its linkage to long-term economic development in Africa, found that infrastructure is important but is not solely necessary for improving economic development in the continent as well as attracting more foreign direct investments together with investments from more developed African countries into majority of the undeveloped African countries. This study as well as others has highlighted the importance of infrastructure development to ensure greater levels of investment in emerging countries like those in Africa. The general consensus, however, is that even though general availability and efficiency of infrastructure is an important factor that is considered by firms planning to diversify into these markets, infrastructure on its own will not be solely responsible for attracting this investment, and other factors are considered such as those highlighted by (Baum and Murray, 2011).

With the property market nature of South Africa being polarised from other property markets in Africa due to the level for development, market growth and transparency in the country, the likelihood of, South African listed property companies that do diversify into the rest of Africa, being integrated and adapting to the market nature of these relatively underdeveloped markets will have to be analysed as it might also be a deterring factor to diversification into the rest of Africa. The nature of property markets is that they differ by location, even within a single country.

Thus, this understanding would imply that the nature of the African property markets would not depict something new, research by (Olaleye, 2008), has however highlighted the issue of a lack of uniform market structure, such as the Real Estate Investment Trusts (REITs), in majority of the African markets, excluding South Africa which is about to adopt that structure this year. The two paper which give a somewhat clear indication of some of the property market structures in Africa, is firstly one paper by, (Olaleye, 2011), studied the market structures in South Africa and will be the bases to analyse if Property Loan Stocks and Property Unit Trusts structure are viable for diversification into Africa.

The second paper which is crucial is, (Olaleye, 2008) study on the Nigerian property market structures as it highlights the current realities of African property markets, excluding South Africa, where it found that in Nigeria, the portfolio tend to be small in size and there is scarcity of transactions in the market. Another point discovered by the study is that the underdeveloped nature of the market and the lack of advanced academic training and knowledge have influence the choice of diversification strategies which might prove beneficial to South African property companies which would be importing knowledge and experience into these markets.

As this literature review has highlighted with regards to real estate diversification into emerging markets, the task is not a linear one. Many factors have to be taken into consideration, such as, if a firm does so wish to diversify into these markets, it has to analyse if the diversification benefits outweigh the inevitable cost of cross-border and also the choice of diversification type to embark on. The naïve portfolio diversification strategy has been found to be popular due to its simplicity and this will have an impact on South African firm that do choose to diversify into Africa as most will have to adapt to the native strategies in these markets.

The investigation has also revealed some of the barriers to real estate investments into emerging markets, but further empirical research was carried out, which is later presented that contextualises these barriers to the South African situation. Analysing market selection criteria has helped us understand the reasons as to why there is enthusiasm or reluctance to invest in Africa by Listed South African property companies.

The African business environment itself has experienced positive changes in the recent past, even though there are still some concerns; and provides untapped potential that South African listed companies could take advantage of. Regardless of high risks inevitable in the African environment, most markets in Africa assure high returns.

The literature review has revealed a gap in the literature. Majority of the authors have looked at diversifying property into developed countries and also emerging markets in general. This is highlighted by the different studies reviewed in this paper. A specific look at real estate diversification in Africa by international investors is minimal at best and this study's specific area of focus has to our research never been conducted. Thus, research in this area is of the outmost importance as it is contributing to the limited body of knowledge. An analysis of both international literature and the limited African literature and also an empirical research has been undertaken in order to answer the research question that owes its roots to the general problem of the lack of substantial diversification into Africa by South African listed property companies.

RESEARCH METHODOLOGY

The methodology that we have followed involves triangulation. Triangulation is a method involving the mixed use of one or more research methods, combining both qualitative and quantitative techniques. This method produces results that are both valid and reliable, (Fellows and Liu, 2008). The reason for choosing this method is to obtain a holistic point of view for our research. Both sets of quantitative and qualitative data have been analysed, and with findings that are consistent, this further emphasised the validity of the findings.

Through a study involving questionnaires our aim is to either validate or dismiss our hypotheses. We have developed a holistic questionnaire and were be able to test our hypotheses accurately. Our questionnaire is designed in such a manner that all of our research questions and sub-questions are answerable. The opinions of listed property companies on the JSE will provide a subjective view, while the analysis of return data from the JSE will provide an objective point of view. Both the qualitative and quantitative data will be analysed in order to answer all questions.

The questionnaire was also planned to have been pilot tested with several companies that are similar in nature to our target sampling group. The sample population which consisted of only listed property companies was chosen due to the availability of information on the companies as compared to unlisted private companies. The time constraint of the study resulted in the researchers opting for a less time consuming approach to conducting this research. Financial reports of listed property companies are readily available and this motivated the researcher in choosing this sample population. As the sample group consists of listed property companies in South Africa, pilot questionnaires were sent to firms that are part of secondary division of the JSE, namely Alt X. However, this approach of trying to conduct pilot tests proved to be unsuccessful due to the lack of interest from these companies to take part in the study. This strategy of pilot testing enables researchers' to test run the effectiveness of the questionnaires, which may assist in refining the questionnaire if there are any obvious weaknesses. This was overcome by acquiring the assistance of a notable author in this field to review the questionnaire.

An in-depth questionnaire was sent to all the listed South African property companies, which represents the sample group of our research, to determine which criteria act as barriers to entry in the continent. Our first approach has been to develop and email a questionnaire to the relevant companies. The majority of people that receive questionnaires do not return them (Leedy, 2010), and as such, our secondary back-up approach involved calling these companies to set up an appointment to administer the questionnaire personally.

The findings of the survey can be compared to the results of two similar survey questionnaires (Falkenbach, 2009) and (Baum and Murray, 2011), that was administered to property firms and investors on an international scale, in order to determine whether the market selection criteria or barriers to investment in Africa are perceived in the same way by South African listed property companies.

The target for our research was to obtain information from a total of 36 listed property companies on the Johannesburg Stock Exchange (JSE). These companies were chosen based on the limitations that were set for this study. This sample size however included companies that were different in industry specialisation and also market capitalisation of the companies approached for this study, the researchers managed to only receive 12 responses out of the 36 companies. This low response rate could be explained by analysing the time in which the data was gathered. The data was gathered during a period in which some of this companies where preparing their year-end financial statements and also lack of interest from participants could be blamed. The validity of the data gathered from the low responses was justified by the fact that the companies that responded belonged to all the different property markets needed for our study and the market capitalisation of the companies represented different sections of the market.

The 36 listed property companies were firstly identified from looking at both the JSE and Bloomberg websites. These companies contact details were then abstracted from the aforementioned websites as well as the actual companies' websites. Both contact telephone numbers as well as email addresses of these companies were taken down.In an attempt to increase the chances of firms responding to the questionnaire, firms were first contacted via e-mail, and if no responses were achieved then they were telephonically contacted. If this resulted in a further lack of response, then meetings were then set up with the companies to invite them to partake in the study.

To obtain a holistic approach to the research, a mixed-method approach was used to conduct our study. A questionnaire is the mean that has been used in our research, as this encapsulate both the qualitative as well as quantitative aspects of the research. Questionnaires have been sent to all the firms listed on the main board of the JSE electronically, via email. More specifically, the emails were sent to the asset managers or directors of the funds. These questionnaires were obtained either by phone call or email exchange from the firms. This method is low cost and could result in the questionnaire being completed timeously. Questionnaires were chosen because they offer a variety of advantages. They have identical questions for the firms to respond to (Denscombe, 2007). This has provided consistency and accuracy. It is vital to distinguish between questions of fact and questions of opinion (Denscombe, 2007), as the respondents various answers will be affected according to whether fact or opinion is asked for.

The questionnaire was designed around two main categories: the first part involves a background analysis of the sample group such as the companies' classification, core strategies, objectives, the value of the company, the age of the company, and the asset classes that the company invests in. The second part involves analysis of the diversification strategies and perceptions on investing in real estate in the other parts of Africa. To make the process as simple and quick as possible in favour of the respondents, most questions in the questionnaire were structured using a 5-point Likert scale or multiple choice options. Graphs were then drawn up from the results of these questions from which to conclusions and deductions were then made easily. As I explained earlier the process of getting the companies to respond to us was rather difficult and only 12 out of the 36 companies filled out the questionnaire which results in a low 33% response rate.

Secondary data analysis was conducted through writing up a summarised report on each company that partook in the study based on their website information. In the secondary data analysis, the most important parts looked at was the geographic diversification strategies of the fund and the property type diversification strategies of the fund such as commercial, retail, or industrial. This was undertaken in order to provide further back up to the primary analysis and to further understand the strategies chosen. We found that the results of the primary and secondary data correlated.

ANALYSIS

A limitation of this study is that 12 out of the potential sample size of 36 Listed Property companies on the JSE that were contacted via email, telephone, and through physical meetings, completed the questionnaire. This translates into a 33% response rate. Regardless as to the limitation of responses, the companies that have responded each represent different diversification strategies and it’s a good classification of the South African property sector as it includes a range of companies from high market value to companies that have low market value.

Background Information

The intention of the survey was to choose the appropriate persons to complete the questionnaire within the respondent company who are actively involved in the international diversification decisions of the company. The following table illustrates the various respondents by their positions within the company. Total number of respondents: 12.

Table 1: Respondents Designation/ Position in Company

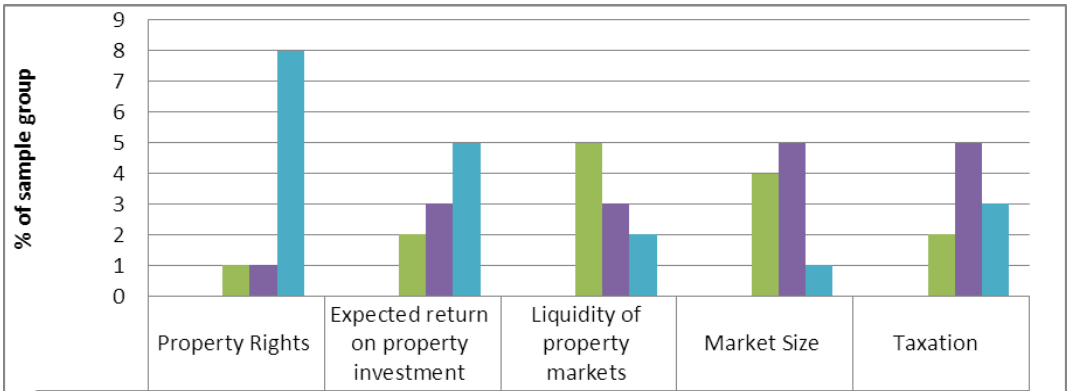
Position	No. of responses
Asset Manager	4
Chief Financial Officer	1
Fund Manager	1
Accountant (with assistance from director)	1
Investor Relations Executive	1
Finance and Administration Manager	2
Financial Director	1
Deal Manager	1

The sample size is dominated by Asset Managers (33%). 20% of the respondents are Finance Mangers, with an equal split of approximately 8% of the remaining positions. The questionnaires included questions based on obtaining background information on the various listed property companies. Questions surrounding classification, asset class, value, period of existence and diversification strategies were asked as background information. This was to further establish and analyse trends within the study. The various findings of this study as well as diversification strategies may be influenced by the aforementioned factors and so it is appropriate to demonstrate all background information in order to obtain a holistic understanding of the study.

Questionnaire Analysis

Out of the five different market selection criteria listed in *Figure 1* below, each criteria was rated by the respondents regarding their take on diversification into African markets according to a 5-point scale: 1 - not important, 2 - slightly important, 3 - important, 4 - very important, 5 - extremely important.
67% of the respondents felt that Property Rights is an extremely important category to take into consideration before undertaking investment into other parts of Africa. Expected returns on property investment were also rated as extremely important by a majority of the respondents (42%). Liquidity of property markets were rated as important by the highest percentage of respondents (42%). 42% of the respondents rated market size as very important. Lastly, taxation was rated by 42% of the respondents as very important.
The market selection criteria can be arranged into a list in order of importance as rated by the sample group:

1. Property rights – Extremely important
2. Expected return on property investment – Extremely important
3. Taxation – Very important
4. Market size – Very important
5. Liquidity of property markets - Important



	Property Rights	Expected return on property investment	Liquidity of property markets	Market Size	Taxation
First	0	0	0	0	0
Second	0	0	0	0	0
Third	1	2	5	4	2
Fourth	1	3	3	5	5
Fifth	8	5	2	1	3

Figure 1: 5-point scale rating of market selection criteria when undertaking real estate diversification into Africa

The respondents felt that the following market selection criteria were additionally regarded as important to take into consideration:

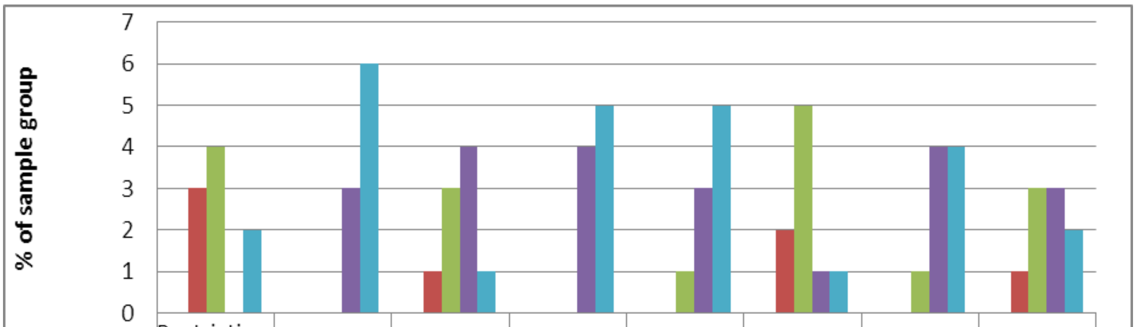
- Political Stability – 25% of the respondents considered this factor as additionally important.
- Exchange Control
- Interest rates
- Sustainability of investment
- Retail landscape and factors impacting

Different factors that serve as barriers to entry in real estate investment were graded by the sample group with regards to their perception on the African markets rating, as depicted in *Figure 2* below. Each barrier was rated using the 5-point scale once again. A count of 33% of the respondents felt that restrictions to capital accounts were best classified as important. A 50% majority of the respondents classified legal and title risks as extremely important. 33% of the respondents classified taxes and costs as very important. Political risks were classified by 42% of the respondents as extremely important.

Economic stability was also rated by 42% of the respondents as extremely important. 42% of the respondents were of the view that currency risk is best classified as important. Corruption was most rated in an equal distribution of respondents with 33% of the respondents classifying it as extremely important and another 33% classifying it as very important. Lastly, another equal distribution resulted in the classification of liquidity risk, as 25% were of the view that it was best rated as very important and another 25% felt that it was best classified as important.

The factors that serve as barriers to entry in real estate investment in African countries can be arranged into a list in order of importance as rated by the companies:

1. Legal and title risks – Extremely important
2. Political risks – Extremely important
3. Economic stability – Extremely important
4. Corruption – Extremely important and very important
5. Taxes and costs – Very important
6. Liquidity risk – Important and very important
7. Restrictions to capital accounts – Important
8. Currency risk – Important



	Restrictions to capital accounts	Legal & title risks	Taxes & costs	Political risks	Economic stability	Currency risk	Corruption	Liquidity risk
First	0	0	0	0	0	0	0	0
Second	3	0	1	0	0	2	0	1
Third	4	0	3	0	1	5	1	3
Fourth	0	3	4	4	3	1	4	3
Fifth	2	6	1	5	5	1	4	2

Figure 2: 5-point scale rating of barriers to entry when undertaking real estate diversification into Africa

The respondents were of the view that the following barriers to entry were regarded as additionally important when undertaking decisions on whether to invest in real estate in African countries outside of South Africa:

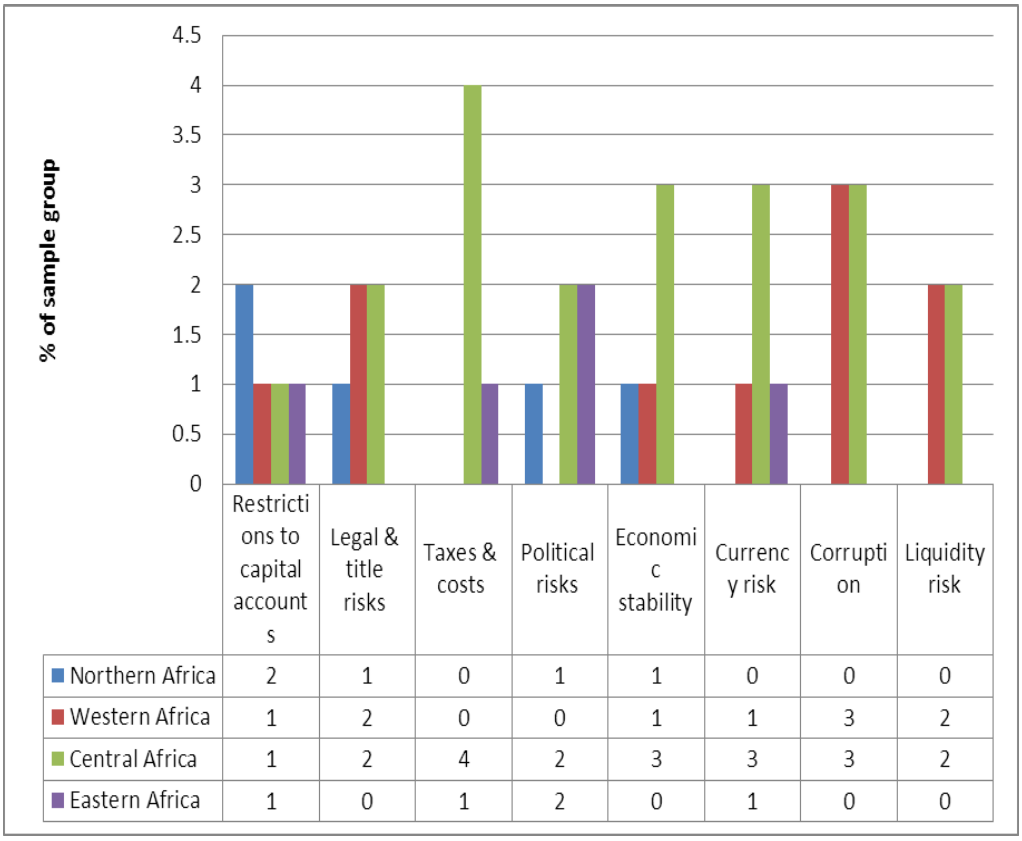
- Political uncertainty driven by market perception
- Distrust – Disclosure and governance is doubtful
- Lack of information - African markets and the listed and unlisted assets in these markets are often not well-researched. This is partly due to large institutions not putting resources on areas not on their clients' radars. Lack of information technology, less stringent reporting requirements and poor physical infrastructure can also make it harder to access data.

The various types of factors that serve as barriers to entry in real estate investment that were rated in order of importance in *Figure 2* above were then rated by the respondents in terms of which region(s) in Africa were mostly affected by each barrier, as shown in *Figure 3* below. The first barrier being restrictions to capital accounts was rated by the highest percentage of respondents (17%) as being most vulnerable in Northern Africa. Legal and title risks resulted in an equal distribution of the highest percentage of respondents, here 17% felt that Western Africa was mostly affected by this factor while another 17% felt that it was Central Africa that was mostly affected.

A confident 33% of respondents felt that Central Africa ranked the highest for being most affected by taxes and costs. Another tie resulted in the ranking of political risk where 17% of the respondents selected Central Africa, while another 17% selected Eastern Africa. A majority of 25% of the respondents stated that Central Africa was mostly affected by economic stability. Central Africa was once again nominated by a majority of the respondents (25%) as being mostly affected by currency risk. An equal majority of 25% of respondents were of the view that corruption played the most part in Western and Central Africa. The last barrier liquidity risk also resulted in an equal majority of 17% of the study group rating Central and Western Africa as the most affected regions.

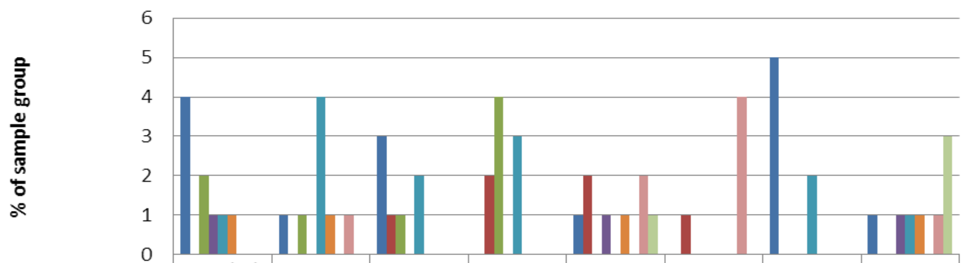
Overall, it is quite clear through looking at the graphs in *Figure 2* below and by computation of the values of each region that the region of Africa that was rated as most affected throughout the barriers to entry list is Central Africa. Therefore, the respondents feel that Central Africa is the region that withholds the most investment arising from the factors mentioned. The next region that was rated the most in terms of the criteria listed above after Central Africa is Western Africa. The list of regions in Africa according to the total rating can be listed as follows (ranging from most affected to least affected):

1. Central Africa
2. Western Africa
3. Northern Africa
4. Eastern Africa



	Restrictions to capital accounts	Legal & title risks	Taxes & costs	Political risks	Economic stability	Currency risk	Corruption	Liquidity risk
Northern Africa	2	1	0	1	1	0	0	0
Western Africa	1	2	0	0	1	1	3	2
Central Africa	1	2	4	2	3	3	3	2
Eastern Africa	1	0	1	2	0	1	0	0

Figure 3: Regions in Africa rated according to the 5-point scale in terms of which are most affected by the barriers to entry.



	Restrictions to capital accounts	Legal & title risks	Taxes & costs	Political risks	Economic stability	Currency risk	Corruption	Liquidity risk
Nigeria	4	1	3	0	1	0	5	1
Ghana	0	0	1	2	2	1	0	0
Mozambique	2	1	1	4	0	0	0	0
Kenya	1	0	0	0	1	0	0	1
Angola	1	4	2	3	0	0	2	1
Tanzania	1	1	0	0	1	0	0	1
Namibia	0	0	0	0	0	0	0	0
Zambia	0	1	0	0	2	4	0	1
Swaziland	0	0	0	0	1	0	0	3

Figure 4: Countries in the African continent rated according to the 5-point scale in terms of which are the most affected by the barriers to entry

With respect to rating the barriers to entry in the given criteria in *Figure 4* below, the companies now had to use the African countries provided by the researchers to distribute in the table in terms of which were the most affected by the barriers.

Restrictions to capital accounts resulted in the majority of the respondents (33%) selecting Nigeria to be the most affected country. In the second row, Angola held the highest percentage of respondents' rating (33%) on countries most affected by legal and title risks. With taxes and costs Nigeria was the most selected with 25% of respondents nominating it. Political risks yielded 33% of respondents' view that Mozambique is the most affected by it. With economic stability, 17% stated that Zambia is the most affected, while another 17% stated that Ghana is the most affected. Zambia is viewed by the majority of respondents (33%) as most affected by currency risk. 42% of respondents feel that Nigeria is most affected by corruption. 25% feel that liquidity risk is experienced most in Swaziland.

Out of the different countries listed in the figure below, it can be stated through analysing the graphs and through calculating the total percentages of each country, that the country rated as most affected by the criteria on average is Nigeria. The second country most affected would be Angola. While, the country that is the least affected by the criteria as it is the only country that received 0% total votes with respect to the criteria listed above is Namibia.

The list of countries according to the total rating is as follows (ranging from most affected to least affected):

1. Nigeria
2. Angola
3. Zambia
4. Mozambique
5. Ghana

6. Tanzania
7. Swaziland
8. Kenya
9. Namibia

DISCUSSION

The benefits of international diversification of real estate into other markets have been highlighted by many authors. It is of great interest to know as to why this approach is hardly practiced by the listed South African property companies and especially within the African continent. The African business environment itself has experienced positive changes in the recent past even though there are still some concerns, and provides untapped potential that South African listed companies could take advantage of. Diversification into other African countries has yielded great returns in the financial services sector due to the improved investment environment in most of these countries as they try to attract more foreign direct investment, (Luiz and Charalambous, 2009). The risk profile of the continent has improved over the few decades and this has been recognised by companies as they see the untapped potential of the markets in these countries.

The lack of investment into Africa by Listed South African property companies has again been highlighted through our research. The main market selection criteria that these companies are concerned about when making decisions to invest into Africa are property rights and the major barrier to entry into these African markets are legal and title risks. It is thus evident that legal factors are the main setback holding South African Listed Property Companies from investing into other parts of Africa. Luiz, et al. wrote that ‘Social, economic, legal and political institutional factors’ are still of concern given to the countries complicated past. However, the overall prospects of investing into Africa are positive and investors are likely to attain great results (Luiz, et al, 2009). Therefore, South African Listed property companies are potentially missing out on returns that can be achieved through this investment, as it is famously stated that with high risks comes high returns. As the political environment of Africa is of a very liquid nature it will be better for international investors to develop strategies that are flexible and to maintain good relations in order to adapt to the dynamic environment. The major problem lies with African countries, however, that are missing out on investments on a global scale due to their countries poor structure and the perceived risks involved in investing in the continent.

CONCLUSION AND RECOMMENDATIONS

The first recommendation suggested to corresponding researchers’ would be to explore the wealth, in monetary terms, that is being ignored by South African Listed Property Companies by not investing in the African continent. This can be achieved by exploring the returns of local property companies in a particular African country. Property type diversification can be investigated in order to determine which property type is most viable for international investment. This research could quantify the possible returns South African Listed Property Companies are missing out on, and potentially give incentive to these companies to invest in certain countries within the continent.

Another recommendation for further research is to investigate any other real estate investments from other continents into the African continent. Using the outcome of our research, further research could determine whether the lack of interest from South Africa itself has acted as a deterrent for other continents when making an investment decision to go into Africa. This could be an interesting exploration into the effect of a country not investing into its own continent, and in turn the global effect this has on investing in that continent.

This research has implications on governments of the African countries which have not been receiving real estate investment from Listed South African Property Companies. The research has highlighted specific countries which are difficult to invest in due to the various barriers to entry that exist in these countries. Governments in these countries could use our study as an aid to improve on these restraints. Another implication of our research would be towards the listed companies themselves as well as the investors in these listed companies. This study could also be helpful to international investors by highlighting the upcoming and attractive investment countries such as Ghana for future investment into Africa. Due to the limitation in terms of our sample size, this research study should be accepted as a generalisation when considering South African Listed property companies investment into Africa and further research on the matter will be required to present an exact reflection of the situation.

REFERENCES

Asiedu, E., 2006. Foreign Direct Investment in Africa: The Role of Natural Resources, Market Size, Government Policy, Institutions and Political Instability. *Foreign Direct Investment In Africa*, pp. 63-77.

Barry, C. B. and Rodriguez, M., 2004. Risk and Return Characteristics of Property Indices in Emerging Markets. *Emerging Markets Review,* Volume 5, pp. 131-159.

Baum, A. and Murray, C., 2011. Understanding the Barriers to Real Estate Investment in Developing Economies, Reading: Working Paper.

Buchner, G., 2008. Methodologies used by Property Fund Managers to make Investment Decisions, Working Paper: s.n.

Cheng, P. and Roulac, S. E., 2007. Measuring the Effectiveness of Geographic Diversification. *Journal of Real Estate Portfolio Management,* 13(1), pp. 29-44.

Chin, W., Dent, P. and Roberts, C., 2006. An Exploratory Analysis of Barriers to Investment and Market Maturity in Southeast Asian Cities. *Journal of Real Estate Portfolio Management,* Volume 12(1), pp. 49-58.

De Wit, I., 2010. International Diversification Strategies for Direct Real Estate. *Journal of Real Estate Finance and Economics,* Volume 41, pp. 433-457.

Denscombe, M., 2007. The Good Research Guide for Small-Scale Social Research Projects. *Open UP Study Skills,* Volume 3 McGraw-Hill.

Dupasquier, C. and Osakwe, P. N., 2005. Foreign Direct Investment in Africa: Performance, Challenges and Responsibilities. *African Trade Policy Centre*, Volume 21.

Eichholtz, P., Koedijk, K., and Schweitzer, M.,2001. Global Property Investments and the Costs of International Diversification. *Journal of International Money and Finance,* Volume 20, pp. 349-366

Falkenbach, H., 2009. Market Selection for Real Estate Investment. *International Journal of Strategic Property Management,* Volume 13, pp. 299-308.

Fellows, R. and Lui, A., 2008. *Research Methods for Construction,* Third edition. West Sussex: Blackwell Publishing.

Han, J., 1996. Targeting Markets Is Popular: A Survey Of Pension Real Estate Investment Advisors. *Real Estate Finance,* Volume 13(1), pp. 66-75.

Heydenreich, F., 2010. Economic Diversification: Evidence for the United Kingdom. *Journal of Real Esate Portfolio Management,* Volume 16(1), pp. 71-85.

Ho, K. H., Ong, S. E. and Sing, T. F., 2006. Asset Allocation: International Real Estate Investment Strategy under a Workable Analytic Hierarchy Process (AHP). *Journal of Property Investment and Finance,* Volume 24(4), pp. 324-342.

Lee, S. and Stevenson, S., 2005. Real Estate Portfolio Construction and Estimation Risk. *Journal of Property Investment and Finance,* Volume 23(3), pp. 234-253.

Leedy, P. D. and Ormrod, J. E., 2010. *Practical Research: Planning and Design.* Nineth edition. Greeley: Pearson Education.

Liang, Y. and McIntosh, W., 2000. Country Risk Premiums for International Investing. *Prudential Securities.*

Lim, C. L., McGreal, S. and Webb, J., n.d. Perception of Real Estate Opportunities in Central/South America and Africa. *Journal of Real Estate Portfolio Management,* Volume 12(3).

Loo, D., 2009. Global Investing: Africa's Property Laws (or lack of). [Online] Available at: http://blogs.reuters.com/globalinvesting/2009/10/14/africas-property-laws-or lack-of/

Luiz, J., 2010. Infrastructure Investment and its Performance in Africa Over the Course of the Twentieth Century. *International Journal of Social Economics,* Volume 37(7), pp. 512-539.

Luiz, J. M. and Charalambous, H.,2009. Factors Influencing Foreign Direct Investment of South African Financial Services Firms in Sub-Saharan Africa. *International Business Review,* Volume 18, pp. 305-317

Markowitz, H., 1952. Portfolio Selection. *Journal of Finance,* Volume 7, pp. 77-91.

Muller, J., 2013. Financial Mail – Tamer Growth for Listed Property Small Pockets of Value. [Online] Available at: http://www.propertyloanstock.co.za/financial-mail-tamer-growth-for-listed-property-small-pockets-of-value/

Nnadozie, E., Katjomuise, K. and Krüger, R., 2008. *NEPAD's APRM and the Investment Climate in Africa,* pp.1-23

Olaleye, A., 2008. Property Market Nature and the Choice of Property Portfolio Diversification Strategies: The Nigeria Experience. *International Journal of Strategic Property Management,* Volume 12, pp. 35-51.

Olaleye, A., 2011. The Effects of Adding Real Estate into Mixed-Asset Portfolios in South Africa. *Journal of Financial Management of Property and Construction,* Volume 16(3), pp. 272-282.

Olaleye, A. and Aluko, B. T., 2007. Evaluating Managers Diversification of Real Estate Portfolios: Evidence from Nigeria. *International Journal of Strategic Property Management,* Volume 11, pp. 179-189.

Olaleye, A., Aluko, B. T. and Ajayi, C. A., 2007. Factors Influencing the Choice of Property Portfolio Diversification Evaluation Techniques in Nigeria. *Journal of Property Investment and Finance,* Volume 25(1), pp. 23-42.

Property Loan Stock Association, 2011. What is a property loan stock?. [Online] Available at: http://www.propertyloanstock.co.za/about-us/what-is-a-property-loan-stock/

Rushin, L. T., 2006. The Impact of Diversification on the Financial Performance of Organisations Listed on the Industial Sector of the JSE. Pretoria: University of Pretoria.

Swart, A. and Kettles, G., 2013. *Absa Asset Management Investment Report - 1st Quarter 2013.* Johannesburg : ABSA Investments.

Valley Vista Enterprises, LLC, 2007. Portfolio Diversification. [Online] Available at: http://www.investing-in-mutual-funds.com/portfolio-diversification.html

Webb, B. and O'Keefe, J., 2002. *The case for Global Real Estate,* Working Paper: UBS Global Asset Management.

HEALING GARDENS FOR THE CONSTRUCTION SITE: AN INNOVATIVE ORGANISATIONAL MANAGEMENT STRATEGY

Rita Obiozo[1] and John Smallwood Error! Bookmark not defined.**2**

Department of Construction Management, Nelson Mandela Metropolitan University, Port Elizabeth, South Africa

The untold hardship experienced by employees in construction, particularly construction workers, calls for a new way of ordering the business of construction. Construction workers are subjected to a stressful form of daily communal living on construction sites that usually results in the average construction worker being worn out and defeated by life and its purpose. The aim of the study therefore, was to investigate the reordering and the creation of communal settings that recreate and introduce the reconstruction of motivational factors in construction. The methodology involved a case study of existing construction sites relative to the perception of healing gardens and the greening of construction sites. Research findings indicate that the broad conception of healing gardens echo those already manifest in health-care facilities where such gardens have been successful as a psychotherapeutic and healing endeavour. This is achieved through a conscious and deliberate ordering of facilities giving due consideration to the aesthetics and humaneness of the construction workplace environment relative to its human occupants. The key implication of the findings established the fact that that there is an intrinsic co-relationship between the lack of contact with nature on the construction sites the negative impact on worker health and performance.

Keywords: biophilia, healing garden, health and safety, performance.

INTRODUCTION

Cognitive psychologists argue that workers cannot be easily motivated when strong demotivators exist (Meung *et al.*, 2007). Ng *et al.* (2004) proffers the solution that the removal of certain demotivators from the worksite necessitates the increase of motivational aspects, and also enhances the need for the addition of certain motivators such as the application of the biophilic construction site model (BCSM). Relevant studies have found that an unsatisfactory work environment can generate negative pressures on workers resulting from the presence of negative energies (Gerstung and Mehlase, 2000; Smallwood; 2003; 2006). These negative energies according to the feng shui principles of the BCSM can emanate from the construction workplace due to the hazards of construction work processes (Smallwood, 2003; 2006; Diamond, 2004; Heerwagen, 2006). The European Agency for Safety and Health (EU-OSHA) (2012) reports on an investigation carried out by the European Survey of Enterprises on New

[1] Ritax2k@gmail.com
[2] John.smallwood@nmmu.ac.za

Obiozo, R. and Smallwood, J. (2014) Healing gardens for the construction site: an innovative organisational management strategy *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 325-338.

and Emerging Risk (ESENER), which findings established the need for continuous support and further knowledge regarding how to establish beneficial psychosocial risk management procedures that include wellness interventions, in-order to relieve such factors as work related stress, which until now have been neglected in construction management. The BCSM is derived from the application of the biophilic design concept, which also includes the incorporation of the feng shui principles of wellness interventions on construction sites (Obiozo and Smallwood, 2012, 2013a, b&c; Smallwood and Obiozo, 2013).

The objective of the study is to investigate the impact of the incorporation of healing gardens on construction sites according to the recommendations of various researchers (Heerwagen, 2006; Kellert *et.al.* 2008) that is aimed at achieving sustainable transformational change in construction. Research findings from Obiozo and Smallwood (2012; 2013a, b&c) and Smallwood and Obiozo (2013) have indicated that the greening of construction sites, which incorporates the BCSM has psychotherapeutic values on construction workers in Western Nigeria located in West Africa, and the Northern Cape Region of South Africa. The findings are further validated by the cross sectional survey as reported in this study on the beneficial impact of the BCSM on workers' well-being, health and safety (H&S), and performance in the Niger delta region of South Eastern Nigeria.

The exploratory research survey carried out as a form of contribution to this agenda investigated the successful contribution of the impact of healing gardens with the biophilic design concept and orientation as experienced in health facilities. The idea is to find a solution to motivational incentives and poor worker performance in construction. According to van den Berg *et al.* (2007) the success of the incorporation of such 'healing gardens' in health facilities recommends it to all workplaces where there is a need for psychotherapeutic healing of psychosocial risk factors such as exists on the construction site. The technique applied towards the investigation involves the longitudinal case study of a particular construction site in the form of the Tinapa Business Resort, Tinapa, Cross River State, Nigeria.

This particular case study was selected for the study because of the impact of the pro-nature approach undertaken during the design processes. It presents the value of the greening of the construction site at the onset of construction and alongside the construction of the other facilities. It was particularly significant as an expression of the impact of the BCSM towards the well-being, H&S of not just the workers, but visitors alike. This was particularly visible in the reaction of the visiting members of the Female Architects of Nigeria (FAN) a subsidiary of the Nigerian Institute of Architects (NIA), who for the first time had such an encounter of the greening or landscaping of the construction site commencing alongside the rest of the project.

Finally, conclusions were drawn and recommendations extracted for the application of the holistic approach to the BCSM, as a relevant aspect of the sustainable sites initiative with a significant impact on H&S and wellbeing of construction workers. The factors will also serve as a motivational incentive for enhanced performance of the workforce in construction.

WORK RELATED STRESS, MOTIVATION AND THE BCSM

The Health and Safety Executive (HSE) defines stress as "an adverse reaction to excessive pressure." (HSE, 2008) Pressure is often an intrinsic part of the work process, which is necessary in-order to keep workers motivated. Excessive and badly managed exposure to pressure could lead to stress. Research findings have established that workers who experience stress, anxiety or depression, are certain to perform ineffectively. Such a negative development can be extremely costly to employers in H&S critical industries such as construction with dire consequences (Meung *et al.*, 2007; HSE, 2008).

The psychotraumatic stress factor and the lack of contact with nature on construction sites constitute a constant threat of fatalities and injuries on workers which compromises the H&S, wellbeing, and performance of workers (The US General Service Association [GSA], 2003; Dhar, 2011; EU-OSHA, 2012). The ever present occupational stress resulting from the reality of the fatal consequences of construction processes could be likened to a similar situation that occurs in health facilities (van den Berg *et al.*, 2013).

The impact of these factors to human occupation on the construction site, and the ecosystem, and the consequent poor performance of workers, according to research findings could lead to an impingement on socio-economic factors in construction (NIA, 2006; cidb, 2011). The United Nations Environment and Protection (UNEP, 2010) presents the socio-economic factors involved as: environmental protection; public safety regulation, and economic instability. The motivational incentive package presented to workers could influence the fundamental coping mechanism of construction workers and the cognitive ability to handle psychosocial risk factors encountered daily in routine construction work (EU-OSHA, 2012, Kazaz *et al.*, 2008).

The biophilic design concept

The BCSM is derived from the application of the biophilic design concept which also includes the incorporation of the feng shui principles of wellness interventions on the construction site (Obiozo and Smallwood, 2012, 2013a, b&c; Smallwood and Obiozo, 2013). The biophilic design concept is derived from the theory of biophilia, and Wilson (1984; 2001) defines biophilia as the innate emotional affiliation of all human kind to all organisms in nature. Kellert and Wilson (1993), in the biophilia hypothesis shared contributions with a great number of researchers cutting across the built environment profession, and the scientific fields; anthropologist psychological and sociologists; substantiating this fact with salient findings. In furtherance of the research findings, Kellert *et al.* (2008) developed the biophilic design concept which integrates the healing of nature as an integral of all human environments in both design and construction.

The aim is to address the adverse effect of technophilia and biophobic substances in nature-devoid environments such as the construction site. Heerwagen (2006) enhances the reality of this fact as a missing link in sustainable design concept by relating the psychological trauma found in confined animals with a comparative analysis that indicates that the animals are more productive moving and living freely in nature. Research findings derived from psychoevolutionary trend in thinking, ecopsychology and nature-psychophysiology has indicated that the natural setting of the savannah type of vegetation is preferred. The reason is due to the fact that it creates the positive wellbeing value of prospect and refuge; where the expanse of grassland viewed from the protective shade of trees or a cluster of bushes generates wellbeing, H&S, comfort, and security in its occupants (Miyake, 2003; David, 2009).

The evidence derived from health facilities leads to the question of a suitable construction site generalisation method that incorporates the BCSM in organisational and construction management structure, in a comprehensible and easy to control manner (Hedge, 2011; Haimes, 2013; Finerran and Gibb, 2013). The essential benefit relative to healing gardens and the greening of the construction site is the reality that as in health facilities the BCSM could provide H&S, and sustainable ergonomic aspects that motivate workforce creativity and productive feedback throughout the life cycle of the project (McCallum, 2005; Erler, 2005; Thiede, 2000; Oldfield, 2007; Hamilton *et al.,* 2008; Obiozo, 2011; 2012; Obiozo *et al.*, 2011; Hedge, 2011; Obiozo and Smallwood, 2013a, b&c; Smallwood and Obiozo, 2013).

RESEARCH METHODOLOGY

The research design was case study involving the Tinapa Business Resort, Tinapa, Cross River State, Nigeria. This is a construction project remarkably associated with the greening of the construction site or the BCSM as an innovative organisational construction management strategy.

The research methodology includes a field survey; with a focus group study of the employees and general workers of the contracting firm. The applied techniques used in data collection included: photo elicitation; mass observation; group and personal interviews with the management and general workers; among whom were representatives of the different trades in construction, and also the visiting team of the FAN a subsidiary of the NIA during the Biennial General Meeting (BGM) held in Uyo, Akwa Ibom State in November 2006, and hosted by the State Governor Obong Attah, who is also an Architect and a Fellow of the NIA (FNIA).

The field survey was carried out during the H&S, Wellbeing and Investment Conference and Workshop of the FAN, among who were experienced Architects involved in Project and Construction Management consulting and practices, in which group the principal co-author participated as the Public Relations Officer (PRO) for FAN (Obiozo, 2006; 2010). The visit was a resource package of the local organising committee of the FAN.

Intrinsic to the conceptualisation of the research study, is that the FAN visit undertaken by the principal co-author occurred during the dry season.

The Tinapa Business and Leisure Resort Construction site is located in the Sub-Saharan climatic zone and vegetation belt of the Niger Delta region of Nigeria in West Africa, as shown in Figure 1 and 2. The climate is characterised by the rainy season between the months of April and October; and the arid, dusty, dry season from November to March (Okpara *et al.,* 2014).

Tinapa is located within the dense rain forest belt of the Niger Delta as shown in Figure 1 and 2, which according to research findings and the report published by the Cross Rivers State Government of Nigeria (CRSG, 2014) is characterised by one million hectares of forest, deep forest sink, forest concessions, and a carbon foot print off-set.

Description of the Project

The project is originally established by the Cross River State Government of Nigeria, as a Private Public Partnership (PPP). The conceptual design of Tinapa according to research findings indicate that it has a novel aesthetic transformational value as a pro nature dream fulfilling fantasy resort that combines business with pleasure, which had a profound impact on the Construction Management’s greening of the construction site initiative. The successful establishment and interweaving of the three main zones comprising trade, leisure and entertainment, has recommended it for consideration as the 'hub of Africa' according to literature sources shown in Photo 1 and 2 (CRSG, 2014).

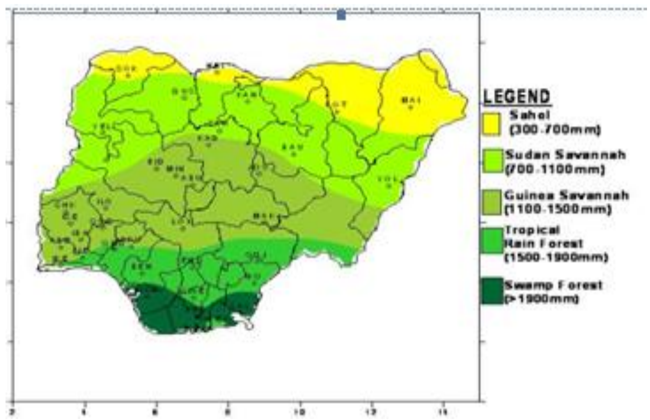


Figure 1: ***Map of Nigeria showing the vegetation belt (Source: Engineering Economic Analysis, 2010; Okpara et al., 2014)***.

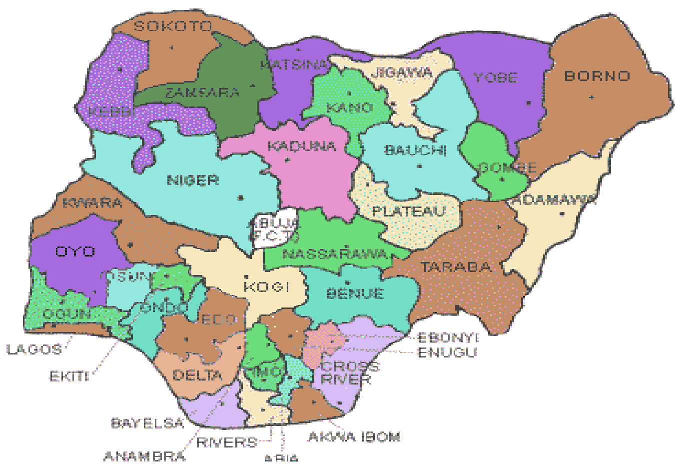


Figure 2: ***Map of Nigeria showing the the location of Cross River State alongside the 36 States in Nigeria (Source: Engineering Economic Analysis, 2010; Okpara et al., 2014).***

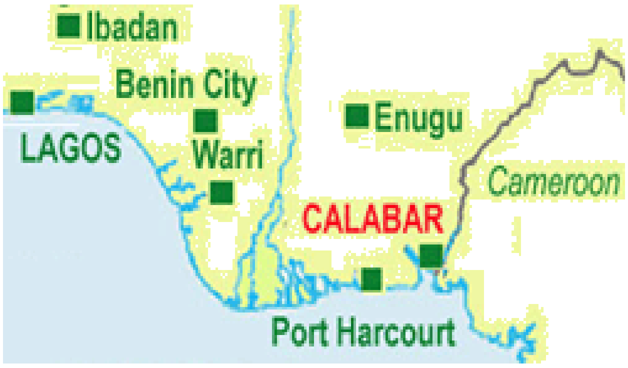


Figure 3: The Niger delta region of Nigeria showing the location of the capital of Cross River State, Calabar the nearest city to Tinapa; (Source: Adisa, 2011).

Tinapa is a world class business and leisure resort located in Calabar, South Eastern Nigeria. Calabar is also the capital of Cross River State, Nigeria, as shown in Figure 3 and 4. The location of Tinapa is contiguous with the Calabar River. Main stream literature findings indicate that Tinapa is Nigeria's first free trade zone (CRSG, 2014).

Photo 1: View of the emporium, whole sale and retail market zones; (Source: Adisa, 2011).

The master plan of Tinapa

In the master plan of the Tinapa business resort there is also an open exhibition area; allocated for trade exhibitions and other events; a movie production studio, which is commonly referred to as 'Studio Tinapa' or 'Nollywood'. This studio is an entertainment strip that comprises a casino, and eight-screen cinema, a children's arcade, mini amphitheatre, restaurant, a night club and pubs (Adisa, 2011). The master / layout plan of Tinapa Business and Leisure Resort is shown in Figure 5. There are also lettable spaces allocated for retail and wholesale activities and trading with several line shops, and warehouses, inter alia, as shown in Figure 5; made available for the acquisition of the general public at a rate fixed by the Government of Cross River State who is the direct Client (CRSG, 2014).

Photo 2: **The entrance to the cultural centre in Tinapa resort showing the local plants and vegetation used in the greening of the construction site (Source: Adisa, 2011).**

Figure 4: Layout Map of Tinapa Buisiness Resort, Tinapa, near Calabar, Cross River State, Nigeria (adapted from Adisa, 2011).

Description of Respondents

The mass observation included the various contractors on the site, among whom were, the road construction team, Julius Berger Nigeria (JBN), who had the islands already landscaped with site nurseries for culturing and development of local species of plants and vegetation existing naturally on the site. They were subsequently replanted in their various locations in the master plan / construction site layout.
The focus group study included the construction management team; up to 10 in number, among whom were the South African Construction Management team, with a mix of Nigerians, including a Nigerian Architect; the general workers of diverse skills and trades in construction, who were recruited from the nearest city, Calabar, were up to a 100 in number. The personal interview involved the construction management team and about 10 of the construction workers and employees who also resided on the construction site.

Recording and analysis of the data

1. The observation included photographs, video recording, note taking, and personal experience and encounters with the construction site and workforce, and

2. No structured questionnaire was used for the interviews as they entailed direct personal interaction with the respondents, which was informal, spontaneous and reactional to the 'impact of the greening initiative' encountered on the construction site. It also included an inspection of the architectural / construction layout plans, details, work sheets, and historical documents of the project, including the site offices and welfare facilities.

Focus Group Study

Observations and Interviews with the management and general workers

The master plan having begun with the road network and landscaping and infrastructure / services was sustainable, and ensured that the construction site did not look and feel like a desert. The drains and greenery having been established relieved the impact of dust and air pollution (Obiozo, 2012). The reasoning behind this corroborates with research findings, which inform that trees and greenery absorb CO2 and purify the air (CRSG, 2014; Okpara et al., 2013). The workers were observed to be relaxed and not tense, and indicated to FAN during the interviews that they actually felt relaxed by the green presence.
In Nigeria, and at the time of the survey, exotic and imported plants were mostly used in landscaping, because they had a general appeal to the Nigerian clientele and people (David, 2009). Tinapa was the first location where the FAN members; most of whom were involved in construction management practices of a diverse scale; first encountered the aesthetic use and natural appeal of local horticulture.

Interview with the Construction Manager (CM)

The CM was asked why plants were incorporated early in the project. According to him, the aim was to evoke the eco-friendly tourism initiative and prevalent sustainability strategy in construction, even though he had no knowledge of biophilia. He felt that the presence of the greenery had a relaxing feel, and was therapeutic, and also gave an aesthetic value to the site. The idea was also geared towards encouraging visitors to the construction site to appreciate the natural feel and concept. According to the CM, this would instil an anticipation of the great tourism initiative of the client which is holistically nature-oriented (CRSG, 2014).

In response to the question regarding the use of local plants, not the usual exotic species, the CM replied that the sourcing of existing plants onsite was because of the need to appreciate the indigenous variety and expose them to public appeal by culturing and maintaining them. In addition to this factor, it was also a cost effective strategy.

Observations and interview with FAN members visiting the construction site

1. The Tinapa project is particularly significant to the 'researcher' because it was an inspiration that triggered the origin of the PhD research study relative to the application of the biophilic design concept to construction, in fulfilment of the sustainable construction site initiative of the Brundtland Commission of 1997 (Finneran and Gibb, 2013);
2. There was a unanimous agreement among FAN members on the visit that the green approach was endearing and builds on fraternal communion, given the fact that not having met the construction management team on arrival to the premises, they were already collectively endeared towards them, and
3. Of particularly note to the FAN members is the fact that unlike the usual practice in Nigeria at the time, it was the first time that pride of place was given to the local horticulture or indigenous plants. Greening was also usually left to the end of the project as external works targeted towards the end users.

Photo Elicitations

The following photos illustrate the research findings relative to the greening of the Tinapa Business and Leisure Resort Construction site, as a case study for the Greening of the construction site survey or the BCSM. It highlights the factors already described in the survey report.



Photos 3, 4, 5, 6, 7, and 8: Different views of the green construction site showing (Reading longitudinally across the page): Photo 3: the undulating land mass; Photo 4: the leisure park; Photo 5: the beach side; Photo 6: the Emporium, wholesale and retail facilities; Photo 7: the park, and, Photo 8: leisure facilities: with the local vegetation already grown to adult size by the time the project was commissioned by the Government, because it was planted at the onset of construction, unlike the current practice in construction (Source: Adisa, 2011; Tinapa, 2014).

ANALYSIS AND DISCUSSION OF FINDINGS

The main relevance of the case study to the particular greening of construction site survey report that makes it significantly different from the other case studies included in the expanded PhD (Construction Management) study is the presence of plants within the site offices and facilities, not just externally. The construction site was not detached and alienated from nature as most construction sites often were in corroboration with research findings (GSA, 2003; Smallwood, 2003; 2006; van den Berg et al., 2007; Smallwood and Obiozo, 2013; Obiozo and Smallwood, 2012; 2013a,b&c). The impact of the landscape inspired construction site as a motivational factor for employees and workers in construction including visitors to the construction site was significant and corroborates with research findings (GSA, 2003; Meung *et al.*, 2007; EU-OSHA, 2012; Smallwood and Obiozo, 2013; Obiozo and Smallwood, 2012; 2013a,b&c). The findings from the study indicate that the provision of healing gardens is an innovative and sustainable organisational management strategy in construction based on salient findings derived from related studies, which include the following:

- The construction industry’s current perspective of sustainability is primarily centred on resource efficiency and the health and productivity of the building occupants or end users of the project;
- Sustainability should be considered across the entire life cycle including the construction phase;
- Green design and construction practices should also consider the H&S of the construction worker, and
- The construction industry’s sustainability philosophy and principles should advance beyond lagging indicators, and incorporate construction worker well-being, H&S for enhanced performance and productivity (Smallwood, 2003; 2006; Hedge, 2011; Dhar, 2011; Sass, 2012; EU-OSHA, 2012; Smallwood and Obiozo, 2013; Obiozo and Smallwood, 2012; 2013a,b&c).

CONCLUSIONS AND RECOMMENDATIONS

The following recommendations are drawn from the case study for sustainable construction site initiatives towards worker well-being, H&S and motivation, for enhanced performance on the project, and improvement of the interface of construction:

- Development of a biophilic design concept strategy, the BCSM;
- Budgeting for the implementation of the biphilic design concept at tender stage;
- Contractor assessment of the impact of the biophilic design concept interventions, and
- Actual interventions such as: pot plants in site offices; landscaping; plant-scaping and interior-scaping within and adjacent to change rooms, canteens, and welfare facilities.

REFERENCES

Adisa, A. (2011) "Tinapa business and leisure Resort". Come to Nigeria. Retrieved October 2012. http\\www.cometonigeria.com.

Bartlett, D. (ed) (2011) Going Green: The psychology of sustainability in the workplace. Liecester, UK, British Psychology Society.

Berigan, H. & Pielage, N. (2013) "A Good Study Break: Effects of Nature versus TV onAttention". Journal of Undergraduate Research, 2013, XVI.

Cross River State Government (CRGS), (2014) "Cross River Africa's warmest welcome".Maryland presentation by his excellency the governor, Cross River State Government Publication, Calabar, Nigeria.

David, N.M. (2009) Landscape design. Enugu, Archimedia Publishing.

Dhar, R.L. (2011) "Leisure as a way of coping with stress: an ethnographic study of the low income construction workers". Leisure / Loisir, 35:3, 339-360.

Diamond, K. (2004) Feng shui for sceptics: real solutions without superstition. Culver City, California, Four Pillars Publishing, 100-110.

Engineering Economic Analysis, (2010) Privacy policy. August 2010 http://engineeringeconomicanalysis.blogspot.com/2010_08_01_archive.html

Thatcher, A (2012) Green Ergonomics: Definition and Scope. "Ergonomics", Taylor andFrancis, UK, 1-10.

Erler, C.T. (2005) New complete home landscape. New Jersey, Creative Home Owner.

European Agency for Safety and Health EU-OSHA. (2012). An analysis of the findings Of the European Survey of Enterprises on New and Emerging Risks (ESENER) – European Risk Observatory Report. Luxembourg, Belgium: EU-OSHA.

Finneran, A. and Gibb, A., (eds) (2013). CIB W099: safety and health in constructionresearch roadmap: report for consultation. In: Proceeding of Safety and Health in Construction. International Council for Research and Innovation in Building Construction CIB W099, 5-9 May, Brisbane, Australia.

Haimes, D. (2013) "Putting university research into practice – challenges and opportunities". Keynote Address: CIOB / ARCOM Joint Workshop; Connecting Academia and Industry in Innovation and Research; 29th ARCOM Conference, 4 September 2013, Reading, UK, Association of Researchers in Construction Management.

Hamilton, D.K, Orr, R.D. and Roboin, W.E. (2008) "Organisational transformation: a

model for joint optimisation of culture change and evidence-based design". *Health Environment Research and Design Journal*, 1:3, 40–60.

Hedge, A. (2011) "Green Ergonomics: The future of green buildings and ecodesign".

Report presented at Schiavello, 23 March, Melbourne Australia.

Heerwagen, J.H. (2006) "Investing in people: The social benefits of sustainable design" Presentation at Rethinking Sustainable Construction'06; September 28–30, 2006, Sarasota, FL.

Health and Safety Executive (HSE) (2008) "Risk assessment tool and guidance (including guidance on application)". Suffolk, HSE Books.

Kazaz, A. Manisali, E. and Ulubeyli, S. (2008) "Effect of basic motivational factors on construction workorce productivity in Turkey". *Journal of Civil Engineering andManagemen*t, 14:2, 95-106.

Kellert, S.R. and Wilson, E.O. (eds) (1993) The biophilia hypothesis. Washington, DC,Shearwater Books/Island Press, 31–41.

Kellert, S. R., Heerwagen, J. H. and Mador, M., (2008), Biophilic design: theory, science, and practice. New York, Wiley.

McCallum, I. (2005) Ecological Intelligence: Rediscovering ourselves in Nature. Cape

Town, South Africa: Africa Geographic.

Meung, M., Skitmore, M. and Chan, Y.S. (2007) Subjective and objective stress in

construction cost estimation, *"Construction Management and Economics*", 25:10,1063-1075.

Miyake, S. (2003) "Nature psychophysiology – its concept and future prospects". In

Proceedings: XVth Triennial Congress of the International Ergonomics

Association (IEA 2003), Seoul, Korea, 3-5 August 2003, 24-29.

Ng, S.T., Skitmore, R.M., Lam, K.C. and Poon, A.W.C. (2004) "Demotivating factors

influencing the productivity of civil engineering projects". *International Journal of Project Management*, 22:2,139-146.

Nigerian Institute of Architects (NIA) (2006) The National Building Code of the Federal Republic of Nigeria 2006 / 2009. Revised edition 2006, Abuja, NIA.

Obiozo, R.N. (2006) "Sustainable healthy investment interventions in the built

environment". In: Edozie-Ighophose, O.J. (ed). Keynote Paper: Female Architects of Nigeria (FAN) BGM and Conference, held at Uyo, Akwa-Ibom State, Nigeria,1-10.

Obiozo, R.N. (2010) "Architectural perspective in sustainable, healthy environmental

development". *Journal of Applied Sciences*, 13:2, 9111-9128.

Obiozo, R.N. (2011) “Green architecture: regeneration of biophilic architectural concepts in building designs in the built environment”. In: Edozie-Ighofose, O. (eds). Keynote paper; Proceedings of the Female Architects of Nigeria (FAN) Biennial General Meeting (BGM) and Conference, 24-25 July 2010, Ikoyi: FAN, 1-3.

Obiozo, R.N. (2012) “Biophilic design: a sustainable response to climate change – the economical ecological solution of a modern day ecocity - the case study of Ecopark, Hanoi, Vietnam”. In: Laryea, S., Agyepong, S.A., Leiringer, R. and Hughes, W. (eds) 4th West Africa Built Environment Research (WABER) Conference, 24-26 July 2012, Abuja, Nigeria, 995-1010.

Obiozo, R.N and Smallwood, J.J. (2012) “Rethinking construction: the transformational change strategy of a biophilic construction site experience”. In: Emuze F, (ed) 2nd Construction Management Conference. Nelson Mandela Metropolitan University (NMMU), 26-29 November 2012, Port Elizabeth, South Africa. 121–130.

Obiozo, R.N. and Smallwood, J.J. (2013a) “Biophilic workplace design: improving construction ergonomics and worker’s performance through enhanced sustainable and psychosocial value of the worksite”. In: Yazdani, S. & Singh, A. New developments in Structural Engineering and Construction. Proceedings of ISEC – m 7 Honolulu, Hawai, July 2013. Singapore: Research Publishing Services, 2013; C– 68, 566-576.

Obiozo, R.N. and Smallwood, J.J. (2013b) “The role of ‘greening’ and an ecosystem approach to enhancing construction ergonomics”. In: Smith, S.D. & Ahiaga-Dagbui, D.D. (eds) Proceedings of the 29th Annual Association of Researchers in Construction Management (ARCOM) Conference, 2-4 September, 2013, Reading, UK, 959-969.

Obiozo, R.N. and Smallwood, J.J. (2013c) “Psychotherapeutic and team building initiative of greening construction sites – the case study of an ‘oasis in the desert’”. In: Emuze, F.A. (ed.) Creating a Resilient and Regenerative Built Environment, Proceedings of the Sustainable Building Conference SB13, Southern Africa, Cape Town, South Africa, 15-16 October, 128-137.

Obiozo, R.N., Uduma-Olugu, N. and Dimoriaku I. (2011). “Biophilic design of the workspace: how living buildings and landscapes enhance environmental health and productivity”. In: Uwakwe B.O. (ed) Innovation and sustainable construction in developing Countries. Proceedings of the International Council CIB W107, 1-3 November 2011. Hanoi, Vietnam: Construction Publishing House, 237–242.

Okpara, J.N., Aondover, A., Tarhule, A.A. and Perumal, M. (2014) “Study of climate change in Niger River Basin, West Africa: reality not a myth”. Bharat Raj Singh (ed), Earth and Planetary Sciences, Oceanography and Atmospheric Sciences, n "Climate Change - Realities, Impacts Over Ice Cap, Sea Level and Risks, INTECH: ISBN 978-953-51-0934-1, January 16, 2013 under CC BY 3.0 license.

Oldfield, S. (2007) Great Botanic Gardens of the World. London, UK, New Holland andn Publishers Ltd.

Sass, C. (2012) “Green Buildings and Worker Health”. Unpublished Bachelor of Science (B.Sc. Honours) Construction Management Thesis, Nelson Mandela, Metropolitan University.

Smallwood, J.J. (2003) “The role of feng shui principles in wellness and performance on construction sites”. Proceedings of the 15th Triennial Congress of the International Ergonomics Association, Seoul, Korea, 24–29 August 2003, CD-Rom \ 01151.pdf.

Smallwood, J.J. (2006) “Wellness and performance on construction sites: workers’ perceptions”. Proceedings of the 16th Triennial Congress of the International Ergonomics Association, Maastricht, The Netherlands, 10-14 July 2006, D:\data\pdfs\art1069.pdf.

Smallwood, J.J. and Obiozo, R.N. (2013) “Green ergonomics, biophilic design, sustainable construction workplaces and workers’ performance”. In: Hauser, G.,Lutzkendorf, T. and EBig, N. (eds), Implementing sustainability – barriers and chances, Proceedings of Sustainable Building Conference (SB13), 24-26 April,Munich, Germany.

The Construction Industry Development Board (cidb). (2011). Construction Quality in South Africa: A Client’s Perspective. The Construction Industry Development Board, Pretoria: cidb.

Thiede, C. (2000) The art and spirit of home décor: inside log home décor. Utah: Gibbs Smith and Publishers.

Tinapa, 2014) Great cities of Africa series: inspired by the UN World Forum. http://www.africa-ata.org/ng_tinapa.htm.

United ations Environment Programme (UNEP) (2010) UNEP-FI /SBCI Financial and sustainability metrics report: an international review of sustainable building, performance indicators and benchmarks. United Nations Environment Programme Finance Initiative, Paris, France.

US General Service Administration (GSA) (2003) Innovative workplace strategies. Washington DC, GSA Office of Governmentwide Policy.

van den Berg, A.E., Hartig, T. and Staats, H. (2007) “Preference for nature in urbanized societies: stress, restoration, and the pursuit of sustainability”. *Journal of Social* Issues, 63:1, 79-96.

Wilson, E.O. (1984) Biophilia. Cambridge, MA, Harvard University Press.

ICT COMPETENCIES OF BUILT-ENVIRONMENT STUDENTS IN A NIGERIAN POLYTECHNIC

Iyanu Pelumi Oguntuyi[1] and Olumuyiwa Bayode Adegun[2]
1. Department of Computer Science, Rufus Giwa Polytechnic, Owo. Nigeria.
2. School of Architecture and Planning, University of the Witwatersrand, Johannesburg, South Africa

Information and Communication Technology today plays an almost indispensable role in the built-environment and construction sector. A new breed of professionals needs to meet the human resource challenge in the digital age. But, are students prepared for an industry driven by digital technologies? This paper reports a survey of first and final year built-environment students in a Nigerian polytechnic using a cross-sectional questionnaire survey. Statistical analysis of the findings shows what simple logic might suggest. The greater portion of the first year students, though more proficient with general ICT application packages, are not proficient with ICT tools specifically related to the built-environment disciplines, but are willing to learn. Final year students show a higher degree of proficiency in ICT packages related to the built-environment profession, although some have not gained competency. Generally, there is a higher level of ICT competency among the final year compared to the first year students. The final students' ICT skill gap has implications for built-environment education as well as post-school ICT tooling for professionals.

Keywords: ICT, competency, built-environment education.

INTRODUCTION

Since computer scientist Ivan Sutherland's seminal application of computer graphics, virtual and augmented reality to spatial realm in the 1960s, the deployment of Information and Communication Technology in built-environment professions have grown incredibly across the world. The Nigerian built-environment industry is not exempted from the ICT pervasiveness. Despite the slow uptake in the Nigerian scenario, which can be linked to various barriers within and beyond it, certain realisations have emerged, with several prospects and potentials evolving (Oladapo, 2006; Ayo and Gbadeyan, 2007; Zietsman Mbi, 2008). As identifiable from literature, these realisations cut across professional disciplines in the industry.

In a study which surveyed construction professionals and contractors, Musa et al (2010) observes the positive impact of ICT-led technological innovations on service quality in the Nigerian construction industry. There is a high level of awareness on ICT's contribution towards improved productivity by Nigerian quantity surveyors (Ibironke et al, 2011). 70.7 % of the 184 town planners surveyed by Egila and Agbola (2012) strongly agree that ICT makes their professional job easier. Other benefits realised include savings on transaction costs, smoother and speedier exchange of

[1] iyanup@yahoo.com
[2]

Oguntuyi I. P. and Adegun O. B. (2014) ICT competencies of built-environment students in a Nigerian polytechnic *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 339-348.

information, accountability and transparency (Olukayode and Adeyemi, 2011). The level of ICT deployment among recognised real estate practitioners in Nigeria was found to be appropriate within the Nigerian National Bureau of Statistics' framework, based on a 26.25 % 'slight' commitment and at least 38.75 % 'somewhat' commitment to digital technology (Oni, 2013).

These realisations and realities show that built-environment education must prepare students for the increasingly digital industry. Altomonte (2010) sees ICT skills as a worthwhile 'response to the significant challenges that higher education is currently facing', especially in relation to changes in the pre- and post-professional educational landscape which requires more integrated teamwork and [interdisciplinary] communication. Anigbogu (2012) contends that construction education in Nigeria can be leapfrogged through ICT to produce internationally qualified and globally competitive graduates for the construction industry.

There is therefore a need to link academia (pedagogy) and the industry (practice) in relation to ICT competencies. However, there has been (and still) a gap between ICT skills required in the workplace and those taught and acquired in academic institutions, especially in a developing country like Nigeria (Mourshed et al, 2000; Ayofe et al, 2009). Olotuah et al (2012) found that only 29.65% of practicing architects in Nigeria learnt and started using Computer-Aided Design (CAD) during their course of architectural study in the higher institutions. Amassoma et al's (2010) study found low ICT deployment and internet usage by students in a Nigerian polytechnic and linked this to poor manpower development for the country. They recommended the provision of comprehensive ICT infrastructure and personnel, not just procuring computers in the higher institutions.

In order to bridge the gap on ICT between academic institutions and the industry, it is important to assess competency (ies) of the students, who invariably constitute tomorrow's work force. ICT competency herein would relate to basic skills usable in solving problems efficiently in a given problematic professional situation. In this sense, competency is more than merely having access to electronic devices and the internet. It is palpable that many students are having access to computers, the internet and other digital technology platforms more than ever before. This however does not translate to their possession of ICT skills necessary for higher education (Jane, 2009) or relevant to the needs of their future employers in the industry (Lim and Amanda, 2001).

In this study, we considered ICT competency of built-environment students as they enter the institution and while they are going out (into the industry). With this depth, the study is to allow a peep into the level of pre- and post- higher education competencies that students' possess; how they have acquired and fared with such during their time in the institution.

RESEARCH QUESTION

For the purpose of this study, a research question was formulated which also guided the research. We asked, 'What is the level of ICT competency of first and final year built-environment students?' We probed how the competency was acquired, and how it is being deployed during their time in the institution.

STUDY METHODOLOGY

This study utilised a questionnaire-based survey. The questionnaire consist 9 sections which deal with the respondent's profile; ICT tool(s) ownership and use; self-rating on

ICT competencies and the means by which these were acquired; ICT use during internship and their perception of preparedness for an ICT-driven built-environment industry. The study's population consist of students from the six departments in the Faculty of Environmental Studies of a Nigerian Polytechnic. The departments are Architecture, Building Technology, Estate Management, Quantity Surveying, Surveying and Geo-informatics, and Urban and Regional Planning. The questionnaire was distributed among first year and final year students in each of the department. A sample of 20 respondents (10 first years, 10 final years) was taken for each department. As a result, 120 questionnaires were self-administered, but only 103 (85.8% return rate) were received back and used for analysis. Figure 1 shows a distribution of the respondents by department. The result were analysed through descriptive and inferential statistics.

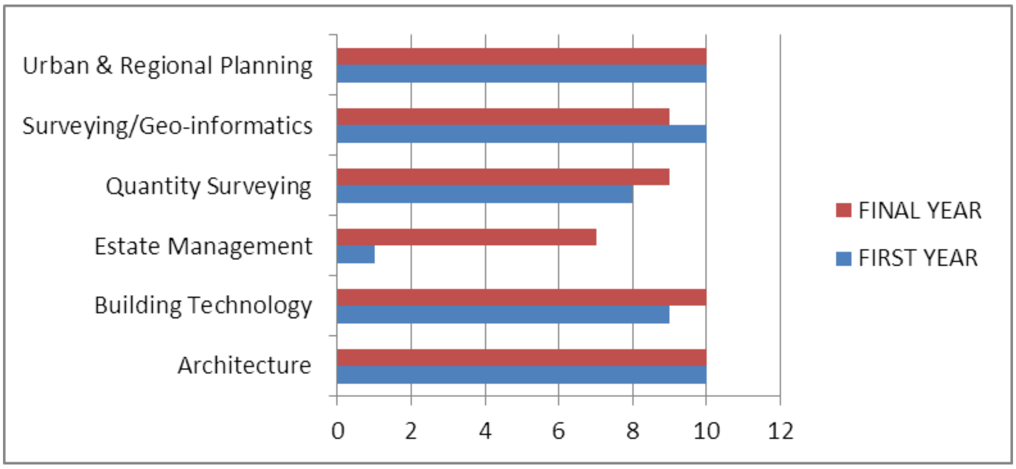


Figure 1: Distribution of Respondents by Department.

The analysis laid emphasis on the fourth item in the questionnaire which states dwelt on self-rating of ICT competency. ICT packages were listed, most of which were directly related to built-environment disciplines, and the respondents were asked to rate their competency on a 7-point scale. The scale included: Expert (7-points), Competent (6-Points), Still learning (5-Points), Not Competent (4-Points), Willing to learn (3-Points), Don't know about it (2-Points) and No comment (1-point). The analysis was carried out using t-test distribution, mean (X), standard deviation as statistical tools. Frequency and simple percentage were also. A mean response of less than 4 was regarded as "Reject" while a mean response greater or equal to 4 was regarded as "Accept". The null hypothesis was tested [H_0] was tested at 0.05 level of significance such that any calculated t-test value at 1.658 or above 0.05 level of significance ($p > 0.05$) was regarded as significant. The details are shown in Table 6, Table 7 and Table 9.

HYPOTHESIS

Two forms of hypothesis was formulated for this study, these are the NULL hypothesis [H_0] and the Alternative hypothesis [H_1].

Null Hypothesis [H_0]: There is no significant difference in the mean responses of both first year and final year built environment students in their level of ICT competencies.

Alternative Hypothesis [H_1]: There is a significant difference in the mean responses of both first year and final year built environment students in their level of ICT competencies.

RESULTS AND DISCUSSION

Of the 103 respondents, 48 (46.6%) were first year students while 55 (53.4%) were final year students. Among the first years, 43 (89.5%) were male and 5 (10.4%) were female, while among the final years, 48 (87.3%) were male and 7 (12.7%) female; which gives a total of 91 male and 12 female students. The analysis captures first year and final year students separately in order to show students' competencies at the initial as well as outgoing stage in the institution.

We found that a greater percentage of first year students own and use ICT tools that have direct relevance to the built-environment education (Table 1). Also, almost all the final year students own and use at least one of these tools; the majority (48.1%) owning a laptop. This means they are largely acquainted with some of the basic hardware tools relevant to the industry before leaving school. More than half of both the final and first year students use these tools daily (Table 2). Using them has become part of their daily life. The greater percentage of the use takes place in the school laboratory/studio, indicating that such forms part of the students' academic work.

Table 1: ICT Equipment used and owned by students

Equipment	**First year**	**Final year**
	Frequency [%]	Frequency [%]
Desktop/Personal Computer	9[18.8]	15[27.3]
Laptop	13[27.1]	27[48.1]
iPad	-	4[7.3]
Handset	23[47.9]	11[20.0]
Laptop and Handset	3[6.3]	5[9.1]
Desktop, Laptop and Handset	-	2[3.6]
	48	**55**

Table 2: Regularity of ICT Tools' usage

Interval	**First year**	**Final year**
	Frequency [%]	Frequency [%]
Daily	26[54.2]	30[54.5]
3-4 times per week	6[12.5]	9[16.4]
Weekly	1[2.1]	8[14.5]
Monthly	2[4.2]	1[1.8]
No Response	13[27.1]	7[12.7]
Total	**48[100]**	**55[100]**

Table 4 sheds light on what the students use these tools for. Academic purposes (preparing assignments and other school work) got the highest percentage of 45.4% for final years and 39.6% for first years. Only a small percentage of the students engage with a wide range of use which include academic and non-academic purposes.

It means that the students have not had a full realisation of ICT tools for everyday life, which obviously goes beyond academic purposes.
It is clear from Table 5 that the greater portion of the students acquired ICT skill through a friend (27.1% and 41.8% for first and final year respectively). This shows the notable role peer-learning mechanism plays among the students in these disciplines. Twenty percent of the final year students acquired ICT skills through school class sessions, while 5.5% learnt it during internship. Some of the students went beyond the school's academic program, to attend training centre in order to acquire the necessary ICT skills. When asked if they paid to acquire the skills, 31.3 and 30.9 percentage of the first and final year students respectively indicated that they paid. More than half of students did not pay to learn. They had utilised non-fee paying means such as personal study and practise, friends/colleagues or as part of school classes.

Table 3: Location where the ICT tools are used

Venue	**First year**	**Final year**
	Frequency [%]	Frequency [%]
School lab/studio	17[35.4]	17[30.9]
Home	8[16.7]	11[20.0]
Cyber café	2[4.2]	3[5.5]
School lab/studio and Home	6[12.5]	5[9.1]
School lab/studio, Home and Cyber Café	2[4.2]	4[7.3]
Others	5[10.4]	9[16.4]
No response	8[16.7]	6[10.9]
Total	**48[100]**	**55[100]**

Analysis show that of the final year students, 69.1% made use of the listed ICT tools during their internship while 30.9% did not. Respondents who are first year students have not gone on industrial attachment (internship), and therefore do not have an answer in this regard. This shows that the organisations where the students interned have largely incorporated ICT into their operations. A large percentage of the final year students who made use of ICT tools during their industrial attachment were exposed to some of the application packages directly related to their discipline. This include AUTOCAD for drafting building plans, preparing land survey plans and so on as well as packages used for the preparation of Bill of Quantity.

Table 4: What the ICT tools are used for

ICT Tool use	**First year**	**Final year**
	FREQUENCY[%]	FREQUENCY[%]
Preparing assignments/academic work	19[39.6]	25[45.4]
Online publishing	3[6.3]	1[1.8]
Communication, e.g. E-mail	7[14.6]	7[12.7]
Social media/entertainment only	2[4.2]	7[12.8]
Preparing Assignments, e-mail and social media.	8[16.7]	11[20.0]
All of the above	4[8.3]	3[5.5]
No response	5[10.4]	1[1.8]
Total	**48[100]**	**55[100]**

Respondents were asked to rate their competencies on some of the ICT packages related to the built environment professions. Specific classes of packages were given, with relevant examples under such named. For example, Building Information Modelling/Three-dimensional illustration package mentioned ArchiCad and Revit. The Self-rating was on seven scales – expert, competent, not competent, still learning; don't know about it, willing to learn and no comment. Table 6 and 7 shows our analysis of the rated competency levels.

Table 5: How the ICT skill(s) was acquired

Source	**First year** Frequency[%]	**Final year** Frequency[%]
On my own	10[20.8]	9[16.4]
Through a friend/colleague	13[27.1]	23[41.8]
As part of school classes	8[16.7]	11[20.0]
During Internship	-	3[5.5]
A training centre	7[14.6]	4[7.3]
On my own and training centre	3[6.3]	2[3.6]
As part of school classes and during Internship	-	2[3.6]
On my own, through a friend and As part of school classes	-	1[1.8]
Other means	1[2.1]	
No response	6[12.5]	-
Total	**48[100]**	**55[100]**

In Table 6, the first three ICT packages (Word Processing, Presentation and Database) packages shows a mean score above the cut-off point which is 4.0, hence it is accepted. The other packages show a mean score below the cut-off point (4.0), hence it is rejected. This implies that many of the first year students are not too proficient with ICT tools that are specifically related to the built environment profession, but are more proficient with general ICT application packages (Word Processing, Presentation and Database packages). One major fact also emanating from the first year students is their willingness to learn and acquire skills they hitherto do not possess. This is especially notable on the built-environment packages such as CAD, GIS/spatial data management and project management software where 43.8%, 47.9%, 43.8% of them indicated interest respectively.

In Table 7, Word Processing, Presentation, Database, Computer Aided Drafting, Building Information Modelling, Estimating/ Quantity Surveying Packages, Project Management and Programming Languages have a mean score above the cut-off point (4.0), while other tools (Animation and Virtual Reality and Mathematical Modelling) have a mean score below 4.0. This implies that the final year students have a higher degree of proficiency in ICT tools that are directly related to the built-environment profession. Almost all of them are knowledgeable with word processing packages while 49.1% rated themselves as competent in CAD packages. 40% of final year students are still learning but not yet competent with BIM/3-dimensional packages.

Following up on the self-rating on ICT competency, we investigated the final year students' opinion on their readiness for an increasingly digitally driven workplace. 87.3 % of them believe they are fully prepared as shown in Table 8.

We compared the calculated value of t, tcalculated to the tabulated value, ttabulated for the appropriate level of significance and degree of freedom. The table above (Table 9) shows that tcalculated> ttabulated in that 2.326 which is the calculated value of t is greater than 1.658 which is the tested value of t at 0.05 level of significance and 101 degree of freedom. Hence, we can reject the null hypothesis H0 which states that "There is no significant difference in the mean responses of both first year and final year built-environment students in their level of ICT competency" and accept the alternative hypothesis which states that "There is a significant difference in the mean responses of both first year and final year built-environment students in their level of ICT competencies. This implies that there is a higher level of ICT competency among the final year built-environment students compared to that of the first year students.

Table 6: Self-rated ICT competency among first year students

	N	Mean	Std. Deviation	Std. Error Mean	Decision
WORD PROCESSING (MS WORD, ETC.)	48	4.85	1.762	.254	Accept
PRESENTATION (MS POWERPOINT, ETC)	48	4.19	1.853	.267	Accept
DATABASE MANAGEMENT (MS EXCEL, ETC.)	48	4.02	1.874	.270	Accept
COMPUTER AIDED DRAFTING (AUTOCAD, ARCHICAD, SKETCHUP, ETC.)	48	3.58	1.622	.234	Reject
BIM - BUILDING INFORMATION MODELLING/ 3-DIMENSIONAL ILLUSTRATION (ARCHICAD, REVIT, ETC.)	48	3.69	1.475	.213	Reject
ANIMATION AND VIRTUAL REALITY	48	3.46	1.637	.236	Reject
ESTIMATING/QUANTITY SURVEYING PACKAGES	48	3.35	1.707	.246	Reject
PROJECT MANAGEMENT (BUILTTOOL, ETC.)	48	3.19	1.454	.210	Reject
GIS/ SPATIAL DATA MANAGEMENT (ARCGIS, ETC.)	48	3.21	1.529	.221	Reject
PROGRAMMING LANGUAGES (JAVA, BASIC, FORTRAN)	48	3.25	1.670	.241	Reject
MATHEMETICAL MODELLING	48	3.19	1.439	.208	Reject

The students expressed problems they face in their bid to gain competency on ICT skills. Such include; difficulty in learning of some tools and packages and absence of competent trainers. Other problems which relate to ICT infrastructure include lack of personal computer systems to practice what has been learnt; absence of internet access and poor internet connectivity; epileptic power supply on campus and other places. They also identified financial problem as a challenge.

students made some recommendations. They recognised the need for improvement in the ICT teaching in their institution and other tertiary institutions in Nigeria. They believe learning ICT packages related to their fields of study should be made compulsory for all students in all the institutions. They recommended the need to provide personal computers for the students at cheap and affordable prices.

With the mode of ICT learning, manner of use, self-rated competencies, and perception on preparedness for the workplace shown above, transforming first-year students (raw materials) into final-year finished product fit for an industry driven by digital technologies is a compelling necessity. The final year students' self-rated competency level for all ICT skills show that not all of them are adequately prepared for the industry. In comparison with what Olotuah et al (2012) observed, the situation is however better. We found out a 49.1% competency level for final year students while Olotuah et al (2012) found that only 29.65% of practicing architects in Nigeria learnt and started using CAD packages during their course of architectural study in the higher institutions.

Table 7: Self-rated ICT competency among final year Students

	N	Mean	Std. Deviation	Std. Error Mean	Decision
WORD PROCESSING (MS WORD, ETC.)	55	5.42	1.384	.187	Accept
PRESENTATION (MS POWERPOINT, ETC)	55	4.78	1.343	.181	Accept
DATABASE MANAGEMENT (MS EXCEL, ETC.)	55	4.96	1.587	.214	Accept
COMPUTER AIDED DRAFTING (AUTOCAD, ARCHICAD, SKETCHUP, ETC.)	55	5.27	1.557	.210	Accept
BIM - BUILDING INFORMATION MODELLING/ 3-DIMENSIONAL ILLUSTRATION (ARCHICAD, REVIT, ETC.)	55	4.58	1.512	.204	Accept
ANIMATION AND VIRTUAL REALITY	55	3.78	1.629	.220	Reject
ESTIMATING/QUANTITY SURVEYING PACKAGES	55	4.11	1.674	.226	Accept
PROJECT MANAGEMENT (BUILTTOOL, ETC.)	55	4.24	1.688	.228	Accept
GIS/ SPATIAL DATA MANAGEMENT (ARCGIS, ETC.)	55	3.91	1.703	.230	Reject
PROGRAMMING LANGUAGES (JAVA, BASIC, FORTRAN)	55	4.07	1.526	.206	Accept
MATHEMETICAL MODELLING	55	3.71	1.449	.195	Reject

Table 8: Final year Students' preparedness for ICT-driven industry.

	Frequency	Percentage (%)
Yes	48	87.3
No	4	7.3
Don't know	3	5.5
TOTAL	55	100

Table 9: Hypothesis

Level	N	Mean	Sd	Df	t-calculated value	t-tabulated value	Decision
First Year Final Year	48 55	3.635 4.439	1.638 1.550	101	2.326	1.658	Significant

To address the challenges inherent in acquiring the relevant ICT competencies, the

Also, academic institutions need to wake up to realities in the industry and incorporate this into the training of future built environment professionals. This would involve the provision of necessary facilities and infrastructure, curriculum review, pedagogic alignment and the deployment of competent personnel. Based on the authors' interaction with built-environment students, the location of ICT tools' use by the students and the outstanding place of peer-learning in this study, the pedagogic context is important in gaining competency of the appropriate ICT skills. Inference on our findings concurs with Gray's (2011) position that although some students are computer literate, a substantial proportion lacks the resources and skills to fruitfully learn under their own devices in a technology-driven tertiary education setting producing graduates for an ICT-driven industry. Also, because the shelf-life of cutting edge digital technologies is now becoming smaller, post-school ICT competencies development need to take place. Continuous on-the-job tooling is important.

CONCLUSION

The study has shown the ICT competencies of built-environment students in their first and final year. The survey findings show that many of the first year students are not too proficient with ICT tools that are specifically related to the built environment profession, but are more proficient with other general ICT application packages. They however showed willingness to learn and gain competency. Final year students showed a higher degree of proficiency in ICT tools that are related to the built-environment profession, although some of them are still learning but have not gained competency. Generally, there is a higher level of ICT competency among the final years compared to the first year students.

Tertiary institutions need to be better positioned through the provision of relevant and adequate facilities and infrastructure, pedagogic alignment and the deployment of competent personnel. This would improve the ICT teaching and learning environment for their built-environment courses. It will in turn help to produce graduates that are adequately prepared for a digitally driven built-environment industry.

We acknowledge that this study is limited with the consideration of just one institution and limited respondents. We hope that future studies would include another institution, thus allowing a revealing comparison. To take this further, it would also be interesting to delve into ICT teaching and how it links up with the students' competency and preparedness for the industry.

REFERENCES

Altomonte, S., (2010). Enhancing Teaching and Learning of Sustainable Design Through lCTs.2nd International Conference on Education Technology and Computer (ICETC).22-24 June, Shanghai, China.

Amassoma, D., Ayanda, D., Tijani, K., (2010). Internet Usage among Nigerian Polytechnic Students and its Impact on Manpower Development: A case study approach. *Journal of Information Technology Impact*. 10(3):161-170.

Anigbogu, N., (2012). Leapfrogging, tunneling through and overcoming: Meeting the needs of construction education in Nigeria. AARCHES 2012 BGM and Annual Conference.University of Jos, Jos. 3-5 October.

Ayo, C.K and Gbadeyan, J.A., (2007). The role of technology in the built-environment. In Okewole, I., Daramola, S., Ajayi, S., Ogunba, O., Odusanmi, K. (eds.) The Built Environment: Innovation Policy and Sustainable Development. Ota: Covenant University. P 446-451.

Ayofe, AN, Ajetola, AR and Oyewole, AS. (2009). Assessment of Existing Gap Between Industrial IT Skill Requirements and Computer Science Curriculum in Tertiary Institutions. *Pacific Journal of Science and Technology.*10(2):326-336.

Egila, MM and Agbola, B. (2012) The Relevance and Application of Information and Communication Technology on Physical Planning Practice (June 5, 2012). Available at SSRN: http://ssrn.com/abstract=2244209 or http://dx.doi.org/10.2139/ssrn.2244209

Gray, M. (2013) When digital native meets analogue reality: a case study of ICT skills in first year university students. In Annual Conference of the Portland International Center of Engineering and Technology, 28 July-1 August 2013, Marriott Hotel, San Jose, CA.

Ibironke, OT, Ekundayo, D and Awodele, OA. (2011) A survey on the use and impact of information technology in quantity surveying service delivery in Nigeria. In: 27th Annual ARCOM Conference, 5-7 September 2011, University of the West of England, Bristol.

Jane, N. (2009) Computer skills of first-year students at a South African University. Proceedings of Annual Conference of South African Computer Lecturers' Association. June 29 – July 01. Eastern Cape.

Lim, KF and Amanda K. (2001) IT skills of university first-year undergraduate students: Two 2001 matriculation cohorts. *UniServe Science News*. Vol. 16.

Mourshed MM, Matipa WM, Keane M, Kelliher D (2000) Towards interoperability: ICT in academic curricula for sustainable construction. Proceedings of the CIB W107 1st international conference: creating a sustainable construction industry in developing countries, pp 11–13.

Musa, N., Oyebisi, T., Babalola, M. (2010) A study of impact of ICT on the quality of quantity surveying services in Nigeria. *The Electronic Journal of Information System in Developing Countries*. 42(7): 1-9.

Oladapo, AA. (2006) The Impact of ICT on Professional Practice in the Nigerian Construction Industry, *The Electronic Journal of Information System in Developing Countries,* **24**, 2, 1–19.

Olotuah, O., Adedeji YMD. and Odeyale, TO. (2012) Re-visiting Curriculum Design in Architectural Education in Nigeria: the information technology factor. *Education Research Journal*. 2(4): 127 – 131.

Olukayode, SO. and Adeyemi, AA. (2011). A survey of the state of art of e-tendering in Nigeria. *ITcon*. 16.

Oni, OA. (2013) Digital divide – a challenge to real estate practise in Nigeria? *Property Management*. 31(1): 22-38.

Zietsman Mbi, E. (2008) ICT and construction: where are we? Proceeding of IFIP Working Group 9.4- University of Pretoria Joint Workshop. P 253-260.

IDENTIFICATION OF CRITICAL SUCCESS FACTORS FOR THE SURVIVAL OF SMALL, MEDIUM AND MICRO ENTERPRISE CONTRACTING FIRMS IN THE GREATER JOHANNESBURG METROPOLITAN AREA

Aigbavboa CO[1], Tshikhudo LM[2] and ThwalaWD[3]

Department of Construction Management, University of Johannesburg, Doornfontein Campus, Johannesburg, South Africa,

The objective of this study is to investigate the critical success factors (CSF) that influence the success of small and medium sized contractors in the greater Johannesburg metropolitan area, Gauteng province of South Africa. An all-inclusive literature study was carried out. A structured questionnaire was developed for 50 SMME contracting firms to access the standing of their enterprises and also to scrutinize the CSF that influence the success of their businesses. Findings emanating from the study reveal that good management skills, maintaining good relationships with clients, proper record keeping and good cash flow management were the prime CSF needed by the SMME in the greater Johannesburg region for the survival of their firms. This study contributes to the preposition that CSFs are necessary for the survival of SMMEs as they are seen to hold the key to the development of the local economies and the nations at large.

Keywords: contractors, critical success factors, Gauteng Province, South Africa

INTRODUCTION

Small, Medium and Micro Enterprises (SMMEs) play an important role in global economies by creating employment and reducing poverty (Lewis, Pun and Lalla., 2006). For instance, the South African Minister of Finance, Mr. Pravin Gordhan, in his 2013 National budget speech stated that SMMEs play a vital role in the development of the South African economy and are a significant generator of employment. The minister further state that the financing of SMMEs in South Africa has been simplified with the creation of the Small Enterprise Finance Agency (SEFA) in 2012 in order to foster growth and survival amongst them. With that said, the growth of construction SMMEs is a great concern to the South Africa government because of the peculiarity of the SMMEs and as these firms struggle to survive after years of operations.As a major client of the construction industry, the government would gain when SMME companies that are involved in the execution of its projects have the necessary capacities and capabilities to provide value as required. The South African government Small Enterprise Development Agency (SEDA) is vested with

[1] caigbavboa@uj.ac.za
[2] livhuwanimt@yahoo.com

Aigbavboa *et al*.. (2014) Identification of critical success factors for the survival of small, medium and micro enterprise contracting firms in the Greater Johannesburg metropolitan area *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 349-356.

the responsibility to ensure and monitor SMMEs growth in the country. SEDA is an agency of the South African Department of Trade and Industry (DTI). It is mandated to implement government's small business strategy; design and implement a standard and common national delivery network for small enterprise development; and integrate government-funded small enterprise support agencies across all tiers of government. SEDA's mission is to develop, support and promote small enterprises throughout the country, ensuring growth and sustainability (SEDA: online). However, construction SMMEs still have a great amount of factors that they need to analyze and understand in order to survive in the industry. Hence, the study seeks to investigate the CSF for the survival of SMME contracting firms. The paper starts with an overview of the literature on SMME and CSF, followed by an explanation of the research design method; presentation of the findings and discussions before conclusion are drawn and recommendations made.

SMMES AND CRITICAL SUCCESS FACTORS

There is consensus among policy makers, economists, and business experts that small and medium enterprises are drivers of economic growth. A healthy SME sector contributes prominently to the any economy through the creation of employment opportunities, generating higher production volumes, increasing exports and introducing innovation and entrepreneurship skills (National Credit Regulator, 2011). The special role of SMMEs in a developing countries, for instance South Africa insures them as engines through which the growth objectives of developing countries can be achieved. Daniels and Ngwira (1992) and Daniels (1994) estimated that SMMEs employ 22% of the adult population in developing countries. Also, the United Nations Industrial Development Organisation (UNIDO) estimates that SMMEs represent over 90% of private business and contribute to more than 50% of employment and of gross domestic product (GDP) in most African countries (UNIDO, 1999). A recent study conducted by Abor and Quartey (2010) estimates that 91% of formal business entities in South Africa are SMMEs, and that these SMMEs contribute between 52 to 57% to GDP and provide about 61% to employment. Despite the acknowledged level of contribution and significance of these SMMEs, the Global Entrepreneurship Monitor (GEM) Reports (2001-2010) noted that South Africans SMMEs suffer from poor management skills which is a result of lack of adequate training and education. Thus, this results in high rates of business failure making SA one of the national state with one of the lowest SMMEs survival rates in the world (National Credit Regulator, 2011).

Despite the dynamics of the SMME sector, Baard and van den Berg (2004) states that they faces high failure rates in the first three years of existence. For instance in South Africa, this failure rate is somewhere between 70 and 8%, costing the South African economy millions of Rand (Barron 2000; Streek 2001). SMME failures according to previous scholars have been found to bear on internal factors such as managerial incompetence, a lack of managerial experience, inadequate planning and poor financial control (Pickle and Abrahamson, 1990; Gaskill, Van Auken and Manning, 1993 and Scarborough and Zimmer, 1994). SMMEs exist in a hostile external environment containing legal and regulatory constraints, where access to finance is limited and it operates within a global environment characterized by intensified competition (Goodall, 2000). In South Africa much emphasis is placed by national, provincial and local governments on SMMEs to drive wealth creation and black economic empowerment. Therefore, in order for SMMEs to fulfil this role in the broader society, an investigation into the CSF necessary for their survival is of vital importance.

Arslan and Kivrak (2008) defined success as, being traditionally known as the degree to which goals and expectations are met. Similarly April (2005) points out that success is achieved if an organization uses its performance to meet, or to exceed the financial, social and personal growth expectations of the persons who have an interest in organization. Although, there is no single agreed definition of business success, but researchers generally use continued viability or longevity as a surrogate for business success (Rogoff, Lee and Suh, 2004). However, Murphy (1996) states that some business owners measures success in their capacity to sustain a lifestyle foundered on independence, while for others success would be measured by profit and business growth. Presently the construction SMMEs in the South African construction sector are assessed on the basis of the financial 'well-being' of their entities and a demonstrable track record of work that they have done prior (Gasa 2012). Therefore, it can be concluded that SMMEs success depends on competent skills, adequate resources, proper timing of activity planning and performance, teamwork, effective communication, fair dealing with people, honesty and integrity are essential. Despite this assertion, during the formative process of growth, SMMEs need to pay attention to certain prospects/factors that tend to determine their longevity in existence.

Previous studies have disclosed different kinds of variables that impact on the success of SMMEs, but most of these studies concentrated on a few sets of variables such as: the psychological and personality traits of the entrepreneurs; managerial skills and training of entrepreneurs and the external environment (Benzing and Kara, 2009). Also, Jaafar and Abdul- Aziz (2005), surveyed 172 SME's contractors in Malaysia and concluded from what they call Resource-Based-View that contractor success lies in project and financial management capability, marketing and supply chain relationship. However, Wijewardena and Zoysa (2005) identified six main factors that had positive and significant impact on the success of their sample firms, these factors include: customer orientation, product quality, efficient management, supportive environment, capital accessibility and marketing strategy. In construction terms, a good reputation in terms of projects history is vital for a company's longevity in existence. If previous projects have positive feedback from the clients it eventually leads to interests from possible future clients as well as recommendations by the satisfied client base.

Nieman (2006) states that general scarcity of resources occurs for SMME success is lacking, the process of networking is therefore vital for their growth and survival. Likewise Burke (2006) states that networking skills are possibly the most important entrepreneurial trait helping the entrepreneur achieve success. Moreover, De klerk and Kroon (2007) informs that business networks have a huge impact on the capacity of a firm to maintain competitive advantage and further states that it improves the ability of firms to operate by using marketing and distribution models efficiently. Likewise Apulu and Latham (2011) found that the competitiveness of SMMEs will be increased through adopting Information and Communication Technology (ICT). Most firms using some form of technology is a question of whether or not these technologies encourage innovation, efficiency, leadership, and improvements in design etc. Mustafa (2007) states that the need for ICT in organizations and not just construction SMMEs is widely acknowledged and its now accepted that IT is becoming a key element of any organization and researchers have informed that the level of an organization's reliance on IT in the twenty-first century is similar to the reliance on electricity in the previous century when it was not expected for an organization to function without electricity. Marsh and Flanagan (2000) acknowledges that project team members engage in frequent communication during the project, thus ICT plays a major role in easing information sharing among individuals or entities.

Furthermore, Olwale and Garwe (2010) state that managerial competencies are very important to the survival and growth of new and existing SMMEs. Hence, Islam and Siengthai (2010) states that most of the core processes of Human Resource Management, namely, recruitment and selection, performance appraisal, training and development, as well as compensations have a momentous and positive impact on firm performance. Moreover, Scott (2011) expounds that correct financial management is an important contributor to the success of any company. The ability to manage risk is also an important subset of management for small firm survival (Deakins and Freel, 2006). This factor was also pointed out by Arslan and Kivrak (2008) who emphasized on how it is important for an organization to practice business management; risk management within the company, job cost control, quality control, good record keeping to name a few. Moreover, Nieman (2006) states that accurate record keeping is vital as a task under the organizing function. Wright (1995) supports this by stating that when keeping record system is effective, it enables the business managers to keep a diary for business appointments, issue detailed invoices to customers and file copies of such in alphabetical order, in addition he points out that record keeping is not only important for financial, sales or administrative records, but it also enables the business managers to assess the progress of the company periodically.

RESEARCH METHODOLOGY

The research made use of the quantitative research method using structured questionnaires. Targeted participants of this study were project managers, construction managers, quantity surveyors and contractors in Greater Johannesburg area of Gauteng. These were all domicil in the Greater Johannesburg Region while construction team members whose business and construction activities were out of the research range were excluded. The reason for this was that these businesses and construction team members are involved in SMMEs operations on a daily basis and based on their experiences and being domicil in the chossen region, they were are in a better positions to analyze the factors they see as relevant to succeed and survive in the firms. However, not all respondens were involved in the management and operations of these enterprises. Based on the quantitative methodology of simply random sampling, all SMMEs in Greater Johannesburg area of Gauteng Province, had an equal chance to be drawn and participate in the survey. Out of the 57 questionnaires sent out to construction SMMEs within grade 1-5; 36 were received back representing a 63% response rate. The data presentation and analysis made use of frequency distributions and percentages of all the respondents. The research was conducted between the months of June to August, 2013.

MEAN ITEM SCORE INDEX (MIS)

A 5-point Likert type scale was used to determine the critical success factors necessary for the survival of SMMES in the greater Johannesburg region. The adopted scale read as follows, 1=Strongly disagree, 2= Disagree, 3=Neutral, 4=Agree, and 5=Strongly agree. The five-point scale was transformed to mean item scores indices (MIS) for each of the factors identified from literature as potential sources of survival for SMME firms which were assessed by the respondents. The indices were then used to determine the rank of each item. These rankings made it possible to cross compare the relative importance of the items as perceived by the respondents. The MIS was based on the previous studies as conducted by Aibinu and Jagboro (2002), Ayodele and Alabi (2011) and Kometa et al. (1995) that used the 'MIS index' method in rating their study criterions. This method was also adopted to analyze the data collected from the questionnaire survey.

The computation of the relative importance indices (RII) was calculated from the total of all weighted responses and then relating it to the total responses on a particular aspect. This was based on the principle that respondents' scores on all the selected criteria, considered together, are the empirically determined indices of relative importance. The index of RII of a particular factor is the sum of the respondents' actual scores (on the 5-point scale) given by all the respondents' as a proportion of the sum of all maximum possible scores on the 5-point scale that all the respondents could give to that criterion. Weighting were assigned to each responses ranging from one to five for the responses of 'strongly disagree' to 'strongly agree'. This is expressed mathematically below. The relative importance index (RII) was calculated for each item as follows, after Lim and Alum (1995):

$$= \frac{1n_1 + 2n_2 + 3n_3 + 4n_4 + 5n_5}{\sum N} \quad \text{……………………..Equation 1.0}$$

Where;

n_1 = number of respondents for strongly disagree;…………….

n_5 = number of respondents for strongly agree;………………..

N = Total number of respondents

Following the mathematical computations, the criteria are then ranked in descending order of their mean item socre index (from the highest to the lowest). The next section of the article presents the findings of the survey and some discussion.

FINDINGS AND DISCUSSION

Findings from the survey revealed that Black Africans represented 75% of the respondents, followed by 17% of Whites and Indians being 8%. It was further revealed that 16.7% of the respondents had grade 12 as the highest level of education whilst 47.2% of the respondents hold either a diploma or some other degree. Likewise, 19.4% of the respondents hold BTech and the remaining 16.7% hold graduate degrees. Further findings revealed 40.5% of the respondents indicated that their main reason of starting a business was to enjoy the luxury of self-employment, whilst 23.8% was for independence, 14.3% was to make a contribution to the community, 11.9% was for financial reasons, 4.8% was due to the fact that they could not find work, and other 4.8% indicated other reasons such as filling the gap in the market which big corporation where not fully satisfying in the market.

Table 1: Critical Success Factors for Survival of SMMEs

CRITICAL SUCCESS FACTORS	MIS	RANK
Good management skills	**4.72**	**1**
Maintaining good relationships with clients	**4.67**	**2**
Proper Record keeping	**4.58**	**3**
Good cash flow management	**4.53**	**4**
Effective communication channel throughout firm	**4.47**	**5**
Networking with potential future clients	**4.39**	**6**
Marketing strategies	**4.33**	**7**
Having key clients that respond to the services offered	**4.31**	**8**
Having personnel with risk management expertise in firm	**4.25**	**9**
Having a formal short-term business plan	**4.19**	**10**
Light operating costs	**4.11**	**11**
Having an effective recruiting and strong HR	**4.08**	**12**
Use of ICT and adapting to change in technology	**3.97**	**13**
Having a niche market	**3.89**	**14**
Using social media to increase client data base	**3.81**	**15**

Based on the ranking (R) of the weighted average of the mean item score (MIS) for the critical success factors for the survival of SMMEs, the findings revealed that the most critical success factors are good management skills (MIS=4.72; R=1), maintaining good relationships with clients (MIS=4.67; R=2), proper record keeping (MIS=4.58; R=3), good cash flow management (MIS=4.53; R=4). Other factors identified in the study include; having an effective recruiting and strong HR (MIS=4.08; R=12), the use of ICT and adapting to change in technology (MIS=3.97; R=13), having a niche market (MIS=3.89; R=14), and lastly the use of social media to increase client data base (MIS=3.81; R=15) as presented in Table 1. This findings concurs with the work of Deakins and Freel (2003) who found that the difference between those firms that can grow and adapt to conditions and those that do not, lies in the management skills of the entrepreneur and too often the importance of these management skills are ignored through concentration on marketing or the personal characteristics of the entrepreneur. Likewise, Scott (2011) informs that maintaining good relationship is a major critical success factors for the survival of any firms, and also that contractors can benefit from better relationships with their clients through a number of different ways, such as: repeat business, work continuality, and improved profitability.

CONCLUSION

The paper set out to explore the critical success factors (CSF) that influences the success of small and medium sized contractors in the greater Johannesburg metropolitan area, Gauteng province. An all-inclusive literature study was carried out was identified variables that were validated through a structured questionnaire survey conducted amongst construction professional who reside in the research geographical area.

The empirical study, although based on a relatively small sample of SMME construction professionals and contractors in the greater Johannesburg region reveal that the factors which had been identified in the literature as contributory to SMME's success were in other cultural contexts were common in the study area. Hence, it was found that the most critical success factors for the survival of SMME's are: are good management skills, maintaining good relationships with clients, proper record keeping, good cash flow management, having an effective recruiting and strong HR system, the use of ICT and adaptation to changes in technology, having a niche market, and lastly the use of social media. Although the sample was limited, but the findings are indicative of the CSF for the survival of SMME's in the Greater Johannesburg region of the Gauteng Province of South Africa. In terms of reliability of the methodology adopted; when the procedure is followed in a bigger and more diversed sample, findings would justify the current study. Therefore, the results revealed in this study gives valuable insights for the improvement of construction SMMEs in the study area.

It is therefore recommended that construction SMMEs firms should invest more in management training in order to increase performance which will enable them to have a competitive advantage over other those not educated and not upgrading their level of knowledge. Also, SMMEs should employ the services of better qualified personnel's in their firm as well as having construction mentors who can assist to eliminate some of the factors that cause these firms to fail such as the employment of the services of better qualified construction projects financial accountants who will help keep the books as it was identified in the survey that projects financial management is a major contribution to SMME failures in the research focus area. When these recommendations are given considerations, there will be a significantly reduction in the failure rate of construction SMMEs in the Gauteng Province of South Africa.

REFERENCES

Apulu, I., and Latham, A. (2011). Drivers for information and communication technology adoption: A case study of Nigerian small and medium sized enterprises. International Journal of Business and Management, 6(5), 51-52.

April, W.I (2005) Critical factors that influence the success and failure of SMEs in Namibia in the Khomas Region: Masters of commerce, university of Stellenbosch

Arslan, G. and Kivrak, S. (2008) Critical success to company success in the construction industry, World Academy of Science, Engineering and Technology, vol.45, p 43-46

Benzing, C. Chu, H.M. Kara, O. (2009) Entrepreneurs in Turkey: a factor analysis of motivations, success factors and problems. J Small Bus Manag 47(1):58–91

Deakins, D. and Freel, M. (2003) Entrepreneurship and small firms 4th Ed. McGraw-Hill Education (UK)

Donkor, S. (2011) Determinants of business failure: the perspective of SMES building contractors in the Ghanaian construction industry: The department of building Technology College of architecture and planning Kwame Nkrumah University of science and technology, Kumasi

Gasa, Z.B.N. (2012). Measuring the competitiveness of small, medium and micro enterprise contractors through the use of the register of contractors: PHD Thesis, Nelson Mandela Metropolitan University

Islam, M. Z. and Siengthai, S. (2010). Human Resource Management Practices and Firm Performance Improvement in Dhaka Export Processing Zone, Research and Practice in Human Resource Management, 18(1), 60-77.

Lewis, W.G., Pun K. F., and Lalla, T.R.M. (2006). Exploring soft versus hard factors for TQM implementation in small and medium-sized enterprises. International journal of productivity and performance Management, 55(7), 539-554

Marsh, L. and Flanagan, R. (2000). Measuring the costs and benefits of information Technology in construction. Engineering and Architectural Management

Murphy, M. (1996). Small business Management. Pearson Education limited, UK

Mustafa, A. (2007).Rethinking IT in construction and engineering: organizational readiness. Taylor and Francis Group, Milton Park, Abingdon

Rogoff, E.G. Lee, M. Suh, D. (2004) who done it? Attributions by entrepreneurs and experts of the factors that cause and impede small business success. J Small Bus Manag 42(4):364–376

Scott, B.M (2011) Survival strategies of services subcontracting firms in an economic downturn, A Report for Industry Project CONS 7819, Unitec New Zealand.

INNOVATION FOR SUSTAINABILITY IN THE DESIGN AND CONSTRUCTION OF PUBLIC HOUSING: THE CASE OF LAGOS HOME OWNERSHIP AND MORTGAGE SCHEME

Isidore C. Ezema[1]
Department of Architecture, Covenant University, Ota, Nigeria

Lagos State Government of Nigeria established the Lagos Home Ownership and Mortgage Scheme (Lagos HOMS) in 2012 to facilitate access to both housing and mortgage finance by low-income earners in a rapidly growing megacity. Under this scheme, over three thousand housing units are at various stages of construction in parts of the state. Given the huge resources invested in the project, this paper examines the innovations introduced at the design and construction stages with a view to ascertaining their alignment or otherwise with the principles of environmental sustainability. The case study research design was adopted and data were obtained through observation, interviews and review of documentary evidence. Two sites namely Sogunro and Igando were selected for the case study because of the advanced stage of construction. It was found that innovations driven by sustainability principles were adopted at the design stage. Even though dry and wet construction methods were used in some of the buildings, the predominant method of construction was largely conventional and less innovative. The use of energy intensive building materials negatively affected the environmental sustainability of the buildings. It is recommended that for improved environmental sustainability of projects of this magnitude, there is a need for increased innovation in both design and construction methods.

Keywords: Construction methods; housing design; innovation; Lagos HOMS; sustainability.

INTRODUCTION

Nigeria's housing deficit has been estimated to be about 17million housing units as at 2012 (Federal Ministry of Housing and Urban Development, 2012). The above huge deficit was recorded in spite of the various government intervention strategies such as direct provision of housing units, site-and–services schemes as well as public-private partnerships (PPP), all aimed at ameliorating the housing burden being experienced in the urban areas (Akinmoladun and Oluwoye, 2007; Ibem, 2010; Fadairo and Olotuah, 2013). The major challenge associated with housing provision in Nigeria include adequacy in terms of quantity and quality as well as affordability (Ibem and Amole, 2011; Daramola, 2007).

Housing affordability is a major challenge of housing policy both in developing as well as in developed nations (Yates and Milligan, 2007; Daramola, 2007). With

[1] ezema4life@yahoo.com ; isidore.ezema@covenantuniversity.edu.ng

Ezema, I.C.. (2014) Innovation for sustainability in the design and construction of public housing: the case of Lagos home ownership and mortgage scheme *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 357-370.

majority of Nigerian urban dwellers falling within the low-income category coupled with the rising cost of housing provision, affordability is a major consideration. In Lagos, Nigeria, the housing price-to-income multiple, an international index of affordability, has been estimated to be about 20.45 as against 13.5 in Hong Kong, 5.1 in UK and 3.0 as recommended by the United Nations Framework on Sustainable Development (Ashkin, 2013).

In addition to affordability and in accordance with global trend, an often neglected issue in housing, especially in developing countries is the challenge of environmental sustainability. Environmental sustainability is concerned with such issues as resource use and efficiency, energy efficiency as well as emissions control from the housing sector (Akinbani and Lawal, 2010). In the developed countries of Europe and America as well as in rapidly urbanizing developing countries, housing accounts for a sizeable portion of national energy consumption (Diacon, Yafai, Garcia and Williams, 2011; Akinbani and Lawal, 2010). In addition, housing affects environmental sustainability through material consumption and greenhouse gases emissions.

In order to respond to the challenge of housing affordability within the context of environmental sustainability, innovative strategies are needed as conventional approaches have been criticized for producing limited positive results (Adedeji and Fasakin, 2008; Olayiwola, Adeleye and Ogunshakin, 2005). The innovative strategies will aim at delivering affordable housing while simultaneously mitigating negative environmental impact of the housing units. Innovation in this sense refers to observable positive changes in housing delivery practices, technologies and processes which result in improvements in the environment as well as in the quality of life of the occupants who are usually the economically vulnerable groups in society (Diacon et al., 2011). Given the large population relative to limited land area, Lagos presents a good case for innovative housing.

Table 1: Location and Number of Lagos HOMS Projects.

S/NO	Location	Number of blocks	Number of Units
1	Igbogbo	22	264
2	Sogunro I	12	144
3	Sogunro 11	8	96
4	Shitta	3	36
5	Igando	41	492
6	Omole	7	84
7	Magodo	4	48
8	Lekki 1 and 11	15	180
9	Mushin	5	60
10	Ilupeju	10	120
11	Sangotedo	45	540
12	Agbowa 1 and 11	70	560
13	Ijora-Badia	-	1008
	TOTAL		**3,632**

The Lagos Home Ownership and Mortgage Scheme (Lagos HOMS) was established by Lagos State Government, Nigeria in 2012 and has been described as an innovative response to the ever increasing need for housing by the rapidly expanding urban population of Lagos (Alufohai, 2013). It was set up in recognition that one of the obstacles to affordable housing is the absence of an effective mortgage system; hence, in addition to providing housing units, the government is also providing funds for the mortgage facility (Lagos State Government, 2012). Drawing from experience in social housing provision as well as from the 2011 National Housing Policy, Lagos State Government intends to leverage on the Lagos HOMS project to lay a good foundation for affordable housing delivery. The scheme targets first time home-owners who have a steady source of income. Already, more than three thousand housing units are at various stages of construction in parts of Lagos (Table 1).

Against the background of huge resources expended in the Lagos HOMS projects and the need to provide a resource-efficient, affordable and sustainable scheme, this paper examines the design and construction methods employed for the Lagos HOMS projects with a view to identifying the innovative aspects that have implications for environmental sustainability.

CONCEPTUAL ISSUES AND RELATED LITERATURE

Innovation is an indispensable aspect of human progress as it connotes a conscious change in the usual way of doing things for the purpose of improved outcomes. It is central to economic growth, business competitiveness and overall quality of life (Ozorhon, Abbott, Aouad and Powell, 2010). Two broad forms of innovation exists namely process innovation and product innovation (Ross, Saunders and Novakovic, 2007). However, this classification is not rigid as product innovation is often accompanied by process innovation. Philips (1997) classified, innovation into technological innovation, which deals with products and services and non-technological or administrative innovation such as organizational and marketing innovations. The UK Department of Trade and Industry in its classification of innovation includes position innovation and paradigm innovation to the two broad forms of innovation namely process and product innovation (DTI, 2007). A building is both a product and the result of a process.

Innovation differs from one economic sector to the other in terms of what constitutes innovation and innovation metrics (DTI, 2007). In the manufacturing industry, innovation appears better established than in the construction industry. Even though the construction industry is a major economic driver, it tends to lag behind the manufacturing industry in terms of efficiency and innovation (Ozorhon et al., 2007). Building construction is partly manufacturing and partly services; hence the organisational context of construction innovation differs from that of manufacturing (Slaughter, 1998). Often, the rather narrow definition of construction which excludes pre-construction activities tends to limit the scope of innovation in the construction industry. A broad view of construction which includes building materials manufacturing, architectural and technical consultancy as well as project management is adopted in this paper in line with the position canvassed by Barrett, Abbott, Ruddock and Sexton (2007). In this regard, buildings are seen as products of an industrial process (Steven Winter Associates Inc., 2006).

Given the diverse nature of construction, studies on construction innovation have adopted different levels of analysis such as product, project, firm, industry and national levels (Dickinson, Cooper, McDermott and Eaton, 2005). In the literature (Ozorhon et al., 2010), firm-level innovations have received the most attention. However, most innovations in construction take place at the project level. While focusing on the project-level, construction innovation can be investigated at different stages of the building construction life cycle such as design, preparation, construction and maintenance (Ozorhon et al., 2010). The focus of this paper is on innovations at the project level with particular reference to design and construction methods.

Innovation at design stage according to Mattock (2008) is driven by a number of factors such as evolving client requirement and market demand, evolving aesthetic and social values, regulatory changes, cost and time efficiencies as well as competition. The above is corroborated by Ozorhon et al. (2010) who identified the drivers of innovation to include, in order of importance, performance improvement, environmental sustainability, end-user requirement, technological development, competition, regulatory framework and aesthetics. Design innovation is the foundation for innovation at the construction stage, Innovative design in the literature has focused on the following areas: land use efficiency including densification and brown-field utilisation (Baing, 2011; Rerat, Soderstrom, Piguet and Besson, 2009); energy efficiency in terms of passive and active designs as well as use of low-energy materials (UNHABITAT, 2011); water conservation (Marinho, Goncalves and Kiperstok, 2013); use of locally available and low-energy sustainable materials (Adedeji, Taiwo, Olotuah, Fadairo and Ayeni,2013); and use of recycling (Adedeji and Ajayi, 2008; Oloto and Adebayo, 2012).

According to Ross et al. (2007), innovation in construction occur for a variety of reasons which include the desire to speed up the construction process, the need to improve productivity and quality and the need to improve efficiency through reduction of on-site, in-situ construction activities. Accordingly, innovative construction methods and management can be measured by the extent of adoption of lean construction strategies especially lean assembly (Ahiakwo et al, 2012; Koskela et al, 2002; Kim and Park, 2006; Olatunji, 2008). It can also be measured through the extent of adoption of dry construction methods as against wet construction methods (Andalib, Gharaati and Andalib, 2012; Ashkin, 2013; Wahab and Lawal, 2011). The use of locally available materials, use of composite lightweight panels as well as the use of prefabrication constitute another measure of innovation in construction (Adedeji and Ajayi, 2008; Fadairo and Olotuah, 2013; Ashkim, 2013).

Advantages of design and construction innovation include improved efficiency of the construction process, waste reduction in construction, cost efficiency including cost reduction, energy efficiency and resource efficiency. Hence construction and design innovation ties in with environmental sustainability in terms of resource efficiency, waste and pollution mitigation, control of dangerous emissions and boosting of recycling potential.

RESEARCH METHODS

The Lagos HOMS projects are still under construction and are yet to be occupied; hence the case study research design was adopted for the exploratory study. Two project locations were selected namely Sogunro Phases 1 and 11 as well as Igando because of their advanced stages of construction. The whole of Sogunro scheme and about 50 percent of Igando scheme are at the finishing stage. The selected cases also reflect the multi-agency implementation strategy adopted for the Lagos HOMS projects. While the Sogunro scheme is implemented by the Lagos State Development and Property Corporation (LSDPC), the Igando scheme is being implemented by the Lagos State New Towns Development Authority (NTDA). Both cases represent about 20 percent of the housing units currently under construction. Also LSDPC and NTDA are currently in charge of the construction of about 77 percent of the housing units under the Lagos HOMS project (Table 2).

Primary data were collected through observation and interview of key officials involved in the project. Specifically, six people were interviewed and they include a senior town planning officer with the Ministry of Physical Planning and Urban Development, a senior architect with the Ministry of Housing, a corporate affairs manager with LSDPC, LSDPC resident architect for Sogunro site, NTDA resident architect for the Igando project as well as a site engineer with HFP Ltd. The interviews were conducted both in the relevant offices and on site using semi-structured interview. The project sites were visited twice in November, 2013 to observe the construction activities. Secondary data were obtained from government publications on the project and from literature. It was not possible to obtain the architectural and other drawings of the project. However, the author was able to develop a schematic layout of the floor plan of the prototype building from the site visits (Figure 1). Data were analysed using content analysis and cross-case synthesis.

FINDINGS AND DISCUSSION

Planning and Design

The study found out that a prototype design was adopted for the buildings under the Lagos HOMS projects (Figure 1). The projects were planned and are currently executed by the Lagos State Government through the Ministry of Housing. However, the project implementation adopted a multi-agency approach; hence each implementing agency is allocated specific projects to facilitate prompt completion as shown in Table 2. The agencies employed multiple contractors for the works.
According to the LSDPC resident architect on the Sogunro project, the site for the project was part of an existing LSDPC estate, but the buildings were adjudged structurally weak and were demolished to make way for the ongoing construction. This means that the site was a brown-field. Similarly, the Igando scheme occupies a partially developed site originally allocated to the National Youth Service Corps (NYSC). The recourse to brown-field redevelopment in the two cases being studied is a sustainable land management option as it encourages conservation of green-fields. Smith (2008) underscored the importance of brown-fields redevelopment in contributing to urban internal expansion while limiting urban sprawl. Similarly, Mehdipour and Nia (2013) observed that brown-fields redevelopment is a sustainable urban regeneration strategy.

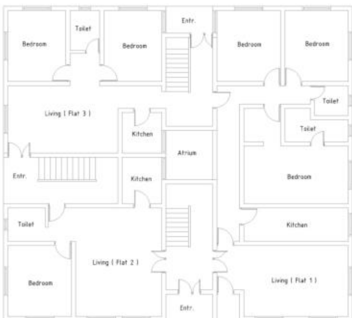


Figure 1: Schematic Floor Plan (Typical)

Table 2: Lagos HOMS Implementation Agencies

	Agency	Projects	Number of units
1	Ministry of Housing	Igbogbo	264 (7.2%)
2	Ministry of Physical Planning and Urban Development	Agbowa	560 (15.4%)
3	LSDPC	Sogunro 1 and 11, Shitta	276 (7.6%)
4	NTDA	Igando, Omole 11, Magodo 11 Lekki 1 and 11, Mushin, Ilupeju, Sangotedo, Badia	2532 (69.7%)

Source: Adapted from Jeje, 2013.

The prototype design comprises of 12 residential apartments (flats) on four floors. The minimum height of multi-family residential blocks as recommended by Lagos State Government is four in line with the densification programme for the city as a result of rapid population growth within a limited land area. This is in agreement with the position canvassed by Oduwaye (2013) to maximize land use, accommodate more people within developed areas, thereby reducing travel distances to existing administrative and business hubs. Densification of existing developments within an urban area is a sustainable urban regeneration strategy as supported by earlier studies (Christeler and Sall, 2008; Skovbro, 2001). Each floor of the prototype is made up of three apartments (1bedroom, 2bedrooms and 3bedrooms). There are three stair cases for the combined use of the occupants. Each block therefore accommodates mixed income dwelling units rather than previous government estates that have separate sections for low-income and medium-income dwellers.

According the Ministry of Housing official interviewed, the design was informed by the need to develop green buildings that are environmentally sustainable. The design therefore incorporated natural ventilation, natural lighting, use of energy saving bulbs as well as rainwater harvesting and storage for use in washing and watering of plants. Portable water is supplied to all the buildings from a central reservoir and distributed through roof- mounted water tanks. A good measure of ventilation was achieved in the building design. However, the living rooms of the one bedroom apartment and the two bedroom apartment have limited opportunity for cross-ventilation. The atrium introduced in the building is not large enough to encourage substantial air-flow. In addition, the almost square shape of the building posed a challenge for orientation to exclude direct rays from the sun. The use of shading devices is therefore inevitable in order to keep out the sun. No such shading was observed in the buildings as built; hence reliance on vegetation to provide enough shades becomes necessary especially as the lean-to roof overhangs are not deep and cantilevered floors which would have acted as wall shading are non-existent. The adoption of lean-to roof for the prototype building is advantageous in another sense; it reduces the roof footprint thus reducing the quantity of material used for roof covering and by implication the embodied energy component of the material.

Materials Specification

Materials specification for the project favoured conventional building materials as shown in the checklist of building materials and construction methods in Table 3. The building is essentially made up of concrete (both in-situ and precast) as well as wet masonry. No lightweight composite material is used in the buildings either as wall panels or as ceiling material. This is in spite of previous research findings to the effect that lightweight composite materials are faster and cheaper to construct (Ogundiran and Adedeji, 2012).

The building frame, walls are roof covering are made of energy-intensive building materials such as cement, steel, concrete and aluminum. High reliance on cement as a major building material makes the buildings less energy-efficient in terms of the embodied energy content of cement and cement-based materials. Given the high negative environmental impact of cement use in construction (Mukherjee and Vesmawala, 2013), the almost total reliance on portland cement for the Lagos HOMS construction work is not a sustainable option. There is need to adopt construction methods that would minimize the use of portland cement and other energy-intensive materials. In this regard, a number of alternative building materials that combine low embodied energy with speed of erection have been developed in Nigerian and they include interlocking bricks for mortarless wall construction, expanded polysterene panels for internal walls and composite building panels for walls and ceilings (Adedeji and Fadairo, 2012; Olukanyin, 2012; Ogundiran and Adedeji, 2012; Adedeji and Ajayi, 2008). However, availability of these alternative materials in large quantities is a major challenge.

Construction Methods

Mixed construction methods were identified in the cases studied. In-situ or wet construction methods characterize the buildings of the Sogunro Schemes 1 and 11. The Igando project combines in-situ and prefabricated construction methods. While the substructure, walls, columns and roof components adopted in-situ construction methods, the beams, lintels and slabs were prefabricated and hoisted into position by the use of cranes. Both cases are reinforced concrete framed structures while the external envelope and internal walls are made of hollow sand-cement blocks. From the foregoing, dry construction methods are applied only on a small scale in the projects.

The construction method adopted is, to an extent determined by the experience and pedigree of the construction companies involved. In the Sogunro Scheme, LSDPC the implementing agency, employed local contractors with limited capacity for deploying modern construction methods. In the Igando project, NTDA relied on HFP Ltd, an experienced high-end construction company with pedigree in prefabricated construction. Hence, construction equipment deployment at the Igando site is more than that of Sogunro. In addition to earth-moving equipments, one tower crane and two mobile cranes are fully deployed at the Igando site. Similarly, metal scaffolding is in use in Igando as against the bamboo scaffolding in Sogunro. Even though the labour intensive construction methods at Sogunro created a lot of ad-hoc jobs, it is less effective in terms of materials use and speedy completion. The implication of the above is that capacity for rapid delivery of housing units through the Lagos HOMS project is limited by the method of construction adopted.

Plate 1: Igando Scheme Showing Wet Masonry Walls

Plate 2: Igando Scheme Showing Hoisting of Precast Slab Panels

Energy Conservation

Energy conservation in buildings can be addressed at two levels namely the embodied level and the operational level. The embodied phase deals with the energy associated with building materials and construction methods while the operational phase deals with energy associated with the use of the building. Careful selection of building materials with preference for low-energy and low-carbon materials is the key to energy conservation at the embodied phase of buildings. In the Lagos HOMS project, energy-intensive building materials such as cement and cement-based materials predominate.

At the operational phase, energy conservation is achieved at the design stage through passive principles such as ventilation and use of atrium as well as through the use of energy-saving electrical fittings and fixtures. Active principles such as use of photovoltaic cells and use of inverter technology are not incorporated in the buildings. According to the LSDPC resident architect at the Sogunro site, each apartment is expected to provide its alternative energy source which may include the use of electricity generators. The generators are to run on either premium motor spirit (PMS) popularly called petrol or on automotive gas oil (AGO) also referred to as diesel which contribute substantially to carbon dioxide emissions from the building sector. In a study by Otegbulu, Osagie and Afe (2011), it was found that 91percent of survey respondents in Lagos use petrol-powered generators for electricity generation which increases carbon emissions from the housing sector. For the Lagos Homs project, diesel-powered electricity generators were recommended as additional backup to the street lights and communal facilities such as community meeting hall and laundry marts. According to Ministry of Housing officials, solar energy use is planned for street and garden lights within the estates.

Plate 3: Sogunro Scheme I Showing Bamboo Scaffold

Plate 4: Sogunro Scheme Showing Rendered External Walls

Process Innovation

The building procurement process followed conventional method as exemplified by use of wet construction processes. The adoption of lean construction processes such as lean assembly is limited. Resource efficiency is also hampered by the use of conventional construction processes. The adoption of low-carbon technology in public housing delivery according to the study is rather rudimentary. Similarly, the adoption of energy efficient processes for both materials production and use is still rudimentary.

CONCLUSION AND RECOMMENDATIONS

This paper examined the innovative aspects of the design and construction methods adopted for the Lagos HOMS projects with particular reference to the Sogunro and Igando project sites. The study revealed that the principles of environmental sustainability informed the adoption of brown-field regeneration, water conservation and reduced roof footprint in the design of the scheme. However, the construction method in use is inclined more towards wet, in-situ construction. Prefabrication is limited in its use. The huge housing deficit requires innovative strategies that will increase the housing stock rapidly and efficiently. The adoption of dry construction methods as well as the use of low-carbon materials will meet the expectation of affordability and environmental sustainability for the housing programme. In the light of the above, the following recommendations are made.

Adoption of Passive and Active Design Principles

There is need to fully incorporate passive design principles into modern housing design. The pressure for density increase should be moderated by the need to make buildings comfortable by harnessing natural attributes. In this respect, creative use of the courtyard idea to facilitate ventilation should be explored. Similarly, orientation of buildings to exclude direct solar radiation as well as maintaining adequate air space between buildings should be given adequate attention even in mass housing programmes. Passive design principles should be complemented by active principles such as use of photovoltaic installations to reduce dependence on fossil-based energy.

Use of Locally Available Low-energy Materials

The use of local building materials especially those that have proved to be sustainable should be encouraged in mass housing programmes. A lot of research has been done in the area of alternative building materials and their use in public housing projects can facilitate their uptake by other stakeholders in housing provision. In this respect, there is need to build capacity in the production of alternative building materials to made them readily available. Government policy can also be made to favour the use of local and low-energy materials.

Adoption of Dry Construction Methods

In order to respond very quickly to housing shortages, the advantages inherent in prefabrication and dry construction methods should be encouraged at all levels of housing provision. In this regard, construction companies should invest in relevant and appropriate technology. In repetitive projects such as mass housing, prefabrication of components in part or in whole should be encouraged to take advantage of the economy of scale.

Table 3: Building Components and Materials

Building Stage	Component	Material
Substructure	Pad Foundation	Reinforced concrete
	Strip Foundation	Concrete
	Wall in Foundation	225mm hollow sand-cement blocks
	Filling to level	Laterite
	Hardcore	Broken Concrete/Stone
	Ground floor slab	Concrete
Frame and Walls	Columns	Reinforced Concrete
	Beams	Reinforced Concrete
	Slab	Reinforced concrete
	External walls	225mm hollow blocks
	Main Internal walls	225mm hollow blocks
	Partition wall	150mm hollow blocks
Roof Structure and Covering	Wall plate	75 x 100 Hardwood
	Tie Beam	50 x 50 ,, ,,
	Rafters/struts	50 x 100 ,, ,,
	Purloins	50 x 75 ,, ,,
	Noggins	50 x 50 ,, ,,
	Fascia Board	25 x 50 ,, ,,
	Roof Covering	Long span aluminum
Finishing	Ceiling	PVC Tiles
	Internal walls	Rendering / Emulsion paint
	External walls	Rendering /Texcote paint
	Slabs	Rendering/ Emulsion paint
	Walls of wet areas	Glazed ceramic tiles
	Floor	Vitrified ceramic tiles
Doors/Windows	External Doors	Imported Steel Doors
	Internal Doors	Imported flush doors
	Windows	Aluminum/glass casement

Source: Field work, 2013.

REFERENCES

Adedeji, Y. M. D. and Ajayi, B. (2008), Cost effective composite building panels for walls and ceilings in Nigeria, *Proceedings, IIBCC,* Madrid, Spain, 5-7 November, 2008, 151-159.

Adedeji, Y. M. D. and Fadairo, G. (2012), Sustainable housing provision: Preference for the use of interlocking masonry in housing delivery in Nigeria, *Journal of Environmental Research and Management*, 3(1), 009 – 015.

Adedeji, Y. M. D. and Fasakin, J. O. (2008), Investigation of Acceptability Indices of Interlocking Masonry for Low-Income Housing in Nigeria, *Pakistan Journal of Social Sciences,* 5(2008), 696-706.

Adedeji, Y., Taiwo, A., Olotuah, O., Fadairo, G. and Ayeni, D. (2013), Low Carbon Construction Materials and Techniques for Sustainable Housing Development in Nigeria, *AEI 2013*, pp. 643- 651.

Ahiakwo, O., Suresh, S., Oloke, D. and Khatib, J. (2012), Client perspective for the implementation of lean construction in Nigerian construction industry In Laryea, S., Agyepong, S, A., Leiringer, R. and Hughes,W. (Eds.), *Proceedings 4th WABER Conference*, 24-26 July, 2012, Abuja, Nigeria, 133-146.

Akinbani, J. and Lawal, A. (2010), Opportunities and challenges to electrical energy consumption and CO_2 emissions reduction in Nigeria's building sector, Cities and Climate Change Workshop, Midrand, South Africa, 345-365.

Akinmoladun, O. I. and Oluwoye, J. O. (2007), An assessment of why the problems of housing shortages persist in developing countries: A case study of Lagos Metropolis, Nigeria, *Pakistan Journal of Social Sciences*, 4(4), 589-598.

Alufohai,A. J, (2013), The Lagos State 2010 Mortgage Law (Lagos HOMS) and the supply of Housing, FIG Working Week 2013 – Environment for Sustainability, Abuja, Nigeria, May 6- 10, 2013.

Andalib, H., Gharaati, M. and Andalib, M. S. (2012), Developing Dry Construction in Developing Countries: Ceiling Detail for Iran, In Ural, O., Sahin, M. and Ural, D. (Eds.), *Proceedings XXXVIII IAHS World Congress*, April 16-19, 2012, Istanbul. Turkey, 265-272.

Ashkin, R. (2013), Innovative Building Technologies - The Social Housing Angle. Paper presented at the Housing Africa 2013 Conference, August 14, 2013, Abuja, Nigeria.

Baing, A. S. (2011), The Future of Strategic Brownfield Regeneration in England- Between Urban Intensification and Green Infrastructure Provision In Schrenk, M., Popovich, V. V. and Zeile, P. (Eds.), *Proceedings, REAL CORP*, 18-20 May, 2011, Tagungsband, 1421- 1427.

Barrett, P., Abbott, C., Ruddock, L. and Sexton, M. (2007), Hidden Innovation in Construction and Property Sectors, *RICS Research Paper Series*, 7(20), RICS, London.

Christeler, S. and Sall, O. (2008), Urban growth without sprawl: Four examples in Genevese region, Paper presented at the 44th ISOCARP Congress on Urban growth without sprawl: a way towards sustainable urbanization, Dalian, China, September 19-23, 2008.

Daicon, D., Yafai, S. G., Gracia, M. and Williams, A. (2011), Innovation, Sustainability, Transfers: 25 Years of the World Habitat Awards, Building and Social Housing Foundation (BSHF).

Daramola, S. (2007), Affordable and functional housing in a developing economy: A case study of Nigeria, *Journal of Land Use and Development Studies*, 2(1),

Department of Trade and Industry, (DTI) (2007), Innovation in Services, Department of Trade and Industry, London.

Dickinson, M., Cooper, R., McDermott, P. and Eaton, D. (2005), An analysis of construction innovation literature, 5th International Postgraduate Research Conference, April 14-15, University of Salford, Salford, UK.

Fadairo, G. and Olotuah, A. O. (2013), Low-cost housing for the urban poor in Akure, Nigeria: Materials and techniques of construction, *Journal of Environmental and Earth Science*, 3(9), 135-142.

Federal Ministry of Lands, Housing and Urban Development (2012), Unleashing the Potential in Housing Sector as a key Contributor to Nigeria's Economic Development, Background Paper, Presidential Stakeholders Retreat on Housing and Urban Development, Abuja, November 12, 2012.

Ibem, E. O. (2010), An assessment of the role of government agencies in public-private partnerships in housing delivery in Nigeria, *Journal of Construction in Developing Countries*, 15(2), 23-48.

Ibem, E.O. and Amole, O. O. (2011), Assessment of the qualitative adequacy of newly constructed public housing in Ogun State, Nigeria, *Property Management*, 29(3), 285-304.

Jeje, B. (2013), Green Buildings and Low energy houses as adaptation tools for climate change in Lagos State, Lead paper, 5th Lagos State Climate Change Summit, 13-15 March, 2013, Lagos, Nigeria.

Kim, D. and Park, H. (2006), Innovative construction management method: Assessment of lean construction implementation, *KSCE Journal of Civil Engineering*, 10(6), 381-388.

Koskela,L., Howell, G., Galland, G. and Tommelein, I. (2002), The Foundations of Lean Construction In Best, R. and de Valence, G. (Eds.), *Design and Construction: Building in Value.* Oxford: Butterworth-Heineman.

Lagos State Government (2012), Lagos Home Ownership Scheme (Lagos HOMS). Avajlable at: www.lagosstate.gov.ng/pagemenus.php?p=106 and k=29. accessed 12th October, 2013.

Marinho, M., Goncalves, M. D. and Kiperstok, A. (2011), Water Conservation as a tool to support sustainable practices in a Brazilian public university, *Journal of Cleaner Production (2013),* http://dx.doi.org/10.1016/j.jclepro.2013.06.053. accessed 10th December, 2013.

Mattock, C. (2008), Design Innovation and Green Buildings. Available at: www.fpinnovations.ca/MediaCentre/Seminars/.../innovative-designs.pdf. accessed 12th December, 2013.

Mehdipour, A. and Nia, H. R. (2013), The role of brownfield development in sustainable urban regeneration, *Journal of Sustainable Development Studies*, 4(3), 78-87.

Mukherjee, S. P. and Vesmawala, G. (2013), Literature Review on Technical Aspects of Sustainable Concrete, *International Journal of Engineering Science and Invention*, 2(81), 01-09. Available online at: www.ijesi.org.

Oduwaye, L. (2013), Rezoning of Residential Areas as a Strategy for increased Housing Supply in Metropolitan Lagos, Paper presented at RC43 Conference, Centre for Urban Studies, the University of Amsterdam, 10-12 July, 2013, Amsterdam, the Netherlands.

Ogundiran, I. A. and Adedeji, Y. M. D. (2012), Urban housing delivery: Expanded polysterene panels initiative in Abuja, Nigeria in Laryea, S., Agyepong, S. A., Leiringer, R. and Hughes, W. (Eds.), *Proceedings 4th Waber Conference,* 24-26 July, 2012, Abuja, Nigeria, 1033-1042.

Olatunji, J. O. (2008), Lean in Nigerian Construction: State, Barriers, Strategies and Go-to-Gemba Approach, *Proceedings, IGLC-16,* 14-16 July, 2008, Manchester, UK.

Olayiwola, L. M., Adeleye, O. and Ogunshakin, L. (2005), Public housing delivery in Nigeria: Problems and challenges, *Proceedings XXXIII IAHS World Congress on Housing.* September 27-30, 2005, Pretoria, South Africa.

Oloto, E. and Adebayo, A. K. (2012), Building with Shipping Containers: A Sustainable Approach to solving housing shortage in Lagos Metropolis, available at www.tempohousingnigeria.com/.../sustainable. accessed 15th December, 2013.

Olukanyin, A. K. (2012), The lifecycle assessment of interlocking blocks and bricks in Laryea, S., Agyepong, S. A., Leiringer, R. and Hughes, W. (Eds.), *Proceds 4th Waber Conference*, 24-26 July, 2012, Abuja, Nigeria, 1123-1130.

Otegbulu, A. C., Osagie, J. U. and Afe, Y. O. (2011), The built environment perspective of climate change: A focus on household activities in Lagos Metropolis, *Journal of Sustainable Development*, 4(5), 174-187.

Ozorhon, B., Abbott, C., Aouad, G.,and Powell, J. (2010), Innovation in Construction: A Project Life Cycle Approach, Salford Centre for Research and Innovation in the Built Environment (SCRI) Research Report 4, University of Salford, Salford, UK.

Philips, R. (1997), Innovation and firm performance in Australian manufacturing, Industry Commission, Staff Research Paper, Canberra.

Rerat,P., Soderstrom, O., Piguet, E. and Besson, R. (2009), From Urban Wasteland to New Build Gentrification: The case of Swiss Cities, *Population, Space and Place.* Available at: www.interscience.wiley.com. Doi:10.1002/psp.595. accessed 15th December, 2013.

Ross, K., Saunders, G. and Novakovic, O. for NHBC Foundation (2007), Climate Change and Innovation in House Building: Designing out Risk, NHBC Foundation, IHS BRE Press.

Skovbro, A. (2001), Urban densification: An innovation in sustainable urban policy? Paper presented at the conference on Area Based Initiatives in Contemporary Urban Policy, Danish Building and Urban Research and European Urban Research Association, Copenhagen, 17-17 May, 2001.

Slaughter, S. E. (1998), Models of Construction Innovation, *Journal of Construction Engineering and Management*, 124(3), 226-231.

Smith, G. (2008), Contributions of brown-field development to urban internal expansion and urban renewal practice, 44th ISOCARP Congress on Urban Growth without Sprawl: A way towards sustainable urbanization, Dalian, China, September 19-23, 2008.

Steven Winter Associates Inc. (2006), Design Implications for Technology Innovation in Housing. Affordable Housing Research and Technology Division, Office of Policy Development and Research, US Department of Housing and Urban Development.

UNHABITAT (2011), Sustainable Building Practices for low cost Housing: Implications for Climate Change Mitigation and Adaptation in Developing Countries, *SICCMA Scoping Paper.*

Wahab, A. B. and Lawal, A. F. (2011), An evaluation of waste control measures in construction industry in Nigeria, *African Journal of Environmental Science and Technology*, 5(3), 246- 254.

Yates, J. and Milligan, V. (2007), Housing Affordability: A 21st Century Problem, National Research Venture 3, Australia Housing and Urban Research Institute.

INTEGRATED PROJECT IDEOLOGY AND PERCEPTIONS OF ITS BENEFIT TO THE SOUTH AFRICAN CONSTRUCTION INDUSTRY

Chris Allen[1] and John Smallwood[2]

Department of Construction Management, Nelson Mandela Metropolitan University,

The management of construction is a complex undertaking with many participants involved in successfully delivering the end product. An effective process is based on a collaborative, integrated, and productive team all working towards a single goal, but current project delivery, procurement, and contracts policies focus on using a Design-Bid-Build approach which creates fragmentation of the design and construction processes, marginalising performance and delivery, resulting in client dissatisfaction.In order to better understand the current trends in project delivery methods and the potential impact of new methods currently being implemented in other geographical regions, an exploratory study was undertaken focussing on project professionals involved in the delivery of construction projects in Southern Africa. The self-administered questionnaires attempted to identify user perceptions relative to the use of current project delivery mechanisms including contractual forms, as well as investigating the knowledge base surrounding alternative methodologies being implemented elsewhere.The research findings indicate that alternatives to design-bid-build are preferred, with develop and construct, partnering, and construction management being the most preferred contract delivery methodologies. Other findings include that the lack of coordinated design information impacts on the ability to deliver projects to program and a less fragmented and adversarial construction delivery process would improve client satisfaction levels. This speaks to the literature and in particular, is linked with some of the other highly regarded items, notably that a fragmented project team impacts on its' ability to effectively communicate and coordinate the project delivery requirements and that this inability to deliver projects on program creates adversarial relationships on projects. Furthermore, alternative delivery methodologies would enable an environment for improved contract delivery. In terms of conclusions, the findings indicate that the problems are inextricably linked and that project delivery systems that integrate processes will reduce waste, enhance delivery, and realise client satisfaction. The implication here is that there needs to be greater awareness placed on alternative forms of contract as those responding were using standard forms of project delivery due to the lack of awareness of alternatives.Recommendations include the use of appropriate forms of project delivery, the integration of design and construction, with specific attention being paid to the provision and awareness of alternative delivery methodologies, including contracts that integrate the delivery process.

Keywords: client satisfaction; integrated project delivery; alternate delivery methods

[1] chris.allen@nmmu.ac.za

[2] John.smallwood@nmmu.ac.za

Allen, C. and Smallwood, J. (2014) Integrated project ideology and perceptions of its benefit to the South African construction industry *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 371-384.

INTRODUCTION

The management of construction is a complex undertaking with many participants involved in successfully delivering the end product. An effective process is based on a collaborative, integrated, and productive team, however research findings such as those emanting from construction consultancy AECOM's 2012 Global Sentiment survey (Davis Langdon, 2013), indicate the majority of countries construction sectors currently operate in an adversarial, rather than a collaborative environment.

The division between design and construction teams as reflected in the number of RFIs per project, difficulty or lack of communication between contractor and architect, non-productive work including the contractors redrawing architectural details alongside the use of contracts where contractors are paid to be less efficient i.e. money is made in delay claims and extras, are all pointers to a system that is generally fragmented. "The reality is that traditional construction has always been characterised by the lack of cooperation, limited trust and ineffective communication leading to an adversarial relationship among project stakeholders." (Burger, 2008) It could be argued that current contract options constrain alternate project delivery methodologies and that a lack of understanding on the behalf of participants to the contract affect the ability to deliver on its requirements. "Despite a very strong willingness to collaborate, culture and awareness remain significant barriers to adoption." (Davis Langdon, 2013). Furthermore, the greater use of technologies such as Building Information Modeling (BIM), which are focussed on the digital integration of assets on a project, alongside a need to increase productivity in the construction industry, have focused stakeholders' attention on the relationship between the contract delivery method and form of contract entered into.

The reasons for the adversarial nature of the industry may be numerous, but focus has increasingly turned towards the type of project delivery method employed. Project delivery refers to the process "that delivers a quality project – on time and on budget – and, more often, takes a life cycle approach to ensure that the built asset is maintained over the long term."(KPMG, 2010). In particular, the use of traditional methods of procurement including design-bid-build and multiple prime contracting have been identified as not meeting the needs of clients. Specifically with these types of contract, the fragmentation of the design and construction process leads to claims from the contractor for additional compensation, which inevitably leads to an adversarial relationship between the various parties to the contract and in extreme cases, litigation. This is partly as a result of the assumption that the project leader, who may be the client or an appointed person acting on their behalf, has completely and accurately defined the scope of work through the design consultant prior to bidding the work. However, the nature of the business of construction and in particular, modern models of project funding, have necessitated the need to identify alternative approaches to project delivery. "In the United States, the public sectors' mandated use of a delivery system where the activities of design, construction and operations were segregated, or independent, from one another has shifted toward a more open framework where other alternatives are now permitted and implemented." (Garvin and Mahalingam, 2011).

Futhermore, and "Partly in response to the high cost of litigation" (KPMG, 2010), starting in the 1970's, alternatives to the traditional method, most notably in the form of design-and-build, partnering and public private partnerships, have become more common place. These delivery methodologies can collectively be termed collaborative or partnership approaches wherein there is greater interaction and communication between the professional and contracting teams and the project owner. As communication, "or rather the effectiveness of communication in construction teams, is a significant factor in the successful completion of projects" (Emmitt and Gorse, 2007), these models have therefore proven to be quite popular with project owners, particularly those who may have had poor project delivery results using traditional means. The biggest challenge "at this point in time is getting to the establishment of the appropriate legal relationship" (Kane, 2011). In order to address some of these inefficiences, owners, architects, construction managers, and even public sector entities in a number of countries, are moving away from traditional contractual models towards variations on integrated project delivery.

Integrated Project Delivery (IPD) can be defined as "A project delivery approach that integrates people, systems, business structures, and practices into a process that collaboratively harnesses the talents and insights of all participants to optimise project results, increase value to the owner, reduce waste and maximise efficiency through all phases of design, fabrication and construction." (AIA/AIACC , 2007) IPD promises a solution which can have a far reaching impact, not only on the ability of project teams to meet client expectations, but also to provide a platform around which technological upgrades and logistical improvements can be implemented to bring construction efficiency levels into the 21st century, which would be of particular benefit to the African continent as it embarks on a major infrastructure upgrade to meet the needs of its citizens in the future.

An exploratory survey was therefore conducted, the aim being to determine how project delivery can be enhanced, the objectives of the study being to determine the:

- Preference for project delivery methodologies;
- Extent to which various issues affect project delivery, and
- Preference for forms of contract.

LITERATURE REVIEW

According to Mbachu and Nkado (2007), in order to create and retain satisfied clients, service providers in the construction industry must meet the expectations and requirements of their clients in the delivery of projects. However, achieving this in an environment where projects are becoming increasingly complex, whether by the nature of the project deliverable or as a consequence of more complex financing arrangements is proving more challenging, especially within the confines of existing delivery models (Sappe, 2011).

The idea that a single individual can perform the role of a 'Master Builder' in today's complex operating environment is one that is being replaced with a recognition that project success relies on multiple participants working together to achieve a common goal. (Chinowosky, 2011) The inability of current teams to do this is highlighted by The Economist Intelligence Unit (EIU) report in 2009, which indicates that only 6% of projects are completed on time and within budget (EIU, 2009). This is engendered by the way projects are generally undertaken, namely using the competitive bid system with its inherent inefficiencies. The system is beset by change orders, waste, and duplication of effort (Kane, 2011). and the tendency to subcontract the majority of the specialist works to multiple organisations, which thereby increases the management and planning skills required of the construction management team. The coordination of 20 to 30 individual firms on a single project can and does quickly become highly complicated (Khanzode, 2012).

Public owners, however, are increasingly aware of the limitations of conventional delivery such as multiple points of responsibility, lack of design and construction integration and little to no lifecycle emphasis (Garvin and Mahalingam, 2011). How best to address this within the adversarial culture that exists on most project sites is one of the major areas of discussion within stakeholder forums, particularly when considering that the most dramatic changes to the construction industry has been the sharp increase in the incidence of serious conflict between the parties to construction contracts (Whitfield, 2012). Furthermore, it has been noted that a common thread at the root of these failures is the lack of early stakeholder involvement. (Tuminello and Dal Gallo, 2011), which is also linked to the way that the project teams are structured and how the independent entities interact (Tuminello and Dal Gallo, 2011).

The capability to capture and manage relations in the business network depends on how well the internal competencies and organisation are adjusted to mirror the business network (Ritter, 2000 as quoted in Windahl and Lakemond, 2006). In the majority of cases, contractors have over the past 30 years reduced employee head count to a minimum thereby focusing more on management contracting and subcontracting the bulk of the construction activities. This in turn creates an environment in which the loyalty and focus of employees to firms becomes clouded. A persons’ work performance is often disrupted by conflicting priorities, unclear project objectives, undefined deliverables, or overloaded resources, which are cited as probable causes for their lack of buy-in to a project (Busch, 2008). This in turn results in poor delivery on the part of the project team.

Furthermore, there is also a similar scenario playing itself out within the professional team, which in turn leads to a negative environment in which those involved in projects commence with inherent baggage. The underlying rationale is that influence on final project outcomes is greatest in the earliest phases of a project and problem resolution is easier where there is closer and early involvement of all parties. (Barlow, 2000). Hence the earlier that project teams evolve a team ethic, start interacting, and providing input with respect to the other members’ disciplines, the more likely improved project delivery is. In essence, early integration enables a team to deliver a higher performing building, on time, and within budget (Khanzode, 2012).

Service and product development as well as the development of business must be handled in an integrated manner. This results in a high demand for cross-functional cooperation., which by its very nature means that project members need to engage in an open and unencumbered environment (Windahl and Lakemond, 2006). An inherent conflict of interest is established by a prescriptive structure that assigns a disproportional share of risk to the contractor (Tuminello and Dal Gallo, 2011). However, it is asserted that current contractual agreements and methodologies achieve the opposite, and therefore clients and construction professionals are looking for an alternative. Not surprisingly, alternative project delivery approaches offer owners more choices to address such shortcomings and to better align objectives and stakeholder interests (Garvin and Mahalingam, 2011). It has been noted in project management literature that having alternative applications for resolving or preventing problems from marginalising the project team’s effectiveness is an effort worth exploring (Busch, 2008).

In order to drive project delivery forward requires a paradigm shift toward collaborative design and construction methods (Tuminello and Dal Gallo, 2011), including breaking down the barriers that currently exist within the project environment. The team should have a common access to information and support for decisions made. The team needs to build a climate of trust and individual team members should acquire a feeling that can influence results (Busch, 2008). In order to achieve this the use of alternative delivery methodologies should be considered. Effectively, any project delivery method, as defined, may be characterised at a fundamental level by examining the tasks required of the contracted service provider, and identifying where the responsibility for financing the tasks and managing the task interfaces rest(Garvin and Mahalingam, 2011). In addition, Kwakye (1991) referenced by Mbachu and Nkado (2007) identifies the choice of procurement approach as a critical determinant of successful project execution.

Owners, architects, construction managers, and contractors are dispensing with the competitive bidding process (Kane, 2011). In particular, it has been noted that since the beginning of the new century, clients, and contractors have focused on implementing alternative management techniques to the delivery of projects. The last decade has seen a drive towards lean construction techniques and IPD, including extensive use of building information modeling (BIM) and colloboration software, along with new organisational approaches (Khanzode, 2012). The need for this has been further highlighted by research that shows that better project coordination would alleviate construction’s major obstacles to better project performance. Many of the industry’s performance problems stem from inadequate inter-organisational co-operation (Barlow, 2000).

Integrated approaches involve contractual relationships that are quite different from traditional contract models. Modifying a non-integrated contract form to call for integration can be a challenge because approaches are very different (AIA/AIA CC, 2007). Therefore, there is a need to consider whether the existing contractual options available can be modified or whether an alternative form of contract should be implemented alongside an amended delivery mechanism. To this end IPD is a multi-party contract designed to incentivise the creation of value through a more equitable sharing of risks and rewards (Tuminello and Dal Gallo, 2011). This, therefore, addresses one of the main issues with standard forms of contract, which tend to differentiate between consultant and contractor responsibility including liability. Conflicting interests arise because project participants have differing goals and priorities, and risk is transferred down the supply chain to those who are generally least able to bear it (Barlow, 2000).

Furthermore, by creating an environment in which consultant and contractor are collectively held more responsible, a need arises to coordinate not just the terms and conditions but also the delivery process. In an integrated project, the project team is formed as close as possible in time to the project’s inception (AIA/AIA CC, 2007), which therefore allows the ability for each participant to integrate individual goals and objectives within the overall success criteria which is essential for project success (Chinowosky, 2011). By involving professionals from both the design and teams in the major decision making processes on a project, they are then empowered to take ownership of the delivery process. People become excited about contributing amplifying the need for a project culture that is conducive thereto (Busch, 2008). This in turn allows for the development of a team mentality wherein team members develop a better understanding of shared project goals and start making decisions for the good of the project (Khanzode, 2012). This sharing of goals and communication between team members forms the basis for an alternative contractual model aligned to these values. Creating an atmosphere and mechanisms that facilitate the adequate sharing of information between and among team members is essential to successfully implementing IPD (AIA/AIA CC, 2007).

Successful team operations rely on collaboration, which, in turn, relies on fluid and open communication (AIA/AIA CC, 2007). By creating a positive atmosphere with tools and environments in which open communication can occur, one of the primary stumbling blocks in current contract arrangements is immediately removed, in addition to the negativity that accompanies adversarial engagement. Collaboration requires a combination of trust and communication (Chinowosky, 2011). Aligned to this therefore, is a more collaborative team who are prepared to discuss challenges openly and to resolve those issues as quickly as possible, thereby generating further benefits for the project. Underlying these performance gains are the beneficial effects of improved communications on problem resolution, the development of inter-organisational and inter-personal trust, and the promotion of an innovation culture (Barlow, 2000). The best means to achieve this is a form of contract that places an emphasis on a shared responsibility, rather than on individual risk and reward. IPD is built on collaboration, which in turn is built on trust. Effectively structured, trust-based collaboration encourages parties to focus on project outcomes rather than their individual goals (AIA/AIA CC, 2007).

One of the other considerations that need to be borne in mind is that governments are looking for more efficient mechanisms with respect to the development of projects including new delivery mechanisms such as Public-Private Partnerships. The insistence on the traditional approach to procurement due mainly to familiarity, even in situations where this type of approach cannot guarantee the realisation of clients' objectives for the project may be a possible cause of unsatisfactory outcomes of the procurement process (Mbachu and Nkado, 2007). By bundling lifecycle advantages – linking construction of facility with service provision, placing the risk of lifecycle performance with a single party (EIU and AC, 1999), a client is seeking to generally create a more efficient delivery mechanism on the back of smaller budget allowances. There is a new public service paradigm where government focus on policy and project / supplier management allows the private sector to deliver most traditional public services (EIU and AC, 1999). The lighter, faster delivery mechanism where specialist delivery teams, using a Public-Private or other similar model, working in areas such as hospitals or schools, allow for not only savings in the cost of the project or programme, but also in the time it takes to deliver and quality, including the likes of improved energy efficiency. As referenced in the Integrated Project Delivery: A Guide, the United Kingdom's Office of Government Commerce (UKOGC) estimates that savings of up to 30% in the cost of construction can be achieved where integrated teams promote continuous improvement over a series of construction projects. Furthermore, they go on to state that single projects employing integrated supply teams can achieve savings of 2 -10% in the cost of construction.'

Traditional Project Delivery		Integrated Project Delivery
Fragmented, assembled on "just-as-needed" or "minimum-necessary" basis, strongly hierarchical, controlled	teams	An integrated team entity composed key project stakeholders, assembled early in the process, open, collaborative
Linear, distinct, segregated; knowledge gathered "just-as-needed"; information hoarded; silos of knowledge and expertise	process	Concurrent and multi-level; early contributions of knowledge and expertise; information openly shared; stakeholder trust and respect
Individually managed, transferred to the greatest extent possible	risk	Collectively managed, appropriately shared
Individually pursued; minimum effort for maximum return; (usually) first-cost based	compensation/ reward	Team success tied to project success; value-based
Paper-based, 2 dimensional; analog	communicatitons/ technology	Digitally based, virtual; Building Information Modeling (3, 4 and 5 dimensional)
Encourage unilateral effort; allocate and transfer risk; no sharing	agreements	Encourage, foster, promote and support multi-lateral open sharing and collaboration; risk sharing

Figure 1: *A comparison of Traditional vs Integrated Project Delivery (AIA/AIA CC, 2007)*

Major construction projects involve the integration of different subsystems and components by a range of participants who form a temporary coalition, which disbands after project completion (Barlow, 2000). This in itself appears to be at odds with a number of the aspects that have already been highlighted, not least that the knowledge built up and relationships formed within that team are lost for future projects. Research is increasingly demonstrating that performance and quality of output is linked to social aspects within the team including trust, reliance, and communication levels (Chinowosky, 2011). It is important, therefore, to create an environment of shared risk and reward whereby the individuals involved will want to continue to work in the interests of the collective. The answer to this challenge is to change the team perspective from a group of participants focusing on a project, to an integrated group of participants within a network (Chinowosky, 2011). In particular, it is important for the various individuals who work together on the same project, but represent separate, disparate organisations, to stay true to the vision of the project and to focus on delivering on that thereby sharing in the benefits of that process. The integrated environment also helps reinforce a project identity separate from the cultures of team members' respective firms (Khanzode, 2012). As a result, the need for a recognised delivery methodology and contract form that marries these ideals is paramount to achieving buy-in from the myriad of subcontractors likely to be involved as the project progresses.

In practice, IPD exhibits fundamental differences from traditional models in two primary areas - team assembly and project phasing/execution (AIA/AIA CC, 2007). Projects delivered traditionally suffer because participant success and project success are not necessarily related (AIA/AIA CC, 2007). In essence, although a collaborative environment in which a project is delivered may exist, if the team does not benefit equally in terms of the risk and aligned reward, many of the relationships certain contracts have been set up to achieve will not necessarily be achieved. Genuinely performance-enhancing relationships frequently involve clients, contractors and other suppliers engaging in some form of collaborative arrangement (Barlow, 2000). Research indicates that where teams regularly work together, they can achieve impressive results in a relatively short space of time. Some 'third generation' partnering relationships, where participants have undergone fundamental changes to attitudes, organisation and technology, demonstrate even greater benefits – 80% time savings and 50% cost savings (Barlow, 2000).

IPD builds off this by bringing all the key players – owners, designers, managers, contractors – to collaborate at the start of the project (Kane, 2011). This early engagement by the main players in the delivery process allows the various follow on phases to be shortened creating a more efficient and effective project. In addition to shifting design decision making forward, redefinition of phases is driven by two key concepts: the integration of early input from constructors, installers, fabricators and suppliers as well as from designers, and the ability to model and simulate the project accurately using BIM tools (AIA/AIA CC, 2007). This is best described by what is known as the MacLeamy Curve, which highlights the cost savings that can be achieved by completing the design process earlier as is likely to occur in an IPD project environment where greater involvement of the various consultant teams as well as main contractors is common.

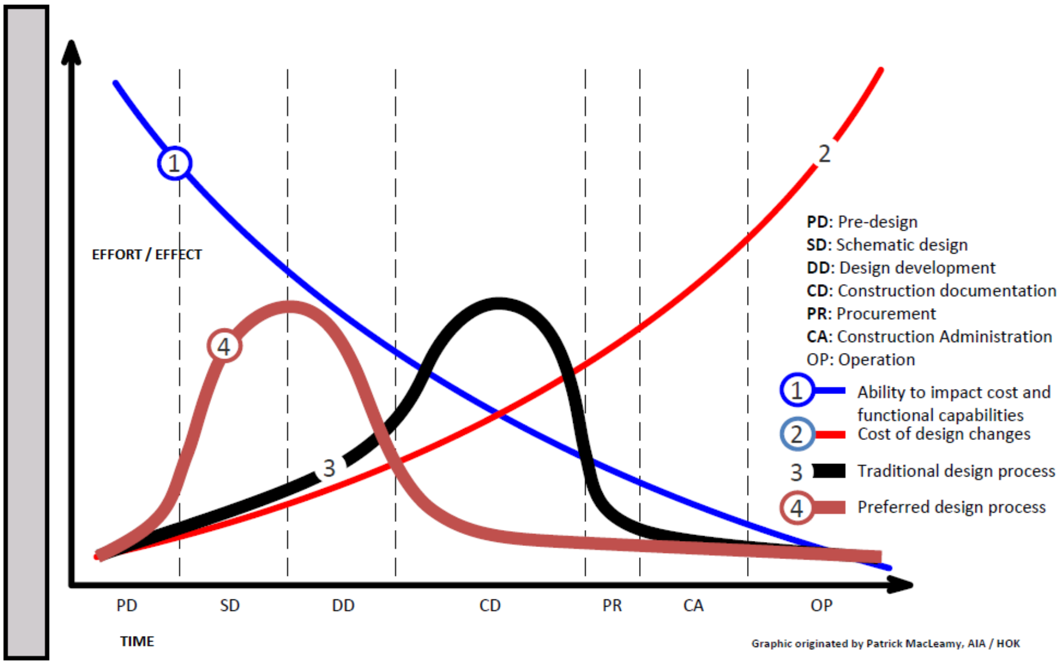


Figure 2: *MacLeamy Curve (WP-1202)*

In summary, it can be said that:

- Projects have become more complex as a result of the project delivery models employed and getting multiple organisations to work together as a team is fraught with challenges;
- Capturing and managing the business relationship is crucial to achieving a positive outcome which means earlier interaction and an increased level of information transfer between project participants is required which will go a long way to fostering a team ethic;

- Trust and collaboration are not best served by current contractual relationships and to this end an integrated delivery model encapsulates this new thinking even when it is enshrined in other methodologies such as Design and Build or Partnering;
- In order to achieve this a contract that meets these needs is required, providing the basis for greater sharing of project risk and improving on the barriers to effective communication, and a more positive outcomes based approach to delivery, and
- IPD provides positive value proposition for the three major stakeholder groups, namely, owners, constructors, and designers. Furthermore, through early collaboration and the use of BIM technology, a more integrated, interactive, virtual approach to building design, construction and operation is emerging. (AIA/AIA CC, 2007).

Reduced to its common functional elements, IPD is and should be defined by: early and more detailed planning and expanded identification of goals and criteria; design phase input / participation by contractors, manufacturers, and suppliers; non-design considerations during design (schedule, cost, construction products); technology based communication, planning and documentation, often using BIM as a base platform (Ericksen, 2010). For those who believe there is a better way to deliver projects this may provide the path to transform the status quo to a collaborative, value-based process delivering high-outcome results to the entire building team (AIA/AIA CC, 2007).

RESEARCH

Research method

The initial phase of the survey entailed the postal delivery of a self-administered questionnaire to the members of the Association of Construction Project Managers (ACPM). The questionnaire consisted of six questions, two of which were five point Likert scale type questions to determine their perceptions regarding current contract delivery methodologies as well as their views on a number of project delivery related challenges. The remaining four questions were open-ended, one of which solicited general comments. The mailing list consisted of 360 members, of which 5 surveys were returned. This was partly as a result of a nearly 10% return rate for addresses provided by the ACPM databases. In addition, the timing of the mailing of the questionnaires, shortly before the end of the calendar year, when project professionals are under pressure to complete projects, may have contributed to the poor response rate. It may also be construed that by not responding, the current status quo and allocation of risk be retained, which could be of benefit to a number of these ‘professionals’.

Subsequently 45 delegates attending the 1st CIOB / SACPCMP conference were surveyed using a self-administered questionnaire, with the return rate from this event much improved with 18 responses. These professionals could be deemed, by their presence at a conference to discuss the state of the construction management profession, as being more interested in adding to the body of ‘project delivery’ knowledge within the profession.

The data was analysed using MS Excel to compute frequencies and a measure of central tendency in the form of a mean score (MS).

RESEARCH FINDINGS

Table 1 indicates the preference of respondents for six project delivery methodologies in terms of percentage responses to a scale of 1 (least preferred) to 5 (most preferred), and MSs between 1.00 and 5.00. It is notable that 5 / 6 (83.3%) MSs are > 3.00, which indicates more preference as opposed to less preference. The project delivery methodology with a MS ≤ 3.00 is public private partnerships (PPPs). It should be noted that all six contract delivery methodologies promote IPD.

However, further interrogation in terms of MS ranges indicates that no project delivery methodology achieved a MS > 4.20 ≤ 5.00 – more than preferred to most preferred / most preferred. The project delivery methodologies ranked 1st to 4th have MSs > 3.40 ≤ 4.20, which indicates they are preferred to more than preferred / more than preferred: develop and construct; partnering; construction management, and design and build. Those ranked 5th and 6th have MSs > 2.60 ≤ 3.40, which indicates they are less than preferred to preferred / preferred: design-bid-build, and PPP.

Table 1: Respondents' preference for project delivery methodologies.

Project delivery methodology	Response (%)						Mean Score	Rank
	Unsure	Least……………………………………….Most						
		1	2	3	4	5		
Develop and Construct	11.8	5.9	11.8	17.6	23.5	29.4	3.67	1
Partnering	5.9	0.0	17.6	29.4	17.6	29.4	3.63	2
Construction Management	5.9	5.9	0.0	35.3	47.1	5.9	3.50	3
Design and Build	0.0	11.1	16.7	16.7	27.8	27.8	3.44	4
Design-Bid-Build	0.0	22.2	11.1	11.1	22.2	33.3	3.33	5
PPP	6.3	12.5	12.5	50.0	18.8	0.0	2.80	6

Table 2 indicates the extent to which respondents agree / disagree with 22 statements in relation to project delivery related challenges in terms of percentage responses on a scale of 'strongly disagree' to 'strongly agree', and MSs between 1.00 and 5.00. It is notable that all 22 MSs are > 3.00, which indicates more agreement as opposed to disagreement. The findings are summarised as follows. Lack of coordinated design information, a fragmented and adversarial delivery process, current conditions of contract, competitive tendering accompanied by the lowest bid 'paradigm', and poor constructability impacts on the ability to deliver projects.

Table 2: Respondents' views on the extent to which they agree / disagree with the statements

Statement	Response (%) Unsure	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean Score	Rank
The lack of coordinated design information impacts on the ability to deliver projects to program	0.0	4.5	4.5	4.5	54.5	31.8	4.05	1
A less fragmented construction delivery process would improve client satisfaction levels	0.0	0.0	9.1	13.6	45.5	31.8	4.00	2=
A less adversarial construction delivery process would improve the project delivery process	0.0	0.0	4.5	18.2	50.0	27.3	4.00	2=
The inability to deliver projects on program creates adversarial relationships on projects	0.0	4.5	9.1	9.1	45.5	31.8	3.91	4
Clients use existing contracting processes because they do not understand alternative options	9.1	0.0	18.2	9.1	27.3	36.4	3.90	5
A fragmented project team impacts on its' ability to effectively communicate and coordinate the project delivery requirements	0.0	4.5	13.6	13.6	27.3	40.9	3.86	6
Alternative delivery methodologies would enable an environment for improved contract delivery	4.5	0.0	9.1	31.8	27.3	27.3	3.76	7
The amount of non-productive work time is increasing on projects	9.1	4.5	4.5	27.3	27.3	27.3	3.75	8
No incentives exist to improve construction methodology using current contracts / contract delivery methods	0.0	0.0	18.2	13.6	45.5	22.7	3.73	9=
Reducing waste on site is integral to achieving energy efficiency targets in the construction process	0.0	9.1	9.1	13.6	36.4	31.8	3.73	9=
The form of contract is integral to the ability of a project team to deliver on time, budget, quality and meet Health and Safety targets	4.5	4.5	9.1	22.7	31.8	27.3	3.71	11
The amount of poorly coordinated issued for construction drawings is increasing	10.0	5.0	5.0	25.0	35.0	20.0	3.67	12
Lowest bid process creates an adversarial culture between bidding parties	0.0	4.5	18.2	13.6	36.4	27.3	3.64	13
Current contracts do not adequately address the constructability of design information	0.0	4.5	13.6	22.7	36.4	22.7	3.59	14
Waste management is related to a coordinated design and construction process	0.0	4.5	18.2	18.2	36.4	22.7	3.55	15
If clients understood alternative contract options, they would change the current preferred contract delivery method	4.5	4.5	4.5	31.8	45.5	9.1	3.52	16
Building Information Modelling (BIM) i.e. smart 3D models with data attached, will likely change the preferred delivery methodology	13.6	0.0	22.7	22.7	22.7	18.2	3.42	17
The competitive bidding process delivers adversarial projects	4.5	4.5	22.7	22.7	27.3	18.2	3.33	18
Current contractual options favour one or other team member to the detriment of the project	4.5	4.5	18.2	36.4	18.2	18.2	3.29	19
The Design-Bid-Build contract process creates a fragmented construction delivery process	4.5	18.2	13.6	22.7	13.6	27.3	3.19	20
Current contract methodology does not deliver to clients' requirements	9.1	4.5	27.3	22.7	22.7	13.6	3.15	21
Design-Bid-Build creates an adversarial relationship between design team and contractors	0.0	4.5	31.8	22.7	27.3	13.6	3.14	22

Adversarial relationships result from the inability to deliver projects on programme, and alternative project delivery methods are not used and competitive tendering accompanied by the lowest bid 'paradigm' results in fragmentation and adversarial relationships. Alternative project delivery methods accompanied by BIM, and the use of appropriate conditions of contract would enhance project performance, and prevent adversarial relationships.

Non-productive work, waste, and poorly coordinated drawings are issues that indicate a need for change.

Respondents were requested to indicate their organisation's preferred form of contract. Just less than a third of respondents are using the JBCC as the preferred form of contract, although a third provided none or no preference as their response. A similar number of respondents were using the other main forms of contract, namely the NEC, GCC, FIDIC and derivatives thereof, including contracts termed as design-build, rather than a generic form of contract.

Respondents were also requested to indicate their personal preferred form of contract. The majority of respondents stated that their preferred form of contract was the JBCC, although a third did not state a preference. For the other standard forms of contract, the numbers increased slightly from those whose organisations use it as a preferred form of contract, although in general the trend in responses was very similar.

Respondents were then requested to provide reasons for their preferred form of contract if the responses to the two aforementioned questions differed. There was no identifiable trend in responses as to the reason for a preference although client preference and integration of design, procurement and construction were the most prevalent reason for the choice of contract.

Respondents were also posed an open ended question 'Do you have any comments in general regarding an Integrated Project Ideology in the South African construction industry?' More than 50% of the respondents were positive with respect to an integrated project ideology within the South African construction industry, although the majority of those believed that the industry was not yet mature enough or needed other technical improvements, including the use of BIM, to increase the use of an IPD mechanism. Some of the comments are as follows:

"There are several delivery project mechanisms. Gov't needs to craft project delivery ideology to promote good project management, innovation and creativity."

"It has to come, but the professions, each with own registration councils, are agents of retardation."

"BIM - if it can demonstrate significant cost and time savings and delivery improvement, will be the biggest spur to changing adversarial relationships and preference for D-B-B."

"This will help the process of design delays experienced during the construction process."

DISCUSSION

The results indicate that adversarial relations develop as a result of the form of certain contracts and project delivery systems. This results from inadequate communication, fragmentation of contributions, unequal sharing of risk, separation of design and construction, and poor coordination, which in turn results in poor constructability, increased cost, schedule delays, non-achievement of quality, and waste. There is a preference for alternative project delivery methodologies in lieu of the traditional design-bid-build methodology, which invariably results in the lowest bid contractor being appointed. Thus contracts are not the sole issue in terms of delivering projects in an optimum manner, but the use of IPD mechanisms would have a positive impact on project delivery. Furthermore, the integration of design and construction is critical, which can also be enhanced by IPD mechanisms. With respect to forms of contracts, the JBCC form of contract is preferred. This is possibly attributable to it being the traditional form of contract, particularly within the building sector of the South

African construction industry. In general, the findings of the empirical study reflect those documented in international literature.

CONCLUSIONS

Based upon the degree of concurrence relative to the various statements, which were based upon the findings of the survey of the literature, the respondents can be deemed to be 'above average' in terms of their understanding and appreciation of the various issues pertaining to the use of IPD project ideology in the South African construction industry.

Given the number of responses the findings can best be described as an 'indicator' due to the study's exploratory nature, and a further study that includes for a wider group of project professionals including architects, quantity surveyors, and contractors as well as clients, needs to be conducted to draw further conclusions.

In terms of the aim of the study, namely to determine how project delivery can be enhanced, it can be concluded that appropriate alternative project delivery methodologies and appropriate forms of contract, accompanied by the use of IPD mechanisms such as BIM, could engender a project environment conducive to optimising project performance.

In terms of the first objective of the study, namely to determine the preference for contract delivery methodologies, it can be concluded that project performance and delivery is not optimised using current project delivery methods and forms of contract, which promote fragmentation and result in adversarial relationships.

In terms of the second objective of the study, namely to determine the extent to which various issues affect project delivery, inadequate communication, fragmentation of contributions, unequal sharing of risk, separation of design and construction, and poor coordination predominate, which in turn results in poor constructability, increased cost, schedule delays, non-achievement of quality, and waste. Alternative project delivery methods and appropriate conditions of contract, accompanied by the implementation of BIM will promote integration and coordination, which in turn will enhance project documentation, including drawings, and constructability.

In terms of the third objective of the study, namely to determine the preference for forms of contract, it can be concluded that the JBCC is preferred, which is likely to be attributable to its traditional use and lack of knowledge with respect to alternative forms of contract, which is in essence self-perpetuating. However, the status quo will remain if clients and other stakeholders are not 'educated'. Even then the status quo benefits certain stakeholders, particularly in terms of the transfer of risk, and therefore 'resistance to change' is likely to be experienced.

REFERENCES

AIA and AIA CC,(2007), Integrated Project Delivery: A Guide, version 1, American Institute of Architects, Washington.

Barlow, J., (2000), Innovation and learning in complex offshore construction projects, Research Policy, 29, 973-989.

Busch, J., (2008), Project Delivery Problems: Why can't we make them go away? PICMET 2008 Proceedings, 27-31 July, Cape Town, South Africa, 1410-1422.

Burger, W.,(2008), 'A collaborative relationship framework for construction subcontracting in South African engineered technology projects', MSc Thesis, Pretoria: University of Pretoria

Chinowsky, P.,(2011), 'A network and culture perspective on organization management', In: Chinowsky, P. and Songer, A. (eds.), Organization Management in Construction, Oxon., Spon Press, 130 - 153.

Davis Langdon, (2013), 'Blue Book 2013 – Collaboration: Making Cities Better', AECOM Australia, available from www.aecom.com

Ericksen, D., (2010), A sustainable standard of care? Managing evolving and innovative products, processes and performance standards in design delivery, Severson and Werson, San Francisco. Downloaded from the AIA Trust: http://www.theaiatrust.com/whitepapers/sustainable/

Economist Intelligence Unit Report,(2009), Closing the gap: The link between project management excellence and long-term success, The Economist, London

Economist Intelligence Unit and Anderson Consulting,(1999), Vision 2010: Forging Tomorrow's Public-Private Partnership, EIU and AC: New York

Emmitt, S. and Gorse, C.(2007), Communication in Construction Teams, Taylor and Francis, London

Garvin, M. and Mahalingam, A.,(2011), 'Project delivery and financing: conventional and alternative methods', In: Chinowsky, P. and Songer, A. (eds.), Organization Management in Construction, Oxon., Spon Press, 130 - 153.

Kane, B,(2011), Partnerships changing design-build industry, Hartford Business. Downloaded from www.hartfordbusiness.com on 22/11/11

Khanzode, A.(2012), Making the integrated big room better, DPR Construction, San Francisco. Downloaded from www.dpr.com

Mbachu, J. and Nkado, R.,(2007), Factors constraining successful building project implementation in South Africa, Construction Management and Economics 25, 39-54

Sappe, R., 2011, Improving business performance in a project intensive world, Oracle, Redwood Shores

Tuminello, R. and Dal Gallo, L.,(2011), How IPD can help your project succeed, Daily Journal of Commerce. Downloaded from www.djc.com

Windahl, C. and Lakemond, N.,(2006), Developing integrated solutions: The importance of relationships within the network, Industrial Marketing Management 35, 806-818.

Whitfield, J, (2012), Conflicts in Construction, 2nd edition, Wiley-Blackwell.

INVESTIGATING THE IMPACT OF SITE ACTIVITIES AND CONDITIONS ON CONCRETE QUALITY BETWEEN IN-SITU AND PRECAST CONSTRUCTION METHODS

Wesley Solomons[1] and Jan Wium[2]

Department of Civil Engineering, Faculty of Engineering, University of Stellenbosch, South Africa

This paper investigates the differences in concrete quality by studying the impact of site activities and conditions. Aside from the literature, the data was also obtained by visiting a number of construction companies were visited where contractors were interviewed. The data obtained was used to design a survey which was sent out to a number of Construction management program (CMP) delegates. Total quality management tools were used to analyse the data such that differences between the two methods could be portrayed. The results of the analysis could be used to aid contractors in the planning phase of a project.

Keywords: concrete quality, quality management, in-situ construction,precast construction, durability

INTRODUCTION

Concrete structural frames may be constructed by using either cast in-situ or precast methods. With the cast in-situ method, these elements are constructed on the construction site as needed. Precast construction on the other hand is more like a production line. The elements are constructed in a precast yard in a systematic fashion and once completed; they are taken to the construction site where they are to be erected. On the other hand, elements can also be precast on the site and lifted into place.

On any construction project quality is an important deliverable. In the construction industry owners and clients desire a pristine level of quality of the product that conforms to the prescribed specifications. In concrete construction there are many factors that influence quality of a product and thus a contractor is exposed to many risks.

Durability, aesthetics and fitness for purpose are considered to be components of quality (Sousa and Voss, 2002: 94). A structural element conforming to these components can be said to have met the requirements of quality. Each of the components mentioned above have specific aspects to be investigated. These aspects include labour, management, subcontractors, safety, access and plant and equipment. Also, the attributes which influence them are of relevance. In this study an investigation is done to determine the differences between the quality of concrete from in-situ construction procedures and precast construction procedures in South Africa.

[1] solomonswesley@gmail.com
[2] janw@sun.ac.za

Solomons, W. and Wium, J. (2014) Investigating the impact of site activities and conditions on concrete quality between in-situ and precast construction methods *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 385-392.

Whilst the quality requirements in terms of concrete mix design may be well known and documented, the impact of site activities and conditions on quality is less known. This was investigated by studying which aspects influence the respective quality components and their consequences. Risk matrices have been drawn up and a ranking system was used to rank the quality aspects against the quality components.

Durability of concrete is determined by specifying, detailing and site practice (Addis, 2005: 51). Specifying relates to attributes such as concrete cover, steel spacing, consistence of the mixture and curing whereas detailing refers to specific information such as bar length of reinforcement, bar number and shape. There are a number of tests which are conducted on site to ensure that certain requirements have been met. These include compression tests and slump tests testing (Illston and Domone, 2001: 130). Emphasis is placed on specifying and detailing but hardly on the effects of site procedures and conditions. Site practice is the area in which this study will based. The procedures and site activities in particular will be investigated.

The purpose of this study is to make a comparison between the quality of concrete using in-situ and precast construction methods. The comparison could be used to aid a project team in deciding between construction methods during the planning phase of the project. The risk model could also be used to identify areas with major risk and to weigh the precast option against an in-situ option.

In this study, an investigation was conducted to determine how site procedures and certain parameters influence the concrete of quality. The intent of this investigation was to determine whether there are any differences between the in-situ and precast construction method. The results of the comparison will be assessed by using appropriate risk management tools. The assessment will enable the relevant parameters which influence quality to be ranked.

RESEARCH METHODOLOGY

Four construction companies, each with their own construction site, were visited. Contractors were interviewed and observations were made all on the subject of achieving quality. These interviews and observations formed the background for the development of the questionnaire survey. Since the study was focussed on concrete quality during the construction and not the design phase, this was a suitable manner to obtain information for the survey.

In doing so, expert opinion could be obtained from a contractor’s perspective. As the study focuses on quality in the construction industry, all the questions in the questionnaire were formulated according to the topics addressed in the interviews. The nature of the research survey is however exploratory and thus the results and conclusions drawn represent groundwork which may be used as a basis for further studies. The companies visited included those involved in in-situ concrete construction, precast construction, and in general concrete repairs. For this purpose, the visits included Cobute, a company specialising in precast concrete construction for multi-storey buildings; Murray and Roberts (Buildings and Roads and Earthworks divisions), one of South Africa’s leading construction companies; and Botes and Kennedy, a company specialising in repair work and general construction work.

This precast company specialises in lightweight structural elements for multi-storey buildings. The precast concrete shutters are manufactured and become part of the final product and thus their method of construction can be seen as an innovative solution to the building industry. Once the interview had been conducted and observations had been made on site, lessons were drawn to be used further in the study. It was first identified that there are certain attributes of labour which may determine on quality in concrete construction. These attributes are:

- Level of skill and experience may determine their ability to understand the scope of the works;
- Training can improve the abilities of labourers;
- Casual labour presents an unskilled group of individuals and therefore they may fail to understand the importance of meeting the requirements of quality;
- Human attitude of an individual influences the level of competency in which a task is carried out thus overall quality will be impacted by it.

Plant and equipment used in the construction process may also impact the quality of the concrete. These attributes of plant and equipment are:

- Choice of Formwork system;
- The quality of the Shutter boards and the number of uses.

Durability of concrete is an important deliverable which determines quality. There are certain attributes which may impact the **durability** of the concrete. The experience by Cobute is that concrete bleeding is an important attribute which determines durability.

A number of employees namely; engineers, site agents and foremen were interviewed at the Portside Building site of Murray and Roberts in Cape Town. The information obtained from this visit is described below. It was found that high traffic volumes in the CDB and limited space may play a role in achieving concrete quality. The aspect of access may be influenced by the following attributes;

- As the building increases in height, a combination of effects such as; lengthy travel times of the concrete truck and limited crane usage, may influence the quality of the concrete;
- A confined working space, such as working on an incline, may limit the ability to achieve adequate concrete quality;
- Locations such as CDB's create logistical problems;
- Distance to the closest supplier.

In addition, it was found that **Management** decisions dictate quality. The attributes which may influence this aspect are;

- Communication from top to lower management throughout the construction period is vital in the process of achieving quality;
- Construction method/technique.

Furthermore, **labour** may negatively influence the quality of the product due to incompetency or lack of understanding. Labour may thus be influenced by the following attributes:

- A labourer may be sent on a course to specialise in erecting formwork or steel fixing. Training of this nature may improve procedures and thus minimise quality defects of concrete;
- The level of skill of a labourer may influence his ability to understand and grasp the construction technique;
- Human attitude of an individual could compromise the spirit within a team and effect workmanship;
- Non-conformance will lead to poor quality.

Subcontractors are utilised to carry some of the risk on a project. They thus also influence the quality of the overall product. The attributes, which have been identified, are:

- Interpretation of the scope of work may determine whether the requirements of quality are met;

- Level of skill and experience of the subcontractor may influence the quality of the work

The component durability of the concrete may be influenced by the following attributes namely:

- Consistency of the mix
- Mix design
- Moisture content (aggregates)
- Bleeding
- Grout loss
- Steel spacing
- Compaction

Similarly, there are certain attributes which may impact the component aesthetics of the concrete. These attributes are:

- Grout loss
- Consistency of the mix
- Kicking of formwork

Similarly, a number of employees namely; engineers, site agents and foremen were interviewed at the bridge site by Concor near Colchester. The information obtained during these interviews on concrete quality were synthesised and lessons were drawn as described below

Deciding when to pour concrete or which technique to use is determined by management. **Management** decisions thus have the potential of influencing overall quality. The attributes which may influence this aspect are;

- Where both precast and in-situ construction methods are used, coordination is vital as precast elements need to match up and fit between or on the in-situ constructed elements;
- Planning is important especially where both in-situ and precast construction methods are utilised. It is important that access be taken into account during the planning phase;
- Changes in scope of the work sometime occur. Rescheduling is then needed and it is important that management deal with this change accordingly as it may impact concrete quality.

Certain attributes of **labour** may influence the effect that labour has on achieving quality in concrete construction. The aspect labour may be influenced by:

- Level of skill of an individual may determine the level of quality of the finished product;
- Understanding of the technical requirements may be achieved through the use of training.

Plant and equipment used in the construction process may influence the appearance of the finished product. The attributes which may influence plant and equipment are;

- The operator controlling the, Machinery (cranes) determines whether precast elements can be placed free of damage. Elements which are damaged in the process are subjected to rework.
- Quality and the number of times the shutter boards may be used will determine the quality of the finish.

The aspect safety, especially when it involves working at height and using cranes, may compromise quality of the product. The attributes which may influence safety have been noted during the site visits and are as follows:

- Experience of crane operator comes into being when conditions are unpredictable and precast elements are to be placed. Unsafe operations may result in damage to the constructed elements;
- Risk identification is the process whereby potential risk which may influence quality of the concrete elements should be identified;
- During toolbox talks, safety procedures are discussed and in addition, all areas which are problematic is discussed between management and the workforce;
- Pre-task planning can aid identification of safety risk. Practicing safe acts may promote precision work.

Durability of the concrete may be compromised by steel spacing.

Fitting up of completed elements is determined by the tolerances of the respective components. There are certain attributes which may impact the component **fitness for purpose** of the precast concrete element. The attributes by which fitness for purpose is influenced are:

- Product tolerances are related to the dimensions of the element;
- Erection tolerances involves fitment of the element into the designated area;
- Interfacing tolerances refers to the elements which surround the individual element.

The interview conducted at Botes and Kennedy was focused on specialised repair work of precast and in-situ constructed buildings or bridges. The information obtained from this visit is given below.

The aspect plant and equipment used in the construction process may impact the quality of the concrete with the attribute being quality of shutter boards. Labour may influence achieving quality in concrete construction, with the attribute being training. Access may impact the quality of concrete during the construction phase with the attribute being working t heights. There are attributes which may impact the component durability of the concrete. These attributes have been identified through the interviews and are:

- Compaction
- Concrete cover
- Cube strength
- Steel spacing

Similarly an attribute which impacts the component aesthetics is kicking of the formwork.

Following the interviews a survey was conducted to enable the ranking of the attributes of concrete quality. The survey conducted in this study was exploratory and the results are thus informative and can be used as a basis for future studies.

Table 1 below represents a summary of the results obtained in the survey for both precast and in-situ construction methods with the components of quality, the aspects of quality and their attributes. After the weighting was applied to the results, the significant areas were identified and are represented by the symbol "*" in Table 1.

In order to successfully design a comparative survey, a combination of total quality management tools was used to design the survey namely matrix analysis, paired comparison and a rating and ranking system. By using these tools in conjunction with each other, a survey was designed and sent out in the form of an excel spread sheet. The questionnaire was distributed to 53 professionals including contractors, clients and contract managers. Of the 53 professionals, 19 returned were comprehensively completed questionnaires constituting a response rate of 36%. A combination of the literature and the site visits had been used as a basis to formulate the questions in the survey.

Table 1: Summary of Result of Survey

Aspects of quality	Components of quality					
	Durability		Fitness for purpose		Aesthetics	
	Precast	In-situ	Precast	In-situ	Precast	In-situ
Access Working height, location, working space, distance to closest concrete supplier	*	*				
Labour Training, level of skill, non-conformance, human attitude	*	*			*	*
Management Drawing revisions, coordination, communication, planning			*		*	*
Subcontractors Interpretation, construction method, knowledge of operation					*	*
Safety Task planning, risk identification, toolbox talks					*	*
Plant and Equipment Machinery, shutter boards, formwork systems					*	*

Data analysis

The participants invited to take part in the questionnaire survey were from leading construction companies around South Africa. These companies included Murray and Roberts, Wilson Bailey Holmes-Ovcon (WBHO), Stefanutti stocks, Haw and Inglis, Basil read, Grinaker LTA, Afristruct, Exeo construction, King Civil Engineering contractors, Ubume Construction and Civil and Cobute. Aurecon, a consulting company, was also asked to respond but from the perspective of a contractor. The information obtained from the surveys can be seen as information received from specialists. The data produced in the survey was analysed using qualitative techniques namely ranking and rating. As aforementioned, the survey was exploratory in nature, the response rates of these surveys are generally low and thus a qualitative approach was used rather than a quantitative one. Once all the surveys had been received from the respondents, a weighting was applied to each of the respondents' ranking. In doing so the values in each survey could be added together such that one matrix would represent the total effect of all the respondents. This approach was applied for both the precast and cast in-situ scenarios. Each of the matrices (precast and in-situ scenario) were prioritised by using a prioritisation table. The prioritisation table prioritises the aspects which are most likely to have the biggest influence on the respective quality component. The results obtained once the matrices were prioritised are shown in Table 2 and Table 3 below. Table 2 and Table 3 represent a condensed form of the survey spread sheet. The aspects of quality are found on the vertical axis whereas the components of quality are found on the horizontal axis.

In Table 2 and Table 3 above, the "underscore (_)" represents a low priority, the symbol "◊" represents a second priority and the "black dot" represents a first priority.

An analysis was conducted by performing a horizontal (line-by-line) analysis and a vertical (column-by-column) analysis of the Table 2 and Table 3.

Table 2: Summary of in-situ results after prioritisation

	Durability	Fitness for purpose	Aesthetics
Access		_	_
Labour		_	◊
Management	◊	◊	
Subcontractors	◊	_	
Safety	_	◊	
Plant and Equipment	_	◊	

Table 3: Summary of precast results after prioritisation

	Durability	Fitness for purpose	Aesthetics
Access		_	◊
Labour	◊	_	◊
Management	◊		◊
Subcontractors	_	_	
Safety	_	◊	
Plant and Equipment	_	◊	

CONCLUSION

The analyses indicate that durability has fewer risks for the precast solution than for the in-situ solution since labour does not play an important role in the case of the precast solution. It may be deducted that achieving durability is better for precast than for in-situ construction. Thus when durability is considered to be a high priority for a specific project, the decision to use the precast option would be more beneficial to the contractor. According to Table 2 and Table 3 above, Fitness for purpose, which involves erecting and fitting of the elements does not concern the in-situ scenario therefore this particular risk does not influence the quality for the in-situ solution. This is however not the case for the precast solution. When working in confined spaces it may thus be a better option for the contractor to select the in-situ solution. This may also apply if the tolerance quality on associated in-situ works may be of reduced standards. Aesthetics on the other hand is a high priority for both the in-situ and precast solution. Access however plays a bigger role for the precast solution than it does for the in-situ solution.

The conclusions drawn from the results in the study represent ground work and could be used as a basis in future studies as part of a quantitative study. It will be necessary to investigate the specific issues related to aesthetics for both construction methods. By considering the specific conditions for a given project, the results of this study will serve as an aid to a project team when a decision is required on the construction concept to be used, being either precast or in-situ construction.

REFERENCES

Addis, B. 2005. Fundamentals of Concrete. Midrand: Cement and Concrete Institute.

Addis, B.J. 1986. Fulton's Concrete Technology. Midrand: Portland Cement Institute.

Anderson, L. 2012. Personal Interview. 6 November, Colchester.

Angelucci, A. 2012. Personal interview. 17 August, Cape Town.

Angelucci, A(junior). 2012. Personal interview. 17 August, Cape Town.

Botes and Kennedy. 2013. [Online]. Available: http://www.botes-kennedy.co.za [2013, February, 28].

Blackledge, G.F. and Binns, R.A. 2002. Concrete Practice. British Cement Association.

Gutt, T.J., LaNier, M.W., Nighawan, J., Schneider, J.A., Wilden, H., 2010. Tolerances for precast and prestressed concrete construction.

Harris, F., McCaffer, R., Edum-Fotwe, F., 2006. Modern construction management, sixth edition. Blackwell Publishing.

Ibbetson, A. 2012. Personal interview. 31 October, Durbanville.

Illston, J.M. and Domone, P.L.J. 2001. Construction Materials third edition. Spon Press

Lagrange, H. 2012. Personal interview. 30 October, Cape Town.

Michaelides, M. 2012. Personal interview. 30 October, Cape Town.

Mikkelsen, H. 1990. Quality of project work and project management. Volume 8 No 3 August 1990.

Mitropoulos, P., Memarian, B. 2012. A framework of teamwork attributes affecting workers safety. Construction research congress 2012 ASCE, 1400-1409.

Murray and Roberts. 2013. [Online]. Available: http://www.murrob.com [2013, February 25]

Nortjie, J. 2012. Personal interview. 8 November, Colchester.

Pheng, L.S., Chuan, Q.T., 2005. Environmental factors and work performance of project managers in the construction industry. International Journal of project management 24 (2006) pp. 24-37.

Republic of South Africa (1982). South African Bureau of Standards 1982. [Law] Pretoria.

Robyn, E. 2012. Personal interview. 30 October, Cape Town.

Ronne, P.D. 2006. Variation in cover to reinforcement: Local and international trends. BKS(Pty)Ltd, 1-11.

Rwelamila, P.D., Wiseman, G.T. 1995. Concrete quality management: a research study of the general contractor in South Africa. Construction and Building Materials 1995 Vol.9 No.3, pp. 173-183.

Sousa, R., Voss, C.A. 2001. Quality management re-visited: a reflective review and agenda for future research. Journal of operations management 20, pp. 91-109.

Swanepoel, W. 2012. Personal interview. 30 November, Cape Town.

Van Niekerk, M. 2012. Personal interview. 8 November, Colchester.

INVESTIGATING THE RELATIONSHIP BETWEEN THE AGE-STAGE DEMOGRAPHIC AND PREFERENCES IN DWELLING TYPE

Agyepong, S. A.[1] and Wuni, A.W.
Department of Business Administration, Ashesi University College, Berekuso, Ghana

Real estate developers will mainly segment their market based on the income level demographic. However, this demographic factor is not the only one that matters. Of a number of factors including lifestyle, income level, culture and the age stage, the age-stage of the dwelling owner motivated this research. This was due to its direct linkages to the dwelling type requirements of the dwelling owner. To investigate the existence of a relationship between the age-stage demographic of individuals and their preferences in residential dwelling type within the Greater Accra Region of Ghana, a preliminary research sampling one hundred and forty (140) dwelling owners within the Adenta Municipality was conducted. By adopting the stratified random sampling method, respondents were randomly selected based on 5 age-stage categories: young adults, adults, lower middle adults; upper middle adults and independent elders. A closed ended questionnaire was administered to investigate the possible existence of this relationship and the reasons why the respondents preferred the particular type, to serve as the basis for a larger study. The investigation concluded that, there is a relationship between the age-stage of a householder and their preferred residential dwelling type. The dominant preference of each main age-stage is further influenced by the income level of the respondents, which directly affects other dwelling place price factors.

Key words: dwelling type, age-stage, demographics, owner preference

INTRODUCTION

Hablemitoğlu, Özkan and Purutçuoğlu (2010) proposed that, housing, which provides physical sheltering, is one of the basic needs of human beings. According to them, it also addresses all needs included in Maslow's (1954) well-known hierarchy of needs: physiological, safety, belonging, esteem and self-actualization. Hablemitoğlu, Özkan and Purutçuoğlu (2010) define housing as a social, psychological and emotional place perceived as the tool for individuals to settle and sustain their existence across generations. Juboye and Ogunshakin (2010) defined housing as a permanent structure for human habitation, which has become a critical component in the social, economic and the health fabric of every nation. According to these authors, its history is thus inseparable from the social, economic, cultural and political development of man.

Overtime, the provision of housing has been met in the form of dwellings which are temporary or permanent, natural or adapted (Ojo, 1998). Subhan and Ahmad (2012) and Huang (2000) suggest that, there are several demographic, social and economic factors that affect the dwelling place preferences of individuals. These authors identified and described

[1] sagyepong@ashesi.edu.gh

Agyepong, S. A. and Wuni, A.W. (2014) Investigating the relationship between the age-stage demographic and preferences in dwelling type *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 393-403.

four main factors: personal, social, physical demographics and cultural demographics. They described Personal demographics to include factors that are as a result of the individual's own personality: example age-stage, socio-economic status, gender-social role, personality-values, comparisons, and dreams for future. Social issues, which also affect the dwelling preference, are as a result of external forces the individual is exposed to: neighbours, norms, others' preferences, and the shape of privacy-security-social interaction. Physical demographics which have to do with attributes of the physical building itself include housing quality, housing form, architectural style, and interior and outdoor areas. The last, cultural demographics refer to the influence that culture has on an individual's choice on a residential dwelling.

Reynolds (1997) stated that, wants and needs for housing, hence the choice of dwelling place to fulfil this need, change over time as events occur that cause adults to re-examine their living environments. She described such events to include marriage, raising families, career promotion amongst others, and explained that as people grow older, they continue to reassess these choices, and make changes accordingly. These are the events that describe the age-stage of an individual.

The age-stage therefore could be said to be one of the primary motivator dwelling preference of a dwelling owner: it is what pushes people to make changes in their lives like moving out of their parents' houses, getting married and having children. It could therefore define to a large extent, what a household will require, with respect to dwelling preference. It is in this vain, that this paper seeks to investigate the existence of a relationship between the age-stage of individuals and their preferred dwelling types within the Adenta municipality in Ghana. This information could be replicated and generalized to serve as a factor to be considered for market segmentation in housing development feasibility studies. Developers could draw from data sources such as census data, and the types and quantity of residential dwelling-types, and to identify areas with deficits so that these gaps can be filled.

THE CONCEPT OF DWELLING

A dwelling as has been explained by Jiboye and Ogunshakin, is a house, apartment or other place of residence where a person or a group of people live, and this fulfills their housing need. According to Coolen (2009), a dwelling forms the primary anchor for many individuals in the environment and provides some primary functions such as concealment from the external environment and shelter.

Over the years, it has been established by social researchers that, a dwelling plays a very important role in the lives of human beings. According to Heblemitoglu, Özkan and Purutçuogl (2010), housing which provides physical sheltering, is one of the basic needs of human beings and it addresses all the needs identified in Maslow's heirarchy. The Table 1 below summarizes how these authors compared the requirements of Maslow's hierarchy versus the housing characteristics that form the basis for dwelling type preference. According to the authors, the group into which any prospective buyer falls depends on his available budget for housing, life experience, family status, and lifestyle aspirations: what they describe as their life-stage.

Table 1: Abraham Maslow's Hierarchy of Needs versus Housing Characteristics

Hierarchy of needs	Dimensions of housing characteristics		
	Physical	**Social**	**Economic**
Physiological	Sound structure offering	Location convenient to employment and	Lowest possible cost

Hierarchy of needs	Dimensions of housing characteristics		
	Physical	Social	Economic
	basic facilities	transportation	
Safety/security	Adequate privacy for family unit	Freedom from environmental hazards and uncertainties of rental market	Ability to exercise control over home environment
Belonging	Adequate privacy for each individual	Socially compatible neighbours	Acceptance into a community of other home owners
Esteem	Attractive home design and landscaping	Prestige address	Pride in owning an asset with appreciation potential
Self-actualization	Facilities for vocational pursuits	Proximity to aesthetic cultural and recreational interests	Expression of commitment to specific set of values

Source: Heblemitoglu, Özkan and Purutçuogl (2010)

DEMOGRAPHIC FACTORS THAT INFLUENCE CHOICE OF DWELLING TYPE

Demographic trends have a heavy influence on the demand for different types of dwelling. Residential dwellings could be categorized based on different characteristics including: number of rooms, nature of building: detached, semi-detached, story building, and the likes, and geographical location amongst others. Four key demographics, identified from the analysis of secondary data, were the lifestyle, income level, culture and the age-stage of the owner of the dwelling or head of household.

According to Beamish, Goss and Emmel (2001), the choice of dwellings is influenced by *lifestyle* demographic factors, and is based on the preferred way of living of the individual. According to them, the lifestyle of individuals could be influenced by factors like household type, social class and housing values. They described the household type factor as encompassing issues like age of the householder, type and size of household. The social class factors include education, income and occupation of the householder. Lastly, the housing values are made up of the values that tie in to that of the household. Examples given by Beamish, Goss, and Emmel (2001) are economic, family, personal and social values. These were all captured in their conceptual framework shown in Figure 1 below.

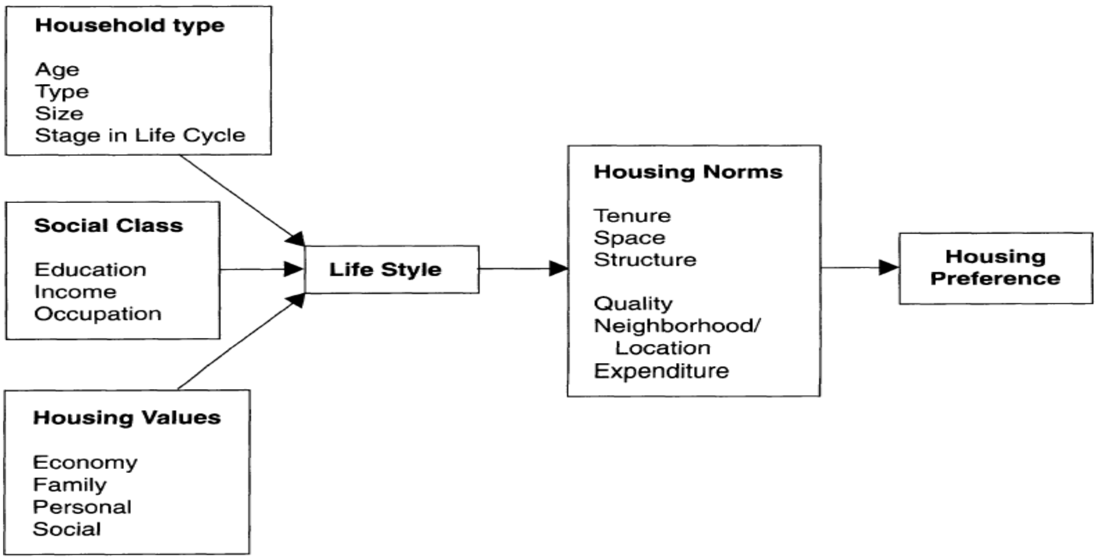


Figure 1: Lifestyle influences on housing
Source: Beamish, Goss, and Emmel (2001)

These authors explained that, a householder's housing preference could be based on their *income level*: money received, especially on a regular basis, for work or through investments. Wright (1979) theorized that, the income level could be defined by considering the different classes of people. Wright went on to define these classes as the lower class consisiting of the poor people; the middle class consisting of the middle income people; and the upper class being the rich people in the society. It could therefore be inferred that, owners of dwellings or heads of households, would prefer certain types of dwellings based on affordability considering their income. This inequality of income also gives rise to residential segregation where communities are formed based on the different classes of people.

Culture is one other demographic, which determines dwelling preference. Coolen and Ozaki (2004) defined culture as a system of inherited conceptions that are expressed in symbolic forms, by which a group of people communicate, perpetuate and develop their knowledge about and attitudes of life. They established that, the notion of culture offers a clear relationship between the reasons for their preferences for certain features in their dwellings and intentions of using domestic space in certain ways. Building on this, Dassah (2011) stated that, the use of space within and around housing is influenced in several ways by cultural forces. For instance, a culture that adopts the extended family system will have larger households hence will require dwellings that can cater for the needs of external family members who will all form one household. In the same vain, a nucler family inclined culture will require smaller dwelling spaces. Buttressing this point, Lee and Parrott (2004) established that the design and use of houses reflect cultural values and ideas of different individuals and therefore, people may have different levels of satisfaction with certain dwelling-types based on their cultural backgrounds.

The Age-stage Demographic

The *age-stage*, which is the focus of this paper, was described as another demographic factor that affects, defines and determines the dwelling preference of a household. According to Reynolds (1997), different events occur throughout people's lives from the early adult stage through marriage, having children, getting promotions at work, and retiring. The author further established that, as people go through the different age-stages, various events continue to occur that causes them to reassess their housing environments.

Steffanson (2012) conducted extensive research on this subject, in which he looked at the dwelling type preference of owners or heads of households in deciding on their age-stage. Figure 2 summarizes his findings on the relationship between the dwelling type preference and age-stage of dwelling owners in Denmark. Steffanson explained that, the findings from this report showed that individuals within the ages of 0 to 17 dwell mostly in the single-family house. The rationale here is as a result of them being very young and under the protection of their parents. From the ages of 18-29, the housing distribution is more inclined towards apartment dwellings: studio or two-bedroom apartment. This is as a result of them coming of age and moving out of their parent's house to college and/or finding jobs to fend for themselves. At this early adult stage, most individuals are not married and therefore are by themselves their own household. The ages from 30 to 60 mark the 'adult-stage' of an individual. At this stage, the average individual has a job, and a family of his own. Therefore the individual will have the need for a bigger residential space that will cater for the entire family, hence the increased demand for single-family dwellings. After the age of 60, the individual reaches retirement and his children would have moved out. With the decline in income-level, the aging of the individual and the increasing problems with mobility, most people within this stage go in for the smaller apartment dwellings where they can easily move around and do not have to stress themselves much with maintenance.

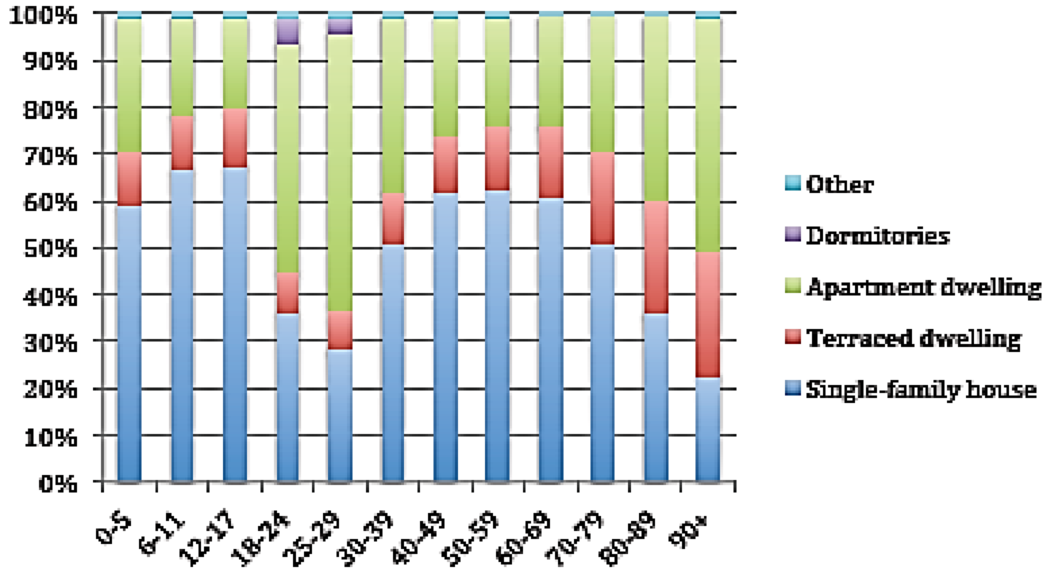


Figure 1.1 Age-stage and dwelling type preference
Source: Steffanson (2012)

This pattern provides evidence of the possible existence of a relationship between the age-stage demographic factor and dwelling-type, and provides some explanation as to the rational behind these preferences. A thorough search on secondary data within the local Ghanaian context showed that, this relationship has not been empirically proven to guide researchers and developers alike. The aim of this paper is thus to report on a preliminary investigation of the existence of this relationship, described in the theoretical framework outlined above, within the Ghanaian context, focusing on dwelling owners within the Adenta municipality. It will serve as necessary background information to support further investigation into this relationship and how other demographic factors moderates this relationship.

CONCEPTUAL DEFINITION: AGE-STAGE

Age-stages and their characteristics for the purpose of this research, is adopted from the work of Wheelwright (2006), on Life stage, which is contained in Table 2 below.

Table 2 Life stages and their characteristics

Life stage	Characteristics of life stage
Infant	Birth through two years. Dependent, brain developing, learning motor skills and sensory abilities.
Child	3-9 years. Growing and mastering motor skills and language. Learning to play and socialize. Continued growth, formal school and organized activities.
Adolescent	10-19 years. Growth spurs. Puberty brings hormonal changes and reactions. Strong emotions may rule decisions. Behavioral risks.
Young Adult	20-29 years. Completing education and beginning career and family. Potential coping and financial pressures.
Adult	30-39 years. Managing family and career growth. Increasing numbers of couples are starting families in this stage. Continued coping pressures.
Middle Age	40-60 years. First signs of aging and effects of lifestyle; menopause, children are leaving the nest, grandchildren arrive, career peak. Aging parents may require care.
Independent elder	Age 60 onward. More signs of aging and lifestyle effects. Eligible for

Life stage	Characteristics of life stage
	government provided retirement and health care benefits or private pensions. Retirement discretionary time. Some health problems and medications. May care for others.
Vulnerable elder	Optional stage. Beginning of frailty, cognitive or multiple health problems. Require some assistance. not able to drive. Possible move to Assistance Living
Dependent elder	Optional stage. Require daily care. Unable to perform all personal functions. Possible move to nursing home.
End of Life (Up to six months)	Diagnosed with terminal condition or end stage of disease. May require hospice care, hospitalization or nursing home care.

Source: Wheelwright (2006)

For the purposes of this paper, the age-stages that were considered were the young adult, adult, middle age and the independent elder. The middle age was broken down into two stages: lower middle age and the upper middle age. This was done to aid the researchers obtain five (5) equally spaced age-stages to form the stratification base for the primary data collection. These stages were selected due to the individual's ability to think, make decisions and act upon a preferred dwelling type.

METHODOLOGY AND METHODS

The research strategy adopted was causal research as it sought to investigate the cause and effect relationship between the variables. The age-stage in this study was the independent variable since it was not affected or influenced by any other variable. This causality was determined by holding the independent variable, age-stage, and measuring the change that it causes to the dependent variables, preference of dwelling type. The sample was selected from the population of individuals within the Adenta Municipality, which is part of the 16 Metropolitan, Municipalities and Districts in the Greater Accra Region of Ghana. The Municipality shares boundaries with Ga East Municipal to the West, Tema Metropolitan to the North, La-Nkwantanang-Madina to the South and Ashiman Municipal to the East. According to the Ghana Population Census (2010), Adenta has a total population of 78,215 individuals, with about 43% representing children and frail persons. The sampling frame was therefore made up of 44,582 dwelling owners within the municipality.

Stratified random sampling, a probabilistic sampling method, was used to select respondents across five different age-stages. The five age-stage demographics were: young adults, adults, lower middle age, upper middle age and the independent elders. After the stratification, thirty respondents from each sub-group were selected randomly to represent each of the five strata. There was thus a sample size of 150 respondents, though only 140 responsive questionnaires were received after administration giving a response rate of 93.3%. The researchers visited the municipality over a four weekend period. Weekends were chosen because dwelling owners who were employed would not go to work; and over four weekend duration so as to grant everyone an equal chance of being selected whether they were in the municipality on a particular weekend or travelled hence missed an initial visit. No respondent had the opportunity to answer the questionnaire more than once. Also, the researchers targeted social centers where it was possible to find a wide range of respondents. Questionnaires were made up of closed-ended questions in which respondents were required to select a response that compared to their preferences in dwelling type and the reason for their choice. Provision was made for respondents to indicate reasons outside the predetermined reasons provided.

Data gathered from the questionnaires were analyzed using cross-tabulation for comparisons between multiple factors, and stacked histograms to establish the distribution pattern of age to preference of dwelling-type. This method was used to allow for effective juxtaposing with the theoretical framework of the paper. Also, this research was preliminary, to establish the existence of this relationship, to serve as a basis for a more rigourous study hence the methods aided in achieving this objective.

FINDINGS AND DISCUSSION

Respondent demographics
The demographic factors that were considered in the questionnaires were age, gender, marital status, number of children/dependents, employment status and household income-level. These demographics were chosen to give a sense of who the respondents were, and to understand the rationale for dwelling-type preference.

From the data, eighty-four (84) males, making up 60% of the total responses of 140 respondents, and fifty-six (56) females responded. The marital status of the respondents sought to give a sense of how much residential space the respondent will need. Also, eighty-three (83) married individuals and thirty-four (34) single individuals, making up 59.29% and 24.29% of the total responses respectively, responded to the questionnaire. Seven separated individuals, six divorced individuals, five individuals living with their partners and five widowed persons, making up 5%, 4.3%, 3.6% and 3.6% respectively responded.

With respect to the employment status, there was equal number of employed and self-employed individuals within the sample: fifty-eight (58) respondents in each category representing 41.43% of the sample. Unemployed persons and retirees made up 11.43% and 5.71% of the sample representing sixteen and eight respondents respectively. Data on the monthly household income showed that, 38.57% of the respondents, representing 54 respondents, ticked their monthly household income to be between USD200.00 and USD400.00. 22.86% of the respondents, being 32 respondents, gain a monthly income of between USD401.00 and USD600.00 while 30 respondents received monthly estimated incomes of USD200.00 or less. 17 respondents also answered that their monthly household income was between USD601.00 and USD800.00. Lastly, 4 respondents said they received more than USD800.00 every month as household income. The remaining 2.14% of the respondents, being 3 respondents, did not want to share this information for confidentiality purposes.

Age-stage and preference in dwelling type
In order to match the dwelling preferences to the various age-stages, a stacked histogram was used. Figures 3 and 4 show the dwelling preferences of the various age-stages, and the reasoning for their preferences, respectively.

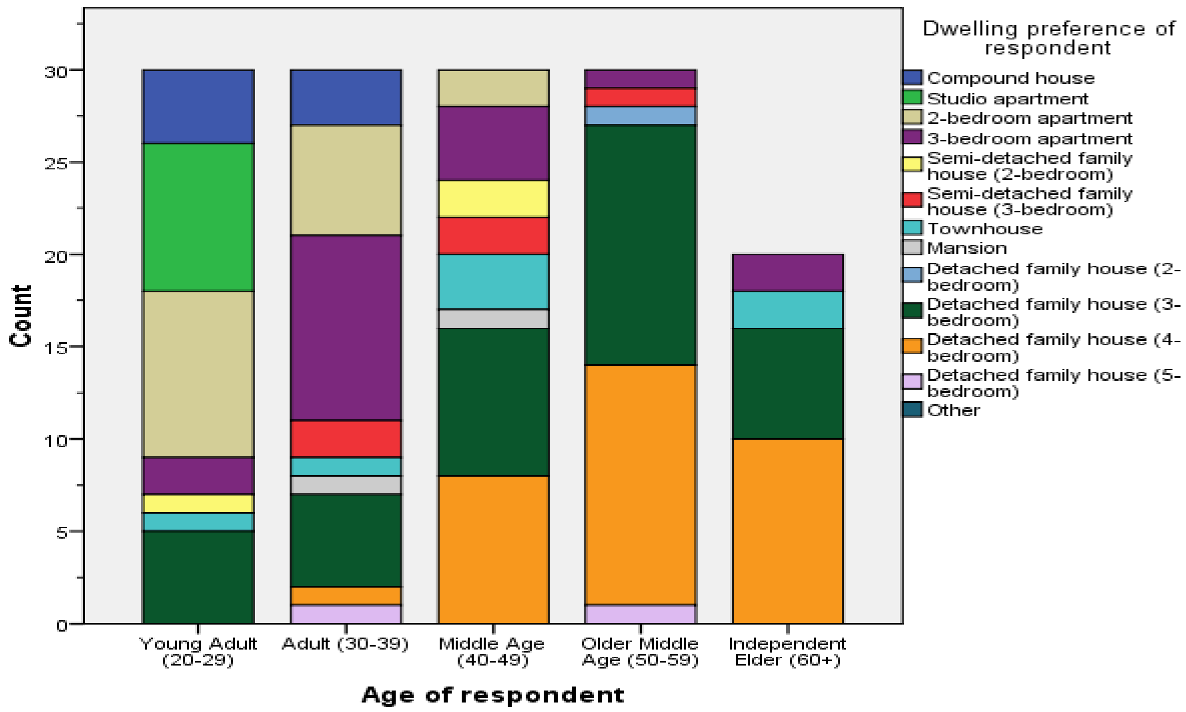


Figure 3 Dwelling preferences of respondents
Source: Field Data

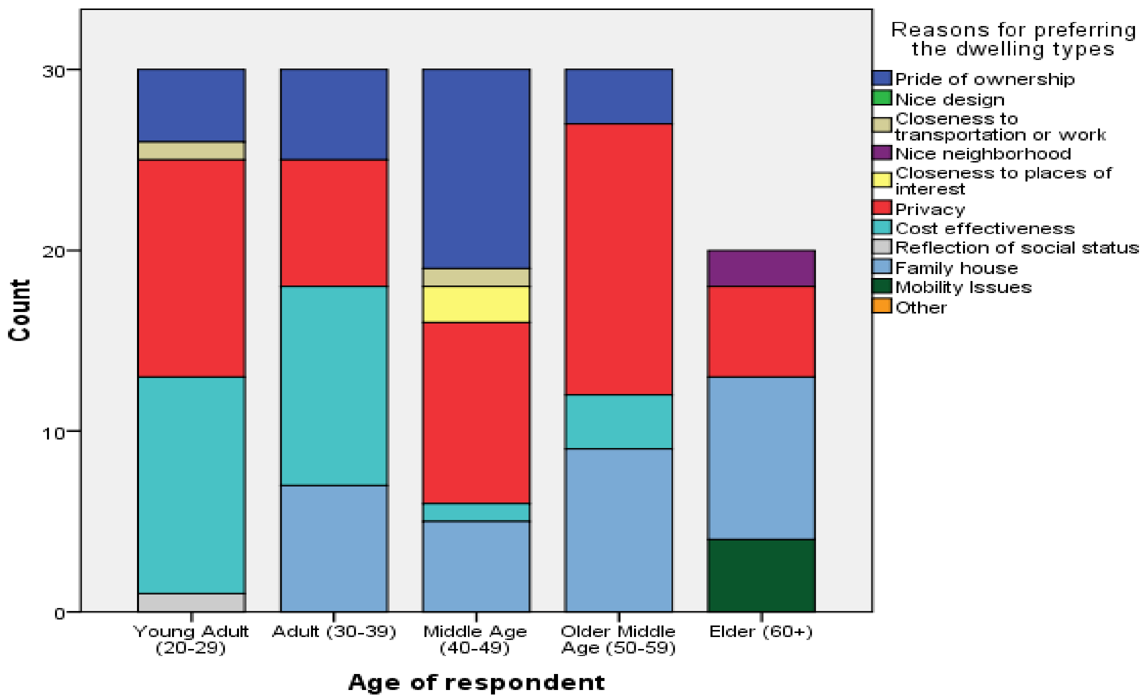


Figure 4: Reasons for selected preferences
Source: Field Data

From Figure 3 majority of the *young adult* respondents preferred to stay in 2-bedroom apartments and in studio apartments because of the need for privacy and cost effectiveness. At this age, one is just starting life and from the cross tabulation in Table 3 below, it could be further inferred that, most of the respondents within this stratum are single, and therefore do not need that extra residential space.

Table 3: Cross tabulation - Age of respondent Versus Marital status of respondent

Age of respondent	Marital status of respondent						Total
	Single	Married	Separated	Divorced	Living with partner	Widowed	
Young Adult (20-29)	21	6	1	0	2	0	30
Adult (30-39)	7	20	1	2	0	0	30
Middle Aged (40-49)	1	23	3	1	2	0	30
Older Middle Age (50-59)	3	21	2	2	1	1	30
Elder (60+)	2	13	0	1	0	4	20
Total	34	83	7	6	5	5	140

Source: Field Data

Further up the age-stage ladder, there is a change in preference where most of the *adults* prefer 3-bedroom apartments with the motivation for this preference being cost effectiveness followed by the need for privacy. Inferring from Table 3, these respondents were mostly married hence needed the bigger space for their families. They also needed a good degree of privacy so that they can socialize their young children selectively.

For respondents within the *lower middle age* stratum, the 3-bedroom detached family house and the 4-bedroom detached family house were the dominant preferences. The major motivators here were pride of ownership being the predominant, and then the need for privacy. In here, it is very evident that people at this stage are at the fourth level of Maslow's hierarchy; hence what they look out for is prestige as well as having enough space to house their teenage children who will also want privacy hence their own spaces within the dwelling.

The preferences of the respondents within the *upper middle age* stratum were not very different from that of the respondents from the *lower middle age-stage*. However, it could be seen from Figure 3 that the number that selected both dwelling-types as their preference, increased. This is as a result of more dwelling owners in this group being able to afford bigger houses. Also, most of the respondents in this category chose privacy as their main motivating factor, followed by the need for a family house that they could leave as a legacy or an inheritance for their offspring when they departed this world. This stems from the fact that, at the older middle age-stage, respondents had started planning for retirement hence focus was more on privacy and peace of mind during their old age, and satisfying Maslow's self-actualization stage.

Lastly the respondents within the *elder* age-stage were more inclined towards the detached 4-bedroom house. This deviation to the "norm" in the theoretical background by Steffanson (2012), was as a result of the extended family culture, which created the need for more space for when children or grandchildren, or other family members, visited. Other factors that motivated these choices had to do with mobility issues, privacy and the beauty of the neighborhood: also moving higher up Maslow's hierarchy of self-actualization. The mobility interest raised some concerns however, as it will be more difficult moving around a big house in their old age. Maintenance was also not on their minds as they expected to have income earning extended family members sharing these dwellings, hence deferred the responsibility of maintenance to them.

CONCLUSION, RECOMMENDATIONS AND LIMITATIONS

Making inferences from both the primary and secondary data gathered from literature, it is evident that there is a relationship between the age-stage demographic and preferred residential dwelling-type. That is, the age-stage of a person, affects their preference in residential dwelling type. There is therefore enough grounds for a more detailed research into how generalizable this finding is, and also determine the extent of the effect of this relationship on owner choice to inform market feasibility in housing development projects.

The main dwelling type characteristic determined by this demographic: age-stage, was the size. Details including amenities, facilities, finishes and the likes, are heavily influenced by owner income levels within the various age-stages. In comparison to the study conducted by Steffanson (2012), which served as the theoretical framework of this paper, a similar pattern up until the *elder's age-stage* was identified. At the *elder stage*, there is a deviation which is as a result of three cultural factors. The first is the extended family practice, the second is the desire to pass on a valuable and relatively bigger dwelling to offspring intestate, and the third is how the achievement of the fourth and final levels of Maslow's hierarchy: esteem and self-actualization, are interpreted.

This finding on the relationship between age-stage and dwelling type with a focus on size, will feed into the market feasibility done by both private and public developers, providing dwelling for the populace. Location and amenities that typically will determine price, should however be varied to support different income groupings within these age-stages.

It is important to be mindful that, only 150 out of a total population of 44,582 potential dwelling owners within the Adenta municipality were sampled, out of which 140 responded. There was also some degree of human interference as some of the respondents could speak only the local dialect hence translation was required. The proficiency of the researchers in these dialects thus limited the translation. There will therefore be the need to manage these limitations effectively in the main study.

REFERENCES

Beamish, J. O., Goss, R. C., & Emmel, J. (2001). Lifestyle influences on housing preferences. *Housing and Society, 28* (1&2), 1-28.

Burney, S. A. (2008, March 6). *Inductive & Deductive Research Approach*. Karachi: University of Karachi.

Coolen, H. (2009). *House, Home and Dwelling.* ENHR conference 'Changing Housing Markets: Integration and Segmentation', Prague, Czech Republic, June 28 - July 1 2009.

Coolen, H., & Ozaki, R. (2004). *Culture, Lifestyle and the Meaning of a Dwelling.* International Conference: Affordable housing for all: Research, Policy, Development. Center for Urban and Community Studies, University of Toronto. Ontario: Toronto June 24-27 2004

Dassah, E. (2011). *An Examination Of The Relationship Between Spatial Morphology And Residential Satisfaction In Residential Settings In Garki, Abuja.* A thesis submitted to the School of Graduate Studies in partial fulfillment of the requirements for the award of the degree of Master of Philosophy in Housing Studies, May 2011. Kumasi: KNUST.

Hablemitoğlu, Ş.; Özkan, Y. & Purutçuoğlu, E. (2010). The Assessment of the Housing in the Theory of Maslow's. *European Journal of Social Sciences*, *16* (2), 222.

Huang, Y. (2000). *Housing Choices and Changing Patterns in Transitional Urban China.* Los Angeles: UCLA International Institute.

Jiboye, A. D and Ogunshakin, L (2010). The place of the family house in contemporary Oyo Town, Nigeria. *Journal of Sustainable Development, 3* (2),117-128.

Lee, H.-J., & Parrott, K. (2004). Cultural Background and Housing Satisfaction. *Housing and Society, 31* (2), 145-158.

Maslow, A (1954). *Motivation and personality*. New York, NY: Harper. p. 236. ISBN 0-06-041987-3.

Ojo, J. R. O. (1998). *Description of houses in Nigeria by travelers and explorers* – 1823 - 1892. In, B. Amole (Ed.), Habitat Studies in Nigeria. Some qualitative dimensions. (pp.48-63). Shaneson Publishers Ltd. Ibadan, Nigeria

Reynolds, S. G. (1997, December). *Independent Living Retirement Facilities: The Effects Of Push And Pull Factors On Residential Satisfaction*. Blacksburg, Virginia, United States of America.

Sarantakos, S. (2005). *Social Research.* NEW York: Palgrave Macmillan.

Steffanson, R. N. (2012). *Dwelling Ideals and Reality: How demographic changes shape future dwelling preferences and how municipalities combine this with environmental challenges*. Long Masters Thesis submitted to the Department of Urban Planning and Management, Aalborg University Denmark for the award of a Masters Degree in Urban Planning and Development, June 2012.

Subhan, D., & Ahmad, D. (2012). The Economic and Demographic Effects on Housing Tenure Choice in Pakistan. *American International Journal of Contemporary Research*, *2* (7),15-24.

Wheelwright, R. V. (2006). *The Personal Futures Workbook.* Personal Futures Network, Texas.

Wright, E. O. (1979). *Class structure and income determination.* Academic Press, London.

MANAGING STAKEHOLDERS' NEEDS AND EXPECTATIONS IN THE ARCHITECTURAL DESIGN PROCESS: A KNOWLEDGE MANAGEMENT APPROACH

Halim, A.S.A. [1] **and Othman, A.A.E.**[2]

[1]*Architectural Engineering Department, Faculty of Engineering, Cairo University and Space Consultants, Cairo, Egypt,*

[2]*Architectural Engineering Department, Faculty of Engineering, The British University in Egypt (BUE), El Shorouk, Cairo, Egypt, .*

.

This paper aims to investigate the role of Knowledge Management as an approach for managing Stakeholders' needs and expectations during the architectural design process. To achieve the abovementioned aim, this research called for a research strategy based on literature review and case studies to gather data sufficiently rich to investigate the research topic. This strategy based on proper understanding of the conflict between the architect's point of view and the business needs of stakeholders. This understanding raises the awareness of both parties towards reaching a mutual configuration to resolve the conflict. Knowledge Management is proposed as a tool for managing stakeholder's needs and expectations in the architectural design process. There is a conflict between stakeholders needs and expectations and the architects point of view. There are a number of challenges that obstruct achieving stakeholders goals and objectives. The traditional approaches to manage stakeholders needs and expectations are limited and hence there is a need to look for a new approach such as knowledge management to resolve these conflicts The key value of this paper is to utilize the benefits of Knowledge Management as a tool and technique of managing stakeholders' needs and expectations in the architectural design process. In addition, this paper covers a topic that received little attention in construction literature specifically in the architecture profession

Keywords: project stakeholder, knowledge management, architectural design process, stakeholder's perception levels and engagements

INTRODUCTION AND RESEARCH METHODOLOGY

Due to the active role they play in the construction industry, managing stakeholders' needs and expectations evolved as a unique and integral knowledge area of managing the architectural design process. Stakeholders' involvement in project development can affect the performance and completion of the project either positively or negatively (Harrison, 2011). This is because different stakeholders may have competing expectations that create conflict within the project team and lead to project failure. In addition, stakeholders' involvement does not only affect project results and

[1] ahmedsaid177@yahoo.com
[2] ayman.othman@bue.edu.eg

Halim, A.S.A. and Othman, A.A.E (2014) Managing stakeholders' needs and expectations in the architectural design process: a knowledge management approach *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 405-421.

deliverables but also affects the project team, strategic business objectives, cost, time and communications (Houndmills, 2006). By considering the perception and awareness level of the stakeholders as individual, the architect as a moderator to the communication process can fill the gap in perception and awareness between different parties. The process aims at upgrading the collective mind of the group from un-self-conscious to the collective self-conscious mind (Schultz, 1985).

A number of approaches have been developed over the years to manage stakeholders' needs and expectations. Although these approaches have their strengths and contributions, they have some limitations towards achieving stakeholder's needs and expectations (Houndmills, 2006). Knowledge management has been introduced as a new approach towards achieving organisational strategic goals and objectives (Donaldson, 2006). Hence, this paper aims to investigate the role that Knowledge Management can play towards managing Stakeholders' needs and expectations during the architectural design process. A research strategy based on literature review was designed to gather data sufficiently rich to investigate the research topic. Through this strategy, the authors were able to understand the conflict between the architect's point of view and the business needs of stakeholders. In addition, this understanding helped raising the awareness of both parties towards achieving a mutual configuration to resolve the conflict. Knowledge Management is suggested as an approach for reconfiguring this conflict, see figure (1).

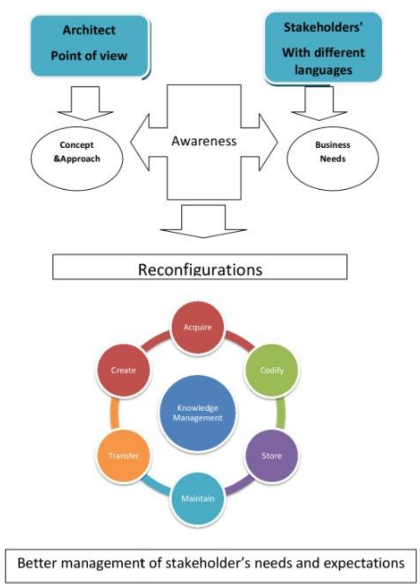


Figure (1) Research Strategy

STAKEHOLDER THEORY

It is a theory of organizational management and business ethics that addresses morals and values in managing an organization. It was originally detailed by R. Edward Freeman in the book Strategic Management: A Stakeholder Approach, and identifies and models the groups which are stakeholders of a corporation, and both describes and recommends methods by which management can give due regard to the interests of those group.

Project stakeholders

Project stakeholders could be defined as individuals, groups, or organizations that may affect or get affected by decision, activity, or outcome of a project. They are comprised of persons and organizations (i.e. customers, sponsors, performing organization and public) who are actively involved in the project, or whose interests may be positively or negatively affected by the execution or completion of the project. Stakeholders may also exert influence over the project and its deliverables. Project stakeholders are existed at different levels within the organization and may possess different authority levels. In addition, they may be external to the performing organization of the project. It is critical for delivering successful projects to identify the stakeholders at early stages of the project life cycle and to analyze their levels of interest, their individual expectations, as well as their importance and influence, see figure (2) (PMBOK, 2013).

This initial assessment of project stakeholders has to be reviewed and updated on a regular basis. Most projects will have a diverse number of stakeholders depending on their size, type, and complexity. Towards assisting project managers using their limited time efficiently, these stakeholders should be classified according to their interest, influence, and involvement in the project, taking into account the fact that the affect or influence of a stakeholder may not occur or become evident until later stages in the project life cycle. This enables the project manager to focus on the relationships necessary to ensure the success of the project (PMBOK, 2013).

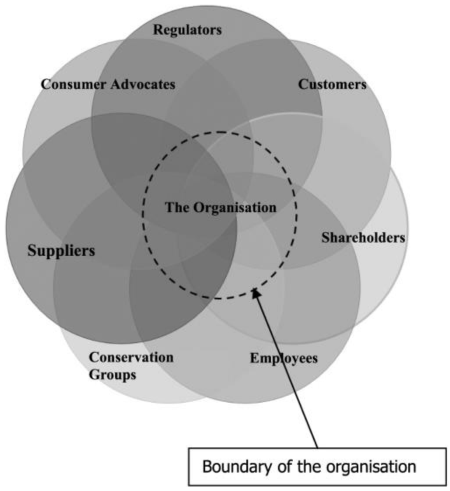


Figure (2)

Types of stakeholders

There are different types of project stakeholders:

Internal Stakeholders

Internal stakeholders are people who are already in that particular line of business or the organization. These are people who already serve the organisation, for example, staff, board members or volunteers.

- Employees - employee satisfaction surveys can often provide useful insides into organisational culture, communications patterns and knowledge flows within an organization; employees, particularly in a workshop brainstorming session, are usually the group best placed to identify potential barriers to successful implementation

- Senior managers - this key group have a better strategic perspective on which direction the organization is heading; they are more aware of key challenges and often very perceptive about the role of knowledge and where lack of knowledge impacts good decision-making; also you will often find competing factions within this group, so understanding their underlying motivations can help during the implementation and change management aspects of Knowledge Management
- Functional support managers - these are from the functions whose input has a key influence on Knowledge Management programme outcomes; it includes in particular HR, training, IT, but may also require involvement from finance, quality, strategic planning; it is important to understand how practically they can support (with resources and knowledge) any proposed Knowledge Management projects

External Stakeholders

External stakeholders are stakeholders outside the organisation, but those who have an impact on the organisation, such as the community or the organisation's clients, see figure (3).

- Customers - although some of the focus is customer knowledge, it is important to understand different types of customers, their expectations from the organization, how they use the organizations products and services; often, a marketing team or sales manager can provide this perspective, but it is also good to interview a few real customers to see things from their perspective; generally it is important to segment the analysis by different customer groups; and don't forget that customers can be internal, the recipient of services from another part of the organisation.

- System users - even today, many computer-based Knowledge Management systems do not give this group enough attention; too much reliance is often given to what the business process documentation says, rather than what individuals do in practice; whereas their knowledge needs and networks should be identified as part of the knowledge audit, the stakeholder analysis should concentrate on their relationships with other departments (especially IT) and their perspectives of earlier systems implementations
- Board members - though not involved in day-to-day affairs, board members come in with a good perspective of the outside world and the competitive environment; they can help reaffirm the strategic inputs that are gained from senior management
- Alliance partners - these can be important, especially where a joint venture generates new knowledge, where defining ownership and rights can be crucial; in any case, the existence and practice of various alliances may influence the way in which Knowledge Management activities are conducted.

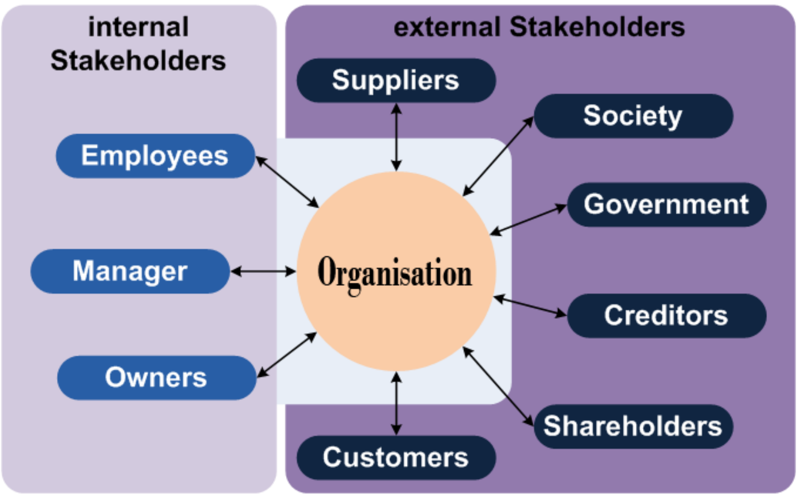


Figure (3) Types of Project Stakeholders

CASE STUDIES EXPLAINING THE RELATIONSHIP BETWEEN THE ARCHITECT'S POINT OF VIEW AND STAKEHOLDERS NEEDS AND EXPECTATIONS

Case study: As an illuminating Public housing project in the history of modern Architecture, the fate of the Pruitt-Igoe, St. Louis housing is a well-known Myth. It raises crucial questions about the history of public housing in the United States, as well as the fate of older industrial cities that have been left to decay. Pruitt-Igoe consisted of 33 11-story buildings containing nearly 3,000 apartments. The project is revealing the consequences of the gap in communications between the Architect and the community he is designing for. Its architect was Japanese-American Minoru Yamasaki, who later became famous for New York's World Trade Centre. When first opened, Pruitt-Igoe was advertised as a big step forward for thousands of families. Within a short time, however, the complex became an example of the urban crisis that was overtaking many US cities. Starved of funds for maintenance and home for many who found jobs and decent wages increasingly difficult to find, by the mid-1960s Pruitt-Igoe was beset by growing crime and was increasingly deserted by its residents. By 1971 state and federal authorities decided to demolish several of the project's buildings. The stakeholders simply lost interest in the project after building and post-occupation. Other case studies should be thoroughly these days due to its dominance and impact in the global and local markets, the Model of the Star architect, as a dictator and source of inspiration and fashion regardless the needs and aspiration of the public as the real stakeholders. The other case is the architect as a community developer. In some cases the Architect design communities without real participation by the end users; the real stakeholders, see figure (4).

Figure (4) the demolition of the Pruitt-Igoe housing development

CHALLENGES OF MANAGING STAKEHOLDERS' NEEDS AND EXPECTATIONS IN THE ARCHITECTURAL DESIGN PROCESS

There are a number of challenges that obstruct achieving the needs and expectations of project stakeholders. Being the main parties to the design process, the following section identifies the challenges related to project clients, user and designer.

Challenges related to project client

- Unclear and incomplete definition of project requirements (Barrett and Stanley 1999).
- Inappropriate communication between the client and the designer (Barrett and Stanley 1999).
- Stakeholders change project requirements and have second thought at later stages
- Brief information is still being given during later design and construction stages (Barrett and Stanley 1999)
- Lack of information provision (Barrett and Stanley 1999).
- Improper response to market demand (smith and Wyatt 1998)

Challenges related to project users

- project users are not involved in the decision making process (Abdellatif and Othman, 2006; Kernohan et al., 1992)

- project users appear at later stages
- users exaggerate their needs

Challenges related to project designer

- Lack of understanding of the client organisations.
- Improper understanding of different users' culture and traditions.
- Improper feasibility studies (de valence 1999).
- Designers ignore the client role and behave unilaterally.
- Uncoordinated and incorrect construction documents (O'Leary 1992).
- Lack of design experience.
- Lack of presentation and visualisation of design (Barrett and Stanley 1999).
- lack of regulatory up-dating
- Lack of functional, aesthetic, safety requirements and constructability.
- Whole project life not considered (CIB, 1996).
- Lack of consideration of environmental requirements (best and valence 1999).
- Inadequate available design time (ICE, 1996).
- Restricted design fees (ICE, 1996).
- Lack of communication and co-ordination between government authorities and design firms over planning and approvals.
- Specifying materials that are no longer available in market (Tenah 1985).
- lack of meeting new technology changes
- Specifying Proven Poor Quality Materials and Equipment.
- Lack of following up Changed Governmental Regulation and Codes (O'Leary 1992).

PROJECT STAKEHOLDER MANAGEMENT

From PMI Perspective

According to the Project Management Institute, Project Stakeholder Management includes the processes required to identify the people, groups, or organizations that could impact or be impacted by the project, to analyze stakeholder expectations and their impact on the project, and to develop appropriate management strategies for effectively engaging stakeholders in project decisions and execution. Stakeholder management also focuses on continuous communication with stakeholders to understand their needs and expectations, addressing issues as they occur, managing conflicting interests and fostering appropriate stakeholder engagement in project decisions and activities. Stakeholder satisfaction should be managed as a key project objective. Project Stakeholder Management processes includes the following (PMI, 2013):

Identify stakeholders
The process of identifying the people, groups, or organizations that could impact or be impacted by a decision, activity, or outcome of the project; and analyzing and documenting relevant information regarding their interests, involvement, interdependencies, influence, and potential impact on project success.

Figure (5) the influence/interest chart

Plan stakeholder management

The process of developing appropriate management strategies to effectively engage stakeholders throughout the project life cycle, based on the analysis of their needs, interests, and potential impact on project success.

Manage stakeholder engagement

The process of communicating and working with stakeholders to meet their needs/expectations, address issues as they occur, and foster appropriate stakeholder engagement in project activities throughout the project life cycle.

Control stakeholder engagement

The process of monitoring overall project stakeholder relationships and adjusting strategies and plans for engaging stakeholders. Every project will have stakeholders who are impacted by or can impact the project in a positive or negative way. While some stakeholders may have a limited ability to influence the project, others may have significant influence on the project and its expected outcomes. The ability of the project manager to correctly identify and manage these stakeholders in an appropriate manner can mean the difference between success and failure.

Stakeholder management in another perspectives

The Stakeholder management is defined by being the process by which an individual establishes and maintains support from internal staff members and external members for a new product or project or change within the organisation.

It can also be defined to be the process of managing the expectation of anyone that has an interest in a project or will be effected by its deliverables.

Stakeholder management is defined as the management of relationships with individuals or groups. It is a planned approach to engage stakeholders (i.e., project team, end-users, business process owners, managers and executives) in the project's success.

Measuring the influence of stakeholders on a project performance is the main aim of initiating stakeholder management.

Stakeholder identification

The process includes brainstorming (alone or in a team) and listing the potential stakeholders accompanied with

- their interest
- their power within the organisation
- their capacity to take action and to implement where do they fit in the organisation
- their goals organisational and personal;
- how approachable they are
- the criteria the stakeholder would use to judge the organisation's performance (expectat organisation)
- how well the stakeholder believes the organisation is performing
- the stakeholder's judgement

Stakeholder analysis and mapping

Stakeholder analysis is a technique of systematically gathering and analyzing quantitative and qualitative information to determine whose interests should consider throughout the project. It identifies the interests, expectations, and influence of the stakeholders and relates them to the aim of the project. It also helps to identify stakeholder relationships (with the project and with other stakeholders) that can be leveraged to build coalitions and potential partnerships to enhance the project's chance, along with stakeholder relationships that need to be influenced differently at different stages of the project or phase.

Stakeholder mapping generally follows the steps described below:

• Identify all key project stakeholders and their relevant information, such as their roles, departments, interests, knowledge, expectations, and influence levels. Key stakeholders are usually easy to identify.

The key stakeholders include anyone in a decision-making or management position who is impacted by the project outcome, such as the sponsor, the project manager, and the primary customer. Expand the list by identifying other stakeholders through interviewing identified stakeholders until all potential stakeholders are included.

•Define an approach strategy by analysing the potential impact or support each stakeholder could generate, and classify them accordingly. In large stakeholder groupings, it is important to prioritize the stakeholders to ensure the efficient use of effort to communicate and manage their expectations.

•Plan how to influence stakeholders to enhance their support and mitigate potential negative impacts through assessing how key stakeholders are likely to react or respond in various situations.

Classification models used for stakeholders' analysis:

• Power/interest form, grouping the stakeholders based on their level of authority ("power") and their level or concern ("interest") regarding the project outcomes;

• Power/influence form, grouping the stakeholders based on their level of authority ("power") and their active involvement ("influence") in the project;

• Influence/impact form, grouping the stakeholders based on their active involvement ("influence") in the project and their ability to affect changes to the project's planning or execution ("impact");

• Salience Model, grouping stakeholders into classes based on their power (ability to impose their will), urgency (need for immediate attention), and legitimacy (their involvement is appropriate).

PERCEPTION AND AWARENESS LEVEL

Model as stated by (Schultz, 1985):

By considering the Perception and awareness level of the stakeholders as individual, the architect as a moderator to the communication process can fill the gap in perception and awareness between different parties. The process aims at upgrading the collective mind of the group from un-self conscious to the collective self conscious mind. These levels as stated by Schultz are:

1. The pragmatic (the layman and basic facts)
2. The perceptual (the categories and the scope)
3. The existential (the human and emotional dimension)
4. The conceptual (the ruling idea and the mission)
5. The cognitive (the vision and the meta language)

Dealing with these levels and dimensions became more and more needed as the architectural projects are becoming more complex and contradictory.

KNOWLEDGE MANAGEMENT

There are several different and sometimes quite confusing statements attempting to be a definition of Knowledge Management and there are different perspectives on what Knowledge Management is. However, they all agree that Knowledge Management is a multi-disciplinary and holistic imitative adopted across the entire organization whose aim is to achieve business objectives by making the best use of knowledge through acquiring, creating and sharing knowledge. It necessitates developing cultural and technical foundations that support its implementation (Young, 2013). Knowledge Management is tied to organizational objectives such as improving performance, sustaining competitive advantage and innovation, transferring lessons learned between projects as well as the general development of collaborative practices.

Knowledge management pillars

Knowledge Management pillars divided into major tree items:

- People : Increasing the ability of an individual in the organization to influence others with their knowledge
- Processes: This approach varies from organization to organization. There are limitless number of processes
- Technology: It is chosen only after all the requirements of a knowledge management initiative have been established.
  Or

- Culture :The biggest enabler of successful knowledge-driven organizations is the establishment of a knowledge-focused community
- Structure : the business processes and organizational structures that initially facilitate knowledge sharing
- Technology: a crucial enabler rather than the solution itself.

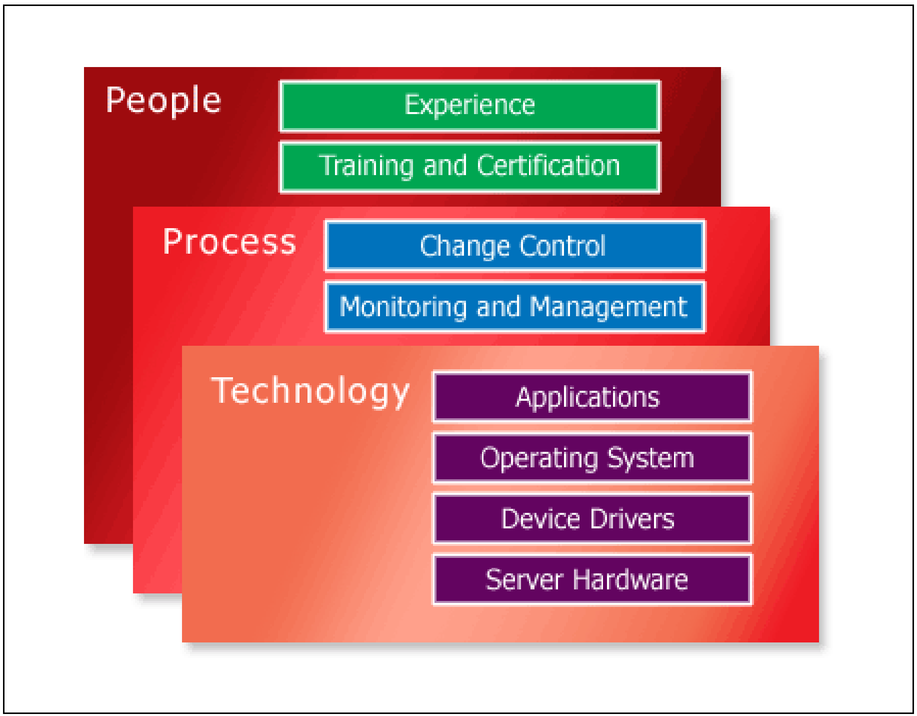


Figure (6) Pillars of Knowledge Management

KNOWLEDGE MANAGEMENT ACTIVITIES

Acquire :Knowledge acquisition is defined as the process by which knowledge is obtained (Huber, 1991), or transferred from a source to a company through written forms, physical objects, people, cooperation between source and recipient, courses and outsourcing (Kraaijenbrink et al., 2006).

Codify: Knowledge codification converts the generated knowledge into accessible and applicable formats (Davenport and Prusak, 1998). It is concerned with the capture, representation and storage of knowledge in computerized knowledge bases (Nevo et al., 2007). Hansen et al. (1999) stated that codification strategy supports the use of knowledge repositories such as documentation and more specifically technological databases to store organizational knowledge.

Store: Knowledge storage involves obtaining the knowledge from organizational members and/or external sources, coding and indexing the knowledge for later retrieval and capturing (Alavi and Leidner, 2001). Storing organizational knowledge enable employees to anticipate future needs of the organization in order for the most valuable knowledge to be stored (Huber, 1991).
Maintain: Maintaining Knowledge stores is essential to the continued progression of an organization's ability to learn. It is about providing accurate, consistent relevant and required quantity and quality of knowledge when needed (Holsapple and Singh, 2004; Anderson Consulting, 1996)

Transfer: Knowledge transfer is established through person-to-person or system-to-person interaction (Joe and Yoong, 2004). Knowledge transfer occurs inside and outside the organization. Thus, an organization may transfer knowledge or receive it from outside the organization, which is knowledge acquisition.

Create: Knowledge creation involves developing new content or replacing existing content within the organization's tacit and explicit knowledge (Pentland, 1995). While it may be argued that new knowledge may be created through formalized mechanisms (i.e. surveys and research and development (Kayworth and Leidner, 2004) others propose that the creation of new knowledge should not be a formalized process but one which is socially constructed and occurs over time through human networks (Brown and Duguid,, 2000; Fahey and Prusak, 1998).

FIELDS OF KNOWLEDGE MANAGEMENT APPLICATIONS

Due its benefit of Knowledge Management it has been applied successfully in a wide range of disciplines and technologies including (Nevo et al., 2007):

- Expert systems, artificial intelligence and knowledge Base Management Systems (KBMS) Library and information science, Technical writing
- Document management
- Decision support systems
- Semantic networks
- Relational and object databases
- Simulation
- Organizational science
- object-oriented information modelling
- electronic publishing technology, hypertext, and the World Wide Web; helpdesk technology
- performance support systems

BENEFITS OF KNOWLEDGE MANAGEMENT

The Many Possible Benefits of Knowledge For The organization:

- Generate new Wealth and increasing Revenue
- Open New Markets, Develop and implement New Business Models
- Enable Sustainable, Organic Growth
- Improve Decision-Making, Mitigate Risk

- Build More Profound relationships and ongoing Mind-Share with Customers - penetrate the mind of the customer
- Lift Productivity and Efficiency and Speed Innovation
- Unleash new Ideas and Creativity
- Help create a more Adaptive, responsive, dynamic, flexible, organization
- Facilitate the evolution of a more Intelligent Enterprise and produce smart engaging products
- Use knowledge To Build Virtual Networked Businesses
- Better prepare for and anticipate The Future
- Improve and accelerate Learning
- Gather superior Business and Competitive Intelligence
- Enhance Team Collaboration and Coordination
- Maximize the organization's use of available collective wisdom, experience, and the Brain-Power of human capital assets
- Improve the Flow of knowledge
- Improve the Service and Support of Customers
- Improve the ability of the organization to Manage Change
- Attract, and retain motivated, loyal, and committed Talent

LINKAGE BETWEEN DESIGN PROCESS, STAKEHOLDER MANAGEMENT AND KNOWLEDGE MANAGEMENT

Due to its nature and involved parties, the concept design process suffers from a number of managerial problems such as inadequate provision of data, undefined scope and poor communication which affects achieving stakeholder’s needs and expectations.

Stakeholder management has many problems in the concept design phase such as defining of project Requirements, Improper understanding of the Design process and Poor estimation of design time.

Traditional methods can solve the problems of each party separately without solving conflicts between parties. This necessitated looking for new tools and techniques like knowledge management to present solutions for this conflict see figure (7).

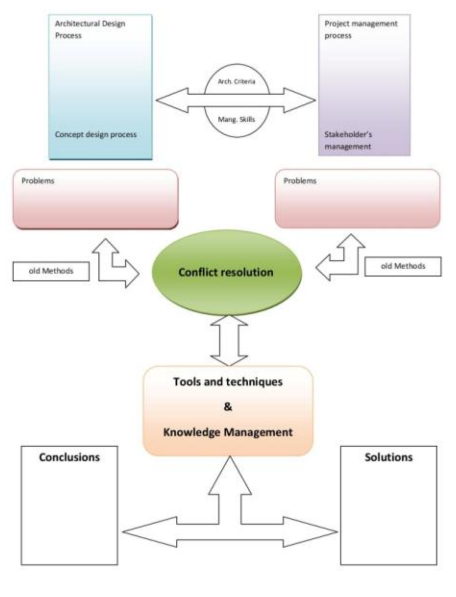


Figure (7) the relationship between design process, stakeholder management and Knowledge Management

KNOWLEDGE MANAGEMENT AS A TOOL FOR MANAGING STAKEHOLDERS' NEEDS AND EXPECTATIONS IN THE ARCHITECTURAL DESIGN PROCESS

Table (1) describes the role of knowledge management towards managing sample of challenges that obstruct achieving stakeholders' needs and expectations in the architectural design process. For example the conflict of Defining of project Requirements, the Acquire activity focuses on obtaining stakeholder's needs and expectation and understanding the business needs, escalating the awareness of stakeholders with regard to design time and improving the communication between the architect and the stakeholders.

Challenges			Acquire	Codify	Store	Maintain	Transfer	Create
	Stakeholders	Defining of project Requirements	⊗		⊗		⊗	
		Improper understanding of the Design process		⊗			⊗	⊗
		Poor estimation of design time	⊗	⊗	⊗	⊗		⊗
	Architects	Inadequate provision of data	⊗	⊗		⊗	⊗	
		Undefined Scope		⊗	⊗		⊗	
		Poor Communication	⊗		⊗	⊗	⊗	⊗

TABLE (1) MANAGING STAKEHOLDERS' NEEDS AND EXPECTATIONS IN THE ARCHITECTURAL DESIGN PROCESS: A KNOWLEDGE MANAGEMENT APPROACH

CONCLUSIONS AND RECOMMENDATIONS

The important role of stakeholders in the construction industry called for achieving their needs and meets their expectations. Although the strengths and contributions of the traditional approaches developed to manage stakeholders' needs and expectations, they have their limitations and shortcomings. Knowledge management has been proposed as a new approach towards achieving stakeholder's goals and objectives. It provides a methodology to make proper decisions that create a balance between satisfying stakeholders' needs, expectations and achieving organizational strategic objectives. Knowledge management enables the organization to overcome stakeholders' conflicts and errors resulted from poor communication. The important role of Knowledge management emerges from the whole perspective approach adopted through identifying stakeholders, planning stakeholder management, managing stakeholder engagement and control stakeholder engagement. This could be achieved through the knowledge management activates of acquire, codify, store, maintain, transfer and create new knowledge.

The research comes to the following recommendations:

Recommendations to Architecture profession:

- Increasing the awareness of the Architecture profession to the importance of managing stakeholders' needs and expectations.
- The need to integrate the different activities of knowledge management in the architectural design process.

Recommendations to Stakeholders:

- Understanding the nature of architectural design process and different views of architects.
- Understanding the role of knowledge management in solving conflicts between their needs and architects point of view.

Recommendations to PMI:

- Adding knowledge management as a tool and technique in the project management activities.

REFERENCES

Freeman, Harrison, Jeffry, Wicks, and Andrew. (2008, April 1st. 2011).*Managing for stakeholders: Survival,Reputation, and Success.* Available: http://site.ebrary.com/lib/unmc/Doc?id=10315690

R. E. Freeman and S. R. Velamuri, "A new approach to CSR: company stakeholder responsibility," *Corporate social responsibility: reconciling aspiration with application. Houndmills: Pagrave Macmillan,* 2006.

F. Peter, *Construction Project management, An Integrated Approach*. USA: Taylor and Francis, 2005.

T. Donaldson and L. E. Preston, "The stakeholder theory of the corporation: Concepts, evidence, andimplications," *The Academy of Management Review,* vol. 20, pp. 65-91, 1995.

R. Phillips, *Stakeholder theory and organizational ethics*: Berrett-Koehler Publishers, 2003.

J. F. J. Vos and M. C. Achterkamp, "Stakeholder identification in innovation projects: Going beyondclassification," *European Journal of Innovation Management*, vol. 9, pp. 161-178, 2006.

R. A. Phillips, "Stakeholder Theory and a Principle of Fairness." vol. 7, ed: Philosophy Documentation Center,

1997, pp. 51-66.

L. Bourne, "Stakeholder relationship management," ed: Surrey, England: Gower Publishing, 2009.

S. A. Waddock, C. Bodwell, and S. B. Graves, "Responsibility: The new business imperative," *Academy of Management Executive,* vol. 16, pp. 132-148, May 2002.

K. Aaltonen, K. Jaakko, and O. Tuomas, "Stakeholder salience in global projects," *International Journal ofProject Management,* vol. 26, pp. 509-516, 2008.

B. R. A. Ronald K. Mitchell, Donna J. Wood, "Toward a theory of stakeholder identification and salience_Who

realy counts," *Academy of Management Review,* vol. 22, pp. 853-886, 1997.

D. Clifton and A. Amran, "The stakeholder approach: a sustainability perspective," *Journal of Business Ethics*, vol.98, pp. 121-136, 2011.

K. Aaltonen and J. Kujala, "A project lifecycle perspective on stakeholder influence strategies in global projects,"*Scandinavian Journal of Management*, vol. 26, pp. 381-397, 2010.

W. F. THOMAS M. JONES, GREGORY A. BIGLEY, "ETHICAL THEORY AND STAKEHOLDERRELATEDDECISIONS THE ROLE OF STAKEHOLDER CULTURE," *Academy of Management Review,* vol.32, pp. 137-155, 2007.

F. Ackermann and C. Eden, "Strategic Management of Stakeholders: Theory and Practice," *Long Range Planning,*vol. 44, pp. 179-196, 2011.

C. Jacobson and S. O. Choi, "Success factors: public works and public-private partnerships," *International Journalof Public Sector Management*, vol. 21, pp. 637-657, 2008.

E. C. Sarah Nash, Rod Gameson, Subashini Suresh, "THE DYNAMISM OF STAKEHOLDERS' POWER INCONSTRUCTION PROJECTS," presented at the 26th Annual ARCOM Conference, 2010.

Accenture (2004), ‘‘eGovernment leadership: high performance, maximum value’’, The Government Executive Series, Chicago, IL, available at: www.accenture.com/xdoc/en/industries/government/gove_egov_value.pdf (accessed 8 May 2005).

Adams, D. and Hess, M. (2001), ‘‘Community in public policy: fad or foundation?’’, Australian Journal of Public Administration, Vol. 60 No. 2, pp. 13-23.

Asoh, D., Belardo, B. and Neilson, R. (2002), ‘‘Knowledge management: challenges and opportunitiesfor government in the new economy’’, Conference Proceedings of the 35th Hawaii International Conference on System Science, Big Island, HI, pp. 1-10.

Barnes, M., Newman, J., Knops, A. and Sullivan, H. (2003), ‘‘Constituting ‘the public’ in publicparticipation’’, Public Administration, Vol. 81 No. 2, pp. 379-99.

Beckman, T. (1997), ‘‘A methodology for knowledge management’’, in Hamza, M.H. (Ed.), Proceedingsof the IASTED International Conference on Artificial Intelligence and Soft Computing, IastedActa Press,Banff, pp. 29-32.

Bertok, J. (1999), ‘‘OECD supports the creation of sound ethics infrastructure: OECD targets both the‘supply side’ and the ‘demand side’ of corruption’’, Public Personnel Management, Vol. 28 No. 4,pp. 673-86.

Blair, J.D. and Buesseler, J.A. (1998), ‘‘Competitive forces in the medical group industry: a stakeholderperspective’’, Health Care Management Review, Vol. 23 No. 2, pp. 7-27.

Blair, J.D., Rock, T.T., Rotarius, T., Fottler, M.D., Bosse, G.C. and Driskill, J.M. (1996), ‘‘The problematic fitof diagnosis and strategy for medical group stakeholders – including IDS/Ns’’, Health Care Management Review, Vol. 21 No. 1, pp. 7-28

Othman, A. A. E., Hassan, T. M. and Pasquire, C. L. (2004b) Analysis of Factors that Drive Brief development in Construction. *Engineering, Construction. and Architectural Management.* Submitted For Publishing.

Barrett, P. S., Hudson, J. and Stanley, C. (1996) Is Briefing Innovation? In: Langford, D. A. and Retik, A. (eds.). *International Symposium for the Organisation and Management of Construction: Shaping Theory and Practice*. London: E and FN Spon, 3, 87-95.

Smith, J. and Wyatt, R. (1998) Criteria for Strategic Decision Making at The Pre-Briefing Stage, In: Hughes, W. (ed.). *Proceedings of the 14th Annual Conference of the Association of Research in Construction Management (ARCOM),* Reading University, Reading, 9-11 September 1998, 2, 300-309.

Kernohan, D., Gray, J., Daish, and Joiner, D. (1992) *User Participation in Building Design and Management: A Generic Approach to Building Evaluation.* Oxford: Butterworth-Heinemann Ltd.

O’Leary, A. F. (1992) *Construction Administration in Architectural Practice.* New York: McGraw-Hill.

ICE. (1996a) *Design and Practice Guide: Creating Value in Engineering.* The Institute of Civil Engineers. London: Thomas Telford.

Tenah, K. A. (1985) *The Construction Management Process.* Virginia: Reston Publishing Company.

MENTORING FUNCTIONS THAT CONTRIBUTE TO CAREER ADVANCEMENT IN THE CONSTRUCTION INDUSTRY- PERSPECTIVES OF FEMALE MENTEES

Ntombekhaya Rose-Anne Yokwana[1], Ruben Ndihokubwayo[2], Abimbola Windapo[3]
[1, 2] Department of Construction Management and Quantity Surveying, Cape Peninsula University of Technology, South Africa
[3] Department of Construction Economics and Management, University of Cape Town, South Africa

The paper examines mentoring functions and the mentoring functions perceived to influence career advancement in the construction industry. The rationale for the examination is because scholars view mentorship as a tool that can be used to advance women in their professional careers. A survey study approach was adopted and a purposive sampling technique was used in selecting the respondents. The data were gathered by means of a questionnaire survey administered to female mentees who are professionals in the South African construction industry. The data were analysed using descriptive statistics. It was revealed that female mentees perceived the most influential mentoring functions contributing to their career advancement were coaching and role modelling portrayed by their mentors. It also emerged that female mentees received less friendship and protection mentoring functions from their mentors. Only female mentees were selected to participate in the study; the participation of colleague male mentees and their mentors as well would have validated the assertions made by the female mentees. The generalizability of the results of the study is also limited by the smallness of the sample size. This study will help mentors to reflect on functions that have received less attention and to improve their mentorship functions. Having received a robust mentorship, it is expected that female mentees will make significant advancement in their careers.

Keywords: career advancement, coaching, female mentees, mentoring functions, role model, South Africa.

INTRODUCTION

In South Africa, gender related human resource management policies and legislation were established in the beginning of the democratic era in 1994 (Ozumba and ozumba, 2012:30). In the human resource management policies and legislation, mentorship programs were encouraged in the workplace to be formed as a method of advancing women (Ozumba and ozumba, 2012:30; Co Co, Groenewald, Mitchell, Nayager, van Zyl Visser, Train and Emanuel 2006:113, 199-201; Staessel and Mahol, 2006:5). Since women were one of the minority groups that have experienced oppression during apartheid (Nelson, 1981:online). Hansman (1998:66) complains that it is difficult for women to be involved in mentorship programs, and even if they

[1] ntombekahaya93@yahoo.com
[2] NdihokubwayoR@cput.ac.za
[3] Abimbola.Windapo@uct.ac.za

Yokwana *et al*. (2014) Mentoring functions that contribute to career advancement in the construction industry- perspectives of female mentees *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 423-433.

are, most of them are provided with less mentorship functions. Hansman (1998:66) and Verwey (2007:3090) posit that women receive less mentoring functions in non-traditional industries such as construction, because there are few female role model mentors. Hansman (1998) and Blake-Beard (2001:336) add that people are uncomfortable to be in cross-gender mentorship relationship because of sexual harassment concerns, sexual tension, gossip and sexual innuendo by co-workers. Chandler (1996:93) and Hansman (2002:40) argue that both female and male mentors are not interested in mentoring women because people believe that women are not serious in the workplace due to family-work conflict.

Hatipkarasulu and Roff (2011:online) established that women progress slowly than their male counterparts in male dominated industries such as construction. Although scholars such as Stoessel and Mahol (2006:5) and Washington (2007:6) view mentorship as a tool that can be used to advance women in their professional careers, the mentoring functions that influence female career development in the construction industry is not known. This study therefore examines the mentorship functions perceived by female mentees to contribute to their career advancement in the construction industry. The objectives of the study are to (1) to find out what mentoring functions are used in female mentee development; (2) to establish how female mentees perceive the mentoring functions they are receiving from their mentors; and (3) to determine whether the mentoring functions provided by mentors contribute to the career advancement of female mentees.

MENTORSHIP PROGRAMMES

Mentees are usually junior employees who are mentored or assisted by mentors who are usually senior employees in the organisation in order to advance in their careers (Gordon, 1993:3; Meyer, Naudè, Shangase and Van Niekerk 2009:160). Mentoring is a process whereby the mentee and mentor are given a chance to grow and develop, to share and learn each other's professional and personal skills and experiences (Gordon, 1999:3). The relationship is based upon constructive comments, encouragement, mutual trust, respect and willingness to learn and share (Meyer et al., 2009:161, 163 and ARMA UK, 2011:online). Scholars aver that mentees have positive career outcomes than their non-mentored counterparts in both objective measures, such as compensation and promotion; and subjective measures, such as career satisfaction, expectation for advancement, job satisfaction, intention to stay and career commitment (Ragins, Cotton and Miller, 2000:1183; Allen, Eby, Poteet, Lentz and Lima, 2004:130). Mentoring provides two kinds of mentoring functions namely psychosocial and career (Kram, 1985:22; Agumba and Fester, 2010:1961).

Psychosocial Mentoring Function

Psychosocial mentoring function is a process that encompasses the interpersonal aspects of mentoring (Kram, 1985:23). The mentor helps the mentee in developing a sense of self-competence and self-efficacy both professionally and personally (Scandura and Hamilton, 2002:295). The following are the psychosocial mentoring functions offered to mentees: role modelling, acceptance and confirmation, counseling, and friendship.

Role modelling

In role modelling, the mentee studies the behaviour of the mentor in given situations, noting the outcomes of those behaviours and applying this knowledge in shaping personal behaviour in a similar context in expectation of similar results and building their professional identities (Singh, Vinnicombe and James 2006:67; Gibson, 2004:145).

Acceptance-and-confirmation

Acceptance-and-confirmation provides fundamental trust that encourages the mentee to take risks and to venture into unfamiliar ways of connecting to the workplace (Kram, 1985:35). The mentor counsels the mentee and this helps the mentee to receive a positive sense of self at work (Kram, 1985:36).The mentor's acceptance-and-confirmation allows the mentee to experience unconditional positive consideration and to be comfortable to express their disagreements with mentors (Kram, 1985:35). Ragins and Cotton (1999:539) and Vanderbilt (2010:49-51) examined the mentorship functions in the social work, engineering and journalism professions and the studies showed that acceptance-and-confirmation was the most influential function.

Counselling

The mentor and mentee discuss openly about anxieties, fears and ambivalence which causes the mentee to be unproductive at work (Kram, 1985:36). The counselling process involves identifying a problem, analyzing it, establishing a solution and committing to it (Klasen and Clutterbuck, 2002:13). Counselling allows the mentee to explore personal concerns that may hinder her or him in the organisation (Kram, 1985:36). Counseling helps the mentee to be able to deal with personal concerns more effectively (Kram, 1985:36).

Friendship

Both individuals find a person in the relationship in order to share personal experiences with, eat lunch with or a friend to escape from the pressures of work with (Kram, 1985:38). The mentee learn increasingly valuable interpersonal skills by observing the mentor and expand association's related networks (de Janasz, 2006:131). Mutual liking and understanding are developed during social interaction of mentee and mentor in the friendship function (Kram, 1985:36). It further provides satisfaction and enjoyable informal exchanges about work and external work experiences (Kram, 1985:38). Through this friendship the mentee gains confidence and self-awareness (de Janasz, 2006:131).

Career Mentoring Function

The career mentoring function is to ensure that the mentor provides support so that the mentee grows in the organisation (Kram, 1985:22). The mentor teaches the mentee the organisation's objectives, norms, values and the mentee's duties and responsibility (Kram, 1985:24). The following are career mentoring function offered to mentees: exposure, sponsoring, coaching, protection, and challenging tasks (Kram, 1985:22, Ragin and Cotton, 1999:547).

Exposure

The mentor provides the mentee with networking opportunities (Kram, 1985:25), which helps the mentee to be in contact and interact with key players in the organisation (Scandura and Hamilton, 2002:295). Key players may influence the career of the mentee positively (Vanderbilt, 2010:12).

Sponsoring

Scandura and Hamilton (2002:295) explain that sponsorship is when the mentor provides the mentee with the recommendation for desirable lateral moves and creates opportunities for progression within the organisation. Kram (1985:25) reveals that these opportunities often happen during formal committee meetings or informal discussions with colleagues. It is not only the recommendations from the mentor that cause the mentee to receive promotions but it is also the knowledge empowered by the mentor and which create opportunities for movement and progression (Kram, 1985:25).

Coaching

MacLennan (1995:4) and Hamilton (2003:62) reveals that coaching is to unlock the mentee's natural ability, to perform, to learn and achieve, to increase awareness of the factors which determine performance, to increase their sense of responsibility and ownership of their performance, to self-coach and to recognize and get rid of barriers to achievements. The mentor observes and records the behaviour of the mentee, gives feedback, reflects by asking questions for the mentee to improve, listens and analyse behaviour as it relates to professional skill and knowledge (National Association of Secondary School Principals, 2007:online).

Protection

The mentor shields a talented mentee from stumbling blocks, difficult relationships and threats to the mentees lateral progress in an organisation (Steinmann, 2006:54; Kram 1985:26). Mentors usually have a successful track record in the organisation; they are more familiar with organisational realities, such as politics and the unique culture or way of doing things in the organisation (Steinmann, 2006:54). Mentees lack these characteristic skills such as experience and work politics (Dreher and Dougherty, 1997:117) which the mentor provides.

Challenging tasks

Mentees receive challenging tasks from the mentor (Scandura and Hamilton, 2002:295); which enable the mentee to further expand their skills through programmes that are organised by the organisation (Vanderbilt, 2010:12). The challenging tasks which the mentor provides, allows the mentee to improve particular competencies and experience a sense of accomplishment (Vanderbilt, 2010:12).

It emerged from the literature review that there are two types of mentoring functions – psychosocial and career. It revealed that the psychosocial mentoring functions in use are role modelling, acceptance and confirmation, counseling and friendship while the career mentoring functions offered are exposure, sponsoring, coaching, protection and challenging tasks. In addition, it was revealed that mentorship programmes provide positive outcomes and empowers women, and that female mentees in the South African Construction Industry have been provided less mentorship functions due to lack and insufficient mentorship programmes for women.

METHODOLOGY

Data was gathered in South Africa by means of a questionnaire emailed, hand delivered and an online survey monkey tool. The research was conducted between 2011 and 2013. A survey study was applied to generalise the result about the population being studied (Alreck and Settle, 2004:447; Girden and Kabacoff, 2011:67). Quantitative approach was adopted in order to investigate the social or human problem measured in numbers and analysed with statistical steps (Creswell, 1994 cited by Naoum, 2003:38). A purposive sampling technique was used to select female mentees who are working as construction industry professionals and workers.

At the end of the study period, a total of 24 survey questionnaires were obtained from female mentees contacted. This represents a 7.5% response rate, the low rate occurred because of the technical problems that were experienced in the online survey monkey tool; few women are involved in mentorship relationships and potential participants showed little interest in participating in the study. Nominal scale was used in order to categorise the demographics of the female mentees (Wegner, 2009:20). An ordinal scale (5-point likert scale) was used to rank how the psychosocial and career mentoring functions have an influence on the female mentees. Ordinal scale is usually used to rank between the implied classifications (Wegner, 2009:20). The data was analysed using descriptive statistics, while cronbach's reliability technique was adopted to test the reliability of scale questions. Maree (2007:216) states that the reliability of test of scale questions is acceptable in the degrees above 0.70. The test for psychosocial mentoring function was 0.712 and for career mentoring function was 0.841. Therefore, the responses provided can be said to be both reliable and acceptable.

FINDINGS

Profile of respondents

The study sought to know the background profile, current position and the highest qualifications obtained by the respondents. The data collected in this regard are presented in Table 1, 2 and 3 respectively.

Table 1: Distribution of respondents by age group

Age group	N	%
Under 26 years	10	44
26-30 years	8	33
31-35 years	2	7
36-40 years	2	7
46 – 50 years	1	4
51 – 55 years	1	4
Total	24	100

Table 1 indicates that a significant number (77.7%) of female mentees that took part in the study were 30 years of age or below.

Table 2: Current position of Participants

Current position of participants	N	%
Engineer in training, intern, civil engineer, engineering technician	4	19
Candidate, assistant and full/professional quantity surveyor	4	15
Research assistant	3	11
Construction health and safety officer, junior health and safety agent	3	11
Environment practitioner and Heritage officer	2	7
Commercial manager	2	7
Supervisor + Junior Foreman	2	7
Labourer	2	7
Director of own company, Associate	2	7
Sales consultant	1	4
Store lady	1	4
Total	24	100%

Table 2 shows that the female mentee respondents were distributted according to the following positions - engineer in training, intern, civil engineer and engineering technician (19%); candidate, assistant and full/professional quantity surveyor (15%); research assistant (11%); construction health and safety officer, junior health and safety agent (11%); environmental practitioner and heritage officer (7%); commercial manager (7%); supervisor and junior foreman (7%); labourer (7%); director of own company and associates (7%); sales consultant (4%); and store lady (4%).

Table 3: ***Highest formal qualification***

Highest formal qualification	N	%
Matric	9	37
Bachelor degrees	6	26
Honours degree	3	11
Master's degree	3	11
Diploma	2	7
N3	1	4
Grade 11	1	4
Total	24	100

Table 3 reveals the highest formal qualification attained by the female mentee respondents distributed as follows: matric (37%), bachelor degree (26%); diploma (7%); honours degree (11%); master's degree (11%); N3 (4%) and grade 11 (4%).

Psychosocial mentoring function of women

The study sought to know the psychosocial mentoring function provided to female mentees in the construction industry. Female mantees were asked to rate each of the 15 items grouped into 4 main areas on the survey that represented the psychosocial mentoring function provided by their mentors shown in Table 1. A 5-point Likert-type scale was used for each item where 1 = not at all, 2 = to a little extent, 3 = to some extent, 4 = to a large extent, 5 – to a very large extent. The data collected in this regard is presented in Table 4.

Table 4 shows that the most influencing function in psychosocial mentoring function is role modelling (3.82) followed by counselling (3.54) and acceptance-and-confirmation (3.52). The least influencing function provided to female mentees is friendship (2.04). The total average mean score of 3.23 indicates that mentees expressed feelings of neutrality in the psychosocial mentoring function they were receiving from their mentors.

Career mentoring function of women

The study sought to know the career mentoring function provided to female mentees in the construction industry. Female mentees were asked to rate the extent of the influence of 13 career mentoring functions grouped into 5 main areas as presented in Table 2. A 5-point Likert- type scale was used for each item where 1 = not at all, 2 = to a little extent, 3 = to some extent, 4 = to a large extent, 5 = to a very large extent. An overall mean score of 3.35 for the rating of career mentoring functions by study respondents suggests that the career mentoring functions received by female mentees surveyed is neutral.

Table 5 shows that the most influential career mentoring function provided to female mentees from a ranking perspective is coaching (3.69) followed by providing challenging assignments / task (3.61), exposure (3.23) and sponsoring (3.17). It emerged that the least influential career mentoring function provided to female mentees is protection (3.13).

Table 4: Psychosocial mentoring function

Psychosocial Mentoring function	Mentees' response			
	N	Mean	Std. Dev	Rank
Role modelling				
I try to imitate the work behaviour of my mentor	24	3.54	1.02	
I agree with my mentor's attitudes and values regarding the industry	24	4.00	.83	
I admire my mentor	23	4.04	.88	
I will try to be like my mentor when I reach a similar position in my career	23	3.74	.81	
Average	23	3.82	.74	1
Counselling				
My mentor has demonstrated good listening skills in our conversations	24	3.83	1.01	
My mentor has discussed my questions or concerns regarding feelings of competence, commitment to advancement, relationships with peers and supervisors or work/ family conflicts	24	3.50	1.06	
My mentor has personal experiences as an alternative perspective to my problems	23	2.96	1.19	
My mentor has encouraged me to talk openly about anxiety and fears that detract me from work	23	3.48	1.08	
My mentor has conveyed empathy for the concerns and feelings and doubts I shared with him in strict confidence	23	3.61	1.03	
My mentor has kept feelings and doubts I shared with him in strict confidence	22	3.95	1.05	
Average	23	3.54	.89	2
Acceptance and confirmation				
My mentor has encouraged me to try new ways of conduct in my job	24	3.33	1.09	
My mentor has conveyed feelings of respect for me as an individual	23	4.17	.89	
My mentor has asked me for suggestions concerning problems she/ he encountered at work	24	3.04	1.37	
Average	23	3.52	.82	3
Friendship				
My mentor has interacted with me socially outside of work	23	1.91	1.00	
My mentor has invited me to join him / her for lunch	24	2.25	1.23	
Average	23	2.04	.92	4
Total Average	23	3.23	.52	

DISCUSSION OF FINDINGS

This paper examines mentoring functions perceived by female mentees to influence their career development in the construction industry. Two mentoring functions – psychosocial and career - were identified through the review of extant literature (Kram, 1985:22; Ragins and Cotton, 1999; Scandura and Hamilton, 2002:295). The psychosocial mentoring functions include subjects such as role modelling, acceptance and confirmation, counselling and friendship, while the career mentoring functions covers subject such as exposure, sponsoring, coaching, protection and challenging tasks. It emerged that while role modelling is perceived as the key psychosocial mentoring function affecting career advancement in the construction industry, coaching is perceived as the key career mentoring function contributing to career advancement. It also emerged that friendship is perceived as the least psychosocial mentoring function contributing to career advancement; this is supported by Noe (1988:464).

These findings are aligned to the findings of previous studies by Noe (1988:464) and Vanderbilt (2010:49) and are not supported by Ragins and Cotton (1999:536). The findings indicated that the influence of the three psychosocial mentoring functions was viewed by female mentees as being provided to a large extent. These functions were role modelling, counselling and acceptance-and-confirmation. The functions were in the scale of 3.52 – 3.83; while friendship was in the scale of 2.04 indicating that it influenced the career advancement of female mentees to a little extent. Two career mentoring functions were perceived by female mentees to be provided to a large extent. These functions were coaching and providing challenging tasks. The functions were in the scale of 3.61 – 3.62; while the exposure, sponsoring and protection were in the scale of 3.13 – 3.23, indicating that they were provided to some extent.

Table 5: Items of Career mentoring function provided to Female Mentees

Career Mentoring Function	**Mentees' response**			
	N	**Mean**	**Std. Dev**	**Rank**
Coaching				
My mentor has encouraged me to prepare for advancement in my career	22	3.73	.99	
My mentor has shared history of his/her my career with me	22	3.64	.95	
Average	21	3.69	.86	1
Providing challenging assignments / tasks				
My mentor has given me assignments or tasks that present opportunities to learn new skills	23	3.57	1.20	
My mentor has provided me with support and feedback regarding my performance as an employee	23	3.52	1.20	
My mentor has suggested specific strategies to my mentee for achieving my career goals	23	3.65	.94	
My mentor has given me feedback regarding my performance in my present job	23	3.65	1.03	
My mentor has suggested specific strategies to my mentee for accomplishing work objectives	24	3.63	.875	
Average	23	3.61	.97	2
Exposure				
My mentor has assigned responsibilities to me that have increased my contact with people in the district who may judge my potential for future advancement	24	3.42	1.18	
My mentor has given me assignments that increased written and personal contact with work administrators	23	3.17	1.15	
My mentor has helped me meet new colleagues	24	3.13	1.08	
Average	23	3.23	1.00	3
Sponsoring				
My mentor has given me assignments or tasks in my work that prepare me for a higher position	23	3.17	1.19	
Average	23	3.17	1.19	4
Protection				
My mentor has helped me finish assignments / tasks or meet deadlines that otherwise would have been difficult to complete	24	3.33	1.31	
My mentor has reduced unnecessary risks that could threaten the possibility of receiving a promotion	22	2.91	1.19	
Average	23	3.13	1.02	5
Total Average	**23**	**3.35**	**.80**	

CONCLUSION

The study examined the perspective of female mentees on the mentoring functions contributing to their career advancement in the construction industry. In psychosocial mentoring function, role model was pointed out as the key influencing function followed by counselling acceptance-and-confirmation while friendship was perceived as the least psychosocial mentoring function. In career mentoring function, coaching was perceived to be the most influencing function followed by challenging tasks/assignments, exposure, sponsoring and protection. Based on these findings, it can be concluded that role models and coaching are required to engender female career advancement in the construction industry and that friendship between the mentor and mentee is not highly contributory to female career advancement. It is recommended that construction organisations and professional bodies should provide more role models and coaching in order to enhance the career advancement of females in the construction industry. The result of this study is limited by the smallness of the sample size, male mentees counterparts and mentors not being selected to participate and therefore further studies will be required to validate it.

REFERENCES

Agumba, J.N and Fester, C.F. (2010). "Participation in formal mentoring programme in South African construction industry: A perspective of new knowledge workers". African Journal of Business Management. 4 (10):1954 – 1963.

Alreck, P. I. and Settle, R, B. (2004). "The survey research handbook: 3rd Edition". New York: McGraw-Hill Irwin.

Allen,T.D. Eby, L.T. Poteet, M.L. Lentz, E. and Lima, L. (2004). "Career Benefits Associated With Mentoring for Prote´ge´s: A Meta-Analysis". Journal of Applied Psychology. 89 (1): 127 – 136.

ARMA UK. (2011). "ARMA mentoring programme". Retrieved on 14 October, 2011 from http://www.arma.ac.uk/about/individuals/mentoring/index.xhtml

Blake-Beard, S. D. (2001). "Taking a hard look at formal mentoring programs: A consideration of potential challenges facing women". Journal of Management Development. 20 (4): 331 – 345.

Chandler, C. (1996). "Mentoring and women in Acedemia: Reevaluating the traditional model". NWSA Journal. 8 (3): 79-100.

Co, M. J., Groenewald, J., Mitchell, B., Nayager, T., van Zyl J., Visser, K., Train.T. and Emanuel, B. (2006). "Entrepreneurship: Fresh perspectives". Cape Town: Pearson Education South Africa.

De Janasz, S. C. (2006). Alternative approaches to mentoring in the new millennium. In Karsten, M. F., (Edition). Gender, race and ethnicity in the workplace: Issues and Challenges for today's organizations. Volume 3: organizational practices and individual strategies for women and minorities. London: Praeger Perspectives. 131 – 148.

Dreher g. F., and dougherty, t. W. (1997). "Substitutes for career mentoring: promoting equal opportunity through career management and assessment systems". Journal of Vocational Behavior. 51 (1): 110 – 124.

Gibson, D. E. (2004). “Role models in career development: new direction for theory and research”. Journal of Vocational Behavior. 65 (1): 134 – 156.

Girden, E, R. and Kabacoff, R. I. (2011). Evaluating research articles: from start to finish – 3rd Edition. Los Angeles: Sage Publications Ltd.

Gordon, F. S. (1999). “Making the most of being a mentor: How to grow from a mentoring partnership”. NETg: Boston. Retrieved on 13 June, 2011 from http://www.Axzopress.co m/downloads/pdf/1426018371pv.pdf

Hamilton, R. (2003). “Mentoring”. London: Spiro Press.

Hansman, C. A. (1998). “Mentoring and Women's Career Development”. New directions for adult and continuing education. 1998 (80):63 - 71.

Hansman, C. A. (2002). Critical Perspective on Mentoring: Trends and Issues. Diversity and power in mentoring relationships. Information series no 388. Retrieved on 4 July 2012 from: http://calpro-online.org/eric/docs/mott/mentoring1.pdf.

Hatipkarasulu, Y. and Roff, S. E. (2011). Women in construction: An early historical perspective. 47th ASC Annual International Conference Proceedings. 6 – 9 April, 2011. Hilton Omaha: Omaha. Retieved on 13 September, 2011 from http://ascpro.ascweb.org/ chair/paper/CEGT 330002011.pdf

Klasen, N. and Clutterbuck, D. (2002). “Implementing mentoring schemes: Apractical guide to successful programs”. Johannesburg: Butterworth Heinemann.

Kram, K. E. (1985). “Mentoring at work: Developmental relationships in organizational life". Journal of Applied Psychology. 84 (4): 529 - 550.

MacLennan, N. (1995). “Coaching and mentoring”. England: Gower Publishing Limited.

Maree, J. G. (2007). “First steps in research”. Pretoria: Van Schaik Publishers.

Meyer, S. M., Naudè, M., Shangase, N. C. and Van Niekerk, S. E. (2009). “The nursing unit manager: third edition. Cape Town: Heinemann.

National Association of Secondary School Principals. (2007). “Mentoring and coaching”. Retrieved 9 September, 2011 from: http://www.nassp.org/portals/0/content/47187.pdf

Nelson, H. D. (1981). “South Africa, a country study”. Washington DC: Supt. of Docs., U.S. G.P.O.

Ozumba, A. and Ozumba, C. (2012). “Women in Construction in South Africa: Investigating the Feminine Footprint of the South African Construction Industry”. Journal for the Advancement of Performance Information and Value. 4 (1): 28 – 43.

Ragins, B. R. and Cotton, J. L. (1999) “Mentor functions and outcomes: a comparison of men and women in formal and informal mentoring”. Journal of Applied Psychology. 84(4): 529-550.

Ragins, B.R., Cotton, J.L. and Miller, J.S. (2000). “Marginal Mentoring: The Effects of Type of Mentor, Quality of Relationship, and ProgramDesign on Work and Career Attitudes”. The Academy of Management Journal. 43 (6): 1177 – 1194.

Scandura, T. A., and Hamilton, B. A. (2002). “Enhancing performance through mentoring”. In Sonnentag, S (editor). The Psychological Management of Individual Performance. A Handbook in the Psychology of Management in Organizations (293-308). Chichester: Wiley.

Singh, V., Vinnicombe, S. and James, K. (2006). “Constructing a professional identity: how young female managers use role models”. Women in Management Review. 21 (1): 67 - 81.

Staessel, J. and Mahol, M. (2006). "The perceptions of barriers to establishing mentor relationships to gender". Retrieved 18 August 2011 from: http://domapp0.shu.edu/depts/uc/apps/libraryrepository.nsf/resourceid/A11FCAC6AA01FEED85257172005D6EA0/$File/Stoessel-Jennifer-Masters6.pdf?Open

Steinmann, N. (2006). "Fundamentals for effective mentoring". Johannesburg: Knowres Publishing (Pty) Ltd.

Vanderbilt, A. A. (2010). "Perceptions of career and psychosocial functions between mentor and protégé teachers". Thesis. University of South Florida (USF).

Verwey, I. (2007). Success factors of women entrepreneurs in Construction. CIB world building conference 2007: Construction for development. 21 – 25 May, 2007. President Hotel: Cape Town. Page 3081 – 3102. Retrieved on 18 August, 2011from http://www.irbdirekt.d e/daten/iconda/CIB5271.pdf

Washington, C. (2007). "Mentoring, organizational rank and women perceptions of advancement". Thesis. Walden University.

Wegner, T. (2009). "Applied Business statistics: Methods and excel-based applications: 2nd edition. Cape Town: Juta and Co LTd.

OVERVIEW OF SCOPE AND VALUE OF BUILDING MAINTENANCE MANAGEMENT

Fredrick Simpeh[1] , Zainu Mohamed[2] and Andreas Hartmann[3]

Department of Construction Management and Quantity Surveying, Cape Peninsula University of Technology, South Africa

Faculty of Engineering Technology, University of Twente, The Netherlands

Building maintenance is gradually gaining recognition in most organisations; however there is still a level of uncertainty regarding scope due to its multifaceted nature. As part of a broader study focusing on maintenance management strategies, fundamentally, this study reviews building maintenance management with respect to its comprehensive nature, scope and value. The discussions and argument presented will help to improve the understanding of the scope and value of building maintenance management. The study is based on a rigorous literature review obtained from text books, articles, conferences and journal publications. Discussions are made in relation to the reviewed literature. The definition of building maintenance management balances both managerial and technical responsibilities; the scope is indeed broad and multifaceted. Building maintenance management is not simply a mixture of repairs and replacements, but involves preservation, cleaning operations and minor alterations to building assets. It thus, embraces some level of upgrading and renovations to raise the original standards to current standards but not the kind that significantly increases the utility or residual value of a building. The paper will be of value to maintenance managers and practitioners, for the reason that, understanding the scope of maintenance is invaluable for budgetary purposes. The paper is exclusively based on theory.

Keywords: building maintenance, nature, scope, value.

INTRODUCTION

Building maintenance management is gradually gaining foothold in most organisations due to recognition of buildings as important assets that contribute to the creation of a conducive working environment. The importance of buildings has been well highlighted; Douglas (1996) opined that buildings are the main physical asset of any institution in terms of both size and cost. In fact, they are not just assets, but valuable assets that provide shelter and facilities for work as well as leisure (CIOB, 1990). Buildings also help to provide the necessary internal environment for living in comfort and safety (Douglas, 1996), thus, increasing the potential of building users (Leaman and Bordass, 1993). Leaman and Bordass (1993) further indicated that buildings help to create an indoor condition which allows more activities to be carried out for longer periods of time. Indeed, buildings play a significant role in sustaining

[1] simfredy24@yahoo.com
[2] mohamedz@cput.ac.za
[3] a.hartmann@utwente.nl

Simpeh *et al*. (2014) Overview of Scope and value of building maintenance management *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 435-443.

and enhancing the core business of any institution (Douglas, 1996). Uline, Wolsey, Tschannen-Moran and Lin (2010) postulated that the physical environment including buildings plays a significant role in creating a productive working environment. Certainly, buildings are very important and play a noteworthy role in creating and sustaining a productive working environment for the most important asset of any institution, *"the human resources"*.

Although building maintenance is now a big business, *analogies* of its nature has their limitations (Wood, 2005). This is indicative that there is still a level of uncertainty regarding the scope of building maintenance management due to its multifaceted nature. Nevertheless, to ensure that maintenance is carried out efficiently and effectively it is important that the demarcations are clearly set. As part of a broader study focusing on maintenance management strategies, this paper reviews building maintenance management with respect to its comprehensive nature, scope and value. The following questions will be addressed:

- What is the general perception of building maintenance management?
- How valuable is building maintenance management to an institution?
- What constitute building maintenance management?
- What is encompassed in the scope of building maintenance management?

The discussions and argument presented will improve the understanding of the scope and value of building maintenance management and could be of great value to maintenance managers and practitioners, since the scope demarcation of maintenance is invaluable for budgetary purposes.

PERCEPTION OF BUILDING MAINTENANCE MANAGEMENT

The perception of building maintenance management is quite diverse, some perceive it as a non-core activity (Olanrewaju, Khamidi and Arazi, 2011), "Cinderella" activity (Seeley, 1987), unproductive (Lam, 2000; Seeley, 1987), unattractive (Lee and Scott, 2009a) and sometimes seen to possess little glamour (Seeley, 1987). Additionally, building maintenance has constantly been treated as the "poor relation" of the construction industry (Lee and Wordsworth 2001). These perceptions have a far reaching negative effect on the level of concerns building maintenance receives at top management level and how it is prioritised. Chanter and Swallow (2007), CIOB (1990), Lee and Scott (2009a) and Lee and Wordsworth (2001) actually highlighted the general lack of concern accorded building maintenance. Buys and Nkado (2006) also opined that maintenance management is indeed neglected by the top management of institutions. As a matter of fact, situations may exist in an institution where management ignores the functions of buildings or considers them a burden (Lee and Wordsworth, 2001). Consequently, building maintenance is prioritised quite low (CIOB, 1990; Lam, 2000; Lee and Scott, 2009a) and attracts only an implicit recognition of its importance (Chanter and Swallow, 2007; Lee and Wordsworth, 2001).

VALUE OF BUILDING MAINTENANCE MANAGEMENT

Building maintenance management relates more to the operation period of a building, at this stage, maintenance ought to be integral. Buildings may have several decades of service life (Douglas, 1996) and therefore need appropriate care upon completion. Allen (1995 and 2005) actually expressed that like all living organisms, buildings also go through the fundamental stages in natural cycles—birth, growth, maturity, decline, decay, death, and rebirth—and therefore require maintenance to keep the cycle under control (cited in Arazi, Khamidi and Olanrewaju, 2009). Although, building deterioration and obsolescence are inevitable and to be expected as part of the ageing process of a building (Douglas and Ransom, 2007), maintenance can help reduce the rate of deterioration, obsolescence and failure (Douglas, 2006; Douglas and Ransom, 2007; Mills, 1994; Seeley, 1987).

The worth of building maintenance cannot be underestimated. Arazi et al. (2009) were of the view that building maintenance helps to minimise decay, defect, deterioration and failure, thus ensuring that buildings perform optimally during their life cycle and represent value to the users. Additionally, maintenance helps in improving the performance of building systems, reducing operating cost, improving user satisfaction, ensuring compliance with statutory obligation and enhancing community perception (Queensland Department of Public Works, 2010). Maintenance is also carried out to ensure that the buildings and their associated services are in a safe condition, that the buildings are fit for use, that the condition of the building meets all statutory requirements, to preserve the appearance of the building, to maintain the quality of the building and to maintain the value of the physical assets of the building stock (Alner and Fellows, 1990; Seeley, 1987). The asset value of a building actually decreases unless maintenance is carried out (Lee and Wordsworth, 2001; Wood, 2009; Olanrewaju et al., 2011). Apart from these advantages, effective maintenance helps to reduce future resource requirements by prolonging a building's life or by strengthening its disposal value (Department of Treasury and Finance, 2005).

BUILDING MAINTENANCE MANAGEMENT DEFINED

The concept and scope of building maintenance is broad and complex (Lee and Scott, 2009a; Lee and Wordsworth 2001). Consequently, the concept is viewed differently by different people; in fact, scholars and practitioners have provided many definitions for the term over the years. Seeley (1987) describes building maintenance as work undertaken to keep, restore or improve every part of a building, the services and the surroundings to a currently accepted standard and to sustain the usefulness and value of the building. According to Cripps (1984), building maintenance relates to the inspection of all parts of a building, including both internal and external decoration and executing the tasks necessary to keep the structure, finishes and fittings in a suitable and acceptable state of repair. Likewise, the British Standards Institution (1993) defines maintenance as "the effort in connection with different technical and administration actions to keep a physical asset in, or restore it to a condition where it can perform a required function" (cited in Lee and Scott, 2009b:270). Douglas (2006) perceives maintenance as the act of keeping a building in a pre-determined condition. Wood (2009) regards building maintenance as the total actions required to keep a building functioning effectively. Olanrewaju (2010) perceives maintenance as a process carried out to preserve, repair, protect and care for a building's fabric and engineering services to enable it to serve its intended functions. From all these definitions, two outstanding activities ensuing are retaining the component in appropriate condition for use and restoring it to such a condition should deterioration have set in (Shohet and Lavy, 2004).

The definitions of building maintenance also balance both technical and management responsibilities (Arazi *et al.*, 2009; CIOB, 1990; Lee and Wordsworth, 2001; Lee and Scott, 2009a; Miles and Syagga, 1987; Seeley, 1987; Shohet and Lavy, 2004). Chanter and Swallow (2007) elaborated that the definition relates not only to the physical execution of maintenance work, but also its initiation, financing and organisation. Miles and Syagga (1987) postulated that the technical criteria pertain to the physical characteristics of the building while the non-technical concern the managerial criteria including environmental, financial consideration, economic criteria, policy consideration and organisational consideration. Seeley (1987) expressed that the technical criteria helps to identify maintenance needs and specify right remedies, while the non-technical criteria are the management aspects which involve planning, directing, controlling and organising the maintenance process (Arazi *et al*., 2009). Computer applications are becoming important tools for effective building maintenance management. The use of computers therefore becomes an invaluable tool in building maintenance management. Lee and Scott (2009a; 2009b) were sure that maintenance efficiency can be improved by applying technologies such as computerised maintenance management systems (CMMS). Balancing the managerial and technical requirement of maintenance would therefore require a great level of creativity and expertise.

The two activities (retaining and restoring) and the two key balancing responsibilities (technical and management) aforementioned are all geared towards an objective. Accordingly, another important component of the definition is related to its objective. In fact, Lee and Scott (2009a; 2009b) and Wood (2009) postulated that the objective of building maintenance is to allow buildings to continue to perform their functions effectively and efficiently. Undoubtedly, the objective is to ensure a continued functional performance of the building at acceptable state of repair without ignoring the appearance. Building maintenance management could thus be defined as "all the actions, both technical and administrative, required ensuring that a building is kept in, or restored to, a condition which sustains its utility and value".

SCOPE/CLASSIFICATION OF BUILDING MAINTENANCE MANAGEMENT

Table 1: Scope of building maintenance management

Author	Scope/Categorisation
Cripps (1984)	main fabric internal finishes specific features cleaning engineering services
Beddington (1984)	preventive maintenance (daily and periodic cleaning) repair restoration (including redecoration)
Miles and Syagga (1987) and Seeley (1987)	servicing rectification replacement
The Chartered Institute of Building (1990)	jobbing cyclic maintenance planned maintenance improvement work
Al-Zubaidi (1997)	fabric maintenance improvement and modification day–to-day repairs
Chotipanich (2004)	refurbishment or restoration (including redecoration) building fabric maintenance repairs landscaping and landscape maintenance cleaning and housekeeping

The scope of building maintenance is perceived and categorised differently by several scholars, the categorisation or classification therefore varies from author to author. Table 1 presents a number of the categorisation or scope of building maintenance. The classifications provided by these and other researchers are underscored by numerous common themes which overlap. The underpinning and common themes including routine or day-to-day cleaning services, repairs and rectification and minor work (improvements) are further discussed.

Routine or day-to-day (cleaning services)

Servicing is an operation undertaken at regular intervals of varying frequency; it is also referred to day-to-day maintenance. Servicing is essential because of the constant use of buildings, the effect of the weather and atmospheric conditions on the components of the building (Seeley, 1987). Hence servicing is carried out to keep the building in an appropriate condition (Chanter and Swallow, 2007). Although servicing generally results in smaller task, it contributes to a significant proportion of the building maintenance time, and consequently, the building maintenance budget because of its labour-intensive nature (Al-Zubaidi 1997; Miles and Syagga, 1987). It is thus, important for maintenance departments to clearly identify these maintenance activities. This type of maintenance activity includes cleaning of floors, cleaning out gutters, polishing floors, and checking and cleaning drains (Miles and Syagga 1987). It also includes monthly washing and cleaning of windows and regular painting for both decoration and protection (Seeley, 1987). Cripps (1984) added that engineering services, including electrical and gas services, heating, ventilation and air-conditioning, lifts, escalators and mechanical handling equipment, security installations, and special equipment like refrigeration installations are all part of routine maintenance services. Landscaping and landscape maintenance also forms part of the routine day-to-day cleaning services (Clamp, 1994; Chotipanich, 2004).

Repairs and rectification

Repairs are mainly undertaken to make good or restore a building and its component to an acceptable working condition (CIOB, 1990; Douglas 2006). Repairs and replacements are inevitable since service conditions cause materials to deteriorate at various and sometimes at unpredictable rates. Chanter and Swallow (2007) added that repair and replacement are required due to natural deterioration and usual wear and tear. In the process of repairing a building or its components some replacements might be required. Some rectification work picked up after construction and commission could be remedied by repairs or replacement while some could result in a minor improvement. It is important to note that some repair and replacement tasks (e.g. replacing of florescent light) could form part of routine maintenance activity (CIOB, 1990; Chanter and Swallow, 2007) while others (e.g. the broken water closet causing the water to flood a room) may form part of the minor sporadic (emergency) upkeep.

Minor work (improvements)

Minor work or improvement is inherent in any maintenance operation (Chanter and Swallow, 2007; Mills, 1994). The Department of Treasury and Finance (2005) explained that minor improvements are alterations necessary to ensure that buildings remain functional, adjust to service delivery needs and meet changing legislative requirements. Given that maintenance is essentially expected to restore a building to its original functional level (Lee and Scott, 2009b), it will be necessary to improve or upgrade a building to a standard appropriate for its intended use or even raise the original standards, where appropriate, to current acceptable standards (AL-Zubaidi 1997; CIOB, 1990; Chanter and Swallow, 2007; Lee and Wordsworth, 2001).

Douglas (2006) also opined that minor work of beneficial improvement or upgrading that brings a building to an acceptable standard is an indispensable component of maintenance because replacing on a "like-to-like" basis may not be adequate to satisfy the users' current and future requirements. Minor works embraces renovations which consist of work done to restore a structure, service and equipment to the original design and specification (Seeley 1987). However, any alteration that significantly changes the functionality or residual value of a building may not be considered a maintenance task but may more properly be considered a capital improvement (Department of Treasury and Finance, 2005). Douglas (2006) added that every activity regarded a maintenance task should fall short of adaptation ("performance adjustment"). Chanter and Swallow (2007) were also of a similar view that conversion and refurbishment with the objective of adapting or increasing the utility of a building are to be excluded from the scope of maintenance.

METHODOLOGY

The research is based primarily on a literature review. Several literatures from text books, articles, conferences and journal publications were reviewed. Summary of findings are deduced from the reviewed literature and the contents is analysed to draw conclusions towards achieving the aim of the study.

SUMMARY OF FINDINGS AND DISCUSSIONS

Based on the preceding literature reviewed, two important parameters are identified which underpins the definition of building maintenance management; the knowledge/responsibility requirement and the objective. The definitions balance both technical and management responsibilities; it requires both technical proficiency and managerial principles. The purpose for which maintenance is carried out is primarily to ensure continued functional performance at acceptable state of repair without ignoring the appearance and value of the building. Two activities relating to purpose are *retaining* the component in appropriate condition for use and *restoring* it to such a condition should deterioration have set in. Accordingly, building maintenance management could be defined as "all the actions, both technical and administrative, required to ensure that a building is kept in, or restored to, a condition which sustains its utility and value".

Important value that accrues from effective building maintenance management includes retaining the usefulness, the appearance and value of the building at levels acceptable by the building users and regulations. Also, effective maintenance could contribute to creating a productive work environment which may in the long run allow the free flow of ideas and information, reduce absenteeism, and lead to increase productivity and ultimately financial gains.

In terms of the scope, building maintenance management is regarded to be more than a mixture of repairs and replacing 'like with like' when individual components wear out, but involves periodic day to day services such as cleaning, repairing, preserving and minor alterations to building assets. The minor alterations may embrace some upgrading and renovations to raise the original standards to current standards, but does not include rehabilitation and refurbishing that significantly increases the utility or residual value of a building. Main fabric or internal finishes maintenance (fabric maintenance) which may relate to routine maintenance, repair, replacement or even minor work is also included. This classification helps to understand the scope of building maintenance work; what exactly is to be regarded as a maintenance activity and what is beyond the scope of maintenance which in turn helps very much when budgeting.

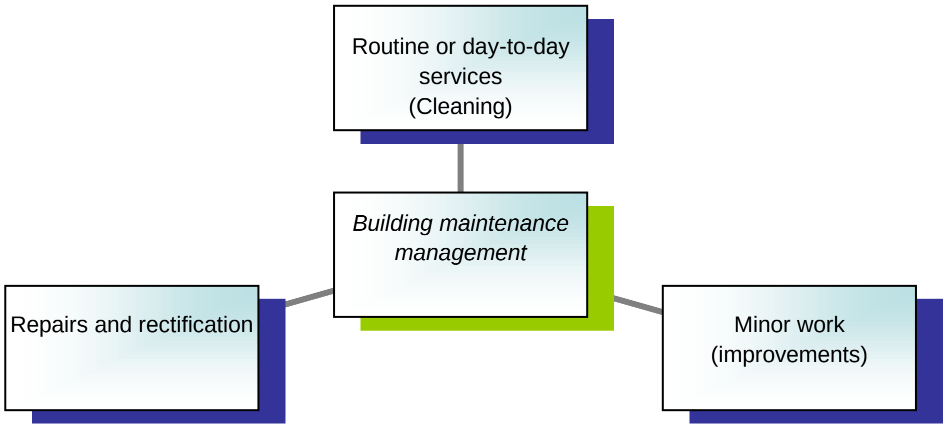


Figure 3: Scope of building maintenance management

CONCLUSION

Maintenance management balances both technical and management responsibilities and requires ingenuity in performing two key activities—*retaining* and *restoring*—to achieve a continued functional performance of buildings at acceptable state of repair. The scope of building maintenance covers periodic day to day services such as cleaning; sporadic replacements and repairs; preservation; and minor alterations. Whatever task or job considered as maintenance should not significantly increases the utility or residual value of building assets. The maintenance of building is indeed very important to the all stakeholders of a facility. Building maintenance management could actually have a *bottom line effect*. Hence the need for maintenance managers and practitioners to understand the value and scope of building maintenance work; what exactly is to be regarded as a maintenance activity and what is beyond the scope of maintenance which in turn helps very much when preparing a maintenance budgeting .

REFERENCES

Al-Zubaidi, H. 1997. Assessing the demand for building maintenance in a major hospital complex. Property Management, 15(3)173-183.

Allen, E. 1995. How buildings work: the natural order of architecture. 1st ed. Oxford: Oxford University Press.

Allen, E. 2005. How buildings work: the natural order of architecture. 2nd ed. Oxford: Oxford University Press.

Alner, G. R. and Fellows, R. F. 1990. Maintenance of Local Authority School building in U.K.: a case study in C.I.B. W-70. Proceedings of International Symposium on Property Maintenance Management and Modernization. Singapore, 90-99.

Arazi, I., Khamidi, M. F. and Olanrewaju, A.L.A. 2009. Value-based maintenance management model for university buildings in Malaysia: a critical review. Journal of sustainable development, 2(3):127-133.

Beddington, N. 1984. Building maintenance-present and future: the present position and a look ahead. In: Harlow, P. (Ed.) 1984. Managing building maintenance. Englemere, Kings Ride, Ascot, Berkshire: Chartered Institute of Building.

BSI. 1993. British Standard BS 3811: 1964 – Glossary of Maintenance Management Terms in Terotechnology. British Standards Publishing Ltd.

Buys, F. and Nkado, R. 2006. A survey of maintenance management systems in South African tertiary educational institutions. Journal of construction management and economics, 24(10)997-1005.

Chanter, B. and Swallow, P. 2007. Building maintenance management. Oxford: Blackwell Publishing.

Chartered Institute of Building. 1990. Maintenance Management: a guide to good practice. 3rd ed. Englemere, Kings Ride, Ascot, Berkshire: Chartered Institute of Building.

Chotipanich, S. 2004. Positioning facility management. Facilities, 22(13/14)364-372.

Clamp, H. 1994. The space between and around buildings. In: Mills, E. D. (ed.) 1994. Building maintenance and preservation. Butterworth-Heinemann Ltd

Cripps, D. J. 1984. Building maintenance-present and future: building maintenance-a client's viewpoint. In: Harlow, P. (Ed.) 1984. Managing building maintenance. Englemere, Kings Ride, Ascot, Berkshire: Chartered Institute of Building.

Department of treasury and finance (Government of Western Australia). 2005. Maintenance policy. Retrieved 6th May 2010 from: http://www.treasury.wa.gov.au/cms/uploadedFiles/04_samf_mp_082005.pdf

Douglas, J. 1996. Building performance and its relevance to facility management. Facilities, 14(3/4)23-32.

Douglas, J. 2006. Building adaptation. 2nd ed. Oxford: Butterworth-Heinemann.

Douglas, J. and Ransom, W.H.B. 2007. Understanding building failures. 3rd ed. Taylor and Francis.

Lam, K. C. 2000. Planning and execution of business-centered maintenance for perfect buildings. Retrieved 16th March 2011 from: http://www.cibse.org/pdfs/Centerd%20maintainance.pdf

Leaman, A. and Bordass, B. 1993. 'Building Design, Complexity and Manageability'. Facilities, 11(9)16-27.

Lee, H.Y.H. and Scott, D. 2009a. Overview of maintenance strategy, acceptable maintenance standard and resources from a building maintenance operation perspective. Journal of building appraisal, 4(4)269-278.

Lee, H.Y.H. and Scott, D. 2009b. Strategic and operational factors' influence on the management of building maintenance operation processes in sports and leisure facilities, Hong Kong. Journal of retail and leisure property, 8(1)25-37.

Lee, R. and Wordsworth, P. 2001. Lee's building maintenance management. London: Blackwell publishing.

Mills, E. D. 1994. Building maintenance and preservation: a guide for design and management. Butterworth- Heinemann Ltd.

Miles, E and Syagga, P. 1987. Building maintenance: a management manual. London: Intermediate technology publication.

Olanrewaju, A. L., Khamidi, M. F. and Arazi, I. 2011. 'Appraisal of the maintenance management practices of Malaysian universities', Journal of Building Appraisal, Vol. 6, no. 3/4, pp. 261–271.

Olanrewaju, A. L., Khamidi, M. F. and Arazi, I. 2010. 'Quantitative analysis of defects in Malaysian university buildings: providers' perspective'. Journal of Retail and Leisure Property, 9(2)137-149.

Seeley, H. 1987. Building maintenance. London: Macmillan press Ltd.

Shohet, I.M and Lavy, S. 2004. Healthcare facilities management: state of the art review. Facilities, 22(7/8)210-220.

Sowden, A.M. 1990. The maintenance of bricks and stone masonry structure. E and FN Spon: An imprint of Chapman and Hall.

Uline, C.L., Wolsey,T.D., Tschannen-Moran, M. and Lin, C.D. 2010. 'Improving the physical and social environment of school: A question of equity'. Journal of school leadership, 20(5) 597- 632.

Wood, B. 2005. 'Towards innovative building maintenance'. Structural Survey, 23(4)291– 297.

Wood, B. 2009. Building maintenance. Oxford: Wiley Blackwell.

PERCEPTIONS ON THE IMPORTANCE OF OFFERING MONETARY AND NON-MONETARY INCENTIVES TO TEAM MEMBERS OF CONSTRUCTION PROJECTS

Ndihokubwayo, R.[1], Crafford, G.J.[2] and Buys, F.[3]
[1]Department of Construction Management and Quantity Surveying, Cape Peninsula University of Technology
[2,3]Department of Quantity Surveying, Nelson Mandela Metropolitan University

The aim of this paper is to determine the perceptions of the construction industry on the importance of offering motivational incentives namely monetary and non-monetary incentives that compel them for a higher performance to achieve a successful project delivery. A web survey was adopted to send out a questionnaire to nationwide purposively selected participants including contractors, quantity surveyors, project managers, architects, and consulting engineers requesting them to base their responses to a specific construction project they have been involved in. Mean ranking descriptive statistics and paired sample test inferential statistics were used to analyse the data. In total, 164 construction industry stakeholders participated in the survey. It was perceived that the project success can be achieved if monetary incentives were transferred to a specific group which was responsible for achieving the target (5.05), and awarded individually to only team member achieving specific objectives (4.72). Also, project success can be achieved if non-monetary incentives such as participation in decision-making (5.74), and growth opportunities (5.69)were offered to project team members. Non-monetary incentives were more preferred than monetary incentives and a statistically significant difference was found between their mean rankings. By understanding the importance of monetary and non-monetary incentives, company owners and project managers would understand how to handle the personnel allocated to construction projects to meet their performance requirements.

Keywords: monetary incentives, non-monetary incentives, motivational incentives

INTRODUCTION

Incentives are referred to as something which is given in addition to wage; which means additional remuneration or benefit to an employee in recognition of achievement or better work (Management Study Guide, 2012: online). Incentives provide a spur or zeal in the employees for better performance. It is a natural thing that nobody acts without a purpose behind. Therefore, a hope for a reward is a powerful incentive to motivate employees. Incentive may be classified as monetary and non-monetary incentives. Non-monetary incentives are some other stimuli which

[1] ndihokubwayoR@cput.ac.za
[2] gerrit.crafford@nmmu.ac.za
[3] fanie.buys@nmmu.ac.za

Ndihokubwayo *et al*. (2014) Perceptions on the importance of offering monetary and non-monetary incentives to team members of construction projects *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 445-456.

can drive a person to perform better; this includes job satisfaction, job security, job promotion, and pride for accomplishment (Management Study Guide, 2012: online).

Most importantly, incentives can be used in a construction project context so as stimulate construction and consultant team members achieve a successful project delivery. According to Rose and Manley (2011:765), the use of incentives is seen as a key means of improving built environment outcomes. Rose and Manley (2011:765) indicate that financial incentives are necessary not only to enhance motivation at personal and organisation levels; but also, to promote unified motivation across highly interdependent and contractually fragmented project teams. Tang, Qiang, Duffield, Young and Lu (2010:465) stipulate that there is a consensus among all parties involved in any construction project that the use of incentives is effective in providing motivation for participants to perform better.

In fact, the spirit in which the incentives are designed is to attempt to align the interests of the contractor with those of the client by basing compensation, to some degree, on the results that are important to the client (Howard, 1996:112). In other words, the more the rewards from the client, the more the contribution of the consultant team member to a successful project delivery. Incentives are used to increase the effort of construction and design teams in voluntary performance goals beyond the contractual specifications (Rose and Manley, 2010:253). While incentives have been recognised as motivational tools for individual employees to achieve certain goals, the South African construction industry has not fully explored which incentives are regarded as important compelling team members to higher performance. The study has been confined to following objectives:

- To identify which monetary incentives is regarded as the most important by construction and consultant team members;
- To identify which non-monetary incentives is regarded as the most important by construction and consultant team members; and
- To identify whether there is any statistically significance difference between mean rankings on the perception of the importance of monetary and monetary incentives that motivate construction and consultant team to a successful project delivery.

Following hypothesis will be tested: "there is statistically significance difference between mean rankings on the perception of the importance of monetary and monetary incentives that motivate construction and consultant team to a successful project delivery."

TYPES OF INCENTIVES

Monetary incentives

Monetary incentives involve granting reward in terms of money such as commissions, bonus (Yavuz, 2004:9). MSG (2012: online) refers to monetary incentivesas those incentives which satisfy the subordinates by providing them rewards in terms of money. Money has been recognized as a chief source of satisfying the needs of people. Money is also helpful to satisfy the social needs by possessing various material items. Therefore, money not only satisfies psychological needs but also the security and social needs. Therefore, in many factories, various wage plans and bonus schemes are introduced to motivate and stimulate the people to work.

Non-monetary incentives

Non-monetary incentives do not involve direct cash payment (Yavuz, 2004:9). MSG (2012: online) indicates that besides the monetary incentives, there are certain non-financial incentives which can satisfy the ego and self-actualization needs of employees. The incentives which cannot be measured in terms of money are under the category of "non-monetary incentives". Whenever managers wish to satisfy the psychological needs of the subordinates, they make use of non-monetary incentives. Some examples of non-monetary incentives are: encouraging employees by providing them with autonomy in their job and participation in decision making, assigning challenging duties, improving working conditions, recognising good work through small gifts, letters of appreciation.

MSG (2012: online) adds that non-monetary incentives can be of the following types:

- Security of service **-** Job security is an incentive which provides great motivation to employees. If their job is secured, they will put maximum efforts to achieve the objectives of the enterprise. This also helps since they are very far off from mental tension and they can give their best to the enterprise.
- Praise or recognition **-** The praise or recognition is another non-monetary incentive which satisfies the ego needs of the employees. Sometimes praise becomes more effective than any other incentive. The employees will respond more to praise and try to give the best of their abilities to a concern.
- Suggestion scheme **-** The organization should look forward to taking suggestions and inviting suggestion schemes from the subordinates. This inculcates a spirit of participation in the employees. This can be done by publishing various articles written by employees to improve the work environment which can be published in various magazines of the company. This also is helpful to motivate the employees to feel important and they can also be in search for innovative methods which can be applied for better work methods. This ultimately helps in growing a concern and adapting new methods of operations.
- Job enrichment **-** Job enrichment is another non-monetary incentive in which the job of workers can be enriched. This can be done by increasing his responsibilities, giving them an important designation, increasing the content and nature of the work. This way, efficient workers can get challenging jobs in which they can prove their worth. This also helps in the greatest motivation of the efficient employees.
- Promotion opportunities **-** Promotion is an effective tool to increase the spirit to work in a concern. If the employees are provided opportunities for the advancement and growth, they feel satisfied and contented and they become more committed to the organization.

Form of incentives in construction projects

There are various forms of incentives that can be set to respond to specific project objectives. In fact, in a study that investigated incentive mechanisms for project success, Bower *et al.*(2002:37) found that the provision of financial incentives must align the needs of the client and the contractor, correctly allocate risk, and allow an appropriate level of client involvement. Howard (1996:i) identified innovative contractor compensation strategies that have been used successfully to meet client's objectives. The following are examples of contracts with incentive features found in a study by Howard (1996). This author investigated various innovative strategies for compensating engineering and construction contractors.

- **Contractor overheads and profits**

The contract was restructured so that the contractor would be reimbursed for overheads based on performance in five incentive areas, including: budget, schedule, safety, quality, and customer satisfaction. The client and the contractor would use these points to calculate individual awards, dependent on successful project completion. The contractor would earn a profit only if the project was completed both on or ahead of schedule and under budget (Howard, 1996:16).

- **Environmental compliance project**

Since the motivation for this project was regulatory compliance, and the project would not directly produce a revenue stream, the primary business objectives of the owner were to minimize costs and to complete the project prior to the regulatory deadline (Howard, 1996:19).

- **The two-tiered incentive contract**

This contract consisted of supplementary maintenance and modifications of construction services of seven fossil fuel and twenty-nine hydroelectric power plants of a major electricity utility company (Howard, 1996:19). Tier 1 consisted of plant performance goals, while Tier 2 was general performance.

- **Corporate team performance incentives**

The client, construction project manager, architect and the engineering team members were all included in the team incentive (Howard, 1996:41).

- **Shared under-run bonus based on performance**

A budget was fixed, and the contract was based on reimbursement of direct project expenses plus a fixed fee. The construction manager's share was 15% of any final under-run costs to budget, conditional on project completion in a predetermined time, together with the satisfactory client's evaluation of construction management performance (Howard, 1996:48-49). A 7% sharing of under-run, relative to the construction budget, was added to the architect's fees (Howard, 1996:48).

- **Pay for performance to enhance teamwork**

The project team strongly believed that previous contracting strategies could be improved upon to drive teamwork and to enhance performance in the areas of cost, schedule, safety and quality (Howard, 1996:54). An average project performance would entitle the contractor and the designer to earn a fee stated in the contract and depending on the performance of the contractor, an additional agreed-upon amount could be earned or lost by both the contractor and the designer (Howard, 1996:55).

- **Client subjective performance appraisals**

The client offered a contract using its standard agreement for engineering and procurement services, with a section added describing a unique compensation scheme based solely on the client's subjective appraisal of engineering performance (Howard, 1996:64). This was a cost-reimbursed contract. It stated that the contractor would earn a fee between 0% and a maximum percentage based solely on the client's satisfaction (Howard, 1996:65). The client communicated performance appraisal measure in meetings with the client's project manager, project engineers and plant customers (Howard, 1996:67).

- **Contractor and craft productivity incentives**

The client sought to motivate the contractor to reduce the construction costs, and thereby arrived at an incentive based on craft productivity (Howard, 1996:80). A labour cost of $25/hour was used to develop an incentive plan. The client's logic in incentive development was that for every hour that could be reduced, there was a saving of $25, and to stimulate the maximum savings, the client was willing to share it on a $15 client, and $10 contractor basis (Howard, 1996:81). The contractor would be paid a $10 bonus for each under-run hour, and the individual worker would receive $0.50 per hour for every month the craft workers could exceed productivity rates that had been built into the targets (Howard, 1996:81).

- **Incentive for field supervision**

The contract between the client and the contractor was a guaranteed maximum for construction costs plus a fixed fee that covered the contractor's profit (Howard, 1996:97). The contractor's objective was to demonstrate his abilities, and to become a contractor of choice against the competitor who had previously done business with the client. The contractor developed an incentive plan for foremen. This was aimed at enhancing productivity, schedule performance, safety and the utilisation of females and minorities (Howard, 1996:98).

METHODOLOGY

A web survey strategy was used to gather the empirical data whereby a questionnaire was purposively distributed nationwide (10,394) to selected construction members of the Engineering Council of South Africa (ECSA) (466), South African Institute of Architects (SAIA) (3,849), South African Council for the Quantity Surveying Profession (SACQSP), South African Council for Project and Construction Management Profession (SACPCMP) (2,825), and general building contractors Grade 3 to 9 (2,535) registered by the Construction Industry Development Board (CIDB). The questionnaire was sent to respondents having e-mails. A quantitative methodological approach was adopted whereby 7 point Likert scale questions were asked.Mean ranking and paired samples test were used to analyse the data.

FINDINGS

Profile of respondents

Table 1 Targeted population

Population	Sent	Not delivered	Delivered
Architects	1,730	442	1,288
Architectural technologists	1,372	300	1,072
Architectural draughtsperson	747	153	594
Consulting engineer	466	122	344
Project/construction managers	2,825	558	2,267
Quantity surveyors	719	215	504
Contractor, Grade 3	529	197	332
Contractor, Grade 4	802	310	492
Contractor, Grade 5	431	142	289
Contractor, Grade 6	467	238	229
Contractor, Grade 7	197	54	143
Contractor, Grade 8	80	25	55
Contractor, Grade 9	29	9	20
Total	10,394	2,765	7,629
Percentage	100	26.6	73.4

From Table 1, it is evident that out of 7,629 delivered e-mails to respondents, only 178 responded using the web survey and their responses were subsequently downloaded in Microsoft Excel. Reasons for not participating included retirement, too busy with work, technical problem with internet. In order to avoid any duplication, responses were further screened; thus, 144 were respondents were retained and 34 were cancelled. The criterion for identification of a duplicated response was: similar responses throughout on two or more consecutive rows, and same date of submission. Other 20 respondents preferred to complete the questionnaire on a soft copy, thus the total number of respondents was 164; hence the research participation was 2.1%.

The result shows that that 80.5% (132) of respondents were males and 19.5% (32) were females. Table 2 shows the age distribution whereby 0.6% were under 25 year old, 8.5% were aged between 25 and 30 years, 23.8% were aged between 31 and 40 years, 20.7% were aged between 41 and 50 years, 25.6% were aged between 51 and 60 years and 20.7% were above 60 years. From Table 3, it is evident that almost 80% of respondents were highly qualified from bachelor degree going upwards.

Figure 2 shows that 73.2% (120) of respondents had experience in the construction industry over 10 years, 22.0% (36) between 5 to 10 years and 4.9% (8) less than 5 years. 42.1% (69) of respondents had been in their current position over 10 years, 31.1% (51) between 5 to 10 years and 26.8% (44) less than 5 years.

Table 2 Age group of respondents

Age group	No.	%
Under 25 years	1	0.6
25-30 years	14	8.5
31-40 years	39	23.8
41-50 years	34	20.7
51-60 years	42	25.6
Over 60 years	34	20.7
Total	164	100.0

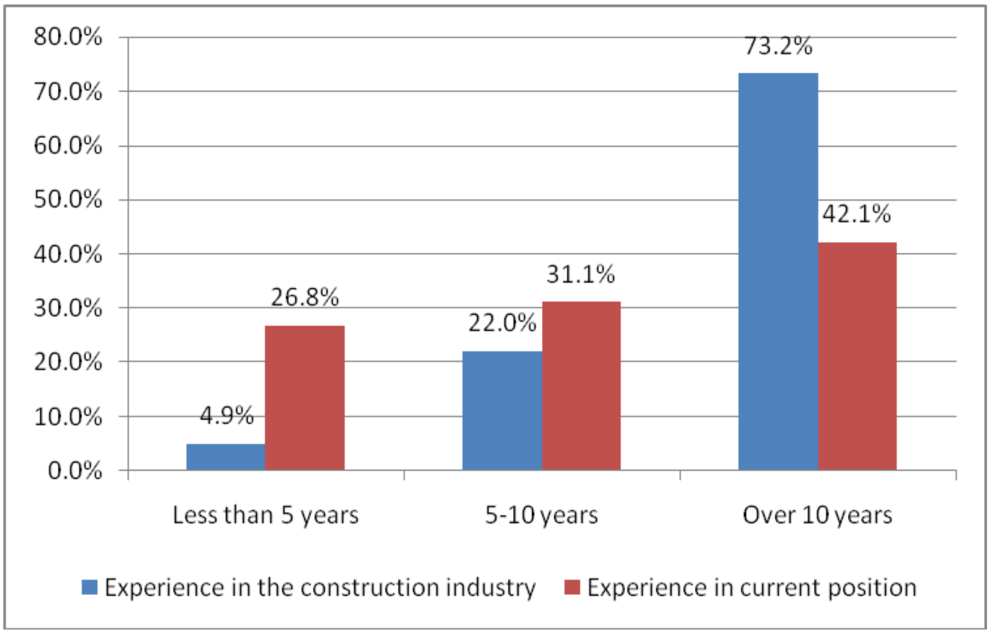


Figure 2 Experience of respondents

Table 3 Formal qualification of respondents

Qualification	No.	%
Matric certificate	9	5.5
Diploma	26	16.0
Bachelor degree	42	25.8
Honours degree	32	19.6
Postgraduate diploma	13	8.0

Masters degree	34	20.9
Doctorate degree	5	3.1
Other unspecified	2	1.2
Total	163	100.0

Table 4 shows that participant companies included contractors (28.8%), architects (19.0%), quantity surveyors (18.4%), project managers (17.2%), consulting engineers (9.2%).

Table 4: Participant companies

Company	No.	%	
Contractor Grade 2	1	0.6	
Contractor Grade 3	7	4.3	
Contractor Grade 4	5	3.1	
Contractor Grade 5	7	4.3	27.8
Contractor Grade 6	8	4.9	
Contractor Grade 7	9	5.6	
Contractor Grade 9	9	5.6	
Project Manager	32	19.8	
Architect	27	16.7	
Quantity Surveyor	27	16.7	
Consulting Engineer	13	8.0	
Government	4	2.4	
Academic	3	1.9	
Agent	2	1.2	
Construction Consultant/Developer	2	1.2	
Engineering	2	1.2	
Logistics	2	1.2	
Property Consultant	2	1.2	
Parastatal	1	0.6	
Construction Regulatory	1	0.6	
Total	162	100.0	

The importance of incentives in construction

Table 5 reports the reliability of motivational incentives. It is evident that the study produced good reliability measures ranging from 0.74 to 0.89.

Table 5 Test of reliability of motivational factors

Incentives	No. of items	Cronbch’s alpha	Comments
Monetary incentives	4	0.74	Moderately reliable
Non-monetary incentives	13	0.89	Highly reliable

MONETARY INCENTIVES

Respondents were asked to indicate their perception about the importance of "monetary incentives" motivating them to achieve a successful delivery of construction projects**;** where **1** = unimportant at all, **2** = little importance, **3** = somewhat important, **4** = important, **5** = very important, **6** = extremely important, **7** = utmost important, and **U** = unsure. From Table 6, mean scores were recorded as follows: monetary incentives transferred to a specific group which was responsible for achieving the target (5.05), monetary incentives awarded individually to only team member achieving specific objectives (4.72), monetary incentives equally shared among team members (4.56), and monetary incentives transferred to employing company(4.15). The average mean was 4.63.

Table 6:The importance of monetary incentives

Monetary incentives	No.	Mean	SD	Rank
Monetary incentives transferred to a specific group which was responsible for achieving the target (example: reward to bricklayer crew who are responsible for exceeding time target)	160	5.05	1.53	1
Monetary incentives awarded individually to only team member achieving specific objectives	159	4.72	1.66	2
Monetary incentives equally shared among team members	162	4.56	1.63	3
Monetary incentives transferred to employing company	154	4.15	1.73	4
ImpoMI		4.63	1.22	

NON-MONETARY INCENTIVES

Respondents were asked to indicate their perception about the importance of "non-monetary incentives" motivating them to achieve a successful delivery of construction projects; where 1 = unimportant at all, 2 = little importance, 3 = somewhat important, 4= important, 5 = very important, 6 = extremely important, 7 = utmost important, and U = unsure. From Table 7, mean scores were recorded as follows: participation in decision-making (5.74), growth opportunities (5.69), and verbal recognition (5.48), job enrichment (5.43), friendly treatment (5.43), verbal compliment on work progress (5.43), the public recognition where name is mentioned in meetings (4.83), letter of appreciation (4.82), the public recognition where the name appear in newsletter (4.61), job rotation (4.47), employee of the month award (4.10), invitation to coffee (3.70), and provision of private office (3.69). The average mean was 4.89.

Table 7: Non-monetary incentives

Non-monetary incentives	No.	Mean	SD	Rank	IL
Participation in decision-making	163	5.74	1.18	1	H
Growth opportunities	162	5.69	1.29	2	H
Verbal recognition/praise	163	5.48	1.38	3	H
Job enrichment - designing work with variety of tasks and responsibilities	162	5.43	1.32	4	H

Friendly treatment	164	5.43	1.38	5	H
Verbal compliment on work progress	164	5.43	1.42	6	H
Public recognition, name mentioned in meetings	164	4.83	1.78	7	Av
Letter/certificate of appreciation	162	4.82	1.67	8	Av
Public recognition, name appearing in newsletters and notice board	163	4.61	1.78	9	Av
Job rotation	161	4.47	1.55	10	Av
Employee of the month award	162	4.10	1.70	11	Av
Invitation to coffee/lunch/dinner	161	3.70	1.72	12	Av
Provision of a private office	160	3.69	1.84	13	Av
ImpoNMI		4.89	1.06		Av

TEST OF MEAN RANKING AND PAIRED SAMPLE TEST ON MONETARY AND NON-MONETARY INCENTIVES

Table 8 reports the mean ranking of the importance of monetary and non-monetary incentives that motivate construction and consultant team members to achieve higher performance. It is evident that ‘non-monetary incentives’ ranked as the highest mean score of 4.88. Furthermore, a paired statistic test was done to assess any statistical difference between motivational factors and the effect of size.

Table 8 Motivational factors contributing to project success

Motivational incentives	No.	Mean	SD	Rank	IL
Non-monetary incentives	164	4.88	1.06	1	Av
Monetary incentives	162	4.63	1.22	2	Av

Table 9 revealed a statistically significant difference paired samples (p=0.003), and the eta squared was 0.1 indicating a small size effect. Therefore, the assumption that there is no significance difference between mean rankings of the importance of incentives can be rejected in favour of an alternate hypothesis. The alternate hypothesis suggests that there is a consistent and predictable difference scores (Gravetter and Wallnau, 2009:344) between monetary and non-monetary incentives. A statistical difference means that there is a good chance that it is right to find that a relationship exists between two variables (California State University Long Beach (CSULB), 2013: online). Typically, the mean ranking upholds, and did not happen by chance.

Table 9 Paired samples test on motivational incentives

Motivational incentives		Paired Differences					T	Df	Sig. (2-tailed)	Eta squared
		Mean	Std. Dev.	Std. Error Mean	95% CI of the Difference					
					Lower	Upper				
Pair 1	MI – NMI	-0.25	1.06	0.08	-0.42	-0.09	-3.07	161	0.003	0.1

CONCLUSIONS

The study investigated the importance of monetary and monetary incentives towards project performance. It was revealed that monetary incentives would be regarded as important if transferred to a specific group which was responsible for achieving the target, and awarded individually to only team member achieving specific objectives. This is a clear indication that there should be a focus on a team rather than their employing organisations. Sawczuk (1996:75) stipulates that if the team's pay or reward is related to team's effort, then it becomes more important for a team to work well as a group of individuals with common cause and objectives. It is imperative that project managers will clearly communicate to project team members the advantages that will be derived from the involvement into the project. Indeed, Rao (2009:239) states that motivation is the work a manager performs to inspire, encourage and impel people to take the required actions. It is a process of people (managers/clients) stimulating other people (employees/construction and consultant team members) to action to accomplish desired goals (Rao, 2009:239).

The study also revealed that non-monetary incentives such as the participation in decision-making, and growth opportunities may compel construction and consultant team members to perform higher. In fact, given the South African background characterized with vast racial and gender inequalities in the distribution of and access to wealth, income, skills and employment (Department of Trade and Industry, 2003:4); the implementation of non-monetary incentives may specifically address such imbalances.

RECOMMENDATIONS

The study revealed non-monetary incentives scored higher than monetary incentives. This implies team members may perform whether regardless the presence of monetary incentives. However, further studies should investigate in which contractual situations monetary or non-monetary incentives are required or not. Also, further studies should investigate which incentives are suitable or application to various professionals and trades. The study on the provision of incentives did not explore performance areas. Further studies should focus on performance areas for example investigate which project objectives can be achieved through the provision of incentives.

REFERENCES

Bower, D.; Ashby, G.; Gerald, K. and Smyk, W. 2002. Incentive Mechanisms for Project Success, *Journal of Management Engineering*, Vol. 18 (1) pp 37-43

California State University Long Beach. 2013. Tests for Significance, , Retrieved on October 01, 2013 from http://www.csulb.edu/~msaintg/ppa696/696stsig.htm#STEPS IN TESTING FOR STATISTICAL

Department of Trade and Industry. 2003. South Africa's Economic Transformation: A Strategy for Broad-Based Black Economic Empowerment, *DTI online publications*, retrieved on May 23, 2011 from http://www.economic.gov.za/bee/complete.pdf

Gravetter, F.J. and Wallnau, L.B. 2009.*Statistics for the Behavioral Sciences*, 8th Ed. Belmont: Wadsworth Cengage Learning

Howard, W.E. 1996. Innovation Strategies for Compensation of Engineering and Construction Contractors, *PhD Dissertation*, Clemson University

Management Study Guide. 2012. Organisational Behavior. Retrieved on August, 22nd 2012 from http://www.managementstudyguide.com/what_is_motivation.htm

Rao, V.S.P. 2009.*Organisational Behaviour*, 1st ed. New Delhi: Excel Books

Rose, T. and Manley, K. 2011. Motivation toward Financial incentive goals on Construction Projects, *Journal of Business Research,* Vol. 64 (7) pp 765-773

Rose, T. and Manley, K. 2010. Client Recommendations for Financial Incentive on Construction Projects, *Engineering, Construction and Architectural Management,* Vol. 17 (3) pp 252-267

Sawczuk, B. 1996.*Risk Avoidance for the Building Team*, London: E and FN Spon

Tang, W.; Qiang, M.; Duffield, C.F.; Young, D.M. and Lu, Y. 2010. Incentives in the Chinese Construction Industry, *Journal of Construction Engineering and Management,* Vol. 134 (7) 457-467

REWORKING TRADITIONAL FUND RAISING INSTITUTIONS FOR AFFORDABLE HOUSING PROVISION: A REVIEW OF NIGERIAN AND KENYAN CASE-STUDIES

C. O Adeokun[1], B. A. Adewale[2] and O. C. Oloke[3]

Covenant University,College of Science and Technology, Department of Architecture, Km 10, Idiroko Road, Ota, Ogun State, Nigeria.

Traditional fundraising institutions such as Esusu Cooperatives in South-West Nigeria and the Harambee system in Kenya have been a vital source of capital formation for low income earners. This paper examines traditional and contemporary funding systems, and proposes alternative strategies for addressing funding challenges that confront low-income earners, by reviewing existing literature related to funding systems in Nigeria and Kenya. Harambee schemes have been successfully deployed in the education sector in Kenya, and similarly, many models of the credit and thrift cooperatives that exist in Nigeria (particularly those based on the Esusu system), have provided improved access to loans and credit for low income earners. It is argued that the advantages of these traditional schemes which rely fundamentally on community collaboration can be successfully utilised in the delivery of housing projects. In conclusion, the financial benefits enjoyed in the Esusu and Harambee systems can be successfully harnessed in the delivery of small and medium-sized housing schemes via housing cooperatives and other finance institutions in urban locations, by focusing on loan default minimization and elimination of collaterals.

Keywords: esusu, credit and thrift cooperatives, harambee, affordable housing.

INTRODUCTION

The need to examine alternative ways of funding and delivering housing projects is clearly established in Adebamowo, Oduwaye and Oduwaye (2012),Ademiluyi (2010), EFinA and Fin Mark (2010),Fadairo and Olotuah (2013), and Ogundiran and Adedeji (2012), which all highlight a significant gap between housing provision and housing needs in urban Africa; underscoring the urgent need to investigate alternative solutions to the dilemma. Nigeria and Kenya have been chosen as case studies because traditional fund raising methods are well established in both countries, and have to some extent been successfully adapted for funding education building projects particularly within the Kenyan Harambee tradition. Secondly, Nigeria and Kenya are improving economies in West and East Africa respectively.

[1] lola.adeokun@yahoo.co.uk
[2] bukola.adewale@covenantuniversity.edu.ng
[3] yinka.oloke@covenantuniversity.edu.ng

Adeokun *et al*. (2014) Reworking traditional fund raising institutions for affordable housing provision: a review of Nigerian and Kenyan case-studies *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 457-469.

Although Kenya's urbanization percentage is lower than that of Nigeria (about 34% and 45% respectively)[4], the paucity of finance products suitable for the urban poor has been identified as a major deterrent to the provision of sufficient affordable housing quantities in both countries (Adebamowo, Oduwaye,and Oduwaye, 2012; Mutero, 2007;Malhotra, 2002; Ondola, Odundoand Rambo, 2013). Kenya's housing shortage shortfall is estimated by Mutero (2007) and Ondola et al. (2013) as between 120,000-200,000 units annually, compared to a supply of 60,000 units according to Mwanza(2012). Estimates of the annual housing requirement in Nigeria vary from about 70,000 (Olotuah, 2010), at least 200,000 dwelling units as stated in Adebamowo, Oduwaye, and Oduwaye (2012), to a massive 500,000 – 600,000 units in Ajanlekoko(2001); all of which are indicative of the existence of a significant challenge.

The lack of access to housing finance by low income earners is also a fundamental obstacle because housing needs constitute a huge capital outlay for most households in the Nigeria and Kenya, as stated in Makinde (2013),Ochieng (2009), and Yakub, Salawu and Gimba (2012), which is also emphasised by the assessment in Rust (2012)that only 3% of Africa's population can currently support a mortgage[5]. Proposals that cheaper building materials and construction techniques ought to be adopted to resolve the affordable housing deficit have yielded limited results in quantitative terms according to Ondola et al. (2013); though these options remain useful.

To this end, this paper explores 'end-user' housing finance for low income households by reviewing the Esusu in South-West Nigeria and the Harambee fundraising system in Kenya. It argues that some of the advantages of these traditional fund raising formats can be successfully blended in with contemporary finance products for the affordable urban housing sector. Current methods of financing low-cost housing projects are also reviewed with attention to the end-user's perspective, in order to answer the question: - *How will the buyer successfully finance the homes once they have been built?* The prospect of the end-user being viewed as a stakeholder in the delivery process is an interesting idea.

THE ESUSU AND HARAMBEE FUND RAISING SYSTEMS

Orvis (2006) views traditional practices as institutions stemming from his adoption of Knight (1992) definition of an institution as a '*set of rules, norms, or standard operating procedures that is widely recognized and accepted, structuring and constraining individuals' actions in a particular arena*' p98. If we also accept this simple description of institution, then it stands that both the Esusu and Harambee are (financial) institutions that ought to be explored.

HISTORICAL OVERVIEW OF THE ESUSU FUND RAISING SYSTEM

The power of collectivism and group association among the Yoruba is rooted in mutuality, cordiality, trust, and understanding, culminating in a sense of community, and istypically directed towards farming, hunting, building of houses and finance (Akinola, 2007). Traditional fund raising systems as a form of social capital are reported extensively in literature about the African setting (Bascom, 1952; Oloyede,

[4]Estimates for Kenya and Nigeria are obtained from www.unhabitat.org based on 2001 estimates.
[5]based on an AFDB Report of (2011)

2005; and Seibel, 2004), and were ways of solving individual and corporate problems, examples of which are the *Esusu* and *Ajo.* However, this paper focuses on the Esusu. The Esusu is a traditional way of facilitating access to housing finance, and the earliest evidence of this financial institution in Africa dates back to the 16th century (Siebel, 2004). They are financial self-help units that are based on local membership and operate a rotating type of savings. Each member contributes a set amount on a monthly basis, and the lump sum contributed is given to individual members in turns. A typical rotating Esusu group continues until at least each member has benefited once, but most have significant longevity with an average of 8.3 years according to Seibel (2004).

The Esusu's role in providing finance for development at grass root levels is established in literature, and according to Adedeji and Olotuah (2012), Akinola (2007) and Oloyede (2005), low income households typically turn to Esusu as an important informal source of capital because they often do not qualify for bank loans due to inadequate collateral. Although exact figures of current membership is difficult to ascertain, EFInA (2010) states that almost 30% of Nigerians belong to an informal savings society like the Esusu.

Bascom (1952) identified two types of Esusu Systems. The 'open' Esusu method which involves contributors from different extended family compounds who may not know one another, which was sometimes prone to cheating by the leader of the Esusu, and the 'restricted' type- involving inhabitants of the same compound; for example, an association of wives, an association of children, or based on trade/occupational affiliation. This type has been reported to be of huge success due to accountability on the part of the leader who is usually known to the members, and consequently cases of default are rarely reported. The Esusu system extended to the Caribbean islands during the slave trade and to other African countries like Liberia (Bascom, 1952) and even to major American cities (Siebel, 2004).

The Esusu was remodelled into modern cooperative societies in Western Nigeria in 1935 after British and Indian cooperatives by the colonial administrators because of their belief that the Esusu is fraudulent. This conversion seemed to have heralded the end of the Esusu when people of different ethnic backgrounds got involved and loans were granted to members without contributions (Siebel, (2004). However, the Esusu remains an important way of generating income for different forms of development and there are thousands throughout the region. Informal Esusus were found to perform better than cooperatives in a small sample by Seibel (2004), suggesting that some of the benefits of the Esusu may be better suited to the needs of low-income households. The main advantages of Esusu over formal methods of fund raising are that a) it attracts no interest rate, and b) it affords the recipient the opportunity to obtain larger sums than would have been possible through individual effort; thereby emphasising the power of collective action.

HISTORICAL OVERVIEW OF THE HARAMBEE FUND RAISING TRADITION

Several sources credit the creation of formal Harambee institutions as a means of generating funds for community projects to Jomo Kenyatta, the first President of independent Kenya (Chebet-Choge, 2012; Orvis, 2006), however the word itself according to Ombudo (1986) is from the bantu word 'Halambee' which literarily means "Let us all pull together'; emphasising the collective effect of harnessing individual efforts to achieve bigger results .Harambee groups existed preindependence in most Kenyan communities and were self-help groups that were typically organised along gender and tribal lines, and devoted to activities such as, agriculture (bush clearing, sowing, harvesting) and house-building, similarly to the Esusu. Harambee groups usually commenced initially without government involvement but often with the hope of attracting additional government support or management. Kenyatta's 'genius' according to Orvis (2006) was to connect pre-existing community self-help efforts to development and political structure within the Harambee system. Godfrey and Mutiso (1973), comments that newly formalised Harambee societies would be giving government funding for infrastructure, but also harness donations from wealthy members of the community.

Modern day Harambee groups are often registered organisations funded by non-governmental organisations, often existing side by side with informal traditional groups. To date, Harambee efforts are most strongly felt in the area of education (with over 600 secondary schools built) but significant contributions have also been made in infrastructure and community based projects according to Chieni(1997), Fullan, Hewlitt and Nnam (2006), and Godfrey and Mutiso(1973).

Though laudable, Harambee projects particularly educational ones have not been without problems. For Kinuthia (2009), the projects are of variable quality because they often ended up with minimal or no government funding, and efforts to formalise government support via a cost-sharing policy introduced in the 1980s were not always successful. Nonetheless, the positive contributions of the formal Harambee movement in Kenya are in the main acknowledged in literature, and are based in part on the fact that the projects are a) initially funded by the community emphasising self-help, and b) harness capital from the private sector and the government, although this commitment needs to be improved (Chieni, 1997).

ESUSU AND HARAMBEE COMPARED

Both systems operate via the power of collective action, and provide much needed capital to low-income earners on an interest free basis. The element of social peer pressure seems to work well in both systems as a means of reducing errant behaviour due to the local community element. However the formal Harambee system has the advantage of being constituted to involve government assistance and to access private capital. In summary, the advantages of both systems are attractive and it is useful to explore ways of incorporating them into housing finance solutions.

CURRENT FUNDING SOURCES OF LOW-COST HOUSING

Adebamowo, Oduwaye, and Oduwaye (2012), CAHF (2010), EFInA and FinMark Trust (2010),Makinde (2013) and Malhotra (2002) all state that finance (at the investor-end and the user-end) is a major factor in housing delivery. According to Makinde (2013), affordable housing based on public–private partnerships and private finance initiatives accounts for just 3% of the required stock in Nigeria, while Alithea Capital (2009) reports that mortgage finance in Nigeria is less than 0.5% of the Gross Domestic Product (GDP), compared to 3% in Ghana and 20% in South Africa. Formal funding supplies about 15% of the housing need, according to EFInA and FinMark Trust (2010), which Folorunsho, Khan and Olowoyo (2012) describe as negligible. Housing costs also constitute about 40% of the income of urban dwellers who are mostly renters (EFInA and FinMark Trust, 2010).

Kenya has a relatively well-developed financial system in comparison to many other African markets, with a mortgage sector that currently constitutes 3.3% of the GDP according to CAHF (2010), but one of its most critical challenges is making finance accessible to the poor. Mutero (2007) reports that whilst the Kenyan economy continues to make some progress with on-going reforms in the financial sector, the combined efforts of the private and public sectors in Kenya produces about 15% of the housing shortfall. Malhotra (2002) states that over 50% of the expenditure in low income households is spent on food, compared to less than 20% on housing, and as a result, it is pertinent to integrate other income generating activities into housing programmes, to make more income available to service housing loans (Mutero, 2007). Currently, very few Nigerians and Kenyans can afford existing mortgage products according to the CAHF (2010) report and unfortunately, there is no well-coordinated housing subsidy system for social (affordable) housing in Kenya as reported in UNHSP (2005), and virtually none are affordable by the poor in Nigeria (Shorebank International, 2011). Formal and informal funding sources are discussed below.

FORMAL MORTGAGES FOR LOW-INCOME FINANCE AND MICROFINANCE

The formal institutions responsible for housing funding in Nigeria are: -

A) <u>The Regulators</u>: -The Federal Ministry of Lands, Housing and Urban Development, the Central Bank of Nigeria; responsible for regulating the banks, primary mortgage institutions, and microfinance banks, and The Securities and Exchange Commission (EFInA and FinMark Trust, 2010 and Makinde, 2013).

B) <u>The Financial Institutions: -</u>

1) The Federal Mortgage Bank of Nigeria (FMBN) was created in 1977 as an apex housing finance institution to provide long-term credit facilities to mortgage institutions, supervise mortgage institutions, fund the National Housing Fund, and promote construction research and mortgage finance.

2) The National Housing fund (NHF) set up in 1992 was specifically aimed at providing low-cost housing finance and is administered by the FMBN. It is a mandatory contributory scheme and according to Sanusi (2003), the fund should provide home building and improvement loans, incentives for the capital market to invest in property development and long-term loans to mortgage institutions.

3) 24 Commercial (private) Banks, and

4) 99 Primary Mortgage Institutions

C) <u>The Developers</u>: -

1) The Federal Housing Authority and

2) State Housing Corporations. The first Housing Corporation was the Western Nigeria Housing Corporation established in 1959, and each of the thirty-six states now has one, to operate as property developers of the government

3) State Ministries of Housing and Urban Development

In more recent times, private institutions such as real estate developers, insurance companies and non-governmental organisations have also become involved in housing provision, although most focus on middle and high income housing units.

The ‘threshold’ established for low-cost affordable housing in Nigeria of N2million according to Makinde (2013) is based on affordability analysis. Alithiea Capital (2009) stated that over 60% of the active population cannot afford houses of

N5million, and few institutions other than the FMBN provide for such housing below N2.5million. According to EFInA and FinMark Trust (2010), both FMBN and the NHF have real operational constraints with less than 100,000 mortgage units allocated in the period between 1960 and 2009; mostly for high-income units with a maximum repayment period of 10 years.

The Kenyan mortgage accessibility conditions according to Mutero (2007) is such that only a small percentage of urban households have traditionally qualified for mortgage loans from housing finance institutions, due to their low income and a variety of reasons. This situation has not improved much despite the lowering of interest rates in the 1990s, which stood at 12.5% -14 % in 2007, and the recent extension of lending terms to 25 years by some Housing Finance Institutions.

Kenya's mortgage industry goes back to 1964, with the main financing organizations being the Housing Finance Company of Kenya, Kenya Building Society (KBS), and Savings and Loans (S and L), with numerous building societies and banks presently. Despite some finance institutions failing in the period from the late 80s to early 90s, (Mutero, 2007) stated that the most important historical development was the freeing of interest rates in July, 1991.Recent innovations include the provision of fixed-rate mortgages, the introduction of 100% financing by one of the banks for certain loans, and the growth of home equity loans secured by mortgaged properties. Although exact figures are not available, Makinde (2013), Malhotra (2002), Ondolaet. al. (2013) and Taylor (2000) all affirm that private developers (small firms and single plot holders) produce the bulk of formal urban housing in Kenya and Nigeria.

Overall, on-going challenges faced in the low-cost mortgage market in both countries include a) the lack of suitable finance products, b) the need to improve the ability of microfinance institutions to access private capital for housing microfinance, c) the need to mitigate default risks, and) the inability of low-income earners to provide collateral or security against their loan application. These challenges remain despite the much lauded aims of Nigeria's NHF, and the efforts of Kenya's mortgage Industry.

OTHER FORMAL SOURCES OF HOUSING FINANCE

Many individual households and builders obtain loans from microfinance institutions however, few institutions concentrate specifically on housing in Kenya (Malhotra, 2002), and Yaqub (2012) review of microfinance in Nigeria also suggested that their impact was limited and rarely resulted in improved income generation.

HOUSING MICROFINANCE

Mutero (2007) describes housing microfinance as an emerging sector in Kenya, but the issue of security for microloans remains a real problem. One of the main peculiarities of the low-income sector in Kenya according to Malhotra (2002), and of developing countries in general according to UNHSP (2005), is the need to build and raise funds in stages (incremental or progressive housing), which UNHSP(2007) estimated at around 70 percent of housing investment in developing countries. This means smaller loans are needed for each stage and consequently, repayments are more affordable. Unfortunately, Malhotra (2002) reports that few housing finance and microfinance organizations in Kenya have attempted many product innovations due to limited access to low-cost long-term funds; and this is also identified as a major handicap for housing microfinance in UNHSP (2007).

Jamii Bora: The Shining Star of Microfinance

A unique solution for providing much needed security for microfinance loans is being used by a Kenyan financing institution- Jamii Bora- founded in 1999. According to Mutero (2007) and Belfrage (2009), this organisation reportedly with about 250,000 members, lends to poor borrowers who have saved with the institution, allowing them to borrow twice as much as they have saved and allowing a repayment period of 5-20 years. The borrowers are organised into small groups, and the loans are in part secured by peer pressure and clearly reminiscent of the experience of Esusu or Harambee group members. Jamii Bora runs numerous social programs designed to remove obstacles and create opportunities for the poor to overcome poverty, including the Jamii Bora Housing Project. The success of the housing project is highlighted by its 99% repayment rate according to Belfrage (2009), which is unprecedented. However, housing microfinance is not as developed as enterprise microfinance because few organizations in both Nigeria and Kenya specialise on this, and the poor continue to struggle to gain access to finance from banks for the above stated reasons.

SAVINGS AND CREDIT COOPERATIVE ORGANISATIONS (SACCOS)

Otto and Ukpere (2011) define a Credit and Thrift Cooperative (a.k.a Savings and Credit cooperative) *"as an association of persons who pool their resources together on mutual basis to solve specific socio-economic problems, which may include income generating activities"p5676*. Co-operative practices in Nigeria predate modern co-operatives in form of the Esusu in Yoruba land (SW Nigeria). It occurs in other Nigerian cultures, and is a precursor to modern Co-operative Thrift and Credit Society (Oluwasesi, 2011). Similarly, these practices have also existed in Kenya since time immemorial (UNHSP, 2010). The modern cooperative movement in Kenya can be traced to 1908, although the first ones to be operated by Africans started in the 1930s and there are now over 14,000 in the country (Kenya Bureau of Statistics, 2013), while Nigeria's first formal co-operative was formed in 1936, with over 80,000 currently in existence according to EFInA (2012) although actual figures are difficult to verify.

Otto and Ukpere (2011) identified at least seven types of cooperatives in operation in Nigeria but the Rotating savings and credit associations (ROSCAs) type[6] is of specific interest in this paper since many savings and credit cooperatives provide small loans that are easily diverted to fund aspects of building projects. The Esusu is an example of the ROSCAs, and some Esusus that have converted to formal cooperatives have performed better than non-Esusu cooperatives according to Seibel (2004). Cooperatives generally are multipurpose, but some focus on a single purpose of which the housing cooperatives is an example that is "*a form of homeownership in which people join to form a cooperative corporation which owns shares in buildings in which they live*" *p2.* (UNHSP, 2010).

The six different forms of housing cooperatives identified in the Kenyan context by UNHSP (2010) range from those where the cooperative member owns a voting share and a registered right to their individual units, where the member can sell their units on the open market, land only cooperatives where only the land is held jointly by the cooperative, to leasing cooperatives whereby the individual units are leased,

[6] Otto and Upkere (2011) list the seven types of cooperatives in operation in Nigeria as follows: - 1. Multipurpose co-operative societies, 2.Marketing co-operative societies, 3.Consumers co-operative societies, 4. Processing co-operative societies, 5.Industrial co-operative societies, 6.Supply/purchasing co-operative societies, 7.Credits and thrift co-operative societies.

sometimes with an option to buy. The main sources of external financing for housing cooperatives in Kenya are the Cooperative Bank, SACCOs, Union Bank, and Cooperative Housing Societies, and typically these cover the cost of the whole project, while internal monthly payments from the cooperative members go towards the mortgage repayment, utilities and maintenance.

Challenges of cooperatives include- a) the risk-averse nature of commercial banks towards the building industry, b) high interest rates of 15-20% with repayment periods between 7 to 20 years in Kenya (UNHSP, 2010), and a maximum of 10 years in Nigeria, c) a down payment of 20-40% of the value of the property (UNHSP, 2010), and d) the inability for most low-income earners to provide adequate collateral and pass credit checks. In addition to these are complex land administration laws in both Kenya and Nigeria which is out of the scope of this paper but is noted nonetheless.

On the whole, SACCOs are increasing in popularity and a few housing cooperatives have succeeded in providing housing for all of their members in Kenya (UNHSP, 2010). In the Nigerian context however, the verdict on cooperatives and housing cooperatives remains split between qualified success (Otto and Ukpere, 2011), and limited progress (Adedeji and Olotuah, 2012). While the numbers of housing units provided through this avenue in both countries are not high, the cooperative environment in Kenya has been a source of some finance product innovation, and one of these products is outlined below.

The NACHU Experiment- Innovation in Housing Cooperative Products
Mutero (2007) outlined a rather innovative finance product piloted by Kenya's National Cooperative Housing Union (NACHU); that takes cognisance of some of the peculiarities of the Kenyan low-income housing rental market. NACHU serves 200,000 people through its membership of 210 housing cooperative societies[7]. The NACHU programme applies to new housing, rehabilitation, infrastructure loans for groups, resettlement loans, and group loans for building construction. The programme utilises an idea from general micro-finance- the use of solidarity sub-groups of five, '*Watano*'- which serves in part to exert peer pressure, and as a way of providing larger longer-term loans yet safeguarding the returns, and has had a good measure of success similar to the Jamii Bora experiment. A Watano can take a group loan after 6 months membership to buy land and then build a housing block, or for home improvements. These housing blocks serve several households and are usually modest accommodation, and the home owner-members are allowed to sub-let some rooms to provide income towards paying the loan. The use of peer pressure as a safeguard against defaults makes it possible for each individual to access larger loan sums, and coupled with the formal sub-letting arrangements, provides much-needed income-generating facilities to the borrower.

INFORMAL SOURCES OF HOUSING FINANCE

The majority of urban dwellers who aspire to build their own dwelling no matter how modest, mostly resort to informal sources such as relatives and friends, according to CAHF (2010), EFInA and FinMark (2010)[8] and Mutero (2007),[9] or to informal

[7]This information is obtained from the UN-Habitat UNHSP (2010) document.
[8] Over 60% of new houses each year in Nigeria are financed by personal income and savings, according to EFInA and FinMark (2010). It is the most preferred option because of high interest rates on loans and inaccessibility of loan products to low-income earners.
[9]Mutero (2007) study of 1775 households in Nairobi informal settlements found that nearly 60% borrow from friends and relatives for home improvements and building projects.

savings groups such as Esusu or Harambee groups, which remain very effective due to self-reliance operating within a network of local communities, opines Chieni (1997) and Seibel (2004). While several informal savings groups have no links with microfinance institutions, they may operate a 'lay-by' approach with building materials retailers particularly in Kenya to pay in instalments; an approach which ensures a segment of income is attached to housing provision. Some informal savings groups have developed relationships with microfinance institutions, and the Kenyan experience of such groups is of low default rates. The main observation is that the relational connections between members of informal groups can be more formally harnessed in pilot schemes to assist low income earners to fund home ownership, since some evidence exists that they can be effective.

LENDING THE ADVANTAGES OF INFORMAL SYSTEMS INTO FORMAL STRUCTURES

Several authorities have offered strategies for improving housing finance, however, the challenges addressed here are those faced by the low-income end-user: -1) The shorter-term tenure versus high monthly repayments format, 2) The issue of creditworthiness and collateral, 3) The absence of finance products with affordable repayment arrangements, and 4) The fact that most low-income households usually build and finance incrementally. The proposed strategies below are in response to these issues, and seek to blend the advantages of traditional systems into contemporary financing structures.

The Watano-Style Strategy: The rotating element of the Esusu, and of the Watano groups piloted by NACHU and Jamii Bora is the foundation for this finance product. A Watano-style group is proposed whereby 'good credit performance' by all members in the group is rewarded by better interest rates on subsequent loans. This needs to be coupled with a degree of flexibility in the repayment period of the products, to enable progressive construction by the Watano-style group on land purchased collectively on the open market, and built on subdivided parcels of land, or to allow for longer-term mortgages within a cooperative structure. Significantly, the formal subletting arrangement of the Jamii Bora pilot is also proposed to be a key part of this strategy, and is an acknowledgement by formal (lending) institutions that subletting is a viable income generating mechanism that is not uncommon. Punitive measures need to be incorporated in this product in case the effect of peer influence fails, and in place of the need for collaterals. The risk of home repossession constitutes a punitive measure in the event of more than 3 months outstanding loan payments, and this must be clearly set out in loan agreements.

The Land-Only Cooperative is proposed within the housing cooperative framework to develop small and medium-sized low-cost housing estates. This is based on the Kenya's Land-only Cooperative in which only the land beneath the property is owned on a cooperative basis. The cooperatives provide a collective mortgage which is repaid by its members over a 10-20 year period, and this needs to be coupled with lower interest rates as advocated by researchers such as Omotoso (2011). This allows for a lower proportion of income to be used for housing mortgage repayments, hence reducing the risk of default. It can also be safeguarded by the 'Watano effect' whereby a single mortgage product covers the whole estate (mainly small estates). Less stringent (or no) collateral demands can be counterbalanced by other safeguards such as strict repossession rules. The Kenyan Market Equity model, whereby the shareholders may buy and sell their shares at full market value can operate similarly.

Progressive Construction Loan Strategy 'embraces' the fact that progressive construction is the reality of most low-income earners in developing countries. Shorter-term loans (2-3years) for building in stages (progressive construction) according to Malhotra (2002) may be less risky than long-term mortgages. Importantly, it can also minimise or eliminate the need for onerous collateral demands. This loan can be provided by SACCOs or housing cooperatives particularly those operating at a local level. The fundamental basis of this product is the need for an on-going term relationship between the borrower and the lending institution, which is not necessarily a bad thing. Also, lessons learnt can be successively modified to improve safeguards against defaults in proceeding years.

ADVANTAGES OF ADAPTING TRADITIONAL ELEMENTS INTO CONTEMPORARY STRUCTURES

The strategies above include lower interest rates, longer loan repayment periods, access to larger sums of money (via the Watano-style strategy), and the formal inclusion of subletting in response to the traditional model advantages outlined in section 2.2.1. However, these strategies are best served if there is relative homogeneity in the disposable income levels of the Watano group or cooperative members which is also advocated in Patibandla and Sastry (2004), or if the members are similarly salaried or self-employed. Otto and Ukpere (2011) noted that the use of peer group influence exists in other formal forms – The Grameen Bank- which originated from India, uses the Grameen solidarity model which gives loans in turns to individuals within a group of five, and which has proved effective in deterring defaults. The use of peer influence and the formalisation of the subletting process may adapt well in various cultural contexts and can empower the low-income earner in the process.

POSSIBLE PITFALLS AND HOW TO AVOID THESE

Some pitfalls are not uncommon in developing countries. Otto and Ukpere (2011) state that peer pressure influence is only effective insofar the individual faces serious social consequences if agreements are breached. They state that high levels of indiscipline and corruption in a country like Nigeria could require further safeguards in the credit system. Any financing institution must address these challenges through contextual safeguards. In response to these perceived shortcomings, salaried beneficiaries can have their monthly repayments deducted directly from their employers, and perhaps include guarantors in the loan process.

CONCLUSIONS - A WAY FORWARD

This paper proposes that the end-user is viewed more as a stakeholder, and recommends that many of the safeguarding elements need to be context-specific. The review of literature indicates that few institutions in both countries have finance/micro-finance products specifically for housing for the urban poor, but the Kenyan context seems more proactive in this regard and has valuable lessons to offer. There is also an urgent need to increase (government and private) capital funding to finance institutions and cooperatives for low-cost housing, and it is interesting to note that the World Bank recently approved a $300 million credit to boost Nigeria's efforts to provide affordable mortgages for middle-income and lower income families (World Bank, 2013).

Finally, efforts to create innovative finance products must embrace some of the pre-existing conditions in the low-income sector, and the three proposed strategies have sought to address some of these conditions. Longer term loans and mortgages are gaining wider acceptance in Kenya, and should be considered in other contexts. People are less likely to default if the monthly repayments are not huge proportions of their income, or if they can take smaller loans in stages commensurate to their modest incomes as indicated in Malhotra (2002). Some of the security elements that make the traditional funding less prone to defaults are already in place in a few financing institutions and this is a viable route to achieving the best of both worlds.

REFERENCES

Adebamowo, M. E., Oduwaye, L., and Oduwaye, O. S. (2012).Problems mitigating housing finance through primary mortgage institutions in Lagos. International Business and Management Journal: 4 (1), 126-134

Adedeji, Y. D., and Olotuah, A. O. (2012).An Evaluation of Accessibility of Low-Income Earners to Housing Finance in Nigeria.American-Eurasian Journal of Scientific Research: 7 (1): 23-31

Ademiluyi, I. A. (2001). Public Housing Delivery Strategies in Nigeria: A Historical Perspective of Policies and Programmes. Journal of Sustainable Development in Africa: 12 (6), 153-161

Ajanlekoko, J.S. (2001, October).Sustainable Housing Development in Nigeria.The Financial and Infrastructural Implication International Conference on Spatial Information for Sustainable Development, Nairobi, Kenya.

Ajayi, M.A. and Omole, F.K. (2012, July) Sustainable housing development and communal provision of infrastructures in Asuwamo residential estate Akure, Nigeria. In S.Laryea, S.A. Agyepong, R. Leiringer,and W. Hughes, (Eds.) Procs 4th West Africa Built Environment Research (WABER)Conference, (pp. 30-46), Abuja, Nigeria.

Akinola, S. R. (2007). Coping with infrastructural deprivation through collective action among rural people in Nigeria.Nordic Journal of African Studies, 16(1), 30-46.

Alitheia Capital Limited. (2009, May 9th). Improving housing finance in Nigeria. Research Unit. Market Update (Newsletter)

Bascom, W. R. (1952). The Esusu: A credit institution of the Yoruba. The Journal of the Royal Anthropological Institute of Great Britain and Ireland: 82(1), 63-69.

Belfrage, S. (2009).Jamii Bora: The Shining star of Microfinance. Uppsala, Sweden: Mikrofinanshuset,

Chebet-Choge, S. (2012).Fifty Years of Kiswahili in Regional and International Development. The Journal of Pan African Studies: 4 (10), 173-203

Centre for Affordable Housing Finance (CAHF). (2010). 2010 Yearbook. Housing Finance in Africa, A review of some of Africa's housing finance markets. South Africa:Centre for Affordable Housing Finance in Africa, A division of the FinMark Trust.

Chieni, S. (1997, August).The Harambee movement in Kenya: The role played by Kenyans and the government in the provision of education and other social services. Paper presented at Seventh Boleswa Symposium "Educational Research for Quality of Life", Kwaluseni, Swaziland.

Downloaded from http://boleswa97.tripod.com/chieni.htm

EFInA and FinMark Trust (2010).Overview of the housing finance sector in Nigeria. A report commissioned by EFInA and FinMark Trust.

EFInA (2012). Understanding Co-operatives in Nigeria. Qualitative report.

Fadairo, G. and A. O. Olotuah (2013).Low-Cost Housing for the Urban Poor in Akure, Nigeria: Materials and Techniques of Construction. Journal of Environment and Earth Science: 3(9), 135-143.

Folorunsho, C. O., T. H. Khan, and S. A. Olowoyo, (2012).Trends, Realities and Prospect of Housing Delivery through Mortgage Financing in Nigeria.British Journal of Arts and Social Sciences: 7 (II), 134-144

Fullan, R, A. Hewlitt, and J. Nnam. 2006. Harambee: Reinforcing African voices through collaborative processes andtechnologies:KM4D Journal 2(2), 72-83

Godfrey and Mutiso (1973).The Political Economy of Self-Help. Working Paper No. 107, Institute for Development Studies, University of Nairobi. Kenya.

Kenya National Bureau of Statistics (2013) Website

http://www.knbs.or.ke/agriculture_Societies.php accessed on 11/01/14

Kinuthia, W. (2009).Educational Development in Kenya and the Role of Information and Communication Technology.International Journal of Education and Development using ICT: 5(2), 6-20

Makinde, O. O. (2013). Housing delivery system, need and demand. Environ Dev Sustain:16, 49-69

Malhotra, M. (2002).The enabling environment for housing microfinance in kenya. Cities alliance shelter finance for the poor series. Washington, DC. USA.

Mutero, J. G. (2007). Access to housing finance in Africa: exploring the issues. A Report by Matrix Development Consultants for FinMark Trust.

Mwanza, K. (2012, April 11th). Kenya's house prices rises slow on high interest rate. For Reuters U.S. Nairobi, Kenya. http://www.reuters.com/article/2012/04/11/ozabs-kenya-property-idAFJOE83A07720120411?feedType=RSSand feedName=investingNewsand pageNumber=1and virtualBrandChannel=0and sp=true

Ochieng, V. M. (2009). 5th Global Housing Finance Conference: Providing Shelter – Creating Jobs – Fueling Growth. Unpublished dissertation submitted at Strathmore University, Nairobi, Kenya.

Ogundiran, I A and Adedeji, Y M D (2012, July) Urban housing delivery: Expanded polystyrene panels initiative in Abuja, Nigeria.In S.Laryea, S.A. Agyepong, R. Leiringer, and W. Hughes, (Eds.) Procs 4th West Africa Built Environment Research (WABER) Conference, (pp. 1033-1042), Abuja, Nigeria.

Olayiwola, L. M., O.Adeleye and L. Ogunshakin (2005, September).Public Housing Delivery In Nigeria: Problems And Challenges. XXXIII IAHS World congress on Housing Transforming Housing Environments through the Design, Pretoria South Africa.

Olotuah, A. O. (2010). Housing Development and Environmental Degeneration in Nigeria. The Built and Human Environment Review: 3, 42-48

Oloyede, J. A. (2005). Informal Financial Sector, Savings Mobilization and Rural Development in Nigeria: Further Evidence from Ekiti State of Nigeria. In Proceedings on the National Conference on Informal Financial Sector and Sustainable Development in Nigeria, Nigeria.

Oluwasesi, A. (2011). The Fundamentals of Cooperative Management, CoralPrints Enterprises, Nigeria.

Omotoso, K (2011, February). Mortgage banking/housing finance sector in Nigeria: past, present, future. Presented at Nigerian Real Estate 2011: Market review and market projections by mortgage banking association of Nigeria (MBAN), Nigeria.

Ondola, S. O., Odundo, P., Rambo, C. M. (2013). Effectiveness of Housing policies and their implementation strategies in the provision of low-cost housing to the urban poor in Kisumu City, Kenya. International Journal of Academic Research in Progressive Education and Development: 2(4), 1-14

Orvis, S. (2006). Conclusion: Bringing Institutions Back into the Study of Kenya and Africa. Africa Today: 53(2), 95-110.

Otto, G. and Ukpere, W.(2011).Credit and thrift co-operatives in Nigeria: A potential source of capital formation and employment. African Journal of Business Management: 5(14), 5675-5680

Patibandla, M. and Sastry, T. (2004). Capitalism and Cooperation: Cooperative Institutions in a Developing Economy. Economic and Political Weekly: 39 (27), 2997-3004

Rust, K. (2012).Affordable Housing Finance New market development in Africa. Presented at 5th Global Housing Finance Conference: Providing Shelter – Creating Jobs – Fueling Growth. Washington D.C. USA.

Sanusi, J. O. (2003, January). Mortgage financing in Nigeria: issues and challenges. Presented at the 9th John Wood Ekpenyong Memorial Lecture, Organized by the Nigerian Institution of Estate Surveyors and Valuers.

Seibel, H. D. (2004). Microfinance in Nigeria: Origins, Options and Opportunities.

Shorebank International. (2011). Final Report (Draft copy), Feasibility Study on Developing a Social Housing Programme at Shelter Afrique.

Taylor, R.W. (2000). Urban Development Policies in Nigeria: Planning Housing, and Land Policy, Centre for Economic Research on Africa. School of Business, Montclair State University, Upper Montclair, New Jersey. USA

United Nations Human Settlements Programme, UN-HABITAT, (UNHSP) (2005).Financing urban shelter global report on human settlements 2005, Nairobi, Kenya.

United Nations Human Settlements Programme, UN-HABITAT, (UNHSP) (2007). Sustainable Urbanization: local action for urban poverty reduction, emphasis on finance and planning, Overview: - Microfinance for the world's poorest people, Nairobi, Kenya.

United Nations Human Settlements Programme (UNHSP), (2010). The Organisation, Management and Finance of Housing Cooperative in Kenya.The Global Urban Economic Dialogue Series, Nairobi, Kenya.

Yakub, A.A., Salawu, A.O., and Gimba, S.D. (2012, July) Housing Delivery via Housing Cooperatives as a tool towards achieving National Development; An Empirical Study In S.Laryea, S.A. Agyepong, R. Leiringer, and W. Hughes, (Eds.) Procs 4th West Africa Built Environment Research (WABER) Conference, (pp. 1427-1441), Abuja, Nigeria.

Yaqub, J. O. (2012). Micro-credit and welfare of micro entrepreneurs in Nigeria: A case study of Alimosho local government area of Lagos state. Journal of Business and Organizational Development: 4, 12-21

World Bank (2013).Press Release, The World Bank Approves Funds to Support Nigeria's Expansion of its Housing Finance Market. Downloaded from: -

http://www.pressreleasepoint.com/world-bank-approves-funds-support-nigeria-s-expansion-its-housing-finance-market accessed on 18/12/13.

RISK MANAGEMENT BY PROPERTY DEVELOPERS IN THE GAUTENG PROVINCE, SOUTH AFRICA

Thabiso B. Maphalala[1] and Chris E. Cloete[2]
Department of Construction Economics, University of Pretoria

The most common risks faced by property development companies in Gauteng, South Africa were identified, as well as the tools used to effectively identify, analyse and respond to risk in the development process. A sample of fifty companies was selected from a comprehensive list of 200 local property development companies in Gauteng. Self-administered questionnaires were completed by 43 small, medium and large companies out of 50 companies selected by systematic sampling from a data base of 200 property development companies in Gauteng. Data from questionnaires were coded, cleaned and analysed qualitatively as well as quantitatively. It was established that significant risks included property market risks, a lack of cost expertise by stakeholders, the quality of the site and control of construction costs. The majority of the firms used no formal risk identification techniques, nor did they do formal risk analysis. A variety of risk management techniques were used. The most common risks of companies that carried out international developments were political risk, and forms of tendering. The steps proposed to decrease the exposure to risk in the development process should assist property development companies to make informed decisions and avoid risks in the development process

Keywords: property development, risks, risk management, Gauteng.

INTRODUCTION

Risk in property investment has been investigated extensively (see e.g. Booth et al 2002), however, research on property development risk is fairly limited (Newell and Steglick 2006; Costello and Preller, 2010). Although each real estate project is different and unique (Brueggeman and Fisher 2005), the risk management process is generally an ongoing and iterative process (Khallafalah 2002), typically consisting of three basic steps: Risk Identification and Initial Assessment; Response and Mitigation and further Risk Analysis (Khumpaisal and Chen 2010).

The objectives of the research were therefore to firstly identify the most common risks faced by property development companies in Gauteng (economically the strongest province in South Africa, contributing about 30 per cent of the GDP), secondly to identify the tools that can be used effectively to identify, analyse and respond to risk and uncertainties and thirdly to make recommendations to developers on the management of risks.

[2] Chris.Cloete@up.ac.za

Maphalala, T.B. and Cloete, C.E. (2014) Risk management by property developers in the gauteng province, south africa *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference*, 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 471-481.

LITERATURE REVIEW

Risks in real estate development originate from several factors. These risk factors may conveniently be categorised as technical, financial, legal, political physical, social and organisational. Other categorisations include risks on the macro level (exogenous), meso level (endogenous) and micro level (stakeholder relationship) (Gehner, 2008), or according the Social, Technological, Economic, Environmental and Political factors or “STEEP” as defined by Morrison (2007), Gehner, et al. (2006) and Clarke and Varma (1999). Following the steps in the property development process, the risk categories may also be classified as land development risks, design risks, entitlement (approval) risks, financing risks, construction risks, leasing risks and sales risks (Gehner, 2008, cf. Millington, 2000).

Table 1. Summary of property development risk factors according to some recent studies

Newell and Steglick (2006)	Mollard (2010)	Strenger (2013)	Agranovich (2013)
Environmental	Poor site	Soil risk	
Time delay		Time delay	
Land cost	Land cost	Land value	Land value
Acquisition terms			
Approvals		Planning delays	Planning permit
Cost increases	Cost increases		
Political		Political	Political
Experience	Insufficient knowledge		Partner
Engineering	Workmanship	Construction	Construction
Market		Market	Revenue
Delivery timing		Duration	Duration
		Capital market / financing	
		Legal	Legal
		Strategic	

The purpose of these categorisations is, however, to cover the spectrum of risks, and not to identify the relative importance of the possible risks. Given that at least 34 property development risk factors can be identified as occurring within the various risk categories (Newell and Steglick, 2006), it is valuable to identify the most important risks that need to be addressed by developers. The relative importance of the different factors will of course vary according to the unique nature of each project: type of project, geography, country and prevalent economic and social conditions. However, some common factors can be discerned in the most important recent studies on the relative importance of risk factors in property development: Newell and Steglick (2006) identified the top ten property development risk factors of major developers in Australia. The pre-construction phase is seen as having the highest overall risk level in the property development process. A comprehensive summary of development risks and their management is also provided by Strenger (2010). On a practical level, Mollard (2013) identified six common risks and Agranovich (2013) identified nine cluster of risks. Table 1 provides a summary of these studies.

Once the important risks have been identified, appropriate risk responses should be formulated. Newell and Steglick (2006) found that a wide range of risk management strategies were used by developers throughout the development process, with the key strategies to mitigate property development risk being in-house management of critical processes, quality assurance procedures and contractually allocating risk to other parties.

- Research is essential in assessing virtually all kinds of risks.
- Phasing: By adequately phasing projects, the steps to be taken are smaller, with possible exits following each phase.
- Contracts: Carefully drawn up contracts, controlled pricing mechanisms, (preferably a fixed price contract), adequate insurance and quality partner agreements.
- Reliable cost calculations:
- Pre-lease/-sales:.
- Timing payments: in the case of costs it is preferred to pay as late as possible, whereas in the case of revenues it is preferred to receive these as early as possible.

A framework for risk mitigation in mixed-use development in South Africa is suggested by McDonald (2010). The present paper is an attempt to extend the above findings, by reporting on the results of an extensive investigation of the risk behaviour of property developers in Gauteng, South Africa.

RESEARCH METHODOLOGY

The study was undertaken by means of a survey using self-administered questionnaires. Using systematic sampling, a sample of fifty companies was selected from a comprehensive list of 200 local property development companies in Gauteng, compiled by e-Global edge. (E-Global is a business portal directory containing lists of various companies all across the globe). Systematic sampling provides the most attractive type of probability sampling. It is accurate, easily accessible, does not contain periodic patterns and the actual list is not always needed. Systematic sampling is suitable for all sizes, the cost to carry out is relatively low and it is easily explained (Welman, Kruger and Mitchel 2005). Both quantitative and qualitative variables were utilised.

A pilot survey was conducted to test the questionnaire. A number of property professionals with interest in property investment, property valuation, property management and property law were consulted in and around Gauteng to get their views on the relevance of the draft questionnaire. The questionnaire was then modified, taking into account the comments made by the professionals.

The questionnaire had fifteen questions grouped into four sub-topics: i) Background information about respondent and company, ii) Risk identification and their impact, iii) Risk analysis and iv) Risk response. Data captured in the questionnaires was coded and then cleaned (detecting and correcting corrupt or inaccurate records from a record set). This stage is followed by data analysis and interpretation.

RESULTS

Characterisation of respondents

A total of 43 (86%) of questionnaires were completed. Most of the respondent companies (80%) had fewer than 25 employees, with a large proportion of companies (45%) having 15 or fewer employees. More than three quarters (77%) of the companies studied were involved in projects valued between R1M and R50M. The rest were engaged in either high (>R50M, 20%) or low value (<R1M, 3%) projects, with varying risk and susceptibility to risk.The companies undertook a variety of development projects, with a fairly even spread between housing (24%), shopping (32%), offices (21%) and industrial (23%). The information however indicates a dominance of shopping centre developments, with risks that vary from the other types of development.

Most of the companies undertook an average of 1-10 of jobs per year, 29 per cent undertook between 10 and 15 projects per year and 20 per cent between 16 and 20 projects per year. Developers undertaking fewer than 10 projects per year argued that this gives sufficient time to prepare for each project undertaken. About half the number of companies reporting successfully completed projects in 15% of the projects they were engaged in, indicating a very low success rate. Only 1% of the companies reported completion of more than three quarters of their projects. The companies attributed the low success rate to a number of risks in the projects.

Most developers (65 per cent) appreciated the concept of site visit whilst the remainder felt it was time consuming and therefore not important. There were differences however between companies in their understanding of site visit. Some would visit the site to see if there was anything appreciable problems, rather than to make thorough investigations of ground conditions and landscaping, for example. Some companies on small projects admitted to not visiting the site at all.

Table 2:Rating of different risk factors by 43 property developers in Gauteng (survey)

	Level of impact (1 = low; 5 = severe)					
Risk factor	1	2	3	4	5	Average risk rating
Economic downturn		15	35		50	3,9
Lack of cost expertise	10	20		25	45	3,8
Poor site	20	15		30	36	3,5
Construction cost increases	10	20	30		40	3,4
Inadequate project information		40	35	10	15	3,0
Excessive site costs	10	50	35		15	2,9
Shoddy construction work	35	30	15		20	2,4
Bankruptcy of contractor	50	25	15		10	2,0

Rating of different risk factors

Developers were asked to rate the importance of a variety of risk factors on a scale of 1 to 5 (1 = low impact; 5 = most severe impact). Table 2 summarises the responses, sorted in descending order of severity.

Risks associated with adequacy of project information.

Most companies (75%) encountered low risk, and only 15% of the companies experienced severe risks. The companies reported that the occasional need to commence as early as possible with a development (before all the necessary information is available) forced them to undertake a project without having the required complete drawings and schedules.

Paying too much for a development site

Only 15% of the companies had a severe problem with having to pay too much for a development site, and for most of the companies (60%) the cost of the development site was not a significant issue. The surveyed companies attributed this to improved feasibility studies that assist them in coming up with a residual land value. This residual land value then determines if the site is suitable for the proposed development.

Impact of purchasing a poor development site

A majority of the companies (65%) responded negatively (level of impact ≥4) to the question regarding the development of the site, and a proportionate 35% of the companies cited the level of impact as severe. They have encountered quite a number of problems with regards to poor development sites. The respondents attributed the risks to lack of proper geotechnical site investigation before purchasing the site.

Impact of construction costs increasing out of control

The challenge of construction costs increasing out of control has been important to most companies (70%), with 2 in 5 companies reporting that the impact of this risk was severe. This was attributed to, among other things, small proportional design changes, the fact that no proper fixed price and time was agreed upon at the initial stages of the contract, additions to the contract while it is already in progress as well as fluctuations in provisional and prime cost items. A few companies (10%) nevertheless, managed to keep costs in control.

Impact of building contractor going bankrupt

The risk of contractor failure and going bankrupt was considered low by most (75%) companies. Half the companies interviewed (50%) reported having this risk under control, and only 1 in 10 (10%) suggested that they were faced with a severe risk of building contractors going insolvent. The companies attributed the low perception of this risk to the use of contractors with a good reputation and a proven track record. They reported rigorous enquiries into contractors' project history; hence, financials were one of their priorities. The issue of warranty insurance was a major requirement in case the contractor experiences difficulties or is unable to complete the works under the contract

Impact of shoddy construction work

A majority (35%) of companies experienced little impact from this risk. Thorough inspections throughout the construction phase performed by various qualified and experienced engineers are one of high priority in their list. (20%) still experienced severe impact.

Downturn in the property market

Because the market cannot be accurately determined all the time, it is important for developers to understand the concept of supply and demand, as ignoring it will even lead to worse losses. A majority of the companies admitted to not having control over this risk although measures can be taken to manage it.

Lack of expertise and experience by estimators and decision makers

A majority (45%) of the companies admitted that proper training for all stakeholders involved in decision-making and management should be undertaken. The decision makers should be well aware of the risks and uncertainties involved in the development process in order for them to know what allowances to make and what management measures to be taken.

International contracts

Companies that carried out developments internationally reported that they encountered the following risks, ranked according to number of companies reporting them (the top risk is one reported by a higher proportion of respondent companies):

a) Country risk (politics)

b) Contractual arrangements used in other regions

c) Availability of plant and other resources

d) Local labour, material and subcontract conditions

e) Currency of payment

f) Different rates of inflation

g) Employee safety

More than half of the respondents (60 per cent) only rely on experience to identify risks (figure 1). Some respondents use checklists (20%) (especially those in large development projects) or rely on the track record (8%) of the contractor concerned to estimate the kind of risk to expect.Half the respondent companies (50%) conduct no risk analysis (figure 2), and amongst those who do, their major focus is on sensitivity (20%) and use of correct data (12%). Elementary risk analysis and Monte Carlo simulation are only used by a few companies (9%). The companies that conduct no risk analysis indicated that they rely on experience, with no formal or computerised analysis method being followed (some do not even know such techniques exist)

Risk identification and analysis techniques

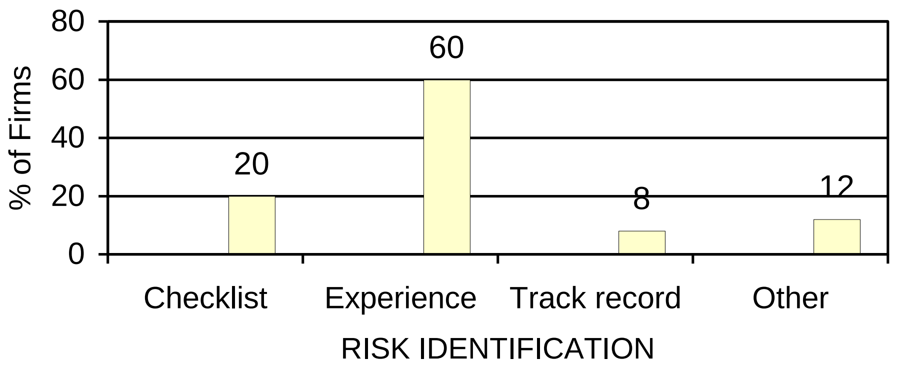


Fig. 1: Use of different methods of risk identification

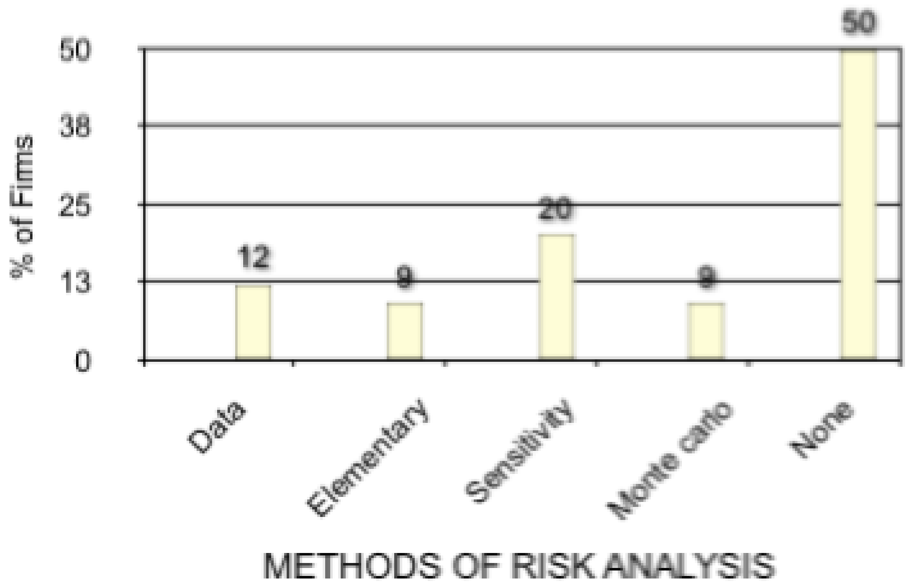


Figure 2: Use of different techniques of risk analysis

Risk response

Avoidance of risk was identified as the most popular strategy, followed by 36 per cent of the respondents. It was suggested that this strategy is adopted if the risk is unquantifiable and their assessment indicates they cannot bear it. More than a quarter of the companies (28%) indicated that they often choose risk transfer by either securing insurance or engaging external contractors for the construction stage. There was however concern amongst those that engage external contractors that transferring risks to external contractors does not relieve them completely of the risks hence they still remain liable.

There were only a few companies (18% in each instance) that reporting resorting to either reduction or retention as strategies for risk response which suggests that these are used as the final resort and when the companies could either not avoid or transfer the risks.

CONCLUSION

The focus of the research was on investigating the risks and uncertainties encountered by property development companies in the Gauteng Province, South Africa: identifying tools used by these companies to effectively identify, analyze and respond to risks and uncertainties.

The findings indicate that the most common risks and uncertainties were:

- Downturn in property markets and variations occurring in real estate markets.
- Lack of expertise in terms of estimators and decision makers.

- Purchasing a poor development site.
- Construction costs escalating out of control.
- Limited project information.
- Shoddy construction work.
- Building contractor going bankrupt.

Property markets cannot be accurately determined, it is quite crucial though that decision makers understand the basics and essentials driving the property cycles so as to be able to time the inception and completion of projects. The property development business is quite sensitive to changes in economy and inflation, for example. These are however, not within the developer's control. Therefore proper structures are required to be put in place to make allowance for such unforeseen situations.

The important role of estimators (quantity surveyors) in the decision making process can never be over emphasized. It is vital that they understand the various uncertainties and risks involved in the development process so as to be able to make due allowances and facilitate proper decisions.

A contractor's track record and financial standing is crucial in selecting a contractor to carry out the actual construction. This would help reduce the risks of having a contractor deliver shoddy work and/or unable to finish the project.

Results indicate that formal risk management techniques are used by less than half the property development companies in Gauteng. This is due to the lack of knowledge and expertise, the difficulty of collecting sound data and the costs associated with risk management techniques such as risk retention and reduction where computerised Monte Carlo simulations will have to be used.

Although not widely used, risk transfer and elimination are preferred. This indicates that there is a need for formal risk management techniques to be employed in the development process.

RECOMMENDATIONS

The findings do indicate that a number of steps can be taken to decrease the exposure to risk by development companies. Companies should ensure that essential information is gathered and accumulated before a development can be undertaken. Sufficient knowledge by all stakeholders is a prerequisite. The use of formal risk management techniques should be encouraged to reduce losses which could have been avoided.

It is recommended that estimators, directors, management as well as people who take part in the decision making process in developments be well trained. This will equip them with skills to be able to identify, analyse as well as respond to risk as early as the pre-planning stage. A thorough knowledge and experience of the industry is vital, and unfortunately a lot of emerging developers do not possess these skills.

It is quite important for these skills to be learnt rather than be acquired through experience alone, though some developers may find the time to acquire genuine skills too long.

It is recommended that risks be transferred when possible. If not, large companies can consider risk reduction methods, but is should be borne in mind setting up Monte Carlo simulation modelling does require a lot of resources.The importance of a proper site visit should be emphasized. This will assist in formulating an informed impression of the site and its surroundings. The decision makers should also be fully aware that visiting the site is not just for mere interest but rather to establish useful factors such as ground conditions, location and topography, access to site as well as weather conditions in that area.

Good planning is necessary to assist in identifying key elements in the project leading to the development of effective construction strategies and the management of resources. Lastly, additions and/ or variations to a project when it is already underway should be kept to a minimum, to prevent unforeseen cost overruns.

REFERENCES

Agranovich, B (2013). "How real estate developers manage their risks". Popular risk management, Part 6. Global Risk Consult. http://www.globalriskconsult.com. Accessed 12 May 2013.

Anderson, L. (2007). Managing Risk in Property Development. Available from http://ezinearticles.com/?Managing-Risk-In-Property-Development and id=447964.(Accessed 17 July 2013).

Atherton, E. French, N. and Gabrielli, L. (2008)."Decision Theory and Real Estate Development: A Note on Uncertainty", Journal of European Real Estate Research. 1(2):162-182.

Booth, P., Matysiak, G. and Ormerod, P. (2002), Risk Measurement and Management for Real Estate Investment Portfolios. Investment Property Forum : London.

Brueggeman, W.B., and Fisher, J.D. (2005). Real Estate Finance and Investments. Avenue of the Americas, New York: McGraw-Hill.

Byrne, P. (1996), Risk, Uncertainty and Decision-making in Property Development. E and F N Spon : London.

Byrne, P. (2005). "Fuzzy Analysis, A Vague Way of Dealing with Uncertainty in Real Estate Analysis?" Journal of Property Valuation and Investment, 13(3): 22-41.

Cameron, S. (1990), Managing interest rate risk in real estate development. Journal of Applied Corporate Finance 3 : 72-79.

Carter, R.L. and Doherty, N.A. (1974). Hand Book of Risk Management. Available from http://www.allbusiness.com/construction/construction-overview/12362109 1.html#ixzz1flqsPD6P.(Accessed on 29 July 2011).

Chapman, C. and Ward, S. (1991). Project Risk Management: Processes, Techniques and Insights. England: John Wiley and Sons Ltd.

Chen, Z., and Khumpaisal, S. (2009). An analytic network process for risks assessment in sustainable commercial real estate development. Journal of Property Investment and Finance, (Special Issue: Sustainable Commercial Real Estate), 27(3): 238-258.

Clarke, J., C., and Varma, S. (1999). Strategic risk management: The new competitive edge. Journal of Long Range Planning, 32(4): 414-424.

Cloete, C.E. (2001). Risk Management in Property. (2nd ed). Sandton: South African Property Education Trust.

Costello, G and Preller, F (2010). Property development principles and process - An industry analysis. Pacific Rim Property Research Journal, 16(2): 171- 189.

Cretu, O; Stewart, R and Berends, T. (2011). Risk Management for Design and Construction. New Jersey: Wiley.

Dullisear, R. (2001), Checklist helps tick off how to avoid pitfalls during development. Australian Property Journal 36 : 509-514.

Fisher, P. (2005), " The Property Development Process", Property Management, 23(3): 158-175.

Fisher, P., and Robson, S. (2006). "The Perception and Management of Risk in UK Office Property Development". Journal of Property Research, 23(2): 135-161.

Flanagan. and Norman, G. (1993). Risk Management and Construction. UK: Blackwell Publishing.

Gehner, E., Halman, J. I. M., and Jonge H. de. (2006). Risk management in the Dutch real estate development sector: A survey. Proceedings of the 6th International Postgraduate Research Conference in the Built and Human Environment, University of Salford, UK. pp. 541-552.

Gehner, E (2008). Knowingly taking risk. Investment decision making in real estate development. Delft: Eburon Academic Publishers.

Godfrey, P. (1996), Control of Risk: A Guide to the Systematic Management of Risk from Construction, Construction Industry Research and Information Association, London

He, Z. (1995). Risk management for overseas construction projects. International Journal of Project Management, 13(4): 231-237.

Hertz, D.B. and Thomas, H. (1983). Risk Analysis: Important New Tool for Business Planning. Journal of Business Strategy, 3: 23 – 29.

Khalafallah, A. M. G. E. I. (2002), "Estimating cost contingencies of residential buildings projects using belief networks", Faculty of Engineering, Cairo University, Cairo, Egypt.

Khumpaisal, S. (2007). Risks in the construction project procurement process and the mitigation methods. Journal of Architectural / Planning Research and Studies, 5(2): 135-145.

Khumpaisal, S and Chen, Z (2010). "Risk Assessment in Real Estate Development: An Application of Analytic Network Process". Journal of Architectural / Planning Research and Studies 7(1): 103-116

Kruger, F. Mitchell, B. and Welman,C.(2005). Research Methodology.(3rd Ed).Oxford: Oxford University Press.

Manaf, Z and Diah, M L M (2006). The management of property development risks in Malaysia - The property development process: a review. Paper presented at the Twelfth Annual Pacific Rim Real Estate Society Conference, 22-25 January 2006, New Zealand.

McDonald, AS A M (2010). Risk in mixed-use property development in South Africa. Unpublished MBA research project, Gordon Institute of Business Science, University of Pretoria.

McGowan, P. H.; Malcolm, R.; Horner, W.; Jones, D. and Thompson, P.A. (1992). Allocation and Evaluation of Risk in Construction Contracts. London: CIOB.

Miles, M.E., Berens, G. and Weiss, M.A. (2000) Real Estate Development, Washington D.C., United States of America: ULI-the Urban Land Institute 2000.

Millington, M F (2000). Property development. Finland: WS Bookwell Ltd.

Mills, A. (2001) "A Systematic Approach to Risk Management for Construction" Structural Survey, 19(5): 245-252

Mollard, P (2013). How to Manage Property Development Risk. www.mollard.com.au. Accessed 12 May 2013.

Morrison, L. J. (2007). The STEEP Factors. University of North Carolina at Chapel Hill, Learning Resources Website, USA. Retrieved January 30, 2008, form http:// horizon.unc.edu/onramp/

Newell, G and Steglick, M (2006). Assessing the importance of property development risk factors. Pacific Rim Property Research Journal, 12(1): 22-37.

Raftery, J. (1994). Risk Analysis in Project Management. London: E and F.N Spon.

Sampson, A. (2000). Risk management in the Tender Process of the Construction Industry. Unpublished MBA dissertation. Johannesburg: University of the Witwatersrand, Faculty of Business Studies.

Smith, J.A. (1995). Estimating, Tendering and Bidding for Construction. Britain: Macmillan Press Ltd.

Smith, J.N. (2002), Managing risk in construction projects, Chapter 6 in Best Value in Construction, edited by Kelly, J., Morledge, R. and Wilkinson, S., Blackwell.

Strenger, M (2010). “Risk management in property development. Understanding market risks”. Dohaland. Slide presentation, accessed 28 September 2013.

STRUCTURAL EFFICIENCY OF CONCRETE MASONRY REBATED FILLER BLOCKS FOR THE BEAM AND BLOCK SLAB SYSTEMS USED AROUND DURBAN, SOUTH AFRICA

Bonga Khuzwayo[1]
Department of Civil Engineering and Surveying, Durban University of Technology,, Durban, South Africa,

The beam and block slab systems use some form of void formers to support the construction loads. Concrete masonry rebated filler blocks (CMRFB) are common due to their fire-resistance (incombustible) and have reduced self-weight as a result of the hollows. These non-structural filler blocks need to provide temporary 'structural' support since they replace formwork. They are therefore expected to provide a safe and stable working platform. Some manufactures are concerned about the level of the structural efficiency of these blocks. A series of load carrying capacity tests were conducted on each of the 13 filler block types from five different suppliers in Durban, South Africa. The structural inefficiency (expressed as a percentage) of each block type was determined based on the magnitude of the ultimate strength to the design capacity (theoretical structural efficiency). It was found that some filler blocks are indeed structurally inefficient (i.e. support way above the required strength as 'non-structural') and the manufacturers were advised to control the significant variation of strength for these filler blocks prior to considering modifying the design.

Keywords: concrete masonry rebated filler blocks, theoretical structural efficiency, structural inefficiency.

INTRODUCTION

Concrete masonry rebated filler blocks (CMRFB) are void formers used as the formwork to support the construction loads and cast in situ wet concrete mix in beam and block slab systems (SANS 1879:2011). The construction loads and wet concrete are both temporary loads (clause 5.7.1). The external profile of the CMRFB provides the shape of the structural topping. These filler blocks are often supported by precast prestressed or reinforced beams/planks/ribs that have a common spacing of 560, 600 and 650 mm (de Klerk, 2013). The arrangement of these precast and cast in situ elements form a series of composite T-sections. The underside of CMRFB provides a

[1] email@wits.ac.za

Khuzwayo, B. (2014) Structural efficiency of concrete masonry rebated filler blocks for the beam and block slab systems used around Durban, South Africa *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 483-491.

level soffit for this flooring system (Figure 1). The heights of the filler blocks range from 60 to 350 mm (de Klerk, 2013).

Figure 1 - Concrete masonry rebated filler block supported by precast ribs.

The construction industry recognises CMRFB as non-structural (i.e. they can be removed once the structural topping is able to support itself). However, these filler blocks have an important duty of providing a safe and stable temporary working platform. SANS 1879:2011 requires that these blocks must be able to resist a concentrated load of 3.5 kN/356.78 kg (clause 4.4.4) applied through a 50 mm x 50 mm x 10 mm hardwood on the top shell of the block in the more unfavourable position both laterally or axially (clause 5.7). Concerns have been raised by some manufacturers of beam and block slab systems in Durban as to whether or not these blocks are working at optimum structural efficiency and if not, what can be done to improve the situation? This paper addresses some of the concerns.

BACKGROUND

The CMRFB can be made from one of the following materials: concrete (mentioned already), burnt clay, fired briquettes, clay and shale (SABS 0100-1:2000, clause 4.5.1.4). SANS 1215:2008 gives a list of other suitable materials for this kind of application (Appendix D, D2). There was a time (2007-2010) where there was a significant increase in the use of expanded polystyrene (EPS) rebated filler blocks (poly-blocks), but currently the use is not increasing due to its high cost compared to the CMRFB. Some manufacturers have advised that the saving achieved by using EPS is significant in floor areas above 100 m^2.

The concrete masonry filler blocks are fire resistant, which make it more favourable over poly-blocks (irrespective of whether or not they are treated with a fire retardant). These filler blocks shield the structural topping against the direct attack by the flames and heat. Therefore, this flooring system may be utilised on a multi-storey building if it complies with the specified fire rating requirements (SANS 0400-T: 2011 and SANS 10177-2:2005) providing less susceptibility to fire progression from one floor to the next. "Most fires will be confined to the compartment or area of origin if the building is designed in accordance with the relevant building regulations" (Strydom, 1986). One should also bear in mind that the fire safety of the building is dependent on the presence of combustible contents in the building and the effective building design. The soffit can easily take sand-cement plaster that complies with SANS 2001-EM1:2007 which also contributes to the fire rating of the flooring system.

PRODUCTION

Site observations revealed that most manufacturers use river sand (e.g. Umngeni), 9 mm stone (e.g. Natal Group Sandstone), cement (e.g. 42,5N) and water (tap water) to make concrete masonry rebated filler blocks. The 42,5N cement or similar SANS 50197-1 approved high-strength cement is often used since early/rapid strength is required to maximize the production. Sometimes the admixtures like DGN Powermaster and Chryso Activator Plus are used. Lower cement content is normally the key to economise or reduce the cost of CMRFB.

The common practice is to do some integrity tests such as, sieve analysis and cleanliness of the sand. Some manufacturers do visual and hand feels assessment. Sometimes trial mix designs are done by independent laboratories. Alternatively, filler block samples are manufactured and then physically tested prior to bulk production.
The curing process normally takes up to 7 days, in dry stacking and sprayed with water. This is important in order to achieve the maximum strength. The strength of the concrete masonry filler blocks from the material's perspective is influenced by the following factors (How to make concrete bricks and blocks: 2011):

1. The geological history of the material.
2. The ratio of aggregate/cement content.
3. Amount of compaction, which is also dependent upon other factors such as:
    - 3.1 The physical method employed.
    - 3.2 Moisture content.
    - 3.3 Geometric shapes of aggregates.
    - 3.4 Grading of these aggregates.
    - 3.5 The ratio of aggregate/cement content.
    - 3.6 The size of the filler block.

METHODOLOGY

Five manufacturers of beam and block slab systems located in Durban donated 10 CMRFB of each type they produce. All filler blocks were between the ages of 7 to 10 days. It was confirmed that only the filler blocks that have been cast for at least 7 days are sold to the public. These blocks were air-dried for 48 hours in the structures laboratory before measuring the mass for each. A two point load testing (Test 1) as shown in Figure 2 was used to load these blocks to failure. A total of 130 blocks of 13 different types were tested.

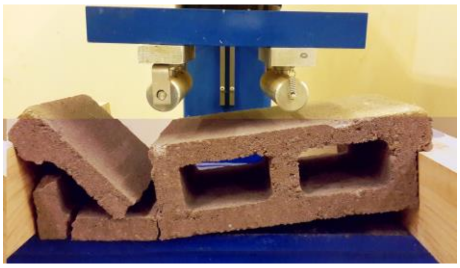


Figure 2 - Typical three core type CMRFB on the testing machine

Other block types were cellular and double core type as shown in Figure 3 and 4:

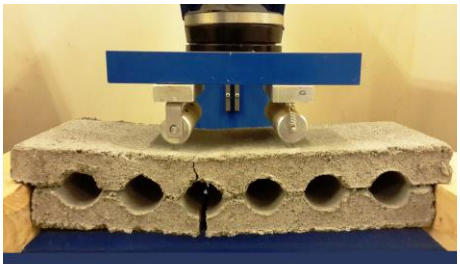


Figure 3 - Cellular type CMRFB on the testing machine

Figure 4 - Double core type CMRFB on the testing machine

The testing load was only applied axially and not laterally (vertically and not horizontally). This testing method differs from that specified by clause 5.7 of SANS 1879:2011. This was done in order to avoid the complexity of physically finding the unfavourable axial position for each filler block type. An unfavourable load is that load that yields to maximum design forces and moments (i.e. maximum design stresses). The same testing procedure, Test 2, was repeated after three months by testing three samples of each CMRFB type. The structural efficiency (ratio of the maximum load carrying capacity divided by the mass of the filler block) of each block type was calculated based on the failure load (i.e. the load recorded by the beam press machine when the filler block failed, given in kilo Newton and converted to kilograms).

Further to this, the 'design structural efficiency' of each filler block type was calculated based on the 'theoretical' design load and the average mass of each filler block. The theoretical structural efficiency is the ratio of the design load (3.5 kN) to the mass of the filler block. The design load comprised the testing load of 3.5 kN and the mass of the filler block was ignored. It was expected that the failure loads for Test 1 and Test 2 could vary significantly. It is therefore assumed that, a statistically correct answer could only be given if more tests are done over a long period of time under the same conditions and using the same materials.

There are different ways one can optimise the structural efficiency of these filler blocks. This can be achieved on the basis of the minimum weight, minimum cost or maximum performance or a combination of these (Iyengar, 2004). In this study, structural efficiency for each block type was assessed by comparing its ultimate load carrying capacity to the theoretical/design load (in terms of structural efficiencies).

The results of the tests are given in Table 1 (for Test 1) and Table 2 (for Test 2, after three months).

Table 1: Test 1 - Average mass and failure load for a set of 10 filler blocks.

Block type	Average mass (kg)	Average failure load (kg)
1	20.2	1245.7
2	17.7	759.4
3	26.1	1379.2
4	12.7	529.1
5	14.7	361.9
6	11.8	357.8
7	12.8	624.9
8	15.7	541.3
9	13.6	751.3
10	13.0	654.4
11	15.4	760.4
12	16.1	865.4
13	22.3	1222.2

Table 2: Test 2 - Average mass and failure load for a set of 3 filler blocks.

Block type	Average mass (kg)	Average failure load (kg)
1	20.0	856.3
2	18.5	533.5
3	22.9	584.4
4	12.2	384.0
5	16.0	492.7
6	11.2	231.1
7	13.6	404.3
8	15.3	394.2
9	13.6	951.4
10	12.6	740.7
11	15.8	883.5
12	16.0	407.7
13	22.1	1539.2

The structural efficiencies for Test 1 and Test 2 from Table 1 and Table 2 respectively, are presented in Figure 5 (Test 1 on the left and Test 2 on the right above the tag/number of each filler block type).

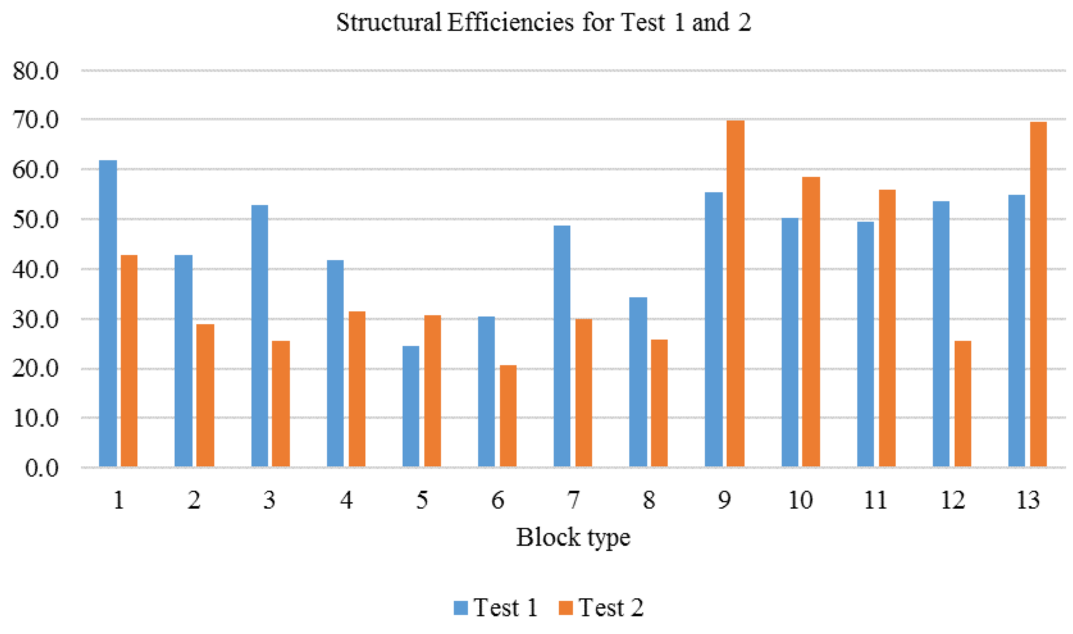


Figure 5: Structural efficiencies of concrete masonry filler blocks (Test 1 and Test 2).

DISCUSSION

A slight variation in the average dry mass of each block type was noted (refer to Table 1 and Table 2), as expected. A significant variation in failure loads of these filler blocks is also evident (as was mentioned by all five manufacturers). All results for Test 1 are either equal to or are above the design load recommended by the SANS 1879:2011. Test 2 results are well above the expected minimum design loads (except for filler block type 6) as recommended by the code. Figure 5 shows a drastic variation in structural efficiency of these filler blocks (comparing Test 1 and Test 2). The theoretical structural efficiency (in Figure 6) provides values that can be used to evaluate the structural efficiency of the blocks. It should be noted that optimising the structural efficiency of these filler blocks would require that the failure load is set as close as possible to the design load. In other words, the structural efficiency (based on ultimate load) is set as close as possible to the theoretical structural efficiency. Figure 6 indicates clearly that the theoretical structural efficiency is mainly affected by the self-weight of the filler blocks.

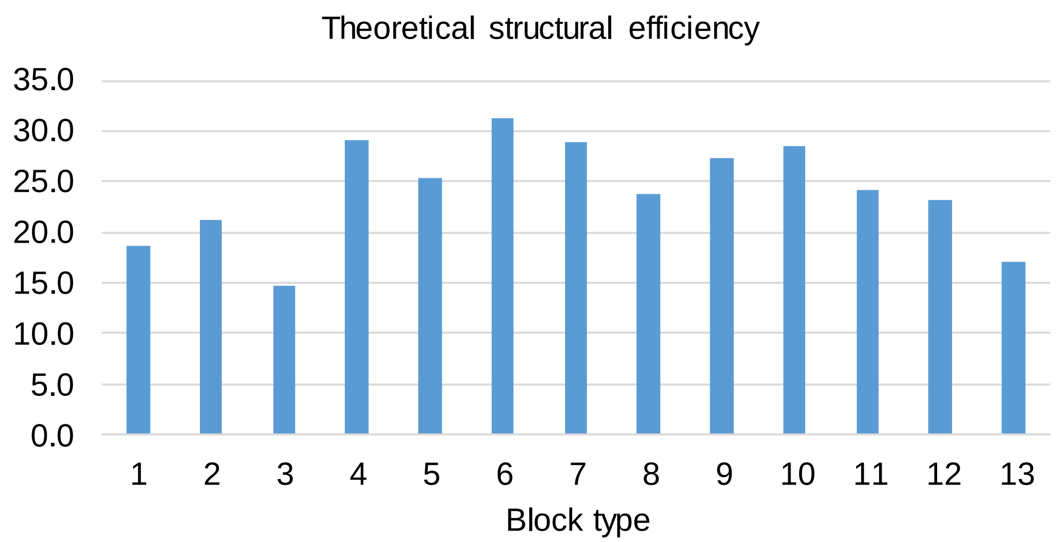


Figure 6: Theoretical structural efficiency of concrete masonry filler blocks.

Appropriate materials and resistance safety factors can be incorporated if necessary. The closer the structural efficiency is to the theoretical efficiency, the more efficient the filler block is. However, there are substantial risks involved. So, the risk is indicated by a structural inefficiency graph (Figure 7). The higher the percentage is above the baseline (positive), the more inefficient the filler block type is. The values below the line indicate inadequate strength (deficiency). It appears that, according to the test method employed, these filler blocks do not comply with the minimum strength required by SANS 1879:2011.

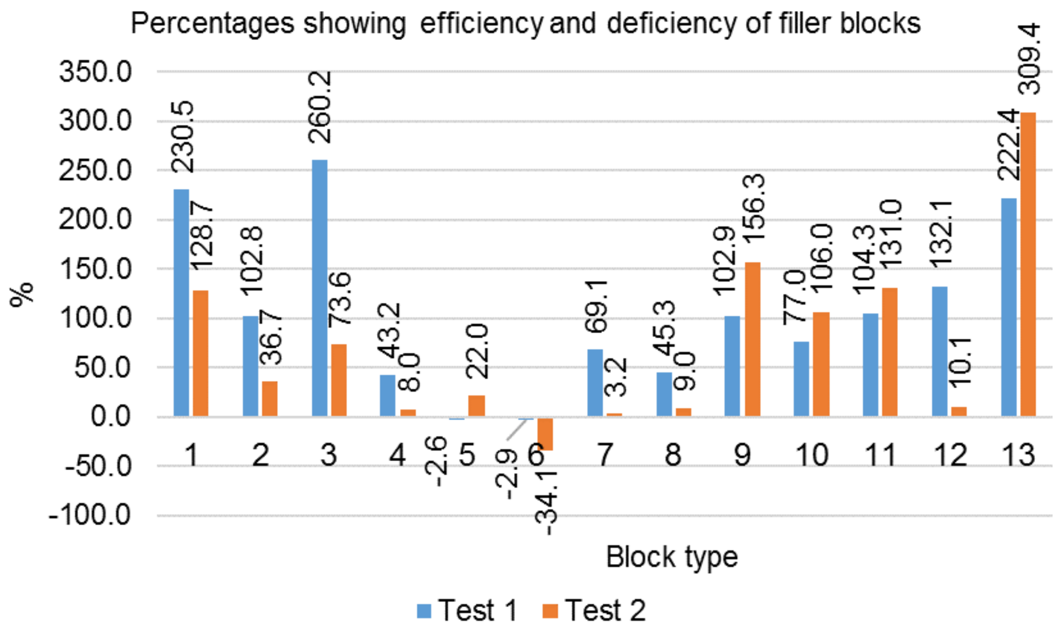


Figure 7: Percentage of structural inefficiencies of concrete masonry rebated filler blocks (Test 1 on the left and Test 2 on the right above the tag/number of each filler block type).

Most of the construction materials used in the building industry are sold by weight. So, the more weight you put in, the higher the cost of the filler block. Therefore, it is now clear that the structural inefficiency is costing some manufacturers a lot of money. This can be seen on block types 1, 3, 9 and 13. Block type 2, 10, 11 and 12 are moderate (although block type 12 in Test 1 was inefficient). Block type 4, 7 and 8 demonstrate a good potential for structural efficiency. Block type 5 and 6 went below the required strength on certain occasions.

CONCLUSION

So to answer the question asked by the manufacturers of these concrete masonry rebated filler blocks, whether or not these blocks are working at optimum structural efficiency and if not, what can be done to improve the situation? It was found that some filler blocks are structurally inefficient, some are moderate and some are deficient based on the testing method. The significant variation of strength for these filler blocks need to be controlled. Thereafter, one can consider reducing the percentage of structural inefficiency of the filler blocks bearing in mind that these blocks have different spans/mass and will therefore have different theoretical structural efficiencies. A manufacturer can decide to maintain a probability of not more than 5% (as an example) that the mean strength will be below the specified load carrying capacity to which the manufacturer undertakes to produce. The probability can be derived based on the manufacturing and construction control conditions.

REFERENCES

How to make concrete bricks and blocks, Cement and Concrete Institute. 2011.

Iyengar, N. G. R. "Optimization in Structural design". DIRECTIONS, IIT Kanpur 6 (2004): 41-47.

De Klerk, D. (2013) Precast Modular Construction of Schools in South Africa.

SANS 10177-2:2005. Fire resistance for building elements. Part 2: Fire resistance test for building elements.

SANS 10400-T (2011). The application of the National Building Regulations. Part T: Fire protection.

SANS 1215(2008). Concrete masonry units.

SANS 1879(2011). Precast Concrete Suspended Slabs.

SANS 2001-EM1:2007. Construction works Part EM1: Cement plaster.

SANS 50197-1(2013). Composition, specification and conformity criteria for common cements.

SANS 9001/ISO 9001. Quality management systems - Requirements.

South African Bureau of Standards, “Structural Use of Concrete". SABS 0100: 1992, Part 1 and, SABS, Pretoria, 1992.

Strydom, J.S. Fires in High-rise buildings (Causes, development and effects), 17th National Conference of the SA Fire Services Institute 9-11 April 1986. National Building Research Institute of the CSIR.

STUDENTS' INVOLVEMENT STRATEGIES FOR LECTURE THEATRE MAINTENANCE MANAGEMENT

Fredrick Simpeh[1]
Department of Construction Management and Quantity Surveying, Cape Peninsula University of Technology, South Africa

Upon completion, buildings are expected to perform certain functions; throughout the entire service life of buildings, it is the continued functioning that users require. Involving the users is thus critical in ensuring that their requirements and satisfaction are met. This study seeks to determine and propose strategies that could ensure the involvement of students in the lecture theatre maintenance management process. The study is based on a questionnaire survey; both closed and open ended questions were used to collect data from students. The questionnaires were distributed by means of a quota sampling method to three departments in a university. Descriptive statistics and content analysis were used to analyse the data. It became apparent that students' involvement in the maintenance process of the lecture theatres could ensure their satisfaction. Students perceived that instituting a maintenance coordinator in the department would be the most effective way of ensuring their involvement, followed by the use of suggestion box, and organising forums at departmental levels. Students also suggested that questionnaire survey and creating a complaint form on the university website and/or black board could ensure their involvement and satisfaction. The proposed involvement strategies could be adopted by maintenance departments in their maintenance management process to enhancing the maintenance practices of lecture theatres and also achieve students' satisfaction. The research also contributes to the body of knowledge in the field of building maintenance management. The findings of the study are based on a case study; however the strategies could be used by other universities.

Keywords: involvement strategies, lecture theatre, maintenance, building performance, satisfaction, student

INTRODUCTION

The quality of education is largely a reflection of the performance of the place where teaching and learning takes place (Olanrewaju, 2010a). In fact, it has been established that the performance of educational facilities including lecture theatres impact on the output and performance of students as well as teaching staff (Amaratunga and Baldry, 2000; Green and Turrell, 2005; Leung and Fung, 2005; Uline and Tschannen-Moran, 2008; Bishop, 2009; Uline, Tschannen-Moran and Wolsey, 2009; Lavy and Bilbo, 2009; and Uline, Wolsey, Tschannen-Moran & Lin, 2010). Smith, Tucker and Pitt (2011) explained that, the workplace—the learning environment—can be viewed as a factor which contributes to engagement. Therefore, the physical learning environment of a university plays an important role in creating and sustaining a productive learning

[1] simfredy24@yahoo.com

Simpeh, F. (2014) Students' involvement strategies for lecture theatre maintenance management *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 493-500.

climate (Uline et al., 2010). The lecture theatres as part of the physical learning environment of a university do not remain new forever and would therefore need to be maintained to ensure continued performance. Upon completion, lecture theatres are expected to perform certain functions; throughout the entire service life, it is the continued functioning that users required. Watt (2007) was of the opinion that the expected requirements could be grouped as: functional, performance, statutory and user requirements. All these requirements are to ensure that buildings (lecture theatres) meet the required function(s) for which they are procured. Building performance relates to “the degree to which a building or other facility serves its users and fulfils the purpose for which it was built or acquired; the ability of a facility to provide the shelter and service for which it is intended” (Iselin & Lemer, 1993, cited from Douglas, 2006:587). The performance concept is more to do with what buildings are required to do (Haupt, 2001). In other words, it determines how the building contributes to fulfilling the expectation and functions required by the building user over time (Williams, 1993; Stanley, 2001). In simple terms, building performance, essentially, relates to user expectations, requirements and satisfaction (Olanrewaju, Khamidi & Arazi, 2011a). In essence, the performance of a lecture theatre will be measured in terms of how the lecture theatre supports teaching, learning and research as required by the users. Involving building users in the maintenance process (students and lecturers) is thus critical in ensuring a sustained lecture theatre performance.

The following questions will be addressed:

- Will involving students in the lecture theatre maintenance management process ensure their satisfaction?
- What involvement strategies could be developed to ensure effective involvement of students in the maintenance management process of the lecture theatres?

USER INVOLVEMENT AND SATISFACTION

The main requirement for ensuring the attainment of quality university education is meeting the satisfaction of the students (Zakaria & Wan Yusoff, 2011). In a university, several factors—including infrastructure, technology and educators—and the management of all these factors, influence student satisfaction (Olanrewaju et al., 2011a; Zakaria & Wan Yusoff, 2011). Infrastructure which includes lecture theatre is one of the main factors that impacts students’ satisfaction, hence the need to ensure that they are well maintained. As a matter of fact, the main reason for initiating building maintenance is for the building users (Arazi, Khamidi & Olanrewaju, 2009; Olanrewaju et al., 2011a). Building maintenance is carried out to ensure that buildings support the needs of the users, with the aim that user productivity and satisfaction is enhanced (Olanrewaju, 2009). In any case, buildings are not procured for their own sake but for the services they offer the users (Douglas, 1996). Certainly, building users are the group interested in the adequate performance of the buildings since they are affected by them (Arazi et al., 2009; Olanrewaju, 2010a; Olanrewaju, Khamidi & Arazi, 2010a). Meeting the requirements of building users, then, invariably affects their satisfaction (Olanrewaju et al., 2011b). Building users are unsatisfied when buildings fail to meet their requirements, but on the other hand, they are satisfied if the management of buildings reflects and meets their requirements and interest (Arazi et al., 2009; Olanrewaju, 2010a; Olanrewaju et al., 2010a). In light of this, the focus of maintenance should be driven by the building users (Arazi et al., 2009). User satisfaction information is thus, a necessity in building maintenance management (Olanrewaju, 2010b). Users actually measure the performance of their building in terms of various criteria that are consistent with their value systems (Olanrewaju, 2009); as a result, building maintenance management must stem from user performance requirements (Olanrewaju et al., 2011b). After all, the two main stakeholders in the maintenance management value chain are the maintenance organisations (i.e. the service providers) and building users (i.e. students) (Olanrewaju, 2010a; Olanrewaju et al., 2011b). Also, efficient and effective building maintenance depends on the availability of information pertaining to the criteria that influences the users' requirements and satisfaction (Olanrewaju et al., 2010b). The sure means of getting information pertaining to the users' requirements so as to meet those requirements is to involve the users in the maintenance process.

The expectations of the maintenance organisations (i.e. the service providers) and those of the building users (i.e. students) are likely to differ. In fact, Olanrewaju et al. (2011b) expressed that a 'gap' actually exists between what the users desire and require and what they receive from the service providers. The service provider in this case is the maintenance department. Olanrewaju et al. (2011b) hypothesised that the performance of buildings could be enhanced if the maintenance organisations were aware of these 'gaps' and took them into consideration when initiating maintenance. The obvious means of identifying the gap is to seek information from the users. Essentially, users should be involved in the development of maintenance management systems to ensure that their satisfaction is taken into account while formulating maintenance policy (Olanrewaju, 2009). The building users should therefore participate in the maintenance process to increase their satisfaction (Shen & Spedding, 1998). In fact, a successful building is one that meets and possibly exceeds the requirements of the users (Arazi et al., 2009). Accordingly, it is imperative that a consensus is reached by all participating parties of the maintenance management process (Shen & Spedding, 1998).

It is evident from the preceding literature that the involvement of building users is crucial for the successful management of the maintenance process of a university. First is the need to identify user requirements. Secondly, to ensure that a consensus is reached by all participating parties of the maintenance management process (i.e. maintenance department and students in this context) is vital in ensuring the success of maintenance. Thirdly, user satisfaction could be achieved if the building users are actively involved in the building maintenance process. Consequently, to ensure that students' requirements and satisfaction are duly met, involvement mechanisms ought to be developed and incorporated in the maintenance processes for lecture theatres.

METHODOLOGY

A quantitative research design is adopted for this study. Data was collected by means of a questionnaire survey; both closed and open ended questions were used. A purposive sampling method was used to select three lecture theatres from three departments; in purposive sampling, the researcher chooses people or other units for a particular purpose (Leedy & Ormrod, 2010). The selection was done purposely to include one old, one intermediate and one new lecture theatre with the intention of ensuring that all the different classes of lecture theatres were represented. The questionnaires were then distributed by means of a quota sampling method to ensure a fair representation of respondents from the different lecture theatres. A total of 430 questionnaires were distributed, out of which 271 representing a response rate of 63.02% were duly completed and returned; the details of the questionnaire distribution and response rate is shown in table 1. Also, only 149 representing 55% of the respondents were able to respond appropriately to the question that required them to rank the strategies that could enhance their involvement; instead of ranking, some respondents ticked all the options provided. Statistics and content analysis were used to analyse the data.

Table 1: questionnaire distribution

Selected Theatres	Year built	Capacity	N issued	N (%) returned
New	2010	173 seats	95	79(83.2%)
Intermediate	1995	232 seats	260	126 (48.5%)
Old	1986	104 seats	75	66 (88%)
Total			430	271(63.02)

FINDINGS AND DISCUSSIONS

Student involvement and satisfaction

Students were asked whether their involvement in the maintenance of the lecture theatre could ensure their satisfaction. The responses from the different lecture theatres are provided to give a general representation of the diverse response. Figure 1 and Table 2 show that the response within the different lecture theatres were similar; however, students from the old lecture theatre responded more affirmatively (66.7% “Yes” to 12.1% “No”); followed by those from the new lecture theatre (59.5% “Yes” to 17.7% “No”); and lastly the intermediate lecture theatre (50.8% “Yes” to 23.0% “No”). The aggregate response indicate that, 155 (representing 57.2% of the total respondents) responded ‘Yes’; 51 (representing 18.8%) responded ‘No’; while 65 (representing 24.0%) responded ‘Unsure’. It is interesting to note that about one-fourth of the students were unsure. The general response suggests that the majority of students supposed their involvement in the maintenance of the lecture theatre could ensure their satisfaction. Similar inference can be made from the literature; Shen and Spedding (1998) insisted that building users ought to actively participate in the maintenance process to increase their satisfaction. Similarly, Olanrewaju (2009) elaborated that building users ought to be involved in the development of maintenance management system to ensure that their satisfaction is proactively taken into account. Involving students in the maintenance of the lecture theatre is therefore essential since that could ensure their satisfaction.

Ways of ensuring students involvement

To determine the most effective involvement strategies that will ensure effective involvement of students in the maintenance management process of the lecture theatres, three different involvement strategies (suggestion box, maintenance coordinators, and forum at departmental levels) were identified and students were asked to rank these strategies. Respondents were requested to write “1” against the most effective strategy that could encourage their effective involvement, “2” against the second and “3” against the third option. Values were assigned to each ranking, the firs ranking is giving a value of 3, the second a value of 2 and the third a value of 1.

The response rate for this question was quite low; instead of ranking, some respondents ticked all the options provided. 55% of the respondents responded correctly; the response is therefore a representation of those who responded correctly. From Table 3, it is evident that students perceived that instituting a maintenance coordinator in the department will be the most effective way of ensuring their involvement (score of 2.19), followed by placing a suggestion box in the department (score of 1.91), and lastly, organising forums at departmental levels for students to provide information on problems relating to maintenance of the lecture theatres (score of 1.89). However, most of the students ranked organising forums as the second most effective strategy, while placing suggestion box in the departments was the most ranked third option.

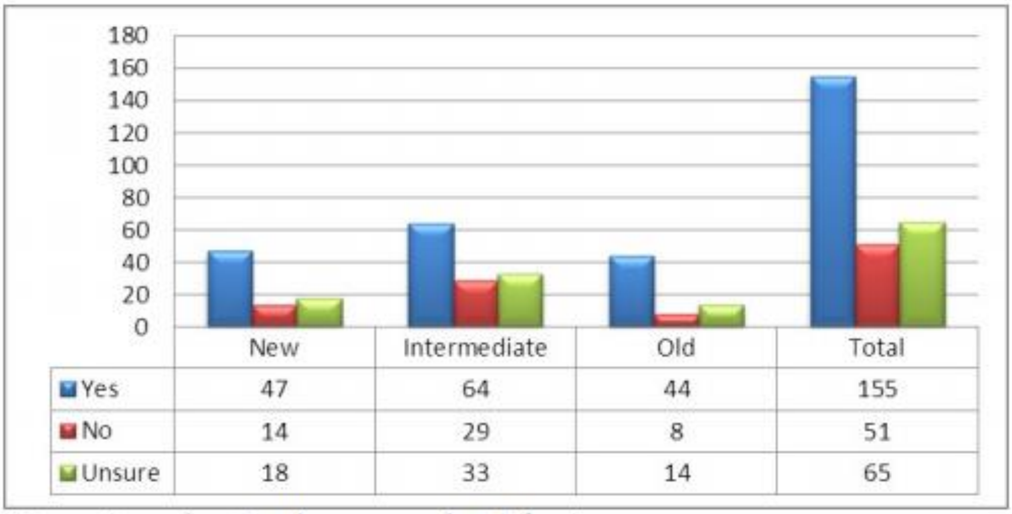


Figure 1: student involvement and satisfaction

Table 2: Student involvement and satisfaction

Effect of involvement	New N	New % Within	Intermediate N	Intermediate % Within	Old N	Old % Within	Total N	Total %
Yes	47	59.5%	64	50.8%	44	66.7%	155	57.2%
No	14	17.7%	29	23.0%	8	12.1%	51	18.8%
Unsure	18	22.8%	33	26.2%	14	21.2%	65	24.0%
Total	79	100.0%	126	100.0%	66	100.0%	271	100.0%

Table 3: Ranking feedback (involvement) options

Feedback system	Frequency & percentage N=149			Sum	Score	Ranking
	First	Second	Third			
Maintenance coordinators	55 (3)	68 (2)	26 (1)	327	2.19	1
Suggestion box	53 (3)	29 (2)	67 (1)	284	1.91	2
Feedback forums	40 (3)	53 (2)	56 (1)	282	1.89	3

Apart from ranking the (above) provided strategies, respondents were also requested to suggest other strategies that could be used to ensure their involvements. Content analysis was used to analyse the strategies suggested by the students. The suggested strategies included the following:

- questionnaire survey (the most suggested);
- interview;
- creating a complaint form on the university website/black board where students could log maintenance complaints;
- electronic mail; and
- class representative meeting.

Others also stated the need for regular inspections of the lecture theatres and follow-ups on maintenance work carried out in the lecture theatres by the maintenance department.

PROPOSED STUDENTS' INVOLVEMENT STRATEGIES

Involving students in the maintenance process of the lecture theatres is the surest way to ensure their satisfaction. It also helps to best prioritise maintenance according to the expectations of students. From the survey, these practical students' involvement strategies are proposed:

- The maintenance department should institute maintenance coordinators (or care-takers) in all academic departments who will direct the business of building maintenance. These coordinators could be tasked with simple observation of the lecture theatres and the buildings and could then meet with the maintenance department on regular basis to discuss issues relating to maintenance.
- Secondly, a suggestion box could be placed in all academic departments; students can then put their complaints in the box. Placing a suggestion box is an inexpensive strategy that could be easily implemented.
- Organising forums at departmental levels for students to provide information on problems relating to maintenance of the lecture theatres could also be considered. This strategy will help the appointed maintenance coordinators to interact with students and thus get valuable information from them.
- An occasional questionnaire survey in a form of post-occupancy (performance) evaluation would be a valuable strategy that will also ensure students involvement and promote their satisfaction. Although it is quite an expensive strategy, the accrued value makes it worthwhile.

CONCLUSION

The main reason for procuring a lecture theatre is to serve the purpose of learners and teaching staff; the maintenance of the lecture theatre should thus be driven by the users. The literature suggests that students are part of the stakeholders in the maintenance management of a university and therefore should be actively involved in the maintenance management system to ensure that their satisfaction is taken into account. It also became apparent that the performance of the lecture theatre could be enhanced if the maintenance department is able to recognise the gaps between what the students require and what they receive and take this into serious consideration when initiating maintenance. The study found that students' involvement in maintenance process of the lecture theatres could indeed ensure their satisfaction. Students perceived that instituting a maintenance coordinator in the department would be the most effective way of ensuring their involvement, followed by placing suggestion box in the department, and organising forums at departmental levels for students to provide information on problems relating to maintenance of the lecture theatre. Students also suggested that questionnaire survey or informal interview and creating a complaint form on the university website/black board could ensure their involvement and satisfaction. Importantly, universities ought to adopt strategies that will ensure stakeholder involvements in the maintenance and/or management of their infrastructures.

RECOMMENDATION

Since the involvement of students in the lecture theatres maintenance process could ensure their satisfaction, it is recommended that universities adopt these strategies (or develop strategies) that will ensure stakeholder involvements in the maintenance and/or management of their infrastructures.

This study concentrated on only the students, a further study to include teaching staff and additional lecture theatres is highly recommended as it will provide a broader perspective to further help the maintenance department better maintain the lecture theatres with the intention of satisfying both students and teaching staff.

REFERENCES

Amaratunga, D. and Baldry, D. (2000), 'Assessment of facilities management performance in higher education properties', *Facilities*, Vol. 18, no. 7/8, pp. 293 – 301.

Arazi, I., Khamidi, M. F. and Olanrewaju, A.L.A. (2009), Value-based maintenance management model for university buildings in Malaysia: a critical review. *Journal of sustainable development*, 2(3):127-133.

Bishop, M. E. (2009), A Case Study on Facility Design: The Impact of New High School Facilities in Virginia on Student Achievement and Staff Attitudes and Behaviours, PHD Thesis, George Washington University, (UMI No.3344635).

Douglas, J. (1996), Building performance and its relevance to facility management. *Facilities*, 14(3/4)23-32.

Douglas, J. 2006. *Building adaptation*. 2nd ed. Oxford: Butterworth-Heinemann.

Green, D. and Turrell, P. (2005), 'Schools buildings investment and impact on pupil performance', *Facilities,* Vol. 23, no.5/5 pp. 253–261.

Haupt, T. C. 2001. *The construction approach to construction worker safety and health*. PHD Thesis, University of Florida, Florida.

Lavy, S and Bilbo, D. L. (2009), 'Facilities maintenance management practices in large public schools, Texas', *Facilities*, Vol. 27 No. 1/2, pp. 5-20.

Leedy, P. D. and Ormrod, J. E. (2010), *Practical Research: planning and design*. 9th ed. Upper saddle river, NJ: Merrill/Prentice Hall.

Leung, M. and Fung, I. (2005), 'Enhancement of classroom facilities of primary schools and its impact on learning behaviours of students', *Facilities*, Vol. 23, no.13/14, pp. 585–594.

Olanrewaju, A. (2009), Building maintenance management in Malaysia. *Journal of Building Appraisal*, 4(3)207-214.

Olanrewaju, A. (2010a), Case for alternative approach to building maintenance management of public universities, *Journal of Building Appraisal*, 5(3)201-212.

Olanrewaju, A. (2010b), Quantitative analysis of criteria in university building maintenance in Malaysia. *Australasian Journal of Construction Economics and Building*, 10(3)51-61.

Olanrewaju, A. L., Khamidi, M. F. and Arazi, I. (2010a), 'Quantitative analysis of defects in Malaysian u niversity buildings: providers' perspective'. *Journal of Retail & Leisure Property*, 9(2)137-149.

Olanrewaju, A. L., Khamidi, M. F. and Arazi, I. (2010b), 'Building maintenance management in a Malaysian *university campuses: a case study'. Australasian Journal of Construction Economics and Building*, 10(1/2)76-89.

Olanrewaju, A. L., Khamidi, M. F. and Arazi, I. (2011a), Appraisal of the maintenance management practices of Malaysian universities. *Journal of Building Appraisal*, 6(3/4)261-271.

Olanrewaju, A. L., Khamidi, M. F. and Arazi, I. (2011b), Behavioural issues in maintenance of university buildings. *Journal of Retail & Leisure Property*, 9(5)415-428.

Shen, Q. and Spedding, A. (1998), 'Priority setting in planned maintenance-practical issues in using the multi-attribute approach', *Building Research and Information,* Vol. 26, No. 3, pp.169-180.

Smith, A., Tucker, M. and Pitt, M. (2011), 'Healthy, productive workplaces: towards a case for interior plantscaping'. *Facilities*, 29(5/6)209-223.

SYSTEMATIC REVIEW OF FACTORS INFLUENCING THE COST PERFORMANCE OF BUILDING PROJECTS

Sunday Julius Odediran[1] and Abimbola Olukemi Windapo[2]
[1]*Department of Quantity Surveying, Obafemi Awolowo University, Ile-Ife, Nigeria*
[2]*Department of Construction Economics and Management, University of Cape Town, South Africa*

A project is described as successful if the client/owner receives value for money; implies that project is ultimately completed within the stipulated time, estimated budget and quality envisaged at the planning stage of a project. Cost is one of the most significant variables of construction project performance and the driving force of project success. Construction project' costs are known globally for exceeding their initial budget often described as "cost overrun'. Studies have linked the incidence of cost overrun on construction projects to many influencing factors and the review of previous studies by this paper highlighted fifteen (15) significant factors including material price fluctuation, variation order, additional works, cost estimation method, project planning and monitoring and design accuracy. Other include financial/cost planning, design and construction errors, labour cost and requirements, poor site conditions, poor financial/cost control and monitoring; poor materials and equipment procurement strategies; market conditions/indices and contract documentation and administration from a ranking perspective. The proposed study will examine those significant factors influencing cost overrun on building projects in Nigeria with extract of literature reviewed as reference point. The study will establish a pre-analysis classification of factors influencing cost overrun in accordance with Royal Institute of British Architects (RIBA) classification of building construction stages, contractual parties involved, consultants engaged on the project and financial claims. A conceptual framework of the independent, dominant and dependent variables that show the relationship between project/cost factors and cost overrun is proposed. The quantitative evaluation of the impact of these factors on construction cost variables and final cost of building projects will be regressed and conclusively, the kind of relationship that exists among these factors using a computer-based model known as the "system dynamic model" will be modelled for future study.

Keywords: construction cost, cost variables, project factors, cost overrun, cost performance

INTRODUCTION

A project is usually regarded as successful if it is completed on time, within budget and to the level of quality standard specified by the client at the beginning of the project (Chan and Kumaraswamy, 1996; Dissanayaka and Kumaraswamy, 1999). Dakas *et al.* (2004) stated that a project is regarded as "successful" if according to Chan and Kumaraswamy (1999 & 2002), the building is completed on time, within budget, without any accidents, to specified quality standards and overall client satisfaction. Balogun (2005) equally emphasized that the ultimate goal of any

[11] sunnyodediran@yahoo.com
[2] abimbola.windapo@uct.ac.za

Odediran, S.J. and Windapo, A.O. (2014) Systematic review of factors influencing the cost performance of building projects *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 501-520.

construction project is to be delivered in the shortest possible time, at the lowest possible cost, with the highest quality; however, for many projects, this goal seems unachievable. Rahman *et al* (2012) further single-mindedly affirmed that the completion of any project within the estimated cost is the basic criteria for the success of any construction project regardless of size and complexity of project. It is however obvious from previous studies that the success and performance of any construction project is often evaluated for three-dimensions including time, cost and quality. Hence, among these performance variables, cost of construction projects has received the attention of most stakeholders in recent time due to the abnormal increase in the cost of projects.

According to Azha et al. (2008), cost has its proven importance as the prime factor for project success. This is because cost is among the major considerations throughout the construction project life cycle and can be regarded as one of the most important parameters of a project and the driving force of project success. Gido and Clements (2003) as well as Azhar et al (2008) further retreated that a project otherwise completed may not be regarded as a successful endeavor until and unless it satisfies the cost limitations applied to it. This was supported by Rahman *et al* (2012) who opined that money is always of special importance to those involved in construction project. Hence, completion of any project within the estimated cost of project is a basic criterion for success of any project. To justify this fact, performance evaluation of cost of projects is an activity that requires actions on any construction project. Hence, project cost performance is typically measured by comparing final cost against budget (Baccarini, 2004). Gido and Clements (2003) described project cost performance it as an effective technique in project management effort. In construction industry, Ali and Kamaruzzaman (2010) opined that it is important to have control on cost performance of projects to ensure the construction cost is within the budget. Bello and Odusami (2010) also affirmed that the aspiration and expectation of building clients and consultants is to keep the final construction cost within the initial budget estimate with justifiable additional costs of uncertainties and risk events. In this regards, Azha et al. (2008) affirmed that it is not uncommon to see a construction project failing to achieve its goal of completion within the specified cost and cost overrun is a very frequent phenomenon almost associated with all construction projects.

Construction projects final cost globally are known for overshooting their initial cost budget (Avots, 1983; Jagboro, 1987; Okpala and Aniekwu, 1988; Elinwa and Buba, 1993; Kaming et al., 1997; Hartley and Okamoto 1997; Achuenu, 1999; Elinwa and Joshua, 2001; Flyvbjerg, 2002; Bali and Price, 2003; Ogunsemi and Aje, 2005). The problem of cost overrun is associated with majority of the projects in the construction industry (Avots, 1983; Angelo and Reina, 2002; Flyvbjerg, 2002; Azhar et al., 2008) and the problem may be found in both developing and developed countries. Although, Angelo and Reina (2002) points out that the trend is more severe in developing countries where these overruns sometimes exceed 100% of the anticipated cost of the project. Balogun (2005) reiterates that the construction industry in Nigeria is faced with many problems and one of the most prevailing factors is cost overrun.

Previous studies suggested that the incidence of cost overrun on building projects is due to influence of many project factors (Kaming et al., 2006; Azhar et al., 2008; Otunola, 2008; Ameh et al., 2010; Ali and Kamaruzzaman, 2010; Mahamid and Bruland, 2011; and Kasimu, 2012). Elchaig *et al* (2005) further affirmed that there are significant factors affecting project costs. This shows that there are project factors influencing the performance of construction projects cost. Hence, this paper reviews factors influencing the cost performance of construction projects with a view to design research instrument in evaluating factors influencing cost overrun on building projects in Nigeria as a future study.

REVIEW OF LITERATURE

Incidences of Cost Overruns

Cost overrun in construction industry is a phenomenon which has been described using many terminologies such as “cost overrun”, “cost growth” or “cost escalation”. Cost overrun has been depicted in many ways including “excess of actual cost over budget”, “change in contract amount divided by the original contract award amount”, “difference between the original cost estimate of a project and actual construction cost” and “when the final cost or expenditure of the project exceeds the original estimation cost” (Avots, 1983; Zhu et al 2004; Choudhry, 2004; Al-Najjar, 2008) respectively. Review of previous studies shows that there are limited researches that have provided quantitatively information on the incidences of cost overruns on construction projects. In a very comprehensive research made by Flyvbjerg (2002) on cost overruns in global construction, it was found that 9 out of 10 projects had overrun; overruns of 50 to 100 percent were common; overrun was found in each of the 20 nations and five continents covered by the study; and overrun had been constant for the 70 years for which data were available. It is believed that construction projects experience an increase in cost of about 33% on average (Hartley and Okamoto 1997). Al-Momani (1996) in a study of construction cost prediction for public school buildings in Jordan established that in the developing countries cost of construction projects exceed original contract price by 30%. Mahamid and Bruland (2010) study on 169 road construction projects in West Bank in Palestine between 2004-2008 found out that 100% suffer from cost divergence, 76.33% have cost over estimation while 23.6% have cost underestimation and discrepancy between estimated and actual cost has averages of 14% ranging from -39.27% to 98.04%.

Pickrell (1990) carried out a study for the US Department of Transportation covering US rail transit projects with a total value of US$24.5 billion. The total capital cost overrun for eight of the projects was calculated to be 61% ranging from -10 to +106%. Another study by the Auditor General of Sweden (1994), covering 15 road and rail projects, revealed that the average cost overrun of eight road projects was 86%. The range for road projects was from -2 to +182%, while the average cost overrun for the seven rail projects was 17%, ranging from -14 to +74%. Another study by Fouracre et al. (1990) carried out for the UK Transport and Road Research Laboratory (TRRL), covered 21 metro systems in developing countries. The outcomes of the study showed that six metro projects had cost overruns above 50%. Two of these projects range up to 500%. Three had cost overruns in the range of up to 100%, and the remaining four ranged up to 50%. Skamris and Flyvbjerg (1996, 1997) conducted a study in Denmark, in which they compared the accuracy of cost estimates on large-scale infrastructure projects. The study considered cost estimates of seven tunnels and bridges before the decision was made to build. The major conclusion from this study was that cost overrun of 50–100% is common for larger transportation infrastructures, and that overruns above 100% are not unusual.

Jagboro (1987) conducted a comparative evaluation through a report of a survey conducted by the Nigerian Institute of Quantity Surveyors in 1981 which showed that construction costs in Nigeria were about 40% more expensive than the same type of construction in Kenya and Brazil, 35% more than in Britain and 30% more as compared with the United States of America. Akewusola (2007) reported that the mean cost overrun was 46.76% during the prosperity period of 1972-1978 on Nigeria, 65.83% during the recession period of 1979-1983 and 23.39% during the depression of 1984 to 2007 while report on events between 2007 till date was delusion. Chindo et al. (2012) in an empirical study of the effect of changes in provisional sums on building project's cost performance in Nigeria established that initial and final provisional sums differ averagely by 18.41%, of which inflation accounted for 61.5% of the difference. The study also revealed that of the 40.54% increase between initial and final contract sums, differences between initial and final provisional sums accounted for 45.41%.

Factors Influencing Cost Overruns on Construction Projects

The occurrences of cost overrun on construction projects are due to influence of many project factors and there are significant factors influencing the performance of construction projects cost. Studies have reviewed factors influencing cost overruns on construction projects and the list of those reviewed and highlighted by this study is shown in Table 1 below. Some of the studies by previous authors highlighted a long list of factors influencing cost overruns on construction projects but the emphasis of this paper was on the top rated influencing factors.

From the studies reviewed both locally and internationally as shown in Table 1, it was observed that factors were repetitive among these authors, however, this paper further extracted and re-casted those factors and came up with a list of twenty-eight (28) factors for this study which include availability of skill labour, frequent change in work scope & specifications, non-availability of construction resources, excessive contractor workloads and poor project planning & scheduling.

Other include poor project monitoring & controlling, poor communication, bad weather, poor project management, poor contract documentation & administration, materials prices fluctuation, deficient cost estimation method, design changes/poor design, additional work/variation, rework, unforeseen site conditions, market conditions, high cost of machineries & equipments, poor project financing, poor financial management & controlling, poor construction methods, technical challenges/project complexity, corruption/fraudulent practices, construction delay & abandonment, contractual claims, wrong choice procurement option, professional's negligence and errors & omissions. These factors were scored based on each author top rated factors and the top cited fifteen (15) factors influencing cost overrun on construction projects by scholars with their scores are shown in Table 2 below. This will form the basis for research design of the future study.

Table 1: Factors Influencing Cost Overruns on Construction Projects

S/N	Author	Year	Country	Top Rated Factors
1	Apolot	2013	Uganda	Inadequate manpower, inadequate/inefficient equipment, tools and plants, reworks due to poor work/wrong materials by the contractor, bureaucracy, frequent change of work scope, unreliable sources of materials on the local markets, contractor workload, poor schedule management, poor monitoring & control, poor communication, bad weather, inadequate manpower
2	Abdul-Azis et al	2013	Malaysia	Contractor's site management, project management and contract administration, design and documentation, labour related, materials and machinery, financial management,
3	Kasimu	2012	Nigeria	Materials price fluctuation, lack of historical cost data, insufficient time, lack of experience in contracts works, incomplete drawings, lack of labour productivity, variation, inadequate specification, personal experience in the contract works, level of competition, terrain of site condition
4	Mahamid and Bruland	2011	West Bank Palestine	Materials price fluctuation, insufficient time for estimate, experience in contracts, size of contract, incomplete drawings, political situation, lack of historical cost data, period of contract, frequent design changes, type and content of contract, poor quality and project management, market conditions, inflation
5	Ali and Kamaruzzaman	2010	Malaysia	Inaccurate/poor estimation of original cost, construction cost underestimation, improper planning, poor project management, lack of experience, poor contract management, inflation of project costs, high cost of machineries, fluctuation in price of raw materials, unforeseen site conditions, insufficient fund, obsolete/unsuitable construction equipment and methods and mistakes in design
6	Ameh et al	2010	Nigeria	Lack of contractor experience, cost of materials, fluctuation in the prices of materials, frequent design changes economic instability, high interest rates charged by banks on loans received by contractors, mode of financing, bonds and payments, fraudulent practices and kickbacks, incorrect planning, high cost of machineries, additional works, contract management, poor financial control on site
7	Cantarelli et al	2010	Dutch	Forecasting price errors, poor project design, incompleteness of estimations, scope changes, inadequate planning process, deliberate underestimation due to lack of incentive, poor financing/contract management
8	Kaliba et al	2009	Zambia	Bad weather, inflation, schedule delay, scope changes, local government pressures, strikes, technical challenges and environmental protection and mitigation
9	Enshassi et al	2009	Gaza Strip	Increment of materials prices due to boarder closures, delay in construction, supply of raw materials and equipment, fluctuation in the cost of building materials, project materials monopoly by some suppliers, unsettlement of local currency in relation to dollar value, design changes, contractual claims (such as, extension of time with cost claims), inaccurate quantity take-off; lack of cost planning/monitoring during pre- and post-contract stages and resources constraints - funds and associated auxiliaries not ready
10	Azhar et al	2008		Fluctuation in prices of raw materials, unstable cost of manufactured materials, high cost of machineries, lowest bidding procurements procedure, poor project (site) management/poor cost control, delays between design and procurement phases, incorrect/inappropriate methods of estimating, additional works, improper planning and unsupportive government policies
11	Le-Hoai et al	2008	Gaza Strip	Poor site management and supervision, poor project management assistance, financial difficulties of owner, financial difficulties of contractor, design changes, unforeseen site conditions, slow payment of completed works, inaccurate estimates, shortages of materials, mistakes in design, poor contract management, price fluctuations
12	Eshofonie	2008	Nigeria	Cost of materials, incorrect planning, wrong method of estimation, contract management, fluctuation of prices of materials, previous experience of contractor, absence of construction cost data, additional cost, project financing, high cost of transportation , poor financial control on site

Table 1: Factors Influencing Cost Overruns on Construction Projects Cont'd

S/N	Author	Year	Country	Top Rated Factors
13	Al-Najjar	2008	Gaza Strip	Increment of materials prices due to continuous border closures, delay in construction, supply of raw Materials & equipment by contractors, fluctuations in the cost of building materials, unsettlement of the local currency in relation to dollar value, project materials monopoly by some suppliers, resources constraint: funds and associated auxiliaries not ready, lack of cost planning/monitoring during pre-and post contract stages, improvements to standard drawings during construction stage, design changes, inaccurate quantity take-off,
14	Otunola	2008	Nigeria	Inflation, fluctuation in material and labour cost, government policy, delay in approving claims, variation/additional works, delay in sub-contractors' works, bad estimation, poor planning, poor financial control, under-pricing of tenders
15	Kaming et al	2006	Indonesia	Inflationary increases in material cost, inaccurate material estimating and project complexity
16	Omoreige and Radford	2006	Nigeria	Price fluctuation, financing and payment for completed work, poor contract management, delay, change in site condition, inaccurate estimate, shortage of materials, imported materials and plant items, additional works and design change
17	Creedy	2005	Australia	Design & scope change, insufficient investigation & latent conditions, deficient documentations, client project management costs, services relocations, constructability, price escalation
18	Wiguna and Scott	2005	Indonesia	High inflation/increase price, defective design, design change by owner, delayed payment on contract, defective construction work, poor cost control, unforeseen site ground condition, weather condition, inadequate compensated variation order, problem with availability of labour, materials and equipments
19	Frimpong et al	2003	Ghana	Monthly payment difficulties from agencies, poor contractor management, material procurement, poor technical performances, escalation of material prices
20	Nwosu	2003	Nigeria	Insufficient and incomplete drawings, weather condition, inaccurate and unrealistic establishment of unit rates, inaccurate estimate, competence and knowledge of owner, unrealistic schedules, number of changes and extra
21	Ogunsemi	2002	Nigeria	Price fluctuation, variation of works, financial difficulty
22	Vidalis and Nafaji	2002	Florida, USA	Plans and modification, changed conditions, actions and inactions, claims, minor changes, weather damages utility delays and invalid reasons
23	Jackson	2002	UK	Procurement route, external factors, claims, design brief, design change, people, site conditions, time limit, design team performance, information availability
24	Okpala and Aniekwu	1998	Nigeria	Shortage of materials, methods of financing & payment for completed projects, poor contract management, price fluctuation
25	Kaming et al	1997	Indonesia	Material cost increased by inflation, inaccurate quantity take-off, labour cost increased due to environment restriction, lack of experience of project location, lack of experience of project type, unpredictable weather condition, lack of experience of local regulation

Table 2: Factors influencing cost overrun on construction projects

S/ No	Source	Factors influencing cost overrun														
		Material Price Fluctuation	Variation/Additional Works/Reworks	Cost Estimation Method	Project Planning & Scheduling	Design Accuracy	Financial/Cost Planning	Design & Construction Errors	Site Conditions	Materials & Equipment Procurement	Cost/Financial Control	Labour Cost & Requirement	Cost Planning & Monitoring	Project Financing	Market Conditions/Indices	Contract Documentation & Administration
1	Rahman et al. (2013)	✔		✔	✔	✔	✔	✔	✔		✔				✔	
2	Abdul-Aziz (2013)	✔			✔		✔	✔			✔	✔	✔	✔		
3	Kasimu (2012)		✔	✔		✔		✔	✔							✔
4	Mahamid and Bruland (2011)	✔		✔											✔	
5	Ali and Kamaruzzaman (2010)	✔	✔	✔	✔	✔	✔		✔	✔			✔			
6	Ameh et al. (2010)	✔	✔		✔	✔	✔			✔	✔	✔	✔	✔		
7	Cantarelli et al. (2010)	✔	✔	✔	✔	✔	✔			✔	✔		✔			✔
8	Kaliba et al. (2009)					✔										
9	Enshassi et al. (2009)	✔			✔		✔						✔	✔		
10	Azhar et al. (2008)	✔	✔	✔	✔					✔	✔		✔			
11	Le-Hoai et al. (2008)	✔	✔	✔	✔	✔	✔	✔	✔			✔			✔	
12	Eshofonie (2008)	✔	✔	✔	✔		✔	✔		✔	✔	✔				✔
13	Al-Najjar (2008)	✔	✔		✔			✔	✔			✔	✔			
14	Otunola (2008)	✔	✔	✔			✔				✔	✔	✔			
15	Kaming et al. (2006)	✔		✔				✔		✔						
16	Omoreige and Radford (2006)	✔	✔	✔	✔	✔	✔		✔	✔				✔	✔	
17	Creedy (2005)	✔	✔			✔		✔				✔				✔
18	Koushki et al. (2005)	✔														
19	Frimpong et al. (2003)	✔	✔	✔	✔			✔	✔	✔	✔					
20	Nwosu (2003)		✔	✔	✔	✔			✔	✔		✔		✔		
21	Ogunsemi (2002)	✔	✔												✔	
22	Vidalis and Nafaji (2002)		✔					✔	✔							
23	Jackson (2002)	✔	✔	✔	✔	✔					✔					
24	Okpala and Aniekwu (1998)	✔	✔	✔										✔		
25	Kaming et al. (1997)	✔		✔			✔									✔
	Total Score	21	17	16	14	11	11	10	9	9	9	8	8	6	5	5

From a ranking perspective, the factors identified by scholars as influencing cost overrun on construction projects are presented in Table 2 which include material price fluctuation, variation/additional works/reworks, cost estimation method, project planning and scheduling, design accuracy, financial/cost planning, design and construction errors, poor site conditions, materials and equipment procurement strategies, cost/financial controlling, labour cost and requirements, cost/financial planning & monitoring, project financing, market conditions/Indices and contract documentation & administration.

PROPOSED FUTURE STUDY

Gap/Need for Study

Previous studies have reviewed factors influencing cost overruns on construction projects. The review suggests that very few of these studies holistically made a comprehensive and all inclusive list of factors which cut across all aspect of construction projects (construction stage, contractual parties and consultants). But it was observed that there were discrepancies in the approaches adopted by those researches, most especially in terms of scope of the study and research methodology including types of data collected. In term of identification of factors, most of the studies evaluated the level of frequency, severity impact and index factor of those factors influencing cost overruns on construction projects. But none of the papers examine how these factors contribute to sources of contractual claims (as origin of cost overruns) such as material price fluctuation, variation orders, additional works and reworks.

Reviewed studies also revealed that most of the previous researches conducted on factors influencing cost overrun did post-analysis classification of those factors (most especially by author's self ranking or factor analysis) (Abdul-Azis, 2013; Mahamid and Bruland, 2011; Ameh et al, 2010; Azhar et al, 2008) which might not give a true classification of those factors as obtainable in practice and very few classified these factors in accordance with RIBA classification of building construction stages, contractual parties involved and consultants engaged on the project. None did classify the identified factors on how they impact contractual claims such as material price fluctuation, variation orders, additional works and reworks on construction projects. How contractual claims contribute to cost variables like measured works, provisional sum, prime cost sum, preliminary cost and contingency sum were not examined and classified by any of these studies.

According to Elchaig et al. (2005), evaluation of most of the factors affecting project costs are based on the respondents' perception while very few studies made quantitative evaluation of their impact on construction project cost performance. It was observed that most of these studies employed questionnaire survey (Apolot, 2013; Abdul-Azis, 2013; Mahamid and Bruland, 2011; Ali and Kamaruzzaman, 2010) with very few used archive cost data to justify cost overrun trends in the construction industry such as Creedy (2005), Flyvbjerg (2002), Hartley and Okamoto (1997) in Florida USA, Al-Momani (1996) in Jordan, Mahamid and Bruland (2010) in West Bank in Palestine, Pickrell (1990) in US Department of Transportation and Auditor General of Sweden (1994), Fouracre et al. (1990) in UK Transport and Road Research Laboratory (TRRL), Skamris and Flyvbjerg (1996, 1997) in Denmark. In Nigeria, Jagboro (1987) study compared cost but the work is outdated while Akewusola (2007) was not an empirical academic research. Chindo et al. (2012) work was an empirical study but was limited to only provisional sums on building project excluding other construction variables such as measured works which forms bulk of construction cost, prime cost sum which covers work to be executed by nominated subcontractors, preliminaries cost and contingency sum. It was also observed that most of the studies were self-administered with very few academic researches such as PhD and M.Sc. studies (Ogunsemi, 2002; Creedy, 2005; and Al-Najjar, 2008,). Methodologically however, tools for data analysis employed by most of these studies were frequency, severity index and factor analysis et al. while the few that used archived cost data employed regression to model the cost overruns of construction projects.

Hence, this study seeks to fill the existing gap in knowledge by identifying those factors influencing cost overrun on building projects and the cost centres through which project cost overrun originated. This will be done using factors identified from the reviewed literature on cost overrun factors. Secondly, classification of factors influencing cost overrun on building projects will be done at pre-questionnaire distribution/pre-analysis stage in accordance with RIBA classification of building construction stages, contractual parties involved and consultants engaged on the project. Classification of how these factors impact financial claims such as price fluctuation, variation order, additional works and reworks on cost of building projects will also be made. The future study will also evaluate the quantitative impact of these factors on construction cost variables (Measured works, Provisional Sum, Prime Cost (P.C.) Sum, Preliminaries and Contingencies) and final cost of building projects. The proportion of contractual claims such as fluctuation, variation/additional works and reworks to construction projects cost overruns will also be made. The proposed study will also establish the kind of relationship that exists among those factors using a computer-based model known as the "system dynamic model".

Aim and Objectives of the Proposed Study

Based on the gap in knowledge identified above, this study therefore aims at evaluating factors influencing cost escalation on building projects with a view to determining the impact of the influencing factors on cost performance of building projects in Southwestern states of Nigeria. The specific objectives of this study are to;

1. identify and assess factors influencing cost overrun on building projects in Southwestern states Nigeria
2. classify factors influencing cost overrun on building projects in the study area
3. evaluate the impact of factors influencing cost overrun on final cost of building projects in the study area
4. develop system dynamic model for factors influencing cost overrun on building projects in the study area

Proposed Conceptual Framework

Figure 1 shows the proposed conceptual framework and provides information on how the set of project factors influence cost overrun on building projects. Figure 1 acknowledges that cost of construction projects originates from cost variables such as value of measured works, provisional sum, prime cost sum, preliminaries cost and contingencies sum. The influence of project factors on these cost variables results into financial contractual claims such as price fluctuation, variation orders, additional works and rework from which cost overrun often originates. The framework also provides information on the classification of the factors influencing cost overrun on building project and this classification will cover different stages of construction, contractual parties who initiate it and through which consultants the contractual financial claims were initiated.

In contrast to previous studies that suggest a direct relationship between the project cost factors and cost overrun, the conceptual framework proposed in this paper suggests that there are also cost variables such as measured works, provisional sum, prime cost sum, preliminary cost and contingency sums that intervene between the identified project factors and the final performance of construction projects costs. The framework also suggests that the cost variables can be further categorized into the following contractual claims – price fluctuation, variation orders, additional works and rework. A future study will use a mixed method approach to outline the trend of this interaction on construction cost variables and contractual financial claims. This will provide information on the behaviour of these factors to significant cost constituents of a building project.

Methodology

Study Area

The study area will be Southwestern states in Nigeria comprising Lagos, Ogun, Oyo, Osun, Ondo and Ekiti states. The Southwestern states of Nigeria have the largest concentration of building projects (Ogunsemi and Jagboro, 2006). The zone also houses Lagos City, Nigeria's former federal capital city and ancient city of Ibadan, the second largest city in Africa after Cairo.

Targeted Population

The target population for the proposed study will comprise of two categories, first category are the construction professionals (architects, builders, engineers and quantity surveyors). The second category is the archive cost data of building projects undertaken in the private practices and public sector ministries, departments and agencies in Nigeria. For second category, construction projects have been classified into different categories such as building, civil, engineering among industrial, services; and renovation/rehabilitation or maintenance works (Ogunsemi and Jagboro, 2006). The type of projects to be used for this study will be building projects which will cover public (educational and health) and private (residential and commercial). A similar study on building projects by Ogunsemi (2002) used residential, commercial, educational and other project types. Previous studies reviewed by this paper used building construction/building projects (Abdul-Azis et al, 2013, Kasimu, 2012

Mahamid and Bruland, 2011; Ali and Kamaruzzaman, 2010; Al-Najjar, 2008; Kaming et al, 2006). The choice of building projects is based on availability and reliability of cost information. However, the choice of educational, health, residential and commercial projects is based on their significance as key indicators to economy performance.

Sampling Procedure and Sample Size

For primary data to be collected for this study, a systematic selection of construction professionals will be made. This will be done through the registers of members of various professional bodies captured by this study including Architects Council of Nigeria (ARCON), Council of Registered Builders of Nigeria (CORBON), Council of Registered Engineers of Nigeria (COREN) and Quantity Surveyors Registration Board of Nigeria (QSRBN). However, for secondary data purposive selection will be made of past building projects undertaken by reputable and well experienced Quantity Surveying professional firms and public establishments within the study area. This is to obtain cost information that will be reliable and accurate for this study. This procedure had been used by previous study in Nigeria (Ogunsemi, 2002; Aibinu, 2002; Chindo et al., 2012).

Since both the primary and secondary data will be elicited for this study, the sample size for this study will be in two categories, first is the number of construction professionals to be contacted for primary data and the proposed list is shown in Table 3 below. For secondary data, the number of completed building projects whose information will be obtained and used for this study is also shown in Table 3. Previous studies had used cost data to model performance of construction project costs, Dissanayaka and Kumaraswamy (1999a) in Hong Kong used data from 32 building projects, Aibinu (2002) used data from 61 building projects in Nigeria, Setyawati et al (2002) used data of 41 educational buildings, Ogunsemi (2002) used data from 87 projects, Sonmez (2004 and 2005) study was based on 30 continuing care retirement community projects, Chindo et al. (2012) used 48 residential and commercial building projects in Nigeria.

Table 3: Sampling Procedure and Sample Size

S/N	Respondents	Private Sector Organizations	Public Sector Organizations	Total	Secondary Data (Project Cost Data)	Project Type	Total
1	Architects	30	20	50	Public	Education	25
2	Builders	20	15	35		Health	25
3	Engineers	40	25	65	Private	Residential	35
4	Quantity Surveyors	50	30	80		Commercial	35
	Total	**140**	**90**	**230**			**120**

Source: Proposed by Author

Methods of Data Collection

Data for this study will collected through questionnaire design. For primary data, a well structure multiple choice questionnaire will be administered to professionals in the private firms and public sector establishments in the study area. The questionnaire will be closed type where options will be provided for respondents to rank. The questionnaire would be divided into two parts. Part 1 will gather professionals' personal profile such as academic qualification, professional qualification, work experience in construction projects et al. Part 2 of the questionnaire would relate to the objectives of the study. Nkado (1995) postulated that the closed type question is easier to respond to and consequently improves the response rate. The scale of rating will be between intervals of 0-100% where 0 represents lowest rating while 100 represents the highest rating. This will be represented by intervals 0-5 on the questionnaire where 0 represents lowest ranking while 5 represents the highest ranking. For secondary/archive data, a well structured questionnaire would also be designed to provide the outlay of data to be collected for this study. The files of selected past building projects will be obtained (using judgement sampling employed by Chido et al., 2012) from the offices of private firms in charge of cost information management of building projects.

Tools for Data Analysis

Data to be collected would be analysis using Statistical Package for Social Sciences (SPSS) software.

Arithmetic Mean/Mean Item Score

According to Jose and Montserrat (2009), if n numbers are given, each number denoted by $a_{i,}$ where i = 1, …., n, the mean score is the (sum) of the as' divided by n or.

Factor Analysis and Principal Component Analysis

Factor analysis will be carried out to reduce many variables to few conceptually meaningful and relatively independent factors, each of which represents some combination of original variables by factor extraction. Factors extraction would be done by means of principal components analysis which transforms the original set of variables into a smaller set of linear combination that accounts for most of the variation of the original set. Various tests required for the appropriateness of the factor extraction will be carried out for this study including Kaiser-Meyer-Olkin (KMO) which measures sampling accuracy and the Barlett test of sphericity which tests the correlation matrix and hypothesis. Also, screen tests where the Eigenvalues of each component are plotted against their associated component will be carried out. The screen plot helps to identify the number of factors to be retained by looking for a relatively large interval between Eigenvalues (Fellows and Liu, 2003). Factor analysis will be used to evaluate factors influencing construction cost variables in the study area.

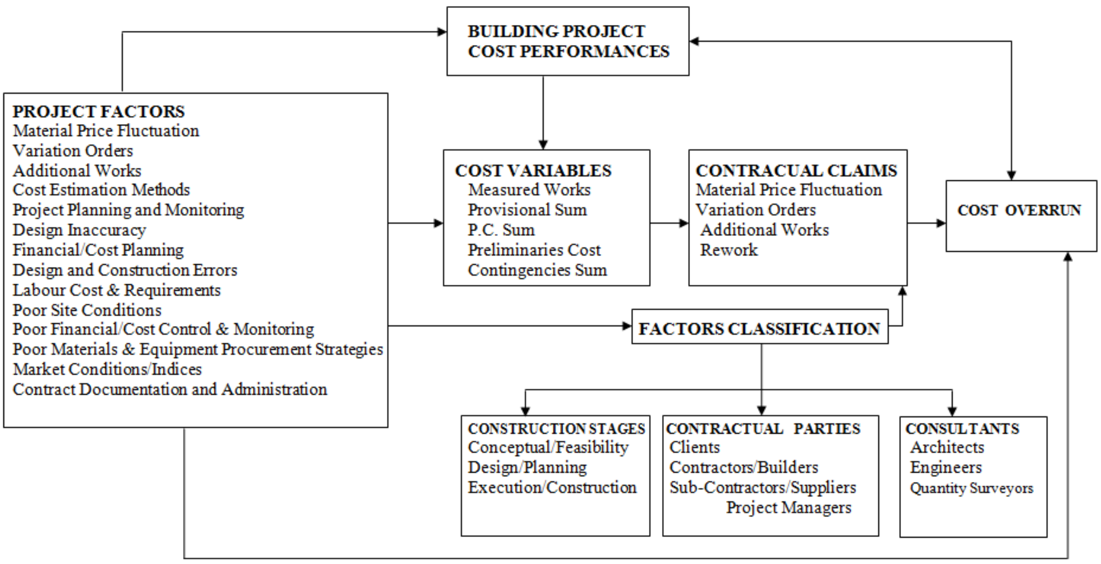


Figure 1: Conceptual Framework of the Proposed Study

Analysis of Variance (ANOVA)

In its simplest form ANOVA gives a statistical test of whether the means of several group are all equal and therefore generalizes student's two-sample *t-test* to more than two groups. One-Way ANOVA will be used for this study to assess the level of significance of cost overruns influencing factors identified by this study. The level of significance will be tested at $P \leq 0.05$ at 95% confidence level or at different significance levels as the case may be.

Regression

Regression models have been used since the 1970s for estimating cost and are a powerful statistical tool for analytical and predictive purposes in examining the contribution of variables to overall estimate reliability (Kim et al 2004). Regression models allow explicit relationships between dependent and independent variables to be analysed. Previous researches had employed regression analysis to forecast the cost of construction/engineering project. Dissanayaka and Kumaraswamy (1999a) in Hong Kong forecasted cost growth during the construction phase of projects. Dissanayaka & Kumaraswamy (1999b) modeled significant factors affecting cost performance of projects in the Hong Kong. Setyawati *et al* (2002) used regression analysis to create a model for predicting construction cost, based on two independent variables: floor area and building height. Attalla and Hegazy (2003) developed a predictive model of cost deviation for reconstruction projects using a stepwise regression. Kim *et al* (2004) employed linear regression to predict actual final costs of residential construction projects. Sonmez (2004 and 2005) used regression analysis for conceptual cost estimating in the United States. Aibinu and Jagboro (2002) in Nigeria employed simple linear regression analysis to analyse cost overrun on loss and expenses claim and of cost overrun on fluctuation claim during delay period. Ogunsemi and Jagboro (2006) used double-log linear and simple double log regression models to construct time-cost model of building projects. Windapo and Iyagba (2007) adopted multiple regressions to develop model for the determinants of housing construction costs in. Many studies had employed various variants of regression to develop models for construction cost overrun and growth. This study will therefore employ regression to model cost overrun of building projects in Nigeria.

System Dynamic Model (SDM)

Regression analysis had been used over decades to predict cost and measure performance of construction projects. This had been employed to evaluate both the qualitative and quantitative (to an extent) impact of project factors on cost performance of construction projects but has not been able to establish level of interaction among both the qualitative and quantitative project factors. This study will employed a system dynamic model, which is a computer-based model that shows a kind of relationship existing among various set of variables or factors. The model through system output indicates whether the relationship is positive or negative. Previous researches on the application of system dynamic models in construction related studies include Boateng *et al.* (2012) who employed a system dynamics approach to modelled risks description in megaprojects development; De-Marco and Rafele (2009) to model construction project performance; Nasirzadeh et al. (2008) to analyse construction risk and Mugeni-Balyejusa (2006) to model changes in construction projects. Others include works of Howick (2003) who modelled delay in complex projects for litigation; Ogunlana *et al* (2003) to examine performance enhancement in a construction; Love (2003) to model hinderance to performance of a project management system organization.; Park (2002) to model change management for fast-tracking construction projects; Chritamara and Ogunlana (2002) on modelling of design and build construction projects and Rodrigues and Bowers (1996) to analyse comparative analysis between two approaches to project management. Such a model has not been used for construction related study in Nigeria and those used globally had not modelled the impact of factors influencing cost overruns on construction cost performance.

Figure 1 is a cast of a computer-based result of system dynamic model on some set of project variables (project factors, cost variables, contractual financial claims and cost performance). The arrow shows the direction and value of relationship between variables. Positive arrow shows that there is a positive relationship while negative arrow indicates a negative relationship. In figure 1, there is a positive relationship between factors influencing cost overrun and cost variables, which imply that the identified project factors will have an impact on cost variables of construction projects. Since cost variables also have a positive relationship with cost performance, project factors has a dummy/indirect positive relationship with cost performance i.e. project factors will influence performance of cost of building projects. Cost variables also have positive relationship with contractual claims as applicable to cost variables and contractual claims is the result of the influence of project factors on cost variables; there is therefore a dummy (indirect) positive relationship between project factors and contractual claims and performance of construction cost.

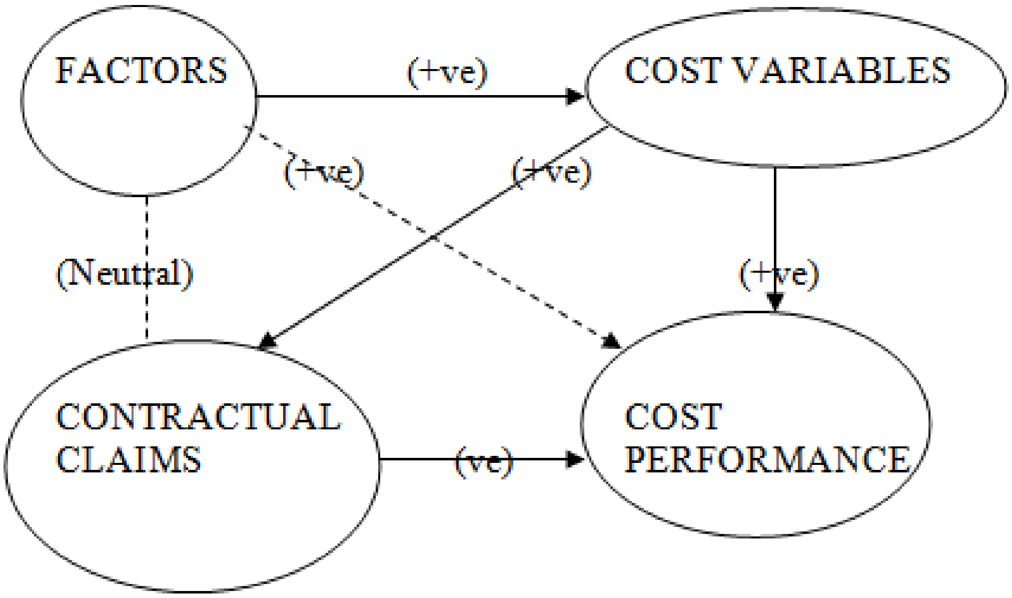


Figure 2. Modelled relationship between project factors, cost variables, contractual financial claims and cost performance of building projects

A positive relationship exists between contractual claims and cost performance of building projects. This emit of a computer-based model for future study shows that project factors will influence cost overrun on cost performance of building projects. For the proposed future study, the kind relationship that exists between the factors influencing cost overrun on building projects will be modelled in this form. It is expected that this will provide more information on the level of interaction and significance of these factors on cost performance of building construction projects. Table 4 below also gives a predicted form of relationship and interaction among cost variables, contractual claims and cost performance whether positive or negative as proposed by this study.

Table 4. Predicted relationship between cost variables, contractual claims and cost performance (+ve or –ve) of building projects

S/N	Cost variables (1)	Contractual claims (2)	Relationship between 1 and 2	Cost performance
1	Measured Works	Material Price Fluctuation	Yes	Positive
		Variation Orders	Yes	Positive
		Additional Works	Yes	Positive
		Reworks	Yes	Positive
2	Provisional Sum	Material Price Fluctuation	No	Negative
		Variation Orders	Yes	Positive
		Additional Works	Yes	Positive
		Reworks	Yes	Positive
3	Prime Cost (P.C.) Sum	Material Price Fluctuation	Yes	Positive
		Variation Orders	Yes	Positive
		Additional Works	No	Negative
		Reworks	No	Negative
4	Preliminaries Cost	Material Price Fluctuation	No	Negative
		Variation Orders	No	Negative
		Additional Works	No	Negative
		Reworks	No	Negative
5	Contingency Sum	Material Price Fluctuation	Yes	Positive
		Variation Orders	Yes	Positive
		Additional Works	Yes	Positive
		Reworks	Yes	Positive

CONCLUSION

This paper has reviewed previous studies that evaluated the factors influencing cost overrun on construction projects and has equally made a comprehensive list of prevailing project factors influencing cost overrun on construction project. The proposed study will further investigate contribution of these factors to financial claims as the sources of cost overrun and contribution of contractual claims to cost variables of building projects. It will also establish pre-analysis evaluation and classification of those factors influencing cost overrun on building project as obtainable in practice and this will be done in accordance with Royal Institute of British Architects (RIBA) classification of building construction stages; contractual parties involved and consultants who initiated cost overrun on building projects. Further investigation of how these factors impact financial claims such as price fluctuation, variation order, additional works and reworks on cost of building projects will also be made. The future study will employ quantitative method to evaluate the impact of these factors on construction cost variables (Measured works, P.C. Sum, Prime Cost Sum, Preliminaries and Contingencies) and final cost of building projects. The proposed future study will also establish the relationship that exists among the identified factors using computer-based model called “system dynamic model”.

REFERENCES

Achuenu E (1999). “Elemental Approach to the Evaluation and Modelling of Cost Overrun of Public Office Building Projects in Nigeria” unpublished Ph.D. Dissertation, University of Jos, Nigeria

Abdul-Azis, A A., Memon. A.H., Rahman, I.S. and Abd. Karim, A.T. (2013). Controlling Cost Overrun Factors in Construction Projects in Malaysia. Research Journal of Applied Sciences, Engineering and Technology, 5(8): 2621-2629

Akewusola W.A.O., (2007). Effect of economic trade cycle on final cost of construction projects in Nigeria. *The Quantity Surveyor*. The Journal of the Nigerian Institute of Quantity Surveyor. 55(2): 31-40.

Aibinu, A.A. and Jagboro, G.O. (2002). The effects of construction delays on project delivery in Nigerian construction industry. International Journal of Project Management 20 (2002) 593–599

Al-Momani, A. (1996). Construction cost prediction for public school buildings in Jordan. *Construction Management and Economics*. 1996, 14: 311-317.

Al-Najjar, J.M. (2008). Factors Influencing Time and Cost Overruns on Construction Projects in the Gaza Strip. Unpublished M.Sc. Thesis submitted to The Islamic University of Gaza

Ali, A.S. and Kamaruzzaman, S.N. (2010). Cost performance for building construction projects In Klang Valley. *Journal of Building Performance,* Volume 1 Issue 1,

Ameh, O.J., Soyingbe, A.A. and Odusami, K.T. (2010). Significant Factors Causing Cst Overruns in Telecommunication Projects in Nigeria. Journal of Construction in Developing Countries, Vol. 15(2), 49-67

Angelo, W. J., & Reina, P. (2002). Megaprojects Need More Study Up Front to Avoid Cost Overruns.

Apolot, R, Alinaitwe, H and Tindiwensi , D (2013). An Investigation into the Causes of Delay and Cost Overrun in Uganda’s Public Sector Construction Projects. Second International Conference on Advances in Engineering and Technology

Avots, I. (1983). Cost-Relevance Analysis for Overrun Control. *International Journal of Project Management*, Vol.1 No.3, 142-148.

Al-Momani, A. (1996). Construction cost prediction for public school buildings in Jordan. *Construction Management and Economics*. 1996, 14: 311-317.

Auditor General of Sweden. (1994) *Riksrevisionsverket.* [The Swedish National Audit Bureau.] *Riksrevisionsverket.*, Vol. 23. Auditor General of Sweden, Stockholm, Sweden.

Azhar, N., Rizwan U. Farooqui & Ahmed, S.M. (2008). Cost overrun factors in construction industry of Pakistan. *Advancing and Integrating Construction Education, Research & Practice*, 499-508.

Baccarini, D. (2004). Estimating Project Cost Contingency – Beyond the 10% syndrome. Faculty of Built Environment, Art & Design, Curtin University of Technology, Perth, Western Australia

Baloi D, Price ADF (2003). Modelling global risk factors affecting construction cost performance. Int. J. Project Mgt., 21: 261-269.

Balogun, O.M. (2005). Clients' Perception on Measure of Indigenous Contractors Performance in the Construction Industry, *The Professional Builders*, Journal of Nigerian Institute of Building, July 2005, pp 42-48.

Bello, W.A. and Odusami, K.T. (2009). Project Variables influencing contingency on construction contracts in Nigeria. *RICS COBRA Research Conference*, University of Cape Town, 10-11th September, pp. 204-214.

Boateng, P., Chen, Z and Ogunlana, S.O. (2012). A conceptual system dynamic model to describe the impacts of critical weather conditions in megaproject construction 1st. International Conference on Infrastructure Development in Africa, p. 364

Cantarelli, C.C., Flyvbjerg, B. and Molin, E.J.E and van Wee, B. (2010). Cost Overruns in Large-scale Transportation Infrastructure Projects: Explanations and Their Theoretical Embeddedness. EJTIR, Issue 10(1), 5-18

Chan, D. W. M. and Kumaraswamy, M. M. (1997) A comparative study of causes of time overruns in Hong Kong construction projects, *International Journal of Project Management*, 15, pp. 55–63.

Chritamara S., Ogunlana S.O., Bach N.L., (2002). "System dynamics modelling of design and build construction projects", Construction Innovation: Information, Process, Management, Vol. 2 Iss: 4, pp.269 - 295

De Marco A., and Rafele C. (2009), Using system dynamics to understand project performance. Available at http://www.aice-it.org/index. php/.../27-ingegneria-economica-n-79-all-2 (Accessed 21 October, 2011)

Dissanayaka, S.M. and Kumaraswamy, M.M. (1999). Comparing contributors to time & cost performance in building projects. *Building and Environment*, 34(1), 31–42.

Creedy, G. D., Skitmore, M. and Wong, J. K. W. (2010). Evaluation of Risk Factors Leading to Cost Overrun in Delivery of Highway Construction Projects, Journal of Construction Engineering and Management, 136 (5): 528–537.

Elchaig, T., Boussabinaine A., and Ballal T. (2005) "Critical determinants of construction tendering costs: Quantity surveyors' standpoint", *International Journal of Project Management.*

Elinwa AU, and Joshua, M (2001). "Time overrun factors in Nigeria construction industry", J. Constr. Engr. Mgt., 127(5): 419-25.

Enshassi, A., Al-Najjar, J. and Kumaraswamy, M. (2009). Delays and cost overruns in the construction projects in the Gaza Strip. *Journal of Financial Management of Property and Construction*, 14(2): 126–151.

Eshofinie, F.T. (2008). Factors Affecting Cost of Construction in Nigeria. Unpublished M.Sc. Thesis, Department of Building, University of Lagos, Nigeria.

Fellow, R. and Liu, A. (2003). *Research Methods for Construction*, 2nd Edition, Oxford, Blackwell Science Publishing Company.

Flyvbjerg, B., Holm, M. K. S. and Buhl, S. L. (2002) Cost underestimation in public works projects: error or lie? *Journal of the American Planning Association*, 68(3).

Fouracre, P.R., Allport, R.J.,& Thomson, J.M., (1990). 'The performance and impact of rail mass transit in developing countries'. TRRL Research Report 278. Transport Research Laboratory, Crowthorn, Berkshire, England.

Frimpong, Y., Oluwoye, J. and Crawford, L. (2003). Causes of delay and cost overruns in construction of groundwater projects in developing countries; Ghana as a case study. *International Journal of Project Management*, 21, 321-326.

Gido, J. & Clements, J.P. (2003). *Successful project management*. New York: South-Western.

Hackney, J.W. (1997). “Control and Management of Capital Projects”. *AACE International*, (2^{nd} Edition).

Howick, S. (2003) Using System Dynamics to Analyse Disruption and Delay in Complex Projects for Litigation. The Journal of the Operational Research Society, Vol. 54, No. 3 (Mar., 2003), pp. 222-229

Jackson, S. (2002). Project Cost Overruns and Risk Management, *School of Construction Management and Engineering, The University of Reading, Whiteknights, PO Box 219, Reading, RG6 6AW, UK*

Jagboro, G.O. (1987) The need for a code of practice for tendering in Nigeria. *The Professional Builder*, 2(1), 26–7.

Kaliba C., Muya M. & Mumba K.. (2009). Cost escalation and schedule delays in road construction projects in Zambia. *International Journal of Project Management*, 27, 522-531.

Kasimu, M.A. (2012). Significant Factors that Causes cost overruns in Building Construction Projects in Nigeria. Interdisciplinary Jurnal of Contemporary Research in Business, Vol. 2, 775-780

Jose, M.M. and Montserrat, C. (2009). The Generalized Hybrid Averaging Operator and its Application in Decision Making. *Journal of Quantitative Methods for Economics and Business Administration, 9, 69-84.*

Kaming, Peter F., Paul O. Olomolaiye, Gary D. Holt and Frank C. Harris. (1997). Factors Influencing Construction Time and Cost Overruns on High-rise Projects in Indonesia. *Construction Management and Economics*, 15: 83-94.

Kaming P. F, Olomolaiye, P.O., Garry, D.H. and Harris, F. C. (2006). Factors influencing Construction Time and Cost Overrun on high-rise projects in Indonesia. *Engineering Construction and Architectural Management*. Emerald Group Publishing Limited.

Kim G H, An SH and Kang K I (2004). Comparison of construction cost estimating models based on regression analysis, neural networks, and case-based reasoning, *Building and Environment*, 39, 1235-1242

Le-Hoai, L., Lee, Y. D. and Lee, J. Y. (2008). Delay and cost overruns in Vietnam large construction projects: A comparison with other selected countries, KSCE Journal of Civil Engineering 12(6): 367-377.

Love PED (2002a). Influence of project type and procurement methods on rework costs in building construction projects. *J. Constr. Eng. Mgt.* 128(1): 18-29.

Mahamid, I. and Bruland, A. (2010). Analysis of cost diverges in road construction projects. *Proceedings of the 2010 Annual Conference of the Canadian Society for Civil Engineering*, Winnipeg, Manitoba, Canada, June 9-12,

Mugeni-Balyejusa B. (2006). “An application of system dynamics modelling to changes in construction projects”. Available at http:// hdl.handle.net/123456789/585 (Accessed 20 September, 2011)

Nasirzadeh F.; Afshar A. and Khanzadi M. (2008) ‘System dynamics approach for construction risk analysis’ International Journal of Civil Engineering, Vol. 6, No. 2.

Nkado, R.N. (1995). Construction Time-Influencing Factors: The Contractor’s Perspective. *Construction Management and Economics, 13 (1), 81-90*

Nwosu, C.C.C. (2003). High Cost of Building in Nigeria: Factors Responsible and Remedies. The Quantity Surveyor, The Journal of the Nigerian Institute of Quantity Surveyors, Vol. 44 (3), 18-27

Ogunlana S.O., Sukhera and Li, H., (2003). “System Dynamics Approach to Exploring Performance Enhancement in a Construction Organization.”, J. Constr. Engrg and Mgmt. ASCE.129. pp. 528-536)

Ogunsemi D.R. and Jagboro G.O. (2006). Time-cost Model for Building Projects in Nigeria. *Construction Management Economics*, 24: 353-258.

Ogunsemi, D.R. and Aje, I.O. (2005): “A Model for Contractor’s Selection in Nigeria”; *Journal of the Nigerian*

Institute of Quantity Surveyor; 50(1), 3-7.

Ogunsemi DR (2002). The cost and time performance of construction projects in south-western Nigeria. Thesis (PhD). Federal University of Technology, Akure,

Okpala, D. and Aniekwu, A. (1988). Causes of High Costs of Construction in Nigeria. *Journal of Construction Engineering and Management*. 1988, 114(2): 233–244.

Omoregie, A. and Radford, D. (2006). Infrastructure delays and cost escalation: Causes and effects in Nigeria. Proceeding of Sixth International Postgraduate Research Conference, Delft University of Technology and TNO, the Netherlands. 3rd-7th April 2006.

Otunola, A.T. (2008). Construction Cost and Time Overrun-A Builder’s Perception of Contributory Factors, *The Professional Builder*, Journal of the Nigerian Institute of Building, September 2008.

Pickrell, D.H., (1990). ‘Urban rail transit projects: forecasts versus actual ridership and cost’. US Department of Transportation, Washington DC.

Rahman, I.S., A A., Memon. A.H., Rahman, I.S., Abdul-Azis, A.A. and Abdullah, N.H. (2013). Modeling Causes of Cost Overrun in Large Construction Projects with Partial Least Square-SEM Approach: Contractor’s Perspective. Research Journal of Applied Sciences, Engineering and Technology, 5(6): 1963-1972

Ramli Mohamad. (2003). *The need for systematic project management in construction industry Malaysia*: Macroworks.

Skamris, M.K., Flybjerg, B., (1997),’ Inaccuracy of traffic forecasts and cost estimates on large transport projects’. *Transport policy* 4 (3), 11–146. SPSS Base System Users Guide (1993). Release 6.0.

Rodrigues and Bowers (1996). System dynamics in project management: a comparative analysis with traditional methods. System Dynamics Review 12(2): 21–139.

Setyawati B R, Sahirman S and Creese R C (2002). Neural networks for cost estimation, *AACE Transactions*, EST.13.1-9

Skamris, M.K., &Flyvbjerg, B., (1996). ‘Accuracy of traffic forecasts and cost estimates on large transportation projects’.Transportation Research Record, 1518.

Sonmez R (2004). Conceptual cost estimation of building projects with regression analysis and neural networks, *Canadian Journal of Civil Engineering*, 31(4), 677-683

Sonmez R (2005). Review of conceptual cost modeling techniques, *AACE Transactions*,

EST.07.1-4

Vidalis, M.S and Najafi, T.F., (2002). Cost and time overruns in highway construction 4th transportation specially conference of the Canadian Society for civil Engineering, Montreal, Quebec, Canada June 5-8 (2002).

Wiguna, I P A and Scott, S (2005) Nature of the critical risk factors affecting project performance in Indonesian building contracts. *In:* Khosrowshahi, F (Ed.), *21st Annual ARCOM Conference*, 7-9 September 2005, SOAS, University of London. Association of Researchers in Construction Management, Vol. 1, 225-35.

Windapo, A. O. & Iyagba, R.O.A (2007). Modelling the determinants of Housing construction costs in Nigeria. COBRA 2007 Proceedings published by RICS 12 Great George Street London SW1P 3AD United Kingdom

THE EFFICACY OF INFORMAL SOCIAL NETWORKS IN JOB SEARCH AMONG CONSTRUCTION ARTISANS FROM VARIOUS ETHNIC GROUPS IN THE WESTERN CAPE

Martin Lekarapa[1] and David Root[2]
School of Construction Economics and Management, University of the Witwatersrand, Johannesburg, South Africa

Informal social networks among the construction craft workers from various ethnic groups can give rise to barriers of entry for craftsmen and trainees. This study investigated informal social networks on three construction sites in an ethnically diverse area, to explore how these give rise to economic exclusion and promote inequality of access to social economic resources such as work opportunities. Using the Social Network Analysis (SNA) method, adopting through the egocentric approach data was collected and analysed using of the social network analysis program UCINET .Findings from the three case studies showed that the primary access to information on work opportunities was through the informal social networks formed among construction artisans, foremen and construction managers. Moreover, artisans on these sites were mostly friends and neighbours with similar ethnic backgrounds strongly suggesting that social relations facilitated the transfer of information around work opportunities. Whilst for those who are a part of these networks, the informal social networks can be advantageous; however, they also act as barriers of entry to those who are not a part of these networks to work opportunities and can act as barriers to skills acquisition for those who do not already possess craft skills. Further findings showed a strong relationship between trade and ethnicity. Minimal interaction was observed between different ethnic groups suggesting a further hindrance in the transfer of information about work opportunities across ethnic groups. To an extent government policies identify this phenomenon and seek to overcome it at the level of businesses and entrepreneurs through actions such as Broad Based Black Economic Empowerment (BBBEE) and preferential procurement. Findings of this study suggest that social networks and the resultant social capital that they engender exist in all manners of forms, and within many different communities, raising the question of the ultimate effectiveness of such interventions.

Key words: craftsmen, artisans, social networks analysis, work opportunities

INTRODUCTION

Most people who join construction industry enter the industry at the level of either unskilled or semi-skilled labourers acquiring skills ‘on the job’ rather than through formalised training processes. Because of the high levels of informality at the lower levels of the industry, this level does not have a dominant pathway in the same way as

[1] lekarapa@icloud.com
[2] david.root@wits.ac.za

Lekarapa, M. and Root, D. (2014) The efficacy of informal social networks in job search among construction Artisans from various ethnic groups in the Western Cape *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 521-535.

construction professionals such as engineers and quantity surveyors who are required to have formal education. As a result, unskilled and semi-skilled labourers need networks to get job access. Social Networks permeate people's social and economic lives (Jackson, 2008). Social relationships play a critical role not only in daily life and behaviour, but also in determining long-run welfare. They affect the opinions people hold and information they obtain and are also often the key to accessing resources. One of the most robust and best-studied roles of social networks concerns obtaining employment and most importantly they play a major role in the transmission of information about job opportunities and are critical to the trade of many goods and services. As much as social networks are important, Lekarapa and Root (2011) argues that social networks can by giving priority to members of particular network, exclude other social groups from accessing the economic resources by providing barriers to access job information opportunities.

This paper posits that the informal social networks from various ethnic groups erect barriers of entry into the construction industry in the Western Cape. The research was carried out in the Western Cape, where the population is not only cosmopolitan but is also diverse. Half of the population is coloureds, one-fourth is black and one is fifth white. The remaining population is Asian of mostly Indian descent. Whilst it is a relatively urbanised region of South Africa, the spatial legacy of apartheid policies and recent migration patterns have resulted in different ethnic groups dominating particular geographical spaces. Since social networks are heavily dependent on the sharing of physical spaces and regular interaction by individuals, it would be expected that social networks might be strongly correlated to ethnic groups.

TRANSMISSION OF INFORMATION IN INFORMAL SOCIAL NETWORKS

People mostly search for jobs through relatives, friends, neighbours, etc. So it is important to look at how information about job opportunities is transmitted through social networks. Granovetter (2005) found that the nature of the ties between the network members is essential. He observed that more novel types of information flows to individuals through weak ties as opposed to strong ties because close friends tend to move in the same circles than individuals do, so the information friends receive overlaps considerably with what they already know. In weak ties networks, Granovetter (2005) argues that people are acquainted with people that they do not know so well and thus are more likely to receive more novel information because their acquaintances are typically less similar to them than close friends, and that they spend less time with them. In addition, by moving in a variety of social circles, people are able to connect to a wider world and that this may be better sources when each of them need to go beyond what their own group knows as regards finding a new job or obtaining a scarce service (Granovetter, 1973, 1983, 2005).

Moreover, Granovetter's argument also would suggest that if each person's close friends already know one another, they are likely to form a closely-knit clique. Therefore individuals are typically connected to other cliques through their weak ties rather than through their strong ties and this implies that the strength of such ties determine the extent to which information diffusion in large-scale social structures can take place (Granovetter, 1973). For Granovetter (2005) there are many more weak ties in social networks than strong ones and most such ties transmit unique and non-redundant information across otherwise largely disconnected segments of social networks.

There is a need for actors to develop strategic information networks. Podolny and Baron (1997) believe that strategic information is a resource and the value of a strategic-information network increases with network size and sparseness. It has previously shown how craftsmen rely heavily on their stock of personal contacts and networks (Assad, 1998; Applebaum, 1981) and personal contacts transmit employment opportunities through word-of-mouth communication and constitute an alternative source of employment information to more formal employment (Calvo-Armengol, 2000). A limited flow of information about work opportunities was observed in countries such as Egypt (Assad 1998), USA (Applebaum 1981) Kenya, (Mitullah and Wachira, 2003), employers also prefer to hire craftsmen to whom they have previous personal ties due to information constraints. As well as the need to maintain a flexible but reliable supply of workers, employers also prefer to hire craftsmen to whom they have previous personal ties. Notably, Assad (1998) argues that they rely on patron-client relationships or ties of kinship and residential proximity to secure the workers they need.

Bexley (2007) also argues that an actor's identity can also indicate whether the relationship an individual has with other networks is 'bridging' or 'bonding' in nature. He indicates that high levels of identification with a group can show a 'close' or bonding relationship[3], whereas low levels of identification can indicate an open or diverse group in which bridging relationships may form[4]. According to Bexley (2007) close, bonded, relationships such as familial relationships help people to deal with day-to-day problems and challenges while bridging relationships can open up new opportunities to individuals. Putnam (2004) suggests that while bonding social capital is crucial for 'getting by', bridging social capital is especially important for 'getting ahead'. This supports Granovetter (1973) who found that weak or bridging, ties were the most effective in helping people find jobs that they might not otherwise have heard about.

CONSEQUENCES OF INFORMAL SOCIAL NETWORKS IN JOB SEARCHES

The formation of informal social networks between the artisans/craftworkers may be argued to have a negative impact such as social exclusion on job seekers who do not belong to more advantaged networks which are connected to more economic opportunities. Lekarapa and Root (2011) arguepreviously that networks exclude other social groups to access the economic resources by erecting barriers to the access of job information opportunities. Narayan (1999) argues that social exclusion refers to the societal and institutional processes that exclude certain groups from full participation in the social, economic, cultural and political life of societies. Social exclusion concept focuses on social structures and how these impact access to power, resources and the lives of different social groups(*ibid*). Being a member of a network with poor economic opportunities may be argued to bring exclusion or a barrier to the unemployed craft workers/artisans to access better job information opportunities. For Narayan (1999) those who belong to social networks which already have access to the resource allocation, decisions of the state or private sector (jobs, location of industry)

[3]This is the main kind of relationship, which Bourdieu (1986) focuses upon.

4 This is shown in Putnam (2000) and Woolcock (1998).

are much more likely to continue to be included in societal processes than those who do not have such access. The above can be argued to be the case in South African society where white South Africans (a minority group) retain more access to social and economic resources than other social groups (coloureds, blacks, etc.), as a consequence of apartheid policies.

Atkinson and Hills (1998) found that social exclusion composed of three aspects, firstly, it is relative - exclusion is from a particular society at a particular place and time. Secondly, it implies an act of exclusion and hence an agent or agency. Lastly, it has a dynamic aspect – that is people are excluded not just because they are without jobs or income, but also due to the fact that they have little prospect for the future. Social capital as explains social exclusion as the ties that binds people together yet excluding others (Narayan, 1999), since the non-overlapping nature of social networks of different social groups normally results in unequal opportunity to access economic opportunities.

From the above, it can be seen that social exclusion results in barriers. This suggests that disadvantaged social networks need to be able to bridge into better networks. The small and emerging construction contractors can be argued to experience the exclusion due to lack of connection into more advantageous networks. It can also be argued that the firm depends more on individual's (owner) network than the enterprise itself.

BRIDGING SOCIAL NETWORKS TO GAIN BETTER RESOURCE OPPORTUNITIES

Bridges are network links that provides the only direct path between two nodes/actors (Harary *et al.* 1965). A bridge between X and Y provides the only route along which information or influence can flow from any contact of X to any contact of Y and consequently from anyone connected to indirectly to Y (Granovetter, 1973). Bian (1997) observed two significances of a bridge that, firstly, it serves as a direct tie between X and Y who presumably are members of direct groups as well as more broadly. Secondly, it serves as a network link that joins otherwise unconnected individuals by bridging X and Y. However Burt (1992) argues that tie weakness is not a pre-condition for a tie to function as a bridge but that a disconnection between individuals having non redundant resources or holding different network positions is critical. Disconnections give strategic players information and control in competition for economic rewards (*ibid*).

Different authors have shown various ways by which to bridge social networks in order to gain access to job opportunities. The use of weak ties to bridge networks is argued to be one way to gain access to job opportunities, because as stated earlier, these kinds of relationships are more valuable to a network as a source of information (Granovetter 1973). Bian (1997) found that in China, weak ties are useful in spreading information. In addition, the use of acquaintance ties is argued to give better access to job informationbecause acquaintances as compared to close friends are more prone to move in different cycles than one's self (Granovetter, 1974). Directly under the idea of weak ties, falls the use of structural holes.

Moreover, the use of structural holes (Burt 1992) falls directly under weak ties. Burt (1992) suggests that the task for a strategic player who is attempting to build an efficient-effective network is to focus on resources and the maintenance of bridge ties. Bridge ties are a key source of social capital that explains the success of those managers with connections, strong or weak to a large number of disconnected others within corporations (*ibid*). The essential role factor is to maintain the social networks, which enables stable networks with continuing benefits. Wegner (1995) found that in Germany persons of low status can choose among strong-tie contacts from a wide status range to access social resources while persons near the upper end of the status hierarchy must rely on weak ties to contact someone of a higher status outside the range of their own network.

Strong ties are also argued to create network bridges, linking previously unconnected individuals (Bian, 1997). Bian (1997) found that in China, job seekers in contact with high-level authorities as many use indirect ties to gain influence. Also, personal networks are used to gain influence from job-assigning authorities rather than to gather employment information, because even when they have access to information, job-seekers cannot apply for jobs as these jobs are secretly assigned by officials as favours to those who are directly or indirectly connected to them. Research shows that '*Guanxi*[5]' networks dominate in China and that these networks facilitate the exchange of favours among people (Bian, 1997; Hwang, 1987; Gold, 1995; Yang, 1994).

METHODOLOGY

The aim of this research was to find out how the social networks among construction craftsmen affect the access to information about job opportunities in an ethnically diverse society. The egocentric approach was preferred for this study as it is one of the most widely used methods in social network analysis research and incorporates most of the concepts discussed above. It was used by Hirdes and Scott (1998) in a study in chronic care hospital, Carrasco and Miller (2006) and Carrasco *et al.* (2006) in studies of social activity-travel behaviour. Chung *et al*. (2005) also explored the use of the socio-centric and egocentric approaches and suggested egocentric method to be more favourable than other methods.

The use of social network analysis tool is not very common in the construction industry globally; however Ruan *et al.* (2011) found that it has been adopted as analytical tool in the research in construction management in UK to provide indications of knowledge integration, collaboration and effective communication. Chinowsky *et al.* (2008) developed social network model of construction focusing on the project team network. Loosemore (1998) also used social network analysis tools in investigating the management of construction crises, arguing that qualitative and quantitative research methods cannot be used in isolation of social networks analysis. Social network analysis (SNA) has also been applied in the research done by Park *et al.* (2009) in Korean Construction companies to investigate the variety of collaboration patterns and also the impact on performance of construction companies. These studies by setting a precedent have encouraged the adoption of the whole/sociocentric approach.

The data for this study was collected through the social network approach using the egocentric approach to determine the ties between the artisans, by interviewing the artisans with the use of questionnaire.This has been chosen over full network method, which Hanneman *et al*. (2005) has found that it can positively yield the maximum of information however, it is costly and difficult to execute and may also be difficult to generalise. One of the first things done was to determine whether networks exist among the construction artisans.

The egos are determined to be the foremen of the artisans as they are or may be part of the hiring of staff on a construction site. These are called "actors" who represent

[5]*Quanxi* literally means "*relationship*" or "*relation*"

different entities such as groups, organisations, nations as well as persons (Carrasco and Miller, 2006). In this case the actors are the craftsmen/artisans. The ties between the actors (artisans) represent flows of resources that can be related with aspects such as control, dependency, cooperation, information interchange and competition. Egocentric approach concentrate in specific actors or egos and those who have relations with them called "alters". Carrasco *et al*. (2006) observed that from the participant's perspective, egocentric networks constitute a "network of me" or a network of actors (alters) with whom the participant has some relationship. Data of this nature is called egocentric data.

Data collection was done consistently in all the three sites of the research. The researcher began with a focal actor (ego) or set of actors. Each of the actors was asked tomention all their ties with other actors. All the actors named (who were not parts of the original list) were tracked down and asked to state all their ties. The process continued until there were no new actors identified. Some researchers according to Hanneman *et al*. (2005), decide to stop the process due to new actors named, and which are considered to be very marginal to the group of study, or for reasons of time and resources. However this was not the case in this study. This process was done with the use of modified 'questionnaire for gathering SNA data' (Pryke, 2012) adapted from Carrasco *et al*. (2006). In this instance the attribute and relational data was collected through an interview with the construction artisans on a face-to-face manner. This assisted in clarifying ambiguous answers, ability to contact hard-to-reach populations, assurance that instructions were followed and yield the highest response rate since the interviewer gained the respondents co-operation through support. The questions were modified to suite this research and designed to take approximately 12 minutes, which was considered the reasonable amount of time construction workers could give up in a day.

SOCIAL NETWORK ANALYSIS

The conceptual origins of social network analysis has been traced from three broad schools of thought, namely sociology, anthropology and role theory (Tichy *et al*. 1979). The evolution of social network analysis has also been discovered from the work of Jacob Moreno, (1934; 1937), Kurt Lewin (1936) and Fritz Heider (1946). Sociologists such as, Park (1924), Cooley (1956) and Simmel (1950) made emphasis on patterns of interaction and communication as the key to understanding social life. On the other hand, the anthropologist literature of Strauss (1969), Malinowski (1922) and Frazer (1919) highlighted the content of the relationships joining individuals, the conditions of which they would exist and the evolution of these bonds over time (Tichy *et al*. 1979).Moreno (1934) investigated how psychological wellbeing is related to the structural features of what he termed 'social configurations' in Moreno (1934) and also in Sociometry (1937). These configurations are the results of the concrete patterns of interpersonal choice, attraction, repulsion, friendship and other relations in which people are involved (Scott, 1992).

Social network analysis (SNA) is the study of social structure and its effects; it conceives social structure as a social network that is a set of actors (nodes) and a set of relationships connecting pairs of these actors (Tindall and Wellman, 2001). Carrasco *et al*. (2006) argues that the core concern of the social network paradigm is to mainly understand how social structures facilitates and constrain opportunities, behaviours and cognitions. This is the advantage of this method hence it was chosen for this study. Furthermore, it is argued to have great potential in social network research and theory (Streeter and Gillespie, 1992).

SNA is argued to be a quantitative tool capable of being applied within an interpretative context in construction research (Loosemore cited in Pryke 2012). Moreover, both quantitative and qualitative methods in combination have a part to play in understanding social roles, positions and behaviour in the construction project environment (ibid). SNA has not only enabled meaningful analysis of individuals, but of relationships within different organisations under study.

The chief innovation by Moreno was to devise the ‘sociogram’ as a way of representing the formal properties of social configurations and these are represented in diagrams analogous to those of spatial geometry whereby points and their social relationships to one another by lines represent individuals. Scott (2000) discovered that before Moreno, people had spoken of ‘webs’ of connection, the ‘social fabric’ and on occasion of ‘networks’ of relations, but none of them had attempted to systematize this metaphor into analytical diagram.

According to Scott (2000), Moreno argued that the construction of sociograms allowed researchers to identify leaders and isolated individuals, to uncover asymmetry and reciprocity and leadership. One of his principal sociometric concepts was that of the sociometric ‘star’ whereby a recipient of numerous and frequent choices from others and who, held the position of great popularity and leadership. And this concept of the star pointed to an easily visualized picture of the relations among group members.

Lewin (1936) argued that a social group exists in a field, a social ‘space’ that comprises the group together with its surrounding environment and the environment of the group is not seen as something purely external to and independent of the group. The group and its environment are therefore elements within a single field of relation and the structural properties of this social space as Lewin argued, can be analysed through a ‘mathematical typology’ and ‘set theory’ (Lewin, 1951 cited by Scott, 2000). Social network analysis is a fascinating mixture of mathematics, IT and sociology (Pryke 2012). Up to the present, it is observed that social network analysts view organizations as systems of objects (people, groups, organizations) joined by a variety of relationships and they are concerned with the structuring of those relationships over time and with their causes and consequences; and the process of social network analysis involved translating the relationships depicted into a mathematical matrix (Loosemore, 2001 and Pryke, 2012).

UCINET

Between the 1980s and 1990s, the SNA theory was developed by creating various software programs aimed at the social scientists (Pryke, 2012). For Pryke (2012), the drive to produce software enabling the fast calculation of a wide range of social network measures brought with it a growing interest in the visualization of social network data. The software program chosen for this study is UCINET. This program has been found by Huisman (2003) in his research of social network software’s that UCINET is a comprehensive program for the analysis of social networks and other proximity. It is the best known and mostly frequently used software package for the analysis of social network data and contains a large number of network analytic routines. UCINET is matrix oriented that is, data sets are collections of one or more matrices and it also provides a large number of data management and transformation tools like selecting subsets, merging data sets, permuting, or recoding data. It also contains graphical tools to draw scatter plots, dendrograms and three dimension diagrams.

RESULTS

The interviewed sample from three construction sites are presented in table 1 below indicating the number of artisans interviewed with their professions. There were 14 artisans in site 1, 20 in site 2 and 17 in site 3.

Table 5:The interviewed artisans

Profession	**Site 1**	**Site 2**	**Site 3**	**Total**
Bricklayers	7	0	0	7
Electricians	3	3	0	6
Plumbers	2	4	3	9
Foremen	1	1	1	3
Construction Manager	1	1	1	3
Carpenter	0	5	0	5
Tiler	0	2	4	6
Painter	0	4	8	12
Total	**14**	**20**	**17**	**51**

Ethnicity

Results from the interviews indicated that artisans from a black race dominated the bricklaying trade as well as the tiling trade in all the three research sites as shown in table 2 below. Another observation was that the following trades: Electrical installation, plumbing, carpentry and paintwork were all dominated artisans of the coloured race in the three sites. Indians appear in small numbers in electrical and paintwork trades only.

The observation of certain trades being dominated by certain ethnic groups, suggesting that the transmission of information about job opportunities is easy within same ethnic groups. For instance, the table below shows that bricklaying is dominated by blacks which means this is a result of communication about job opportunities through the same language as well residing in one location.

Table 6 The Artisans Ethnic Groups from all three sites

PROFESSION	**Black**	**White**	**Coloured**	**Indian**	**Total**
Bricklayers	7	0	0	0	7
Electricians	1	0	4	1	6
Plumbers	2	0	7	0	9
Foremen	1	0	2	0	3
Construction Manager	0	1	2	0	3
Carpenter	0	0	5	0	5
Tiler	5	0	1	0	6
Painter	0	0	11	1	12
Total	**16**	**1**	**32**	**2**	**51**

The type of ties

The ties between artisans were determined by way of the first survey question which aimed to find the number of strong and weak tie network members, with focus on the network members who are: friends, neighbours, other relatives and immediate family.

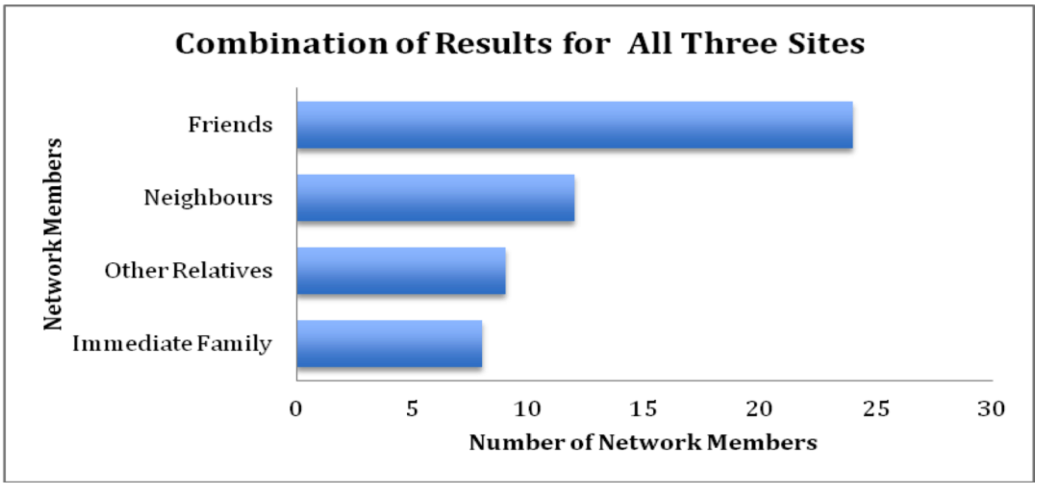


Figure 4: Strong and weak tie members in all sites (1, 2 and 3)

The above graph shows combined results from the three sites (1,2 and 3). Artisans have been categorised in their network members namely friends, neighbours, other relatives and immediate family. The results indicate that on average more artisans employed on the three sites are friends than other groups; followed by neighbours; then other relatives and lastly immediate family. Friendship in this case refers to the rapport which artisans established before they worked together.

From the above data on of the three sites, it can be seen that friendship plays a major role in getting jobs, in that information flows easily in friendship networks. Moreover, being a friend to a foreman as the ego of the network is an advantage for he is the source of information about job availability.

The second best way in which information about jobs flow is when people reside together in the same community. The network members of artisans in the three sites, who are neighbours to one another, suggest that neighbourhood plays an essential role in the flow of job opportunity information. The results of the study further show that being relatives and immediate family with others as well enables artisans to access jobs to some extent.

The Interaction Method

The second survey question investigated the most interaction method used by the artisans. The following were looked into; visiting/hosting as a visitor, meeting at a shebeen/restaurant or a carwash and "Shisa nyama"[6], (all these allow people to meet face to face) and by communicating through cell phone.

Figure 2 below presents results about interaction methods used by artisans in the three research sites in this study.

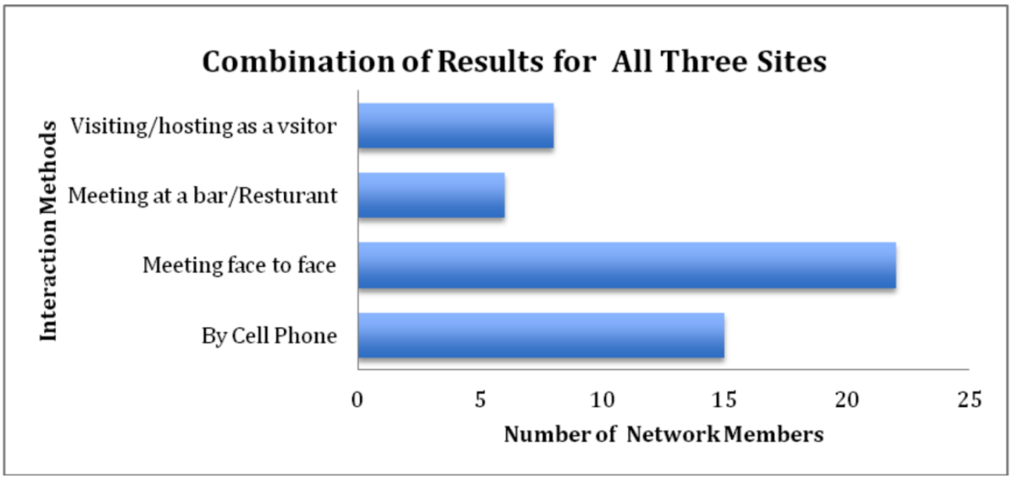


Figure 5: Interaction methods among artisans in all sites (1, 2 and 3)

The results suggest that within the Western Cape construction sector, artisans socialise or meet face to face as to allow the transmission of information about job opportunities. The other means of job information flow is by way of cell phone communication. The information also flows during friendly visits and in social gatherings although in a limited way.

Relationship with the foreman/construction manager

In the second part of the questionnaire, artisans were asked to identify very close people (strong ties) with whom they discuss important matters or with whom they regularly keep in touch or whom they would rely on in a case of need and also close people who are more than casual acquaintances but very close.

The constructed sociograms or networks from each construction site have been constructed to show the relationships between the artisans and the foreman and also among the artisans themselves.

This data was put into a matrix form; this is the interaction between the artisans, foreman and the construction manager as to allow construction of the sociogram.

Sociogram

The sociogram indicates the social network of artisans on each construction site. The red dots represent artisans, whereas the foreman is represented with a black dot. The lines joining the points (artisans, foreman) indicate the interaction/ties between the artisans and the foreman. The figures below indicate different number of ties per person. Among all the people interviewed it can be seen that the foreman as

[6]A social place found in South African townships where people buy and braai meet while music is being played.

represented by the black dot has a higher number of ties or interaction than the artisans. This suggests that the foreman is the central key person of these networks. He is the ego of the network.

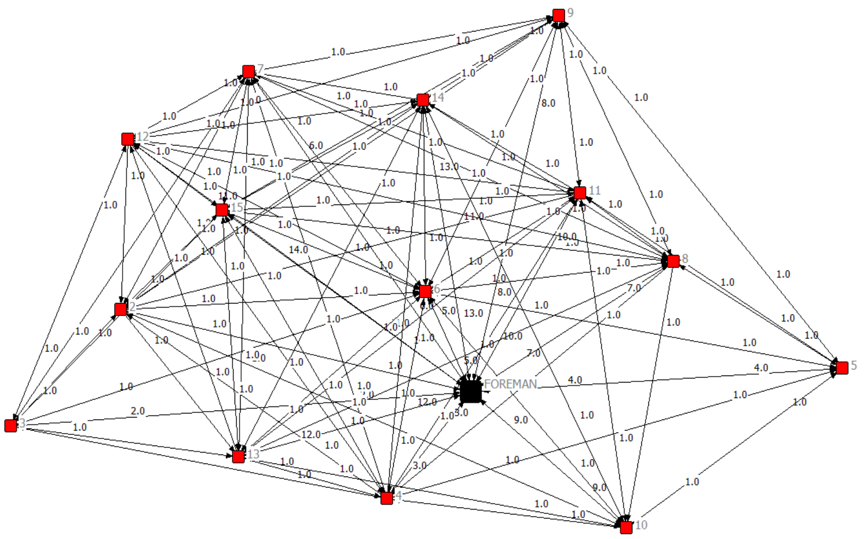


Figure 6: Sociogram for Site 1

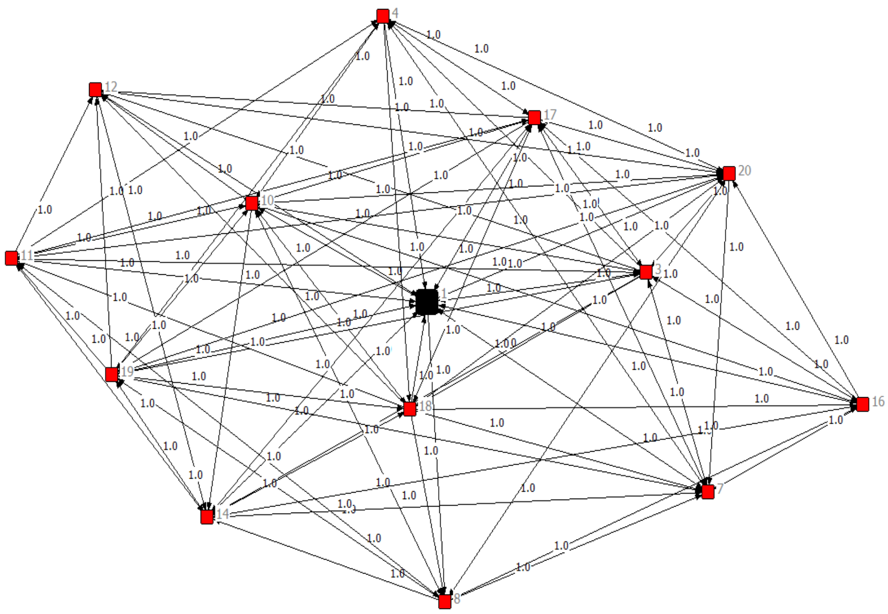


Figure 7: Sociogram for Site 2

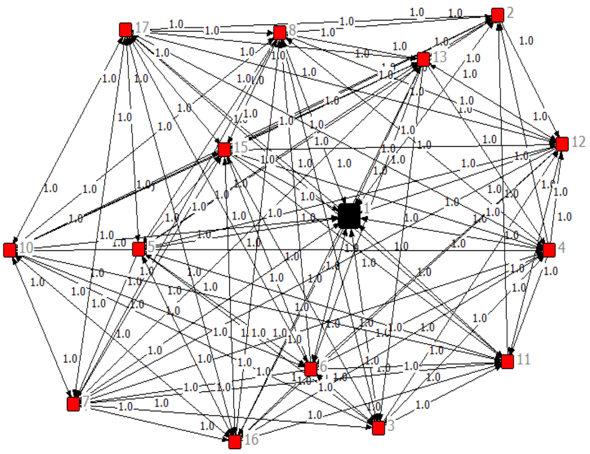


Figure 8: Sociogram for Site 3

FINDINGS

The artisans are composed of different ethnic groups whereby a particular trade is dominated by a particular ethnic group. There is a few mix of races among the trades, showing that people build networks easily when they come from similar backgrounds with same values.

It has been found that the artisans from the three construction sites are tied up mostly by friendship ties which were founded before they worked in this construction sites. The information about jobs seems to be travelling substantially in the friendship relationship between the artisans.

The interaction method among the artisans in all three construction sites is dominated by 'meeting face to face especially in social gatherings like carwash, *Shisa nyama*, etc. This suggests that development of social networks which transmit information about job opportunities occurs in people's favoured social practices. This is in line with the sociological observation of Park *et al.* (2009) that it is important to understand people's patterns of interaction and communication in order to interpret their social life. It was also noted that this social interaction which happens outside work takes place within different ethnic groups, meaning that less information leaks into others' social network.

Also the neighbourhood plays an essential role in job information transfer as most of the artisans reside in the same location as has been found by Assaad (1998) in his study in Egypt. Residing in the same location with the foreman or the construction manager can increase the opportunities of getting information about the job opportunities and also with other artisans.

CONCLUSIONS

The study was only limited to three construction sites and therefore cannot generalise the construction industry in the Western Cape, but it indicates what happens within the construction industry with regards to barriers to entry into the industry for construction artisans.

The network(s) of pre-existing friendships and relationships benefit members by imparting information about job opportunities. However, findings in this study show that the existence of social networks in the ethnically diverse communities can make barriers to enter the construction industry. This is made possible by the fact that members of a certain trade tend to form their networks and information is transferred among them. The barrier is even intensified where the artisans belonging to a particular trade have a similar race.

Certain construction trades have been found to be dominated by a particular race. This shows that a particular race network is orientated to a particular trade. This is because circulation of information about jobs is limited to their own racial network. Essentially, existing networks spread information about job opportunities to friends, neighbours and family members who are in job search. As a result, a certain trade ends up being classified by a race or ethnic group which dominates in it. Consequently, the classifications formed among the artisans exclude other ethnic groups. This informal network channel method of employment is more disadvantageous than a formal employment method. Employment through social networks hinders artisans from accessing economic opportunities beyond their own networks.

The foreman and or construction manager tend to form ego-centred network in terms of information transmission. This means the foreman is the most important and key person for the artisans' relationships in a network. In order to have a fair distribution of economic opportunities, an initiative of assisting groups from building networks and also facilitation of cross network links or bridging networks are encouraged.

The government policies identify the above phenomena and try to combat at businesses and entrepreneurial levels through preferential procurement and BBBEE. This study recommends the tightening and better implementation of these polices as there is still existence of un-equality in resource accessibility among individuals in the construction industry.

REFERENCES

Applebaum, H. A., (1981), *Construction Workers, USA,* First Edition, Greenwood Press, Westport

Assaad, R., (1998), Kinship ties, Social Networks and Segmented Labor Markets: evidence from the Construction Sector in Egypt, *Journal of Development Economics,* Vol. 52, pp. 1 – 30

Atkinson, A. B. and Hills, J., (eds.) (1998), *Exclusion, Employment and Opportunity*, Working Paper No. 4, London: Centre for Analysis of Social Exclusion, London School of Economics and Political Science

Bexley, E., (2007), *Social Capital in Theory and Practice,* The Contribution of Victorian tertiary education in the 'New Economy' disciplines of business studies and IT

Bian, Y., (1997), Bringing Strong Ties back in: Indirect ties, network bridges and job searches in China, *American Sociological Review,* Vol. 62, No. 3, pp. 366 – 385

Burt, R., (1992), *Structural Holes: The Structure of Competition*, Harvard University Press, Cambridge

Calvo-Armengol, A., (2000), Job Contact Networks, *Department of Economics, univesidad Carlos III,* Madrid

Carrasco, J., Hogan, B., Wellman, B. and Miller, E.,J., (2006), Collecting Social Network Data to study Social Activity-Travel Behaviour: An Egocentric Approach, *Presented at the 85th Transportation Research Board Meeting, Washington DC*

Chinowsky, P., Diekmann, J. and Galotti, V. (2008), Social Network Model of Construction, *Journal of Construction Engineering and management,* October, pp. 804 – 812

Granovetter, M. (1973), 'The strength of weak ties', *American Journal of Sociology*, Vol. 78, No. 6, pp. 1360-80

Granovetter, M., (1974), *Getting a Job,* Cambridge, MA, Harvard University Press

Granovetter, M., (1983), The Strength of Weak Ties: A Network Theory Revisited, *Sociological Theory*, Vol. 1, pp. 201 – 233

Granovetter, M., (1994), Business Groups, in the *Handbook of Economic Sociology* (Smelser, J.N. and Sureberg, R., eds) pp. 453 – 475, Prince town University Press, Prince town

Granovetter, M., (1995),Cease revisited: Business groups in the modern economy. *Industrial and Corporate Change*, Vol. 1, pp. 93-130

Granovetter, M., (2005), The Impact of Social Structure on Economic Outcomes, *Journal of Economic Perspectives*, Vol. 19, No. 1, pp. 33 – 55

Hanneman, A. and Riddle, M. (2005), Introduction to social network methods, Riverside, CA, University of California, Riverside (published in digital form at http:/\faculty.ucr.edu/~hanneman/)

Harrary, F. , Norman, R. and Cartwright, D., (1965), *Structural Models,* New York, Wiley

Hwang, K. (1987), Face and Favor: The Chinese Power Game, *American Journal of Sociology,* Vol. 92, pp. 945 - 974

Jackson, M. (2008), *Social and Economic Networks*, Princeton University Press, New Jersey

Lekarapa, M. and Root, D., (2011), Investigating Informal Social Networks among Construction Artisans in South Africa, *7th CIDB Post Graduate Conference on Construction Industry Development, University of Pretoria, Pretoria South,* pp. 91 – 99

Lekarapa, M., (2013), Investigating Informal Social Networks in Construction Artisans in the Western Cape, *Unpublished Dissertation, University of Witwatersrand, Johannesburg*

Loosemore, M. (1999), Responsibility, Power and Construction Conflict, *Construction management and Economics*, Vol. 1, pp. 5 – 16

Moreno, J. (1934), *Who Shall Survive? Foundations of Sociometry, Group Psychology and Sociodiagrama*, Washington D.C.: Nervous and Mental Disease Monograph, No.58

Mitullah W. V. and Wachira I. N.,(2003), Informal Labour in the Construction Industry in Kenya: A Case Study of Nairobi, *Working Paper*, *Sectoral Activities Programme, International Labour Office*, Geneva

Moreno, J. (1960), *TheSociometry Reader*, Glencoe, IL: The Free Press

Narayan, D., (1999), Bonds and Bridges: Social Capital and Poverty, *Poverty Group*, Prem World Bank

Podolny, M. J. and Baron, J.N. (1997), Resources and Relationships: Social networks and mobility in the Workplace, *American Sociological Review*, Vol.62, pp. 673 – 693

Park, H., Yong, W. and Han, S. (2009), Social Network Analysis of Collaborating Entries for Construction Firms in International Construction Projects, *26th International Symposium on Automation and Robotics in Construction (ISARC)*

Pryke, S. (2004), Analysing Construction Project Coalitions: Exploring the Application of Social Networks Analysis, *Construction Management and Economics*, Vol. 22, No. 8, pp. 787 – 797

Pryke, S. (2012), *Social Network Analysis in Construction*, Oxford, Wiley-Blackwell

Putman, R., (1995), Bowling Alone: America's Declining Social Capital,*Journal of Democracy*, Vol. 1, pp. 65-78

Putman, R., (2000), *Bowling Alone: The Collapse and Revival of American Community*, Simon and Schuster Paperbag, New York

Wegner, D. (1995), A computer network model of human transactive memory,*Social Cognition*, Vol. 13, pp. 319–339

Scott, J., (2000), *Social Networks Analysis, a Handbook, Second Edition.* Sage Publications: London

Tichy, N., Tushman M. and Fombrun C. (1979), Social Network Analysis for Organisations, *Academy of Management Review*, Vol. 4, No. 5, pp.507 – 519

Woolcock, M., (1998), Social Capital and Economic Development: Toward a Theoretical Synthesis and Policy Framework, *Theory and Society*, 27, pp. 151-208

THE IMPACT OF DESIGN CHANGES ON BUDGETED COST OF BUILDING PROJECTS IN SOUTH AFRICA

Akinyede I. J[1]. and Fapohunda, J. A [2]

Department of Construction management and Quantity Surveying, Cape Peninsula University of Technology, South Africa

Literature reveals that design changes affect budgeted cost, delivery time and quality of building product substantially. This makes the need to investigate the impact of design changes on budgeted cost of building projects in South Africa. This study used quantitative questionnaire to collect data. The surveys are conducted within Cape Town of South Africa and the information are collected from architects, structural engineers, quantity surveyors, project managers, contractors, clients, and contract managers in the construction industry. SPSS software is used for the quantitative data analysis. Based on the findings obtained, the major problems due to design changes include scope of work not well define for contractors affect budgeted cost, design details discrepancies found between drawing and specification affect construction phase has effect on budgeted cost, decision making on materials selection during design stage cause change in design at construction phase has effect on budgeted cost during production process, changes to new technology affect budgeted cost and non-compliance design with government regulations affect budgeted cost. Thus, accurate briefing by the client and planning at conception stage will influence effective production process, adequate design and proper checking for error by designers will enhance efficient design, and establishment of design management and readiness of design before the construction phase is a necessity towards avoidance of delivery of building product at construction cost greater than budgeted cost. This avoidance will not only lead to efficient construction production process, reduction of resources waste, but will enhanced client satisfaction and delivery of building product at construction cost equal to budgeted cost or at construction cost less than budgeted cost.

Keywords: building product, budgeted cost, construction cost, cost constraint, design team

INTRUDUCTION

The goal of this study is to establish the impact of changes in design on budgeted cost of building projects in South Africa. Purpose of the study is to deliver efficient building projects free from rework during production process, at construction cost equal to budgeted cost within the time specified. Constant changes in design are challenging construction and delivery of building product at budgeted cost, at specified time and quality expected (Al-Dubaisi 2000). Likewise, Arain and pheng (2006) discovered that constant changes to design during building production process have led to rework, delay, variation, claim and cost overrun. Also Al-Dubaisi ague

[1] **seyiakinyede@yahoo.co.uk**
[2] **fapohundaj@cput.ac.za**

Akinyede I. J . and Fapohunda, J. A. (2014) The impact of design changes on budgeted cost of building projects in South Africa *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference*, 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 537-546.

that clients are been challenged by difficulties in the management of constant variation orders as a result of poor design This unpleasant situation can be avoided if a good management system has been invoked for handling of design. Likewise Arain and pheng *(*2006) confirmed that design changes is constant in construction industry and may cause substantial change to project time, cost and quality. Also, Al-Dubaisi (2000) discovered that design changes are inevitable in any construction project; the client may be forced by the market situation and new technology to affect change order into design. Similarly, Azmy (2012) argue that client and designers determine the starting and completion date of any project. Also, argue further by Azmy that delivery time depends on the nature of the drawing and specification that is available before the contractor. Equally, Lam, Wong and Wong (2007) confirmed that design outcome has important effect on simplicity of construction. Also, Arain and Assaf (2006) support the argument that client, designer and contractor should have common goals in order to achieve effective building production process within the budgeted limit.

Zhang and Rusell (2005) argued that contractors have difficulty in capturing, representing and managing the vast array of quality requirements that portray a project. Also, describe further by Zhang and Rusell argued that some of the requirements are set out in the design drawings and specifications, while others are left to be define by the contractors. Thus, many problems exist in the interface between the design phase and contraction phase, which affects the constructability of design components and resultant quality, time and cost. Similarly, Benjooran and Sae-Tae (2011) supported the argument that construction project contain many uncertainties. Argued further by Benjooran and Sae-Tae that construction project required a number of resources and large amount of investment. Also, time and cost are main management goals. Contractors to achieve maximum goal, therefore contractor should plan adequately to complete the project in early time with a minimum cost at quality expected.

Nina (2003) argue that building production process is the organisation and management of the plan, equipment, materials and labour involved in the construction of a building. Also, ague further by Nina that procurement of production process should be define in such a way to keep cost of construction very low and delivery of building product at stipulated time. Similarly, Hoai, Lee and Lee (2008) confirm the argument that construction duration and cost at project closing are two of criteria of successful project and successful project management.

This study will investigate the effect of changes in building design during production process on budgeted cost. Likewise, Eshofonie (2008) confirmed that cost consideration and error free design are the main criteria of assessing quality of building design.

BUILDING DESIGN IMPACT ON COST DURING PRODUCTION PROCESS

Construction are constraint with budgeted cost, cost has been identified as one of the major constraints that hinder efficient building production process and delivery of product at estimated cost (Memon, Rahman, Abdullah and Azis 2010). Also, Ashar, Farooqui and Ahmed. (2008) contend that a project is successful when it is completed at estimated budgeted cost within time frame. Also clarify by Ashar, *et al* (2008) that a construction processes may be delayed when a production processes has spent above the financial limitation. Likewise, Ganiyu and Zubairu (2010) discovered that cost has been the major problem to construction industry in Nigeria to deliver project at budgeted cost. Also, Ganiyu and Zubairu (2010) suggested the need to develop analytical cost models that capture the factors affecting cost.

Building design impact on cost may be linked to frequent changes into building design as a result to errors and omission found in building design has effect on budgeted cost, causes construction cost to be delivered above budgeted cost (Alsuliman, Bowles and Chen 2012). Building design is an integral part of building production process. Literature reveals that continual changes in design affect budgeted cost, delivery time and quality expected. Likewise, Al-Dubaisi (2000) argued that at design stage environmental sustainability need to be considered by the design team, the design impact on environmental have both positive and negative effects on cost. To reduce cost during the design stage emphasis must be on social sustainability and safety, the effect on society must be considered. Jaggar and Smith (2002) defined design as the act of providing the required prototypical of a building. Similarly, clarify by Jaggar and Simth that building design and construction are affected by wide range of building codes and standards, planning, zoning, environmental protection, and site safety law and regulations. Also, Bowen (2007:462) conducted a survey and discovered that these requirements, and regulatory fees, usually vary considerably from locality to locality. These factors most be considered during the design stage to avoid increase on budgeted cost during production process.

Law, wong and wong (2007) argued that design made flexible will help the building element adapt to site environment and help to save resources and increase flexibility for change. Further argue by Law *et al* that to avoid unnecessary cost increase during construction process emphasis must be on material selection during building design by the designers. Likewise, Ogunkah and Yang(2012) ague that design decision making process, it is very important to identified best option in the selection of materials by design-decision maker and to put into consideration several material selection factors or variables. Similarly, Law et al (2007) argued that design must be very simply to the understanding of the contractors and workers on site to avoid costly mistake, which influence increase in construction cost. Hence, irregular shapes complex geometrical profiles, complicated installation details, multi-disciplinary designs and additional resources should be avoided. Alsuliman et al (2012) stated that the construction team should established a knowledge base of similar past projects, this will give them the opportunity to planning effectively before starting a project during design and construction stage. Lack of proper planning is common causes of change in design which affect construction processes, a frequent change to design will attract claim from the contractor, and claims affect construction cost. A change in contract plan, drawings and specification will alter the contractor plan, the contractor need to go back to the drawing board to recalculate cost of labour; cost of materials and schedule, change can be initiated by any of the construction team member subject to the approval of the client.

Planning is very important in construction industry, a good planning at the start of any project by the design team will enhance design process and it will facilitate construction activities, planning ahead of activity in construction industry will improve efficiency of working operation of the team members. Al- Dubaisi (2000) discovered that cost of ineffective planning of work in construction industry usually leads to delay, progress of work disorder and change orders

Arian *et al* (2006) argue that the conceptualizations of project initiatives are always conveyed by the client to the design team. Also, argue further by Arian and pheng that end-users requirement usually undervalued or not even considered at all. Hence, Arian *et al* argue that, there is no access fact of the adoption of a system that includes maintenance managers during design processes. Al-Dubaisi (2000) confirmed that client's design initiation and end-users real requirement are made worse when client's practical brief excessively difficult to understand or appear to be imprecise. Also, Al-Dubaisi (2000) argue that the client should clearly define the require quality needed in design before design inception, design requirement paper on client concept development should be well explained. Esohofonie (2008) argues that client is the financier, the project motivator, plays a prominent role in construction industry in term of decision making. Al-Dubaisi (2000) argues that the client should conduct site investigation at the inception stage of design to reduce frequent changes in design and construction process. Alsuliman et al (2012) confirmed that client initiate most changes during the design phase. Also argue further by Alsuliman et al (2012) estabilised that design error are considered as the most important causes of variation orders in large building project in Saudi construction industry. Hence, failure of designer to compliance with the client's request will cause frequent changes during construction process.

Arain and Pheng (2006) argue that construction manager should develop ability to quickly respond to the variation to reduce contrary effect on project. Further argue by Arain et al that variation occur as a result to design changes in construction project. Al-Dubaisi (2000) argues that differences in construction documents, specification and drawings usually lead to changes in design. Al-Dubaisi (2000) argues that client should check design in a well regulated process after completion of design.

RESEARCH METHODOLOGY, DATA ANALYSIS AND DISCUSSION OF FINDINGS

Research Methodology

The objective of this research is to establish impact of design changes on budgeted cost of building projects in South Africa. The targeted population are construction stakeholders in Cape Town of South Africa. Questionnaires were administered to selected group of stakeholders in construction industry in Cape Town. Data were collected from construction stakeholders operating within Cape Town on 10 September 2013. Cape Town is located in the Western Cape province of South Africa with large population and it accommodates professionals in construction industry. Thus, allows the small sampling of the population for generalization. The study used quantitative questionnaires; 30 closed- ended questionnaires were dispensed by hand to stakeholders in the construction industry. Ten questionnaires were retrieved from stakeholders and checked for accuracy and errors. The data collected were analysing using SPSS software for quantitative data analysis. The use of experience construction stakeholders that have been working in construction industry had shown the believability and validity of data captured represent the concept of the study. The random selection of group of stakeholders in construction industry that have been working for over 5 years confirms validity of the data. Also, the concentration of construction industry in Cape Town allows the sampling of the population which confirm the reliability of the result. The study is on-going research and the result is from pilot study conducted.

DATA ANALYSIS AND DISCUSSION OF FINDINGS

Data Analysis

Demographic profile of respondents

On Table 1, a total of 10 questionnaires were retrieved for the analysis. The construction firm has the highest number of professionals as respondents with 60%, while the architectural firm recorded 30% and quantity surveyor firm has 10%. As observed from the table, years of experience of the respondents show that less than 10years is 50%, above 10 years is 40% and 10% is the respondent that has experience above 20years. Another remark indicates that 70% respondents participated in the study are male while 30% are female. Age of the respondents show that 50% is below 46years and 10% of the respondent is above 46years. Also 80% of the respondents involved in construction of public building while 20% involved in construction of residential building.

Table 1 Shown demographic of the respondents

Descriptor	Respondents	Percentage
Professional firm	Architectural firm	30
	Contractor firm	60
	Quantity surveyor firm	10
Years of experience	1-5years	30
	6-10years	20
	11-20years	50
Age	21-35years	50
	36-45years	40
	46years above	10
Type of structure	Public building	80
	Residential building	20

This section present the ranking of factors, effect of changes in building design on budgeted cost as recorded in the survey, from scale 1 (strongly disagree) to 5 (strongly agree). Table 2 presented the result that indicate scope of work not well define for contractors causes change in building design, 50% of the respondents strongly agree that scope of work not well define for contractors causes change in building design and has effect on budgeted cost. While 20% of the respondent agrees that scope of work not well define for contractors causes changes in building design and has effect on budgeted cost. Accurate briefing by the client at conception stage and planning will improve proper define of scope of work for contractors.

Table 2 Scope of work not well define for contractors has effect on budgeted cost

	Frequency	Percent	Valid Percent	Cumulative Percent
Neutral	3	30.0	30.0	30.0
Agree	2	20.0	20.0	50.0
Strongly agree	5	50.0	50.0	100.0
Total	10	100.0	100.0	

Table 3 Finding shows that design details discrepancies found between drawings and specification causes changes in design during construction phase, 70% of the respondent agrees that design details discrepancies causes changes in design during construction and has effect on budgeted cost. While 20% of the respondent agrees that

discrepancies in design details during construction cause change in design and has effect on budgeted cost. Likewise, Azmy (2012) argue that delivery time depends on the nature of the drawing and specification that is available before the contractor.

Table 3 Design details discrepancies affect budgeted cost

	Frequency	Percent	Valid Percent	Cumulative Percent
Neutral	1	10.0	10.0	10.0
Agree	7	70.0	70.0	80.0
Strongly agree	2	20.0	20.0	100.0
Total	**10**	**100.0**	**100.0**	

Table 4 Decision making on materials selection has effect on budgeted cost

	Frequency	Percent	Valid Percent	Cumulative Percent
Neutral	3	30.0	30.0	30.0
Agree	3	30.0	30.0	60.0
Strongly agree	4	40.0	40.0	100.0
Total	**10**	**100.0**	**100.0**	

Table 4 Findings indicate that decision making on materials selection during design stage causes changes in design at construction phase and has effect on budgeted cost, 30% of the respondents agree that decision making on materials selection cause changes in design and has effect on budgeted cost. While 40% of the respondent strongly agree that decision making on materials cause changes in design and has effect on budgeted cost. Similarly, Table 5 Finding indicate that changes to new technology as a result to new innovation causes changes in design and has effect on budgeted cost, 60% of the respondents agree that changes to new technology causes changes in design and has effect on budgeted cost. While 20% of the respondent strongly agree that changes to new technology cause changes in design and has effect on budgeted cost.

Table 6 Finding indicate that non-compliance design with government regulations that guiding construction phase causes changes in design and has effect on budgeted cost, 30% respondent strongly agree that non-compliance design with government regulation cause changes in design and has effect on budgeted cost. While 30% of the respondents agree that non- compliance design with government regulations cause change in design and has effect on budgeted cost.

Table 5 Changes to new technology affect budgeted cost

	Frequency	Percent	Valid Percent	Cumulative Percent
Neutral	2	20.0	20.0	20.0
Agree	6	60.0	60.0	80.0
Strongly agree	2	20.0	20.0	100.0
Total	**10**	**100.0**	**100.0**	

Table 6 **Non-compliance design with government regulations cause change in design**

	Frequency	Percent	Valid Percent	Cumulative Percent
Neutral	4	40.0	40.0	40.0
Agree	3	30.0	30.0	70.0
Strongly agree	3	30.0	30.0	100.0
Total	**10**	**100.0**	**100.0**	

Table 7 Design complexity affect budgeted cost

	Frequency	Percent	Valid Percent	Cumulative Percent
Disagree	1	10.0	10.0	10.0
Neutral	3	30.0	30.0	40.0
Agree	2	20.0	20.0	60.0
Strongly agree	4	40.0	40.0	100.0
Total	10	100.0	100.0	

From Table 7 Finding indicate that design complexity to the understanding of contractors causes changes to design and has effect on budgeted cost, 40% of the respondents strongly agree that design complexity cause changes in design and has effect on budgeted cost. While 20% of the respondents agree that design complexity cause changes in design and has effect on budgeted cost. Also, 10% of the respondents disagree that design complexity cause changes in design and has effect on budgeted cost.

From the table 8 shows the overall ranking of the factor that cause changes in building design and effect on budgeted cost as recorded in the survey. The tabulated data are particularly significant because of the need to create awareness of the factors that cause change in design and effect during building production processes on budgeted cost.

The percentage of the responses is from scale 1 (strongly disagree) to 5 (strongly agree). In table 8, inadequate scope of work for contractors cause change of design has effect on budgeted cost ranked 1st with 84%, likewise design discrepancies cause change in design has effect on budgeted cost ranked 2nd with 82%. Also, decision making on materials selection affect budgeted cost through changes in design ranked 2nd with 82%. Similarly, changes to new technology cause change in design has effect on budgeted cost during building production process ranked 4th with 80%, Others respondents ranked above 60% this indicate that the respondents agree that the factors affect budgeted cost through change in design during building production processes in South Africa construction industry.

DISCUSSION OF FINDINGS

Major findings indicate that Scope of work not well define for contractors during design stage affect budgeted cost through design changes. Hence building product are delivered above budgeted cost specified, re-define of scope of work influence budgeted cost, timely delivery and quality expected during building production process. Equally, Azmy (2012) supported the finding that cost and delivery time depends on the nature of the drawing and specification that is available before the contractor. Design details discrepancies found between drawing and specification during construction stage affect budgeted cost, during building production process causes changes in design, most project are delivered above budgeted cost specified. Likewise, Zhang and Rusell (2005) supported the findings that some of the requirements are set out in the design drawings and specifications, while others are left to be define by the contractors. Thus, many problems exist in the interface between the design phase and construction phase, which affects the constructability of design components and resultant quality, time and cost. Decision making on materials selection during design stage affect budgeted cost during construction phase. Likewise, Ogunkah and Yang(2012) supported the finding that design decision making on selection of materials affect budgeted cost, it is very important to identified best option in the selection of materials by design-decision maker and to put into consideration several material selection factors or variables. Change to new technology as result of new innovation by the technologist; affect budgeted cost through design changes. Also, Al-Dubaisi (2000) supported the finding that design changes are inevitable in any construction project; the client may be forced by the market situation and new technology to affect change order into design.

Table 8 shown overall factors

Factors	Sum	Mean	%	Range
Scope of work not well define for contractors affect budgeted cost	42.00	4.2000	84	1st
Design details discrepancies affect budgeted cost	41.00	4.1000	82	2nd
Decision making on materials selection affect budgeted cost	41.00	4.1000	82	2nd
changes to new technology affect budgeted cost	40.00	4.0000	80	4th
Non-compliance design with government regulation affect budgeted cost	39.00	3.9000	78	5th
Design complexity affect budgeted cost	39.00	3.9000	78	5th
Replacement of materials affect budgeted cost	39.00	3.9000	78	5th
Weather condition affect budgeted cost	38.00	3.8000	76	8th
Change in specification by consultant affect budgeted cost	38.00	3.8000	76	8th
Non-compliance design with owner requirement affect budgeted cost	38.00	3.8000	76	8th
Budgeted cost affect value engineering	37.00	3.7000	74	11th
Safety considerations affect budgeted cost	36.00	3.6000	72	12th
Budgeted cost is affected by long lead procurement	36.00	3.6000	72	12th
Coordination on site affect budgeted cost	36.00	3.6000	72	12th
Budgeted cost is affected by ambiguous design details	34.00	3.4000	68	15th
Change in government regulation affect budgeted cost	34.00	3.4000	68	15th
Contractor involvement in design affect budgeted cost	32.00	3.2000	64	17th

Importance of the study

Most of the construction industry completed project above the budgeted limit. Thus, demands the need to identify the impact of design changes on budgeted cost of building projects in South Africa.

The identification of these factors will assist stakeholders in the construction industry to plan adequately toward efficient building production process. Similarly, the output of this research will educate the stakeholders on modality of achieving efficient building product during production process. The result obtained from the investigating

of the effect of changes in building design during production process on budgeted cost, will assist design team to plan for effective design. Also, outcome of this research will help the contractor to achieve the best output from workforce.
This research will tutor the stakeholders on how to manage budgeted cost within time frame and delivered product at quality expected.

CONCLUSION AND RECOMMENDATION

Major finding obtained, indicates that scope of work not well define for the contractors cause changes in design and has effect on budgeted cost. Hence, building products are delivered at construction cost greater than budgeted cost specified during building production process in South Africa. Similarly, design details discrepancies between drawings and specification cause changes in design and has effect on budgeted cost specified. Therefore, changes in design causes increase in construction cost and the building product are delivered above time specified. Decision making on materials selection during design stage causes change in design at construction phase and has effect on budgeted cost and the building product are delivered above budgeted cost specified. Also, new technology as a result of new innovation cause change in design during construction phase and has effect on budgeted cost. Non-compliance design with government regulations affect construction phase and has effect on budgeted cost. Thus, accurate briefing by the client and planning at conception stage will influence effective production process, adequate design and proper checking for error by designers will enhance efficient design, and establishment of design management and readiness of design before the construction phase is a necessity towards avoidance of delivery of building product at construction cost greater than budgeted cost. This avoidance will not only lead to efficient construction production process, reduction of resources waste, but will enhanced client satisfaction and delivery of building product at construction cost equal to budgeted cost or at construction cost less than budgeted cost.

REFERENCES

Azmy, N., (2012) the role of team effectiveness in construction project team and project performance, graduate

thesis and dissertation pp1-198

Al-Dubaisi, A. H. (2000) change order in construction projects in Saudi Arabia,Pp1-146

Alsuliman, J., Bowles, G., and Chen, Z. (2012) current practice of variation order management in the Saudi construction industry, association of researchers in construction management pp1-10

Arain, F. M., and Pheng, L. S. (2006) a knowledge-based system as a decision making tool for effective management of variations and design improvement: leveraging on information technology applications I Tcon vol11 pp373-392

Azhar N., Farooqui, R. U and Ahmed, S .M. (2008) Cost Overrun factors in construction Industry of Pakistan.First International conference on construction in developing countries.PP500-508.

Esohofonie, F., P. (2008) factors affecting cost of construction in Nigeria,

pp 1-44

Ganiyu, B. O., and Zubairu, I. k. (2010) regression for public building projects in Nigeria. Journal of building performance volume 1 issue 2010 pp 21-28.

Hoai, L. L., Lee, Y. D., and Lee, J. Y. (2008) Delay and cost overruns in Vietnam large construction project, A comparison with other selected countries. Journal of civil Engineering (2008) pp 367-376.Jaggar D and Smith J (2002) Building cost planning for the design team

Lam, P. T. I, Wong, F. K. W., and Wong, F. W. H. (2007) building features and site-specific factors affecting buildability in Hongkong, journal of engineering design and technology vol5 no2 pp129-147

Memon, A. H., Rahman, I. A. and Azis A. A. A. (2011) preliminary study on conservative factor leading to construction cost overrun. International journal of sustainable construction engineering and technology pp57-70 Ogunkah, I. and Yang, J. (2012) Investigating factors affecting materials selection, the impact on green vernacular building materials in the design-decision making process, journal of building pp1-32

Nina, R., (2003) from building production- focused toward a client-focused briefing process, pp55-67 Vacharapoom, Benjooran and Numpheungk Sae-Tae. (2011) Time-cost Trade-off scheduling under construction labour resources constraints. Journal of suranaree J.sci techno vol 18 pp29-40

Zhang, K., and Rusell, A. D. (2005) Quality management and IT 6^{th} contruction speciality conference ppCT-190-1 – CT190-8

THE INFLUENCE OF PROJECT MANAGEMENT SERVICE PROVISION ON ROLE-PLAYERS WITHIN THE SOUTH AFRICAN CONSTRUCTION INDUSTRY

A. Hefer[1], D. Vosloo[2] and B. Botha[3]

Nelson Mandela metropolitan University, School of the Built Environment, Port Elizabeth, South Africa

The legitimate existence of the Project Management Profession in the South African construction industry needs to relate to positive project influence on the industry role-players. This study assessed the perceived lack of recognition and acceptance of Project Management as a stand-alone profession relating to: Appointments of Project Managers being questioned due to a perceived lack of influence and impact on project success; Project Managers not being recognised as an integral part of the industry and Project Management not being perceived as having a unique and defined function.Interviews were held with 23 industry role-players made up of clients, contractors and consultants. The interviews solicited input on the role-players' perception and experience related to the influence of Project Management over the past 10 years, not only on a list of success criteria relative to their own role in the industry, but also their perception of the influence on the other defined role-player groups. Included in the interview questionnaire was also a range of general questions to refine the feedback and further test the hypotheses. The data were interpreted and analysed by comparing the feedback of the respondents as a combination and separately as groups. The results of the study indicate that project Management could be seen as a legitimate part of the industry; the industry role-players perceive Project Management as making an impact and having a growing influence on the industry; a specific but broad set of skills are required by Project Managers; the Project Management function cannot be fulfilled by other consultants, but there are project related criteria which should be considered before making a final judgment. These criteria relate to project size and complexity; and Project Management is currently perceived to be more related to a specific person's skill than to a specific profession. The study's aim was to influence and inform the views of industry role-players on the appointment of a Project Manager in the construction industry.

Keywords: recognition, acceptance, project management, success criteria

INTROUDUCTION AND THEORETICAL BACKGROUND

The South African Council for the Project and Construction Management Professions (SACPCMP) was established towards the end of 2000 through the promulgation of the Project and Construction Management Professions Act no. 48 of 2000 (RSA Government, 2000). This introduced and established the first professional body for project managers as a stand-alone discipline in the South African construction industry. In comparison with the other professional service providers and consultants

[1] andre.hefer2@nmmu.co.za
[2] derick.vosloo@nmmu.co.za
[3] brink.botha@nmmu.co.za

Hefer *et al.* (2014) The influence of project management service provision on role-players within the South African construction industry *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 547-561.

in the construction industry (more specifically Architects, Quantity Surveyors and Engineers), who have had established professional bodies for over thirty years prior to the establishment of the SACPCMP, it is perceived that the Project Management profession, only in existence for 10 years, is still in its infancy (Association of South African Quantity Surveyors, 2005).

The Project Management professions' influence will need to be assessed before other role-players in the industry will accept the new profession as a legitimate or even integral part of the industry and project delivery process (Himayumbula and Prinsloo, 2010:29). Weaver (2007 b, p. 2) and Weaver (2007 a, p. 15) indicates that if certain criteria are applied to Project Management, it can be described as an emerging profession and a reason could be that even while there is a defined Body of Knowledge for the discipline, there are quite contradictory views across the world from different professional associations. Weaver (2007 a, p. 15) also notes that if Project Management is not at present a profession; it will certainly emerge as one over time.

It is perceived that professional recognition and registration does not grant a profession immediate acceptance or recognition in the eyes of the other role-players in the construction industry, namely Clients, Consultants or Contractors. This acceptance will need to be earned. The queries regarding legitimacy of existence are also accentuated in times of economic recession, as is currently being experienced nationally and internationally (Creamer Media, 2011:3).

Thus, in the case of Project Management in the construction industry, the practice, and appointment of a professional Project Manager in the past 10 years, since the inception of the SACPCMP, needs to be defended with logic and justification. The Project Management profession needs to, without any doubt, show that it has a legitimate place in the South African construction industry hierarchy, and even more so for the Project Manager, at the top of the consultant hierarchy as the leader of the project consultant team and as the leading client agent during construction.

Kwak and Anbari (2009:436) reinforce the logic behind the study by indicating that research on Project Management through the viewpoint of allied or cross disciplinary role-players (in this case Clients, Consultants and Contractors), will lead to a situation where Project Management and its influence can be better understood and will enhance the current body of knowledge. This understanding will lead to improved education, training in the field and finally to superior project success or performance (Kwak and Anbari, 2009: 436).

Project Management – the past, success and future

Burke (2000) and Weaver (2007 a) indicate that Project Management originated in the 1950's. Weaver (2007 a) states that the term "Project Manager" was first used in the 1950's and further indicates that on the "Trans Mountain Oil Pipeline" in Canada, was the first time that a firm was appointed as a Project Manager. Weaver (2007 a), further states that by the end of the 1950's the appointment of a project manager "to take full and undivided responsibility for achieving the project objectives" was unquestionably gaining ground and seemingly becoming stable in the western world. Weaver (2007 a) concludes that the use of the terms 'project' and 'project management' only became common in the last 50 years and was largely aligned with the growth in establishment of Project Management associations. Even though many large scale projects were undertaken in the early nineteen hundreds, the term Project Management only really came into use in the 1950s.

In a recent article by Watermeyer (2010, p. 34), the four presentations which were made during the University of Witwatersrand Construction symposium around the topic “The Project Management Profession: Adding Value” were summarised. The symposium’s aims confirmed that the Project Management profession still needs to prove that it is adding value and that in the South African perspective; it is still a growing and learning profession which is far from being mature and settled.

In South Africa and internationally, definite questions have arisen with regards to the traditional roles and responsibilities of the built environment consultants, especially with regards to the role of the architect as the traditional project team leader or principal agent (Jones, 2006, pp. 20, 25, 87) (Shaw, 2009, p. 46). Jones (2006, p. 30) goes on to comment that “designers are typically inadequate in performing construction management services”. Barnes (2009, p. 4) reiterates the fact when noting that the application of Project Management is not well established when it comes to design professions in the construction sector.

Morris (2000, p. 19) indicates that research on the topic of the business benefits of investing in Project Management is urgently needed and to date very little has been done. It is perceived that Morris (2000, p. 19) indicates that 10 years ago queries were raised with regards to the validity or business benefits of Project Management in first world countries.

In the African and growing economy context of Zambia and Ghana, it is indicated by Shakantu, Zulu and Matipa (2002, p. 5), and Ofori and Hinson (2004, p. 98), that it is critical for construction managers and clients to undertake change in the management of construction projects and to adopt a Project Management methodology similar to those indicated in the Project Management Body of Knowledge (PMBOK), but that local issues also be investigated and researched.

In research (Brown and Botha, 2005, p. 7) on lessons learnt on implementing Project Management in South African municipalities, it is noted that high-level decision makers are typically very knowledgeable in the field of Project Management and that proper Project Management is integral to the implementation of the municipal development plans. It also refers to the fact that formalised Project Management is extremely suitable to solve the numerous challenges which local authorities face (Brown and Botha, 2005, p. 3). Brown and Botha (2005, p. 5) conclude that “there is no empirical proof that the project way of making services available in a local authority is better than the traditional way”.

In contradiction to the above, Van der Waldt (2007, p. 251) categorically states that the use of “Project Management techniques and processes will give a higher likelihood that service delivery projects will be completed on time, within budget and to an acceptable level of quality”. Van der Waldt (2007, p. 240) further proposes that the South African government needs to develop overall Project Management skills and applications to ensure improved delivery of services and enhancing the management capability. Van der Waldt (2007, p. 258) also states that redefining and rearranging the old-fashioned way of service provision in the public sector is required and goes on to ask the question as to what extent Project Management could be part of the solution of service delivery. Van der Waldt (2007, p. 251) also indicates that Project Management should be the central starting point for policy makers and the Project Management way of thought should guide the entire government policy to achieve the desired outcomes.

Steyn et al. (2003, p. 14) indicates the following benefits of Project Management:

- Customer satisfaction;

Potential growth in the market and future business with current clients;

Personal growth opportunities for successful Project Managers;

Constant professional demand due to general skills of professional operatives; and

All involved parties "win" if a project is successful.

Boninelli (2005, p. 200) states that many projects fail due to poor change management and leadership skills of Project Managers and the lacking knowledge of people problems and solutions they could encounter. The outcome of the failure is that countless resources are wasted (Boninelli, 2005, p. 200).

Steyn, Basson, Carruthers, du Plessis, Prozesky-Kuschke, Kruger, van Eck and Visser (2003, p. 2) indicates the following factors related to the growth and importance of the Project Management field:

Globalisation;

Increased speed of product development;

Increased client demands;

Knowledge explosion; and

South African governmental service delivery intentions.

Steyn *et al* (2003:2) note that Project Management is believed to be the fastest growing form of management in the world.

The Major Projects Association summary (2009:2) argues that, future key drivers for Project Management of major projects will include environmental change, changing expectations, and the competitive demand for various resources. With regards to global developments influencing Project Management, it is argued that emerging economies' wealth and output has risen significantly and that these statistics are led by the Brazil, Russia, India and China (BRIC) countries of which South Africa has recently become a member. The BRIC countries accounted for close to 40% of the world growth since the turn of the century and in the future it is foreseen that the growth in the emerging markets will keep being stronger than the developed markets or economies.

The future mega trends are that a new globally recognised system of regulation of the world and local business markets needs to be developed and that innovations in technology will need to be managed and embraced. With regards to the short term future, it is argued that less major projects will be planned and more projects will be delayed; and the biggest changes in the future of Project Management and construction in general will be driven by cost and carbon waste reduction.

A seminar report (Major Projects Association, 2006:2) proposes some changes in the Project Management field, which will have to be taken into account by practitioners. These proposed changes for the 21st century include:

- The mind shift from being product orientated to being more focused on value creation and benefits for shareholder groups;
- Changes in Project Management focus will increase the complexity of the project environment and requires a new set of skills to be successful; and

- Training will shift from tools and techniques to development of the individual Project Manager's capabilities, which will enable the practitioners to operate in the 21st century environment.

The same report (Major Projects Association, 2006:3) also argues that a 21st century practitioner will need to adapt and have the following capabilities:

- To be informed by principles and frameworks;
- To see knowledge as temporary and dynamic;
- To be pragmatic in their approach to practice;
- To embrace uncertainty;
- To give professional judgement when it counts;
- Be able to emphasise reflection and deliberation; and
- Be able to develop professionally.

Du Plessis, Smith and Vermeulen (2009, p. 97) note that globalisation is confronting organisations with many challenges and it is in fact these challenges which are prompting these organisations to adopt Project Management which in turn gives them the ability to implement their chosen strategy and help to achieve their goals.
In addition to sound technical expertise of Project Management practitioners, the following "habits of great project leaders" will enable role-players to identify the best Project Managers (Major Projects Association, 2008 April, p. 2):

Setting Health, Safety, Security and Environmental expectations;
Understanding the overall project scope;
Forming a procurement strategy;
Understanding and help set up the clients organisation scope of issues and objectives;
Induce and facilitate performance monitoring;
Developing others during projects;
Creating the vision in the project team;
Planning;
Intervention when required; and
Problem solving.

The literature review defines certain aspects related to the study's sub-problems and hypotheses. This should inform the reader of topics and trends in the field of study and guide the process of interpretation of the study's findings.

PURPOSE/PROBLEM STATEMENT AND OBJECTIVES

The objectives of the research culminate into the following:

- Clarify the respective project success criteria for Clients, Consultants and Contractors in a construction project;
- Evaluate the influence which Project Management (PM) has on the project success criteria relative to Clients, Consultants, and Contractors;
- The evaluation of the influence of Project Management service provision over the past 10 years;
- To appraise the future impact and influence of Project Management service provision on the industry role-players;

- Assess the legitimate utilisation of Project Management as a stand-alone discipline in the construction industry through the perspectives of the Clients, Consultants and Contractors;
- Clarify and question general perceptions towards Project Management; and
- To influence and inform the views of industry role-players on the appointment of a Project Manager.

METHODOLOGY

The research was undertaken in two main stages to ensure that the primary data collected by means of questionnaire survey on Project Management population would be ably applied in the testing of the hypotheses. The first stage encompassed the extraction of data from research articles and other written sources relevant to the critical project success criteria for each of the role- players, so identified as part of the study. A list was finally compiled of the critical success criteria relating to each of the role-players. Written resources in the literature review were also used to gather data and trends on the future impact of Project Managers to ensure that sufficient questions relating to this issue were drafted and included as part of the interview questionnaires.
Secondly, questionnaires were developed for use as part of the structured interviews (Leedy and Ormrod, 2001:200) in which both qualitative and quantitative data were sourced. The questionnaires were set up to yield mainly quantitative data, but open-ended questions were included in order to provide qualitative data from comments made by the respondents. The input for the questionnaires was obtained from and guided by the information gathered in the first stage as explained above.
The questionnaires were tested twice through a process of pilot questionnaires to ensure that the respondents understood what was required and to ensure that the feedback received aligned with what was required to test the hypotheses. The questionnaires were circulated and the purpose explained to the pilot test group. After the first feedback was received from the group, the revised questionnaires were again distributed for refinement. Through this process and constant feedback from the study supervisor, the full questionnaire was finalised for use in the interviews. The twenty-three persons who were requested to participate in the interviews were contacted via telephone and email.
From the above literature review, it is therefore hypothesised that:

Hypothesis 1: Project Management service provision has positively influenced role-players with regard to their respective and combined project success criteria.

Hypothesis 2: Project Management service provision will have a perceived impact and growing positive influence on the future of the construction industry and its role-players.

Hypothesis 3: The fulfilment of the Project Management function in the construction industry requires a comprehensive and specific set of skills, attributes, and professional conduct.

The population for this study consisted of experienced persons involved in the built environment as identified from the following role-player groups: Clients; Contractors, and Consultants. These three groups were clearly defined in different strata and were chosen as they are seen to be the three major role-players during any built environment project cycle and would be intensely involved with an appointed Project

Manager. They would thus be able to provide sufficient input into the sub problems and hypotheses stated earlier. In this case, the sampling was defined by (Leedy and Ormrod, 2001:215) as Proportional Stratified Sampling, where the sample for each strata would be in proportion to the members in a generic built environment or construction project team. In this instance a generic team consisted of: one client or representative; one Contractor; and six consultants consisting of an Architect, Quantity Surveyor and four Engineers (Mechanical, Electrical, Civil and Structural).
The ideal sample size was set out in relation to the 1:1:6 ratio derived from the Proportional Stratified Sampling (Leedy and Ormrod, 2001:215). It was aimed to involve as many role-players as possible until saturation point in the interview data was reached and no new or alternative trends could be identified. During the interview process it was found that the group information reached saturation point after twenty three interviews which included four clients, four contractors and fifteen consultants.

Questionnaire design

The questionnaires were tested twice in the form of pilot questionnaires, which were circulated to a group of five colleagues in the field of construction. The first round of circulation of the questionnaires solicited worthy feedback and the questionnaires were changed accordingly. The questionnaires were then again circulated to ensure that the information required will be in line with what is required to test the hypotheses. The second round of testing resulted in some minor changes being made to the questionnaires, before it was finally approved for use in the study. The pilot questionnaires yielded enough feedback to set up and undertake the interviews with the final questionnaires so drafted, guiding the process. The questionnaires were set up and adapted to ensure that enough data and balanced information would be obtained to relate to the sub-problems and to be able to properly test the relevant hypotheses. Specific questionnaires were set up for each of the different role-player groups, which formed part of the study

ANALYSIS AND INTERPRETATION

The demographic profile analysis would aim to reveal the relevant experience and applicable background of the respondent group to be able to add value and substance to the research topic and the findings. From the analysis of the interview feedback, the following can be deduced:
The age group information combined with the experience gives a good indication of the potential value of input gained from the respondents. The vast majority of the respondents were aged above forty (48% between forty and fifty, and 35 % over fifty).The majority of the respondents interviewed had more than 20 years' experience in the industry (65%). The interpretation can go further to note that the results show that the respondents can relate their feedback to a period when there were no professionally registered Project Managers in the industry. All respondents had some form of formal qualification with most having a bachelor's degree. The entire group's statuses within their organisations comprised of Managing directors, Directors/Senior Executives, Managers, Associates and Senior Staff. The group's status can be viewed as being persons with a high level of status in their organisations. In summary, the group of respondents can be viewed to be well experienced/educated in the construction industry. The group is mainly made up of individuals from the higher status groups in their organisations and involved locally on construction projects, ranging from R 5 million to more than R 150 million, where Project Managers have been appointed.

Critical Success criteria interpretation

This section was set up to deal mainly with the testing of Hypothesis 1, which relates to the positive influence of Project Management on the construction industry role-players, over the past ten years, with regard to their respective and combined success criteria. From the analysis done on the data, the following can be interpreted:

Combined influence on the role-players

The majority of the feedback noted that Project Management has positively influenced the industry role-players over the past 10 years (60.9% positive influence and 11.9% extremely positive influence). The percentage indicated for "no-influence" (21.1%) could also be interpreted to be related to sections of the success criteria where role-players either do not require the Project Manager to have an influence or areas which could be beyond the Project Managers' sphere of influence. Project Managers should investigate and decide on which criteria they need to or can have an influence on.

Influence on the client success criteria

Relative to the other two group's success criteria feedback, the positive influence on the client's success criteria was rated to be the highest (Client 64.3%, Contractor 59.1%, Consultant 59%). This positive influence feedback is reinforced by the related criteria feedback for the "Iron Triangle" (Weaver and Bourne, 2009) success criteria of time, budget and quality. In all three of these individual success criteria for the client, the percentages were high (70% and higher). The "no-influence" feedback on the client success criteria is also the lowest (13%) of the three role-player group success criteria inputs. The above two points relating to the clients success criteria can be perceived as an indication that Project Managers have the most positive influence on the clients success criteria. From the contractor's group feedback on the Project Managers influence on the client's success criteria, it can be seen that the vast majority of the role-players views the influence of the PM on the client as positive (85% "positive influence" and 10% "extremely positive influence"). Contractors in particular seem to find the influence of a PM on the client very positive. Consultants noted the highest "no influence" feedback. This can be interpreted to be linked to specialist knowledge of the limits of influence and control which a Project Manager can exert on a project, or it can be allied to some consultants being in competition with Project Managers for certain sections of professional services rendered to clients (Morton, 2002).

Influence on the contractors success criteria

The combined feedback from role-players indicated that the influence on the contractor's success criteria was mostly positive (59.1% "positive influence" and 10.1% "extremely positive influence"). The combined role-players indicated a 25.2% "no influence" feedback which could again be perceived as either areas which the role-players view Project Managers to have no role to play or those criteria being outside of the Project Managers direct influence. Consultants (29%) were the highest contributor to this figure, and the perception could be that consultants view Project Managers as only having limited influence on the contractor's success criteria or

Project Managers not fulfilling their roles properly. In this case, the group's highest score for "no influence" was for "skills training" (61%). This could definitely be an area where Project Managers currently have little or no perceived influence. The contractor group of respondents indicated the highest positive response (67% "positive influence" and 15% "extremely positive influence"). This could be interpreted to be a positive aspect with regards to the role that Project Managers play in relation to the mediation; objectivity and fairness which is required during a construction project.

Influence on the consultants success criteria

Again, the combined overall positive feedback (59.2% "positive influence" and 11.7% "extremely positive influence"), can be interpreted to indicate a majority positive influence of Project Managers on the consultants success criteria. Consultants individually scored the highest "extremely positive influence" percentage (15%). This indicates that Project Managers are in certain areas influencing consultant's success criteria extremely positively and the group recognises this. The highest negative influence feedback came from the consultant group (5%). This could evolve from the Project Manager requiring more input from the consultants than what they would have liked to have done. This is in relation to the high percentage of negative influence on the "Consultants Budget" (26%). In paradox to the above, the role-players indicated that the highest "extremely positive influence" feedback was for "Consultants Time/Schedule" (26%). This could be interpreted that the Project Managers positively influenced the consultants in achieving their time related goals. The vast majority of Contractors were very positive in their feedback (72% "positive influence" and 9% "extremely positive influence"), and it can be perceived as the value they see in the Project Manager influencing the consultants in a positive manner. With regard to the "no influence" feedback, the client group in this instance indicated the highest percentage (28%) feedback. This could be interpreted to show the client groups focus of required influence not being aimed at the consultants, but more to the contractor. It can also be interpreted as an indicator that clients view other professionals as having the general ability to take responsibility of sections of a project which the Project Manager does not have to influence or cannot influence at all (example, Consultants profit and budget).

Agreement, exclusions and additions with regards to the list of success criteria

With the results indicating 91% of the respondents agreeing that their respective sets of success criteria are applicable to them, it can be observed that the list of criteria was sufficient. Further to the above observation, only respondents from the consultant group disagreed with the list of criteria. It can be seen that the criteria noted for exclusion could seemingly be those on which the Project Manager cannot or will not have an influence. Additions to the list were interpreted as items which could still relate to items in the respective criteria lists. This could have been clarified if further discussion and refinement of the list was required. In this case, it was not required.
To summarise the above, it can be argued that Project Managers have, to date, influenced the project success criteria of the construction industry role-players positively. Although some role-player feedback fluctuated slightly, it can be interpreted that the majority positive influence (60.9%) relates to their respective and combined sets of success criteria. It can also be interpreted that the group agreed with their respective lists of success criteria.

GENERALISATION FOR THE STUDY FOCUSING ON THE PRACTICAL AND POLICY IMPLICATIONS

The interview questions in Section 3 (Appendix 4) were compiled to assist with the testing of Hypothesis 2 and 3. Hypothesis 2 dealt with the perceived impact and growing influence of Project Management on the future of the construction industry and its role-players. Question 13, 14, 15, 16 and 21 in the interview questionnaire related to Hypothesis 2. Hypothesis 3 on the other hand, required input on the comprehensive and specific skills, attributes and professional conduct required when fulfilling the Project Management function. Question 18, 19 and 20 solicited feedback for this data. For ease of understanding, the interpretation of the analysed information has been done separately for Hypothesis 2 and 3. Interpretation of the analysis of the data linked to Hypothesis 2 can be summarised as follows: From the supporting analysis results below and comments made by the respondents, it can be deduced that role-players observed that Project Management was making an impact on the industry and will have a growing influence on the industry and its role-players.

Future improvement of the influence of Project Management on project success criteria of the role-players related to skills in Technical, People, Management, Budgetary and Schedule aspects. The vast majority of respondents (91.3%) indicated that they experienced and perceived Project Managers to be a legitimate or integral part of the construction industry. The vast majority of respondents (91%) answered “yes” when requested to give feedback on the question of an appointed Project Manager increasing the probability of a project being more successful. Of the combined group of respondents, 87% indicated that the Project Management function is more successful when fulfilled by a standalone Project Manager. Further, 96% of the combined group of respondents noted that they would be positive with regard to the appointment of a Project Manager on the next construction project they are involved in.

The interpretation of the analysis of the data related to Hypothesis 3 refers. The combined respondents mostly (52%) noted that Project Management is more related to a specific person’s skill, than to a specific profession. Of the respondents, 30% noted that it is both a skill and profession; and 17% indicating that it is a profession. This can be interpreted to indicate that the Project Management skills required to manage a project could overshadow the actual requirement to be a professional in the field. In many ways, it can be apparent that the professional registration of the Project Manager or the individual fulfilling the function is not as highly rated as the actual skill behind the individual to successfully manage projects. The explanatory feedback, however, strongly suggests that the skill and profession behind Project Management is a combination. From the combined role-player results, it can be observed that the respondents partly stated (48%) that the Project Management function cannot be fulfilled by other consultants during a project, and should be fulfilled by a stand-alone Project Manager. The number of mixed responses (“yes” and “no” : 35%) and explanation feedback from the respondents can be noted to indicate the fact that a range of other aspects could play a part in the Project Management function being fulfilled by other consultants. These were mainly related to project size and complexity. Interestingly, it can be noted that 100% of the client group felt that other consultants couldn’t fulfil the role. All of the respondents contributed towards the identification of an extended list of skills and attributes which a Project Manager should have to be able to positively influence the role-players success criteria. This can be interpreted to mean that a Project Manager must have a vast and extremely broad base of skills to manage a construction project. The interpretation can go further into noting that the skills are as much technical and managerial as they are people skills and personal attributes.

In summarising the above, it can be deduced that role-players in the construction industry notice Project Management to be more related to a specific person's skill than to a specific profession. The respondents only partly (48%) noted that the Project Management function cannot be fulfilled by other consultants, but the mixed responses ("yes" and "no": 35%) indicated that there are other issues to consider when trying to get to finality on who can or cannot fulfil the Project Management function. This could relate to the fact that regulatory boundaries do not prohibit other professions to either perform the role of the Project Manager or produce relevant documentation, which would be part of the duties of a Project Manager.

It can also be argued from the above that a Project Manager should have broad technical skills, managerial skills, people skills, and personal attributes related to the function.

Testing the hypothesis

Hypothesis 1 indicated that Project Management service provision has positively influenced role-players with regard to their respective and combined project success criteria. Taking into account the analysed data relating to the majority of positive feedback in relation to both the combined overall results and the individual role-player group results (60.9% "positive influence" and 11.9% "extremely positive influence") on the influence of Project Management, there is sufficient evidence for the hypothesis to be tested. Due to the fact that the respondent groups were from allied or cross disciplinary role-players, as suggested by Kwak and Anbari (2009:436), the results are apparent to be balanced and objective. Furthermore, the findings seem to be in line with the thoughts and conclusions of previous studies and papers which noted that project Management have definite benefits (Steyn,*et al*.,2003:13). Project Management being a means of strategy realisation (du Plessis,*et al*.,2009:98) (van der Waldt, 2007:253) Thus, from the feedback received, analysis done and the interpretation made, it can be noted that Project Management has over the past ten years positively influenced the project success criteria of the role-players. This positive influence was noted for the combined and respective success criteria of the industry role-players. This hypothesis is therefore supported by the findings

The second hypothesis noted that Project Management service provision will have a perceived impact and growing positive influence on the future of the construction industry and its role-players. The study findings were overwhelmingly positive in relation to the questions of future improvement of the professions influence. It was shown that the Project Manager is a legitimate part of the industry (91.3%) and the appointment of the Project Manager increasing probable project success (91%). The study highlighted the positive feedback related to project success when the Project Management role is fulfilled by a stand-alone Project Manager (87%), and the response on the role-players reaction on subsequent appointment of Project Managers (96%). The findings of the interpretation compare to comments made by other authors who indicate that the challenges that Project Management faces, can be defined by the professions success (Weaver , 2007 b). Companies gain a competitive edge by means of implementing Project Management (Da Vinci Institute of Technology Management and Technology, 2009: 3). Project Management being one of the fastest growing forms of management in the world (Steyn,*et al*.,2003:2). Project Management will emerge as a profession over time (Weaver, 2007a:15). When all the above is taken into context, it can be deduced that, related to the hypothesis, role-players perceive Project Management as making an impact and will have a growing positive influence on the industry. This hypothesis is therefore supported by the findings.

The third hypothesis relates to the fulfilment of the Project Management function in the construction industry requiring a comprehensive and specific set of skills, attributes and professional conduct. The findings of the interpretation note that project Management is more related to a specific person's skills than to a specific profession (in this case, the Project Management Profession) (52%); a vast majority (87%) of role-players felt that the Project Management function cannot be fulfilled by other consultants, but there are project related criteria which should be taken into account when making such a judgement. Project Managers will require a vast and wide group of technical, managerial, and people skills, as well as personal attributes to fulfil the Project Management function. The findings relate to the seminar summary by the MPA which identified that a wide array of skills is required by a Project Manager (2008:2).The outcomes above were found to be somewhat uncertain and can be seen to only partially support the third hypothesis. The uncertainty of the study findings seems to only reinforce the vagueness in the construction industry, especially if the statements from other studies (Jones, 2006; Crafford and Smallwood, 2007; Shaw, 2009) and comments from respondents in this study, are looked at together. No empirical proof can be presented with regards to the question relating to whether professional Project Managers are the only professionals in the current built environment which are sufficiently skilled or professionally qualified to fulfil the Project Management duties. The findings being uncertain, could relate to the fact that the Project Management profession does not have sufficient regulatory protection with regards to the duties performed and documentation they should produce during a project life cycle. This can be seen in the light of other built environment professions having statutory regulations which stipulate that certain duties and documentation can only be performed and produced by those professions (for example Architectural/Engineering specification or drawings and Quantity Surveying Bills of Quantities). The question beckons that if regulations do not provide Project Management professionals with a clearly defined role which only they are allowed to perform, whether the uncertainty will ever be resolved. Taking the above comments into account, it can be noted in support for clarification purposes that:

- Respondents indicated a preference (87%) towards a stand-alone professional, which only fulfils the role of the Project Manager and does not over and above the Project Management duties, still aim to fill the role of another professional on a project.
- Project size and complexity seems to be major factors in determining if a defined professional is required to manage a project or not (65%). This hypothesis is therefore partially supported by the findings.

SUMMARY AND CONCLUSIONS

As was stated in the introduction to this paper, the logic behind the study (Kwak and Anbari, 2009:436) was based on the perspective that the viewpoint of allied or cross disciplinary role-players could lead to a situation where: Project Management influence can be better understood, which would lead to better education and training in the field, and superior project success or performance. Thus, the study aimed to take input from the three main industry role-players in relation to their prevalence in

projects and request feedback from them in connection with certain aspects of Project Management. These aspects were:
the influence of Project Managers on the role-players' own set of success criteria; the views on the influence of Project Managers on the other role-players' success criteria and the impact and growing influence of Project Management and the comprehensive and specific skills, attributes and professional conduct for Project Managers. The interpretation of the study findings led to the hypothesis 1 and 2 being supported. Hypothesis 3 was found to be only partially supported.
The study found Project Management as a stand-alone profession, has over the past years positively influenced the construction industry role-players. This positive influence was measured against the influence on the respective and combined role-player project success criteria. The findings indicated that:

- Project Management, as a profession, could be seen as a legitimate part of the South African construction industry.
- The industry role-players perceive Project Management as making an impact and having a growing positive influence on the industry going into the future.
- A specific but broad set of skills are required by Project Managers.
- The study findings showed that in general the Project Management function cannot be fulfilled by other consultants, but there are project related criteria which should be considered before making a final judgment. These criteria are mainly related to project size and complexity.
- Project Management is currently perceived to be more related to a specific person's skill than to a specific profession.

It is recommended that construction industry role-players, as a group, realise, accept and recognise the role of a stand-alone Project Manager within the industry. The study has argued findings that note that Project Management as a stand-alone profession adds value and positively influences the industry role-players and could be perceived as a legitimate part of the South African construction industry.
It can also be recommended to the Project Management professional fraternity and professional bodies to find ways of accentuating the value added and formulate procedures to show and document positive influences on construction projects. This will create a platform where Project Management appointments can be defended with logic and justification based on facts and not on mere experience and perception.
Furthermore, the authors proposes that the SACPCMP further investigate the options of regulatory guidelines with regard to the duties performed and documentation produced as part of the Project Management functions.

REFERENCES

Association of South African Quantity Surveyors, 2005

Crafford, G. J. and Smallwood, J. J., 2007. Clients views on quantity surveying competencies. *Acta Structilia,* 14(1), pp. 33-53.

Creamer Media Construction Report 2011, s.l.: Creamer Media.

Da Vinci Institute of Technology Management and Technology, 2009. *Project Management: A systematic view,* Johannesburg: Da Vince TIPS.

du Plessis, Y., Smith, R. and Vermeulen, L. P., 2009. An assessment tool for change dynamics within project management. *Journal of Contemporary Management,* Volume 6, pp. 97-120.

Himayumbula, T. and Prinsloo, H., 2010. Is project management a benefit to the Botswana construction industry?. *Acta Structilia, University of the Free State,* pp. 25-43.

Jones, 2006; Crafford and Smallwood, 2007; Shaw, 2009

Jones, C. B., 2006. *The role of the Architect: Changes of the past, Practices fo the present, and Indications of the future,* Brigham: Brigham Young University.

Kruger, A. M., 1992. *The History of the South African Council for Professional Engineers 1968 - 1991,* s.l.: ECSA.

Kwak, Y. H. and Anbari, F. T., 2009. Analyzing project management research: Perspectives from top management journals. *International Journal of Project Management,* Volume 27, pp. 435-446.

Leedy, P. D. and Ormrod, J. E., 2001. *Practical Research Planning and Design.* 7th ed. Ohio: Courier/Kendaville Inc.

Major Projects Association, 2006 December. *Management styles and leadership,* London: Major Projects Association.

Major Projects Association, 2006 October. *Rethinking project management - new directions, new practice,* London: Major Projects AssociationMorton, 2002

RSA Government, 2000. *No. 48 of 2000 Project and Construction Management Professions Act 2000,* Cape Town: Government Gazette.

Steyn, H. *et al*., 2003. *Project Management: A Multi-Disciplinary Approach.* 6th ed. Pretoria: FPM Publishing.The MPA summary 2009:2

van der Waldt, G., 2007. Project Management: a new service delivery paradigm. *Koers,* 2(72), pp. 239-258.

Weaver , P., 2007 b. *Trends in modern Project Management, past, present and future.* Queensland, Mosaic Project Services Pty Ltd.

Weaver, P. and Bourne, L., 2009. *Mosaic Projects.* [Online] Available at: http://mosaicprojects.wordpress.com/2009/11/19/the-demise-of-the-iron-triangle/
[Accessed 10 November 2012].

APPENDIX 4: SAMPLE OF QUESTIONS.

Question 13 - Improvement of influence on project success criteria

How can Project Managers further improve their influence relative to the project success criteria?

Question 14 - Project Management’s legitimate or integral part in the industry

Through your experience and perceptions, do you regard Project Managers as a legitimate or integral part of the South African Construction Industry?

Question 15 - Probability of success when appointing a Project Manager

The question relating to the probability of the project being more successful when a Project Manager was appointed read as follows: Do you think the appointment of a Project Manager increases the probability of the project in general being successful?

Question 16 - Project Management success when fulfilled by a stand-alone Project Manager

The question relating to the success of Project Management when it is fulfilled by a stand-alone PM stated: Through your experience and perceptions, is the Project Management function more successful when fulfilled by a stand-alone Project Management Professional?

Question 17 – Respondents' feedback on future response to a Project Manager appointment

The question relating to future appointments differed slightly with regards to the role that each of the respondent groups usually plays on a project: Contractor/Consultant question: Would you be positive or negative with regards to the appointment of a PM on the next construction project you are involved with?

Question 18 - Project Management – Skill or Profession

The question with regard to PM being a skill or profession stated the following: Would you understand Project Management as being more related to a specific person's skills than to a specific profession?

Question 19 - Other consultants' time to fulfil the Project Manager's role

The question requesting feedback on other consultants having the time to fulfil the PM role stated: Do you perceive other consultants (other than Project Managers) as having the time during projects to be able to still fulfil the role of the Project Manager?

Question 20 - Critical skills and attributes

Respondents were also requested to comment on the following question: What skills or attributes should Project Managers have to ensure that they may positively influence the project success criteria?

Question 21 - Appointment of Project Manager – project size/value related

The following was asked with regard to the appointment of a PM: Would you perceive the need for the appointment of a Project Manager as being in direct relation to the size and value of a project?

THE RISK MANAGEMENT PRACTICES AND TECHNIQUES UTILIZED IN THE SWAZILAND CONSTRUCTION INDUSTRY- A REVIEW

Olutope Olamiwale Ibidapo[1], Alfred A Talukhaba[2] , James Okumbe[3]
Tshwane University of Technology, Department of Building Science Pretoria, South Africa

Risk is a predominant phenomenon and an inherent challenge in the construction industry, the ability to control its occurrence minimizes its impact in the operation of the industry and determines the profitability of the cons|ruc|ion8proJectK. TPis {tudq wa{ carried out to identify and examine the techniques, procedures and approaches to risk management in the Swaziland construction industry. Fifty one Indigenous and Twenty three Multinational construction industry were covered by the survey using questionnaire as the instrument for data `ollection. \he study revealed that the risk identification techniques mostly adopted by the Swaziland construction industry were; brainstorming and documentation review. The risk assessment techniques frequently used were; probability and impact maLrix4 rikk minagemen| probability method and decision analysis. The risk response strategies employed in the industry were; provision of insurance, use of contingency fund and use of subcontractors. The study recommends that risk management practices be taken as proactive measures, as well as organizing training on risk management for the professionals in the Swaziland construction companies to get them acquainted with the various techniques in use.

Keyword: risk management, Swaziland

INTRODUCTION

Swaziland popularly referred to as Kingdom of Swaziland is a small country of about 1.1 million people. It is located in the Southern Region of Africa, has a land area of about 17,364 kilometres square and is bordered by South Africa to the North, West and South and to the East by Mozambique. One of the major sources of employment in Swaziland is construction and also plays a significant role in the local economy. The construction industry in Swaziland comprises of both the indigenous and multinational construction companies and has contributed about 3.5% to her GDP in 2008 (Central bank of Swaziland 2008).

Risks in projects have considerable impact on the success of any construction project in terms of quality, time and cost and when not properly managed, can negatively impair the project objectives (Getachew, 2009). The construction projects undertaken by the Swaziland construction industry have been characterized by cost and time overrun as well as poor quality of work, owing to the inability of the industries to properly identify and manage inherent risks early in a project. This has resulted into

[1] Topsyo2001@yahoo.com
[2] TalukhabaAA@tut.ac.za
[3]

Ibidapo *et al.* (2014) The risk management practices and techniques utilized in the Swaziland construction industry- a review *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 563-577.

conflict, misunderstanding and disputes between the clients and contractor. Creedy (2005) explained that the problem of time and cost overrun is a general issue confronting the construction industry and that this has led into resentment between clients and contractor, but this is a common experience in the Swaziland construction industry which has resulted into poor performance of the construction firm and this is partly attributed to the industry not able to manage risks associated with construction.

Efficient and timely risk management is important in the construction environment to safeguard unexpected consequences (Maytorena et al. 2007 cited in Osipova 2008:1). Achieving the construction project objectives in terms of time, cost and quality requires a comprehensive and detailed risk management; this is lacking in the Swaziland construction industries. Hence the need to evaluate risk management practices and technique in the Swaziland construction industry with a view to making suggestion on other practical methods for managing construction risks.

This study is aimed at investigating risk management practices and risk management technique in use in the construction industry in Swaziland. If the risk management practices and techniques of construction companies are identified, it would be become easier to find-tune strategies that can lead to improved risk management in the industry. The findings at the end of the study would help to identify the applicable practices used for risk management in the construction industry. Such identification would engender circulation of ideas on approaches and techniques for handling risk amongst construction industry contractors. The intention is to underscore risk management techniques that have gained acceptance in the industry.

To achieve the objectives of this study, the following Hypothesis was postulated:

H0: There is no significant difference between the risk identification and assessment techniques by various construction companies.

H1: There is significant between the risk identification and assessment techniques used by various construction companies.

Several studies have been conducted in the past on the risk management practices and techniques deployed in construction industry. According to Akintoye and MacLeod (1997) in their questionnaire survey carried out on risk analysis and management in the UK Construction Industry, it was revealed that risk management in the construction industry is usually viewed from three perspective; personal intuition, judgement and experience obtained from past project, this account for the reason why risk management techniques are scarcely used for risk analysis and management in the construction industry. Ignorance of the application of the techniques, long span of time involved in its application and lack of trained expertise among others were reasons for the rare usage of the risk management techniques in the construction industry.

In the study conducted by Lyons and Skitmore (2004) on Project risk management in the Queensland engineering construction industry, it was found out that the implementation of risk management is high at both the planning and the execution stage of the construction life cycle, also that the professionals within the Industry are knowledgeable and acquainted with the various techniques that are used in handling construction risks. Kartam and Kartam (2001:14) conducted a questionnaire survey of contractors, and project management practices to find out whether the industry uses risk analysis and management. The conclusion was that formal risk analysis and management are not used due to lack of knowledge and doubts about the aptness of the techniques. Following this, Oztas and Okmen (2003:241) found out that there is a lack of practical risk management techniques and their application in the construction industry.

The study carried out by Yusuwan et al. (2008) on Clients perspectives of Risk management practice in Malaysian Construction Industry. They found out the Industry is exposed to risk of different types which have significant effects on the success of the project being undertaken. Based on this it was recommended that systematic risk management must be in place in order to minimise the effect of this on project cost, quality and time.

These attempts however have not addressed the applicable risk management practices and techniques deployed especially in the underdeveloped economies of the world like Swaziland.

LITERATURE REVIEW

Risk has been a vital subject in construction which has informed many studies to be conducted on it and its management. Risk is comprehensively defined, beyond financial risk, as likelihood of loss, injury, setback, disadvantage or destruction (Abbasi et al. 2005:42). View of Mills (2001:246) is that, project quality, performance, potency, capacity and financial cost could be changed by risk. Construction projects are carried out in an environment defined by varying measure of risk and contingencies that could be from known and unknown condition (Smith et al. 2006:4).

Management of risk is a major part of construction works, Oztas and Okmen (2004:230) considered that the requirement to manage risk in construction project is continuously increasing as a result of intricacy, size competition, client-consumer requirement, political-economical challenges and huge physical condition involved in such projects. Comprehensive management of risk will minimize the possibility of occurrence of a risk event just as it will minimize the extent of its impact.

Risk management process entails the course of action taken in response to risk, risk management process is directed to the needs and priorities of the clients, and it includes approaches, techniques and tools developed mainly for this purpose (Smith et al. 2006:27). According to Osipova (2008:20), the overall goal of risk management process is to increase the opportunities and decrease the result of a risk event.

There are five processes to risk management: context establishment, risk identification; risk assessment; risk evaluation; risk review and monitoring (Cooper et al. 2005:15). Patterson and Neailey (2002:366) however wrote, that there are five steps that are frequently used in current risk management, and these are, risk identification, risk estimation, risk evaluation, risk response and risk monitoring. The five stages sequentially fit into circular procedure, which produces a controlled risk environment if sustained.

In this study, the risk management process considered includes: Risk identification, Risk assessment, Risk allocation, Risk response. Risk management process begins with risk identification exercise; this identifies any possible risk area in a construction work Lisa Turnbaugh (2005) wrote that risk identification consist of detecting any possible risk in a project and documenting the characteristics of each risk. Risks needs to be identified on time in order to implement strategy that will enable the organization make the right decision either to retain the identified risk or transfer them to the appropriate parties to reduce any negative feature that they may have.

There are a number of various methods and procedures mentioned in literature that are employed in risk identification technique. They are:

- Documentation Review- This is carried out on a project from time to time, taking into cognizance all the assumption, plans, previous project files. These can serve as indicators that reveal embedded risk in the project (PMBOK 2004 :247)
- Brainstorming- Brainstorming appears to be an efficient risk identification technique because it entails an open discussion which is attended by project team and participant. However, it is prone to being influenced by stronger parties if check is not in place (Khalafallah 2002:11).
- Delphi Technique-Here, Collective opinion is obtained about future events, of risk arising in a construction projects from expert rather than an individual (Garrido et al. 2011:244)
- Interview - According to Garrido et al. (2011:244), Risk identification can be achieved through interviewing of construction project experts, these interviews can take three forms, unstructured, semi-unstructured and structured interview.
- Expert system - This type of risk identification techniques, make use of past experiences of expert to identify potential risk in a construction project. (Khalafallah, 2002:12)
- Questionnaire - The questionnaire is used to detect potential risk in a project, questions are well structured and distributed to project team members by the manager (Khalafallah, 2002:13)

Cooper et al. (2005) identified risk assessment as the next stage of risk management process and it is the method of using available information to determine the frequency of occurrence and the level of consequences. Risk assessment is done by project team, firm’s risk analyst or in-house specialist and consultants. Project teams are the most commonly used for risk analysis out of the three mentioned (Lyons and Skitmore, 2004:1). Techniques used in risk analysis are dependent on the construction projects, some factors influence the decision on the type of techniques used for the analysis.

Risk assessment or analysis could be put in two groups: qualitative and quantitative. Patterson and Neailey (2002:371) asserted that, after all major risks in project have been identified, it must be followed by risk qualitative assessment which entails further analysis through assessment and estimation of the probability of occurrence and effect of each risk. Quantitative analysis assessment expresses the possible consequences of risk occurring in terms of cost, time, and quality (Oztas and Okmen 2004:230). Quantitative and qualitative risk assessment techniques in use include Monte-Carlo simulation, sensitivity analysis, probability analysis, Decision analysis, Risk management maturity model (RM3), Risk probability and impact assessment.

- **Monte Carlo Technique:** Mun 2006 cited in Gajewska and Ropel (2011: 27) stated that the Monte Carlo method relies on statistics that are used in simulation to ascertain the level of risk in a project. The simulation is applied to estimate, predict and analyze risk by creating diverse scenarios. Smith et al.

(2006: 89) affirmed that this method of assessing risk has been in existence for years and it has turned out to be widely accepted probabilistic risk analysis techniques. This is a computed based technique that works together with model simulation. Monte Carlo method makes use of data from past project to assess risk in a project, Heldman 2005 quoted by Gajewska and Ropel (2011: 27) is of the opinion that the collected data stands for variables of cost and time schedule for each minute activity in a project, and may include pessimistic, most likely and optimistic scenario.

- **Modelling technique - Sensitivity analysis:** Sensitivity analysis is primarily used for ascertaining the greatest risk impact on a project, the established risk events are compared against the objectives of the project. The greater the degree of uncertainty of a specific risk, the higher its sensitivity to the project objectives. Therefore, the most critical risks events which are majorly sensitive require the implementation of effective action. (Heldman 2005 cited in Gajewska and Ropel 2011: 28).
- **Decision analysis:** Flanagan and Norman 1993 cited in Abdou et al. (2004:144) elucidated that decision analysis is a method employed when the decision are taking in an uncertain circumstances that provides solution to risk attitude and exposure. It allows decision makers in the project to make provision for prejudiced thought, risk approach and alternative outcome.
- **Risk Management Maturity Model (RM3):** Risk Management Maturity Model (RM3) as presented by Zou et al. (2010:854) stated five characteristics of management capability which include risk, organizational risk culture, ability to identify risk, capacity to analyze risk and standardized risk management application process.
- **Risk probability and impact assessment:** This method seeks to assess the probability of a particular risk occurrence, here, risk assessment is carried out on the objectives of a project in order to know the positive effect that comes through opportunities and the negative effect that arises through threats. The probabilities of occurrence as well as the effect are evaluated for each risk identified (PMBOK, 2004:251).
- **Probability and Impact matrix:** According to PMBOK (2004:251), Probability and Impact matrix is used to rate in order of priority as regard their possibility of occurrence and effect, and this can be expressed as low, moderate or high priority. Number or other descriptive terms can be used to represent this based on industry preference or choice. Priorities are derived by multiplying impact by probability. The Probability and Impact matrix helps the construction industry to assign the appropriate risk response to each identified risk in the order of priority.

The next stage of risk management process after assessing its impact in a project is Risk allocation. Allocation of risk is all about ownership of risk; it establishes liability in the events of occurrence of a risk. Risks can belong to the owner, contractor or shared by both parties (Lam et al. 2007:485). Unrestricted procurement methods such as relational contracting, partnering have been suggested as possible method for procurement that can guarantee equitable allotment of risks during the construction infrastructure (Klemetti, 2006:50).

Risk response is the last stage of the process, these are measures taken to eliminate, minimize or transfer a risk or its consequence. The risk response process includes planning for the compulsory action to be considered in case a risk event occurs. Different literature recommended diverse response techniques to risks in projects. Wang and Chou (2003:64) identified four: avoidance, reduction, transfer and retention whereas Smith, et al., (2006:92) divided the response techniques into three in which avoidance and reduction were merged together. Lisa Taunbaugh (2005) said that responses of risks can be categorized into mitigation or avoidance and acceptance.

RESEARCH METHODOLOGY

A quantitative research method was utilized for this study. Quantitative method is a formal, objective and step by step process that depicts interaction among variables and use to explore the relationship that exists among them (Burns and Grove 1993:777). Yin (1994) argues that this method use hypothesis and model to examine relationship between different variables. In quantitative method, people's opinion and belief from the data gathered are mostly presented in numerical format for statistical analysis (Amaratunga et.al. 2002:19). Johnson and Onwugbuzie (2004) asserted that quantitative method is characterised with testing of theories, description of occurrences, and mathematical presentation of data.

This study adopted the quantitative method as the most appropriate approach because it supports the processes that was undertaken in carrying out this research work, in this study, research questions and hypotheses were developed and formulated respectively, past literature on construction risk management were critically reviewed, close ended questionnaires were distributed to the respondents which were collected and analyzed using the chi-square in Statistical Package for Social Science (SPSS) and frequency and percentages in the Microsoft excel.

A questionnaire was designed to gather information from construction industry in Swaziland on risk management practices and risk management techniques adopted in their companies. Respondents recorded their responses themselves in spaces provided in the questionnaire according to the instruction given. Close ended question were used and the respondents ticked the category that best described their opinion to the question on risk management practices. The respondents were asked to choose yes, no and not sure on the various question posted at them in the questionnaire and weights of 1, 2 and 3 were assigned respectively to those options.

The targeted population for this research was qualified professionals in the public sector of the Swaziland construction industry which includes Architects, Quantity Surveyors, Civil Engineers, Builders, Project Managers, Electrical Engineers, Health and Safety officers and Mechanical Engineers.

This population were chosen because they were the ones who carry out the construction work in Swaziland and they were in best position to tell the researcher if their organization practices risk management or not. The names and contact details of the construction firms used for the research work were obtained from the ministry of public works. The Swaziland construction industry consists of the indigenous and multinational construction companies, which are registered with the Swaziland Ministry of Public Works. A population of 90 registered construction companies were chosen out of which 74 indigenous and multinational construction companies were randomly selected using stratified random technique to ensure that medium to large scale construction companies are well represented in the selection.

FINDINGS

The following questions were presented to the respondents to find out the various processes, tools and techniques used in carrying out risk management in their organization.

- Does your organization use the following risk management processes in handling risk: risk identification, risk assessment, risk allocation and risk responses?
- When identifying risk in construction projects, what techniques if any does your company use for this process: Documentation review, Brainstorming, Delphi techniques, Interviewing, Expert system, Questionnaire?
- During assessment and analysis of the risk identified to determine the likelihood of the risk occurrence and the degree of its impact on the project objectives, what technique does your companies utilized: Monte Carlo Techniques, Modeling Techniques – Sensitivity Analysis, Decision Analysis, Risk Management Maturity Model (RM3), Risk Probability and impact assessment, Probability and impact matrix?
- What risk response strategies and methods does your company adopt when responding to risk: avoidance, transfer, reduction, retention and acceptance?

Risk Management Processes

Different answers were obtained on the risk management processes the respondent's companies apply in handling risk. Table 1 reveals that among the four processes of handling risk both the indigenous and multinational company spend considerable time to identify risk before its occurrence and assess the likely impact it has on the project while the risk allocation and responses have the lowest percentage

Table 1: Risk management processes

Risk Management Processes	Category	Yes		No		Not Sure	
		F	%	F	%	F	%
Risk Identification	Indigenous	44	86.27	3	5.88	4	7.88
	Multinational	22	95.65	4	5.41	4	5.41
Risk Assessments	Indigenous	39	76.47	9	17.65	3	5.88
	Multinational	22	95.65	1	4.35	0	0.00
Risk Allocation	Indigenous	35	70	11	22	4	8.00
	Multinational	20	86.96	2	8.7	1	4.35
Risk Reponses	Indigenous	31	62	13	26	6	12.00
	Multinational	15	68.18	7	31.82	0	0.00

Code used on Table 1: F= Frequency, % = Percentage.

Risk Identification Techniques

Figure 1 shows that the two dominants risk identification methods used by both the indigenous and multinational company were documentation review and brainstorming. Other methods are not often used in Swaziland construction industry and the most rarely used among these methods is Delphi-technique.

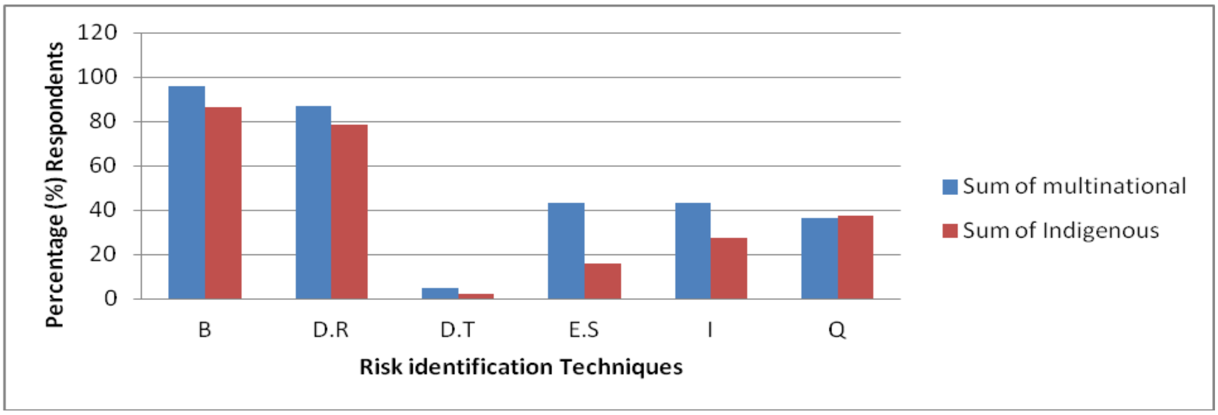


Figure 1: Risk identification techniques. Code Used On Figure 1:B- Brainstorming, D.R – Documentation Review , D.T – Delphi Techniques, E.S – Expert System, I – Interviewing, Q-Questionnaire.

Risk Assessment Techniques

The result obtained from the respondents of the two types of construction company are similar on the techniques their organization employed when assessing and analyzing risk identified to determine the likelihood of the risk occurrence and the degree of its impact on the project objectives. It was found out from the data depicted in Table 2 that these techniques are not mostly used by both the indigenous and multinational companies. The most widely used among them are Decision analysis, Risk management probability method and Probability and impact matrix, despite being the most highly used, the percentage and frequency of use are low. The least and rarely used are Risk management Maturity Model (RM3), Monte Carlo Technique and Modelling Technique-Sensitivity analysis

Risk Response methods

Results received from the respondents on risk response strategies and methods adopted by their companies when responding to risk shows that the indigenous companies use risk transfer majorly as a strategy of responding to risk with the highest percentage of 72.00% while multinational companies use risk reduction with the percentage of 72.73%, the least used strategy adopted to respond to risk by both the indigenous and multinational company is risk retention with 23.4% and 19.05% for local and multinational respectively

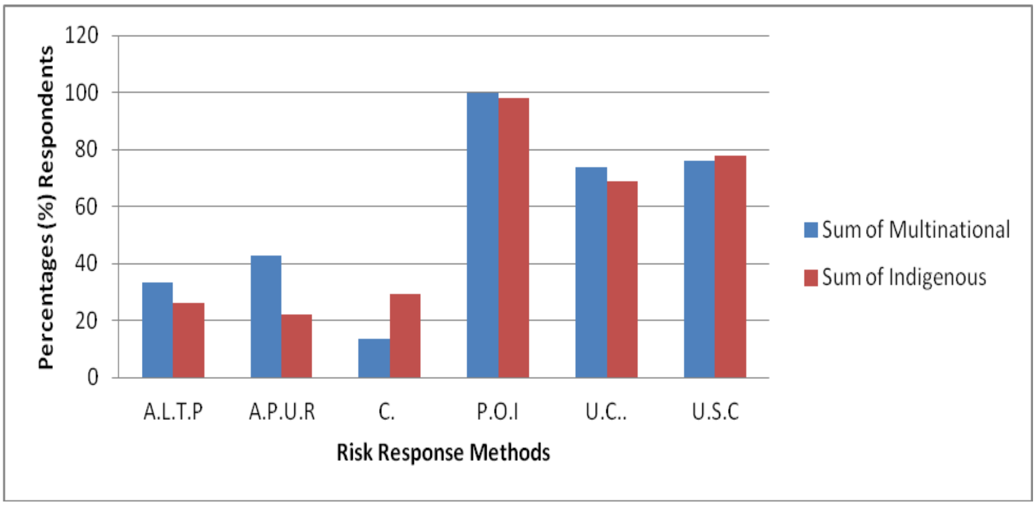


Figure 2 Risk Response methods. Code Used on Figure 2: A.L.T.P- Addition as a lump sum in the preliminary, A.P.U.R – Addition as a percentage to a unit rate, C- Claims, P.O.I – Provision of insurance, U.C – Use of contingency fund, U.S.C – Use of subcontractors.

Table 2: Risk Assessment Techniques

Risk Assessment Techniques	Category	Yes		No		Not Sure	
		F	%	F	%	F	%
Monte Carlo Technique	Indigenous	6	12.00	40	80.00	4	8.00
	Multinational	2	9.09	20	90.91	0	0.00
Modelling Technique	Indigenous	7	13.73	40	78.43	4	7.84
Sensitivity Analysis	Multinational	4	18.18	15	16.18	3	13.64
Decision Analysis	Indigenous	14	27.45	34	66.67	3	5.88
	Multinational	8	36.36	14	63.64	0	0.00
Risk management	Indigenous	1	1.96	46	90.2	4	7.84
Maturity Model (RM3)	Multinational	3	13.04	19	82.61	1	4.35
Risk Management	Indigenous	22	43.14	28	54.9	1	1.96
Probability Method	Multinational	9	39.13	13	56.52	2	4.35
Probability and Impact	Indigenous	21	41.18	27	52.94	3	5.88
Matrix	Multinational	32	43.24	39	52.7	0	0.00

Code used on Table 2, F= Frequency, % = Percentage. .

DISCUSSIONS

Table 1 indicated that risk identification was the highest and the most used risk management process among others by both the indigenous and multinational Swaziland construction companies. This is followed by risk assessment which is used to appraise the impact that the risk would have on the project. The least used among these processes is the risk response followed by risk allocation

It can be seen from the result obtained from the various respondents that these companies spend considerable time to identify risk early that could affect the project in terms of its cost, quality and time. This is so, because risk identification always begin risk management process and it allows inherent risks in construction project to be recognized as early as possible as this will assist the project teams in taking quick and necessary action on the identified risk. Risk identification on a construction project provides opportunity for the construction industry to know the causes, sources and impact that risk could have on the project and once risk is identified it is presumed that it is half solved.

This accord well with the past literature, Baker et al. (1998:567) opined that risk identification is the starting point, and is considered very essential as other phases of the processes depend on it. Johnson (2008:488) stated that risk identification provides interaction among project managers, team and other stakeholders which help them to find out any risk that could arise on the project.

The various identification techniques used by the Swaziland construction industry as presented in Figure 1 are: documentation review, brainstorming, Delphi-Technique, interviewing, expert judgement and questionnaire. It was discovered that both the multinational and indigenous construction industry mostly use brainstorming which has the highest proportion, this is followed by documentation review. The least use among these is Delphi-techniques. It can also be seen that questionnaire, interviewing and expert system are being used but not as much compared to brainstorming and documentation review.

The industry viewed brainstorming as a traditional means of identifying risk in project as it appeared to be the simplest form of risk identification techniques, since this does not require a technical knowhow of sophisticated equipments. It allows project teams to view their opinions on the risk inherent on the ongoing project. The result also revealed that documentation review is widely used because this simply entails making reference to historical data of past similar projects.

The Delphi – Techniques, Interviewing, questionnaire and expert system are rarely used because most of the project team and constructional professionals in Swaziland construction industry are not familiar with them, they are viewed as time consuming, costly and complex to use.

This finding endorsed the past studies carried out by Lyons and Skitmore (2004) as well as Tang et al. (2007) that brainstorming is the most commonly used type of risk identification techniques.

The method chosen through which the two companies under study respond to identified and analyzed risk is mainly provision of insurance which has the highest percentage as reflected in Figure 2.

The result obtained from the respondents on risk assessment techniques that are used to determine the likelihood of risk occurrence and the degree of its impact on construction project objectives as presented and illustrated in Table 2 made it known that probability and impact matrix as well as risk management probability method are the most frequently used risk assessment techniques. Decision analysis ranked next in the usage by both industries and this is followed by modelling technique – sensitivity analysis. The least used risk assessment techniques by the multinational construction industry is Monte-Carlo technique while risk management maturity model is least used by the indigenous counterpart.

As reflected in Table 2, it can be seen that though Decision analysis, probability and impact matrix, risk management probability are the most broadly used, their frequency of use are very low. Generally all the risk assessment techniques are rarely utilized, this is due to the perception of the Swaziland construction project team members and other stakeholders that the benefits of the use of these techniques are not justifiable, and that most construction project are not big enough to deserve the use of these techniques. Another factor responsible for this is the lack of familiarity with the techniques as well as deficiency in the applicability of the techniques and also they are time consuming.

All the aforementioned reasons confirmed the findings of Kim and Bajaj (2000:40), Akintoye and Macleod (1997:36) that these techniques require lots of calculation, expertise knowledge and formal training which are not necessarily needed to achieve the project objectives

The answer provided by the respondents as portrayed on the strategies and methods their organization adopted when responding to risk shows that majority of the indigenous construction companies preferred transfer of risk to other strategies while the multinational companies mostly make use of risk reduction as their own strategies. Risk avoidance is chosen by both industries as the next strategy they employed when responding to risk and the least use strategy is risk retention

This result shows that the indigenous construction companies principally shift the responsibility of managing risk to other parties. This in essence makes other party to whom the risks are transferred to become accountable for the management of such risk. This finding agrees with the assertion presented in PMBOK (2004:262) that risk can be transferred by moving the adverse effect of a threat and its required response to a third party. Transference of risk is done through certain means which includes insurance, bond, guarantee, warranties, contractual shifting among others. According to Perera et al. (2008:25), practically construction risks are transferred via three methods which are insurance, subcontracting and modification of contract condition and among these insurance is the most frequently used form of risk transfer. The study also reveals that respondents from the indigenous companies are not too versatile with the strategies deployed in responding to risk, this is more reason why majority of them believed that risk should be transferred.

The finding also discloses that the multinational construction companies predominantly make use of risk reduction strategy as a way of reducing the likelihood or consequences of a risk event. They adopt this method because they are well equipped with the knowledgeable and experienced expertise who can sufficiently handle risk by reducing the impact of its occurrence on the construction projects. According to Akintoye and Macleod (1997:34), risk reduction entails the use of different strategies that includes project redesign, exploit of various contract approach, diverse construction methods, in-depth and comprehensive site investigation to reduce the possibility of risk occurrence and its negative effect on construction work. This finding also confirm, suggested methods of reducing risk given by (Steyn et al. 2011:351).

Furthermore, the result as depicted in Figure 2 illustrated that among the different methods of responding to identified and analysed risk such as: addition as a lump sum in the preliminary, addition as a percentage to a unit rate, claims, provision of insurance, use of contingency funds and use of subcontractors, the provision of insurance ranked highest as the method adopted by both the indigenous and multinational industries in dealing with risk. This is so because provision of insurance provides the principal method of managing risk, since construction works are complex in nature and has a high degree of exposure to risk which have adverse effects on the industries. Swaziland construction industry in addition opt for provision of insurance because it helps in transferring risk management from various parties in the construction industry to insurers to provide recovery of loss which could be in form of money, properties and others, in the event of risk occurrence. This finding aligns with the comment on Joint Building Contract committee (JBCC) by Finsen (2010:92) that any construction project that is not properly insured could result in liquidation of such construction industry. To avert this adverse situation in the construction industry, Odeyinka cited in Perera et al.(2008:25) stated that insurance serves as a key method of construction risk transfer in Nigeria and this confirm the finding of this research that Swaziland construction industry adopt insurance as their main method of risk management.

Testing of hypothesis

H0: There is no significant difference between the risk identification and assessment techniques used by various construction companies.

H1: There is significant difference between the risk identification and assessment techniques used by various construction companies.

A 2 cells (16.7%) have expected count less than 5. The minimum expected count is 72

The table above shows that the computed chi square of 4.354 is less than the critical value at alpha = 0.05, so we do not have enough evidence to reject the null hypothesis. We therefore accept the null hypothesis which means there is no significant difference in the risk identification method and the type of Construction industry. There is strong evidence that there is no significant difference between the risk assessments used by either local or multinational industry.

Table 3 Chi-Square Tests

	Value	df	Asymp.Sig.(2- sided)
Pearson Chi Square	4.354[a]	5	0.500
Likelihood Ratio	4.217	5	0.519
Linear-by-Linear Association	0.459	1	0.498
N of Valid Cases	197		

CONCLUSION

This study has been able to evaluate successfully, the risk management practices and the risk management techniques employed in the Swaziland construction industry.

Different research techniques and strategies have been employed in collecting and analyzing data in order to achieve the objectives of this study. Questionnaires were distributed to various indigenous and multinational construction companies in Swaziland for collecting data.

It was found out that among the different technique used in identifying risk in Swaziland construction industry were brainstorming, documentation review, Delphi-technique, expert system and interviewing. The risk assessment technique employed also in the industry to determine the impact of risk on project objectives included Monte Carlo technique, modelling technique-sensitivity analysis, decision analysis, risks management maturity model (RM3), risk management probability method and probability and impact matrix method.

The result of this study showed there is no significant difference between the risk identification/assessment methods used by the multinational/indigenous industry. The following conclusions were deduced based on the findings:

- The risk identification techniques mostly used by both the indigenous and multinational industries are brainstorming and documentation review.
- Probability and impact matrix, decision analysis and risk management probability method are the most widely used risk assessment techniques.

The following recommendations are made by the researcher:

- Proactive measure in risk management should be inculcated early enough into project life cycle in order to mitigate risk.
- Training sections on risk management should be organized from time to time and participation mandated for the construction industry stakeholders, this will assist in creating better awareness among stakeholders in the industry.
- Risk management software that can be easily used at every phase of a construction project should be developed and made readily available.

REFERENCES

Abassi, G. Y., Abdel-Jaber, M. S. and Abu-Khajedart, A. 2005. Risk Analysis for the Major Factors Affecting the Construction Industry in Jordan, Emirate Journal of Engineering Research. 10, 41-47.

Akintoye, A. S., and Macleod, A. J. (1997), Risk Analysis and Management in Construction, International Journal of Project Management, 15, 31-38.

Amaratunga, D., Baldry, D., Sarshar, M. and Newton, R. 2002. Quantitative and Qualitative Research in the Built Environment: Application of “Mixed” research approach, Work Study. 51(1), 17-31.

Baker, S., Ponniah, D. and Smith, S. (1998), Techniques for The Analysis of Risk in Major Projects, Journal of The Operational research Society, 49, 567-572.

Burns, N and Groove S. K. (1993). The Practice of Nursing Research – Conduct, Critique and Utilization (2nd Edition), Philadelphia : W.B Saunders.

Central Bank of Swaziland. 2008. Annual Report April 2007- March 2008. Mbabane.

Cooper, D., Grey, S., Raymond, G and Walker, P. 2005. Managing Risks in Large projects and Complex Procurement, Chichester, John Willey and Sons Ltd.

Creedy, G. D. (2005), Risk factors Leading to Cost Overrun in the Delivery of Highway Construction Projects, Queensland University of Technology.

Gajewska, E and Repel, M. 2011. Risk Management Practices in Construction Project – A case Study. Master of Science Thesis, Chalmers of Technology, Goteborg, Sweden.

Garrido, M. C., Ruotolo, M. T. A, Ribeiro, F. M. L. and Naked, H. A. 2011. Risk Identification Techniques Knowledge and Application in the Brazillian Contruction, Journal of Civil Engineering and Construction Technology, 2(11), 242-252.

Getachew, T. 2009. Design Risk Management in Ethiopian Federal Road Projects. Master of Science Thesis, Addis Ababa University, Ethiopia.

Johnson, R. B. and Onwuegbuzie, A. J. (2004) Mixed Method Research: A Research Paradigm Whose Time has Come. Educational Researcher, 33(7), 14-26.

Kartam, N. A and Kartam, S. A. 2001. Risk and management in the Kuwait Construction Industry. International Journal of Project Management 19(6), 5-33.

Kim, S. and Bajaaj, D. 2000. Risk Management in Construction: An Approach for Contractors in South Korea, Cost Engineering, 42, 39-44.

Klemetti, A. 2006. Design Risk Management in Construction Project Network, Laboratory of Industrial Management, Helsinki University of Technology.

Lam, K. C., Wang, D., Lee, P. T. K. and Tsang, Y. 2007. Modelling Risk Allocation Decision in Construction Contracts, International Journal of Project Management, 25, 485-293.

Lisa Turnbough P.E 2005. Risk Management on large Capital Projects, Journal of Professional Issues in Engineering and Practices, 365-374.

Lyon, T. and Skitmore, M. (2004), Project Risk Management in Queensland Engineering Construction Industry: A survey, International Journal of Project Management, 22(1), 51-61.

Mills, A. 2001. A Sysetmatic Approach to Risk Management for Construction, Structural Survey, 19(5), 245-252.

Osipova , E. (2008), Risk Management in Construction Project: A Competitive Study of the Different Procurements Option in Sweden, Phd, Licentiate Thesis , Lulea University of Technology.

Oztas, A., and Okmen, O. (2004), Risk Analysis in Fixed Price Design-Build Construction Projects, Built and Environment 39, 229-237.

Patterson, F. D and Neailey, K. 2002. A Risk Register Database System to aid The Management of Project Risk, International Journal of Project Management, 20, 365-374

Perera, B. A. K. S., Dhanasinghe, I. and Ramdeezdeen, R. (2009), Risk Management in Road Construction: The case of Sri Lanka, International Journal of Strategic Property Management, 13(2), 87-102)

PMI (2004), Guide to Project Management Body Knowledge (PMBOK), 3rd Edition, Project Management Institute, Newton Square, PA, USA.

Smith, N. J., Merna, T and Jobling, P. 2006. Managing Risk in Construction Projects. Oxford: Blackwell Science Ltd.

Steyn, H., Basson, G., Carrutters, M., Plessis, D., Krugger, D., Piennar, J., Kuschke, B. P., ECK, S. V. and Visser, K. 2011. Project Management A Multi Disciplinary Approach, Pretoria, FPM Publishing Finsen (2010:92

Tang, W., Qianq, M., Duffield, C. F., Young, D., M., and Lu, Y. (2007), Risk Management in the Chinese Construction Industry, Journal of Construction Engineering and Management, 133(2), 994-958.

Wang, S. Q., Dulaimi, M. F., and Aguria, M. Y. 2004. Risk Management Framework for Construction Projects in Developing Countries, Construction Management and Economics, Taylor and Francis Journals, 22(3), 237-252.

Yin, R. (1994). Case Study Research: Design and Methods (2nd Editions). Thousand Oaks, CA: Sage Publishing.

Yusuwan, N.M., Adnan, H., Omar, A. F. and Jusoff, H. K. 2008. Cleints ' Perspectives of Risk Management Practice in Malaysian Construction Industry. Journal of Politics and Law, 1(3), 121-130.

Zou, P. X. W., Chen, Y and Chan, T. 2010. Understanding and Improving your Risk Management Capability, Assessment Model for Construction Organization, Journal of Construction Engineering and Managemenr, 136(8), 854-863.

TOWARD SUSTAINABLE DEVELOPMENT: ALTERNATIVES FOR AFFORDABLE HOUSING DELIVERY IN DEVELOPING COUNTRIES

Yakubu Michael Zaki[1], Yakubu Gimson Musa-Haddy, James Jatau and Suraj Abdullahi 3

1, Department of Quantity Surveying, Ahmadu Bello University, Zaria, Nigeria.
2, Department of Quantity Surveying, Kaduna State University, Kaduna, Nigeria.
3, Department of Quantity Surveying, Federal Polytechnic Kaura Namoda, Zamfara, Nigeria.

Housing is one of the most basic of human needs. Provision of houses through the creation of mortgages is taken for granted in developed countries; however, it remains a major challenge in developing countries, especially in sub-Saharan Africa. Governments in most developing countries like Nigeria have made several housing policy intiatives that made no impact on the housing problems, which has been said to be numerous. One of the major housing policy initiatives in Nigeria was the Policy on Affordable Housing that was initiated in 1979 by the Shehu Shagari Administration. The policy though laudable was unable to meet the nation's housing needs because it was based on the unsustainable tenet that houses will be provided by government (this remains the anomaly that needs to resolve till today). This study thus sought toinvestigate stakeholders' perception on the advantages of modern construction technologies. 150 questionnaires were administered to end-users, consultants and developers in four cities in Nigeria. 138 were received and analyzed through the use of descriptive, percentages and inferential statistical tools. Respondents were requested to express their agreement or otherwise in some issues raised from literature on sustainability and affordable housing. It was found that the existing challenges hindering affordable housing vis-a-viz Sustainable Development will give way if sustainable and appropriete technological innovations aare employed . It recommends the adoption of modern construction technology techniques that offer new innovative approach to housing delivery for sustainable Development.

Keywords: affordable housing, sustainable development, modern construction technology, developing countries, Nigeria.

INTRODUCTION

There have been worldwide outcry for sustainability in almost every field of endeavour today; Sustainable energy, sustainable procurement method(s) in Construction, housing delivery and so on, Jatau (2012) . There have been various worldwide Summits held on the issue of sustainability such as the United Nations Earth Summit held at Rio de Janeiro in 1992 and 2012, which gave rise to the adoption of the Agenda 21 by governments, however, since the Rio de Janeiro Summit in June 1992, many countries have embarked on various environmental reform agenda to attain the sustainability mark. It is partinent to note that the concept

[1] yakuzaki2@yahoo.com

Zaki *et al.* (2014) Toward Sustainable Development: Alternatives for Affordable Housing Delivery in Developing Countries *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference*, 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 579-577.

of sustainability has always been with man in his various attempts or endeavour for sustenance through time, even though the rising scope and dire need for sustainability of human development came to the fore by the late 20th century. One major concept that came-up of all these was that of Sustainable Development (SD) or ‘development that re-creates itself’. The Brundtland commission’s report of ‘our common future’ defines SD and succinctly paraphrased it as “...meeting the needs of present generation without jeopardizing the ability of future generation to meet their needs” (as cited in WCED, 1987; Yang, 2012).

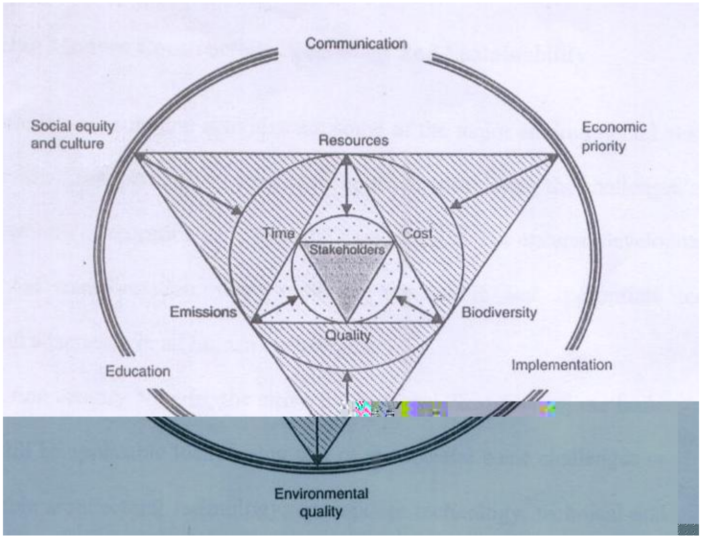
According to Munasinghe (1992) in his attempt at clearly illustrating SD evolved sustainomics concept which describes sustainable development as “a process for improving the range of opportunities that will enable individual human beings and communalities to achieve their aspirations and full potential over a sustained period of time, while maintaining the resilience of economic, social and environmental systems.” Sustainomics approach to development proposes a more focused and practical system base on individual/communities interest and well being as central in ensuring sustainable development. This takes us beyond the traditional concept of ‘development’ and ‘growth’ by introducing the heuristic element that underlies the need for continuous adaptation and rethinking of the framework.

The concept of sustainable development (SD) focused attention on finding strategies to promote economic and social advancement in ways that avoid environmental degradation, over-exploitation or pollution, and sidelined less productive debates about whether to prioritize development or the environment. Central issue in SD of infrastructures and aminities is the challenge of affordable housing. Housing is what provides humanity with a physical environment for living. As a phenomenon of its own everyone needs it, many desire and demand it but only a few study, design, develop, afford, and actually acquire sufficient of it. Also important to note is the fact that housing is demanded, produced, acquired and consumed under an environment of several constraints. These constraints according to Musa-Haddary (2011), could be economic, social legal, political or environmental. Affordability forms part of these constraints, it is a constraint of ineffective demand caused by poverty (lack, or insufficient resources). He further said that “affordability is a major problem in housing delivery the world over because of the fact that ‘the cost of buildings is much higher than the ability of users to pay for them.”

Unfortunately, human knowledge of the process of housing has not translated much to its acquisition nor ownership. The scourge of poverty is the greatest challenge threatening the human race and housing is poverty’s largest beacon. Housing is an intractable problem for poor income nations; but it is even more so for poor income households (and arm-chair researchers as well). Nations, and even experts, may differ in their understanding of the nature and severity of their housing problems, nevertheless, one thing is certain, the resources for housing are becoming too thinly stretched for individuals, groups and nations that the advocates of lean thinking sound very convincing to even the extravagant.

This challenged is best thrown to a gathering of the built environment professionals that are kin to having their contributing to the development of their habitat without endangering the environment, (Ofori, 2002). To ensure a specific contribution to the innovative ideas for affordable housing delivery in developing countries. Thus, this paper main purpose is to highlight the advantages of sustainable construction technology techniques that offer new innovative approach to housing delivery, which are adaptable in developing Countries such as Nigeria for sustainable Development.

In establishing the sustainability and affordability concept all stakeholders; social equity, economic priority and environmental quality must be clearly defined and pursued. (figure 1).



Source: Adapted from Yang (2012)

Figure 1: An integrated approach to developing sustainable projects

Also important to note is the key sustainable issues which must be addressed in establishing sustainability and affordability. These key issues always bring to fore the need for a new model of development, Urbanisation and rural i.e. the consolidation of urban growth with the reciprocal effect on rural areas and development, Sustainability in housing which concerns both formal and informal housing provision as well as regulation of policies that provide housing, these key issues are shown in table 1 below:

Table 1: ***Key Sustainability Issues***

Amenities and recreation	Landscape and Visual Aspects
Biodiversity	Land Use
Climate Change	Material Use
Community	Pollution and Nuisance
Crime and Security	Shareholder and customer relations
Cultural Heritage	Social Inclusion and accessibility
Drainage and Flooding	Stakeholder engagement
Energy	Training and Development
Geology and Soils	Travel and Transport
Health, Safety and well-being	Waste
Human rights and Ethics	Water Use

Source: Student Construction Journal (2010)

CONCEPTUALIZING MODERN CONSTRUCTION TECHNOLOGY AND SUSTAINABILITY

In modem societies, construction activities are some of the major environmental challenges that we are faced with; this is particularly even more apposite considering the challenges of economic meltdown, downturn or recession as is now the case globally. For ensured development that can lead to transformation, there must be sustainable and appropriate technological innovations and adaptation in all human endeavours. Adebayo (2002) posited that for sustainable construction to be achieved it must be hinged on the three pillars of sustainability as shown in the table 2 below:

Table 2: Key impacts of construction

Social	Environmental	Economic
Provides basic shelter	Accounts for half of all energy use	Employs 110 million people
Provides cultural spaces	Responsible for 40% of resource use	Accounts for 70% of all man-made wealth
Creates the basis for social and manufacturing capital	Responsible for land use	Between 8 and 10% of GDP

(Source:ARCOM 2009).

CHARACTERISTICS OF SUSTAINABLE TECHNOLOGIES

New technologies create a paradigm change towards establishing new job profiles thus creating new employment opportunities. In fact herein contemporary technology requirements are reset based on the realities intrinsic in the society. For instance the current Nigeria's National Transformation Agenda identifies lack of continuity, consistency and commitment including absence of long-term development plan by successive government as having culminating effects on the country's development. The consequences' of these on the society have been economic growth without improvement in citizens' welfare hence widespread unemployment, inequality and poverty, Qurix (2012); and poor housing delivery policies leading to unaffordability of the commodity, Musa-Haddary (2011). Table 3 presents a useful framework for analysing the technologies, materials etc, which can help in evaluating inputs in construction industries of developing countries.

Table 3: Characteristics of sustainable technologies

Aspect	Remarks
Low environment impact	Very low benign emissions to the environment in production use or disposal No toxic releases, benefits environment indirectly through its efficiency
Resource efficiency	Efficient utilisation of material resources, often using recycled material Based on renewable resources and energy (or minimal use of non renewable resources) Efficient consumption of energy in production and use Durable, reusable and/or recyclable
Economic advantages	Economically cost-effective compared to conventional product or service Incorporate externalities in market price Can be financed by the user through various financialsaving streams Improve productivity or competitiveness of industry and commerce Enhance or maintain living standards or quality of life Reality available and accessible by all classes and cultures
Social advantages	Consistent with themes of decentralisation, indivitual control, democracy

Source: International Institute for Sustainable Development.

AFFORDABLE HOUSING

Because housing is a heterogeneous phenomenon defining any aspect of it must be viewed within an appropriate context. The Encarta (2010) dictionary meaning of affordable housing is that it is a "low-income housing subsidized housing for people on lower incomes in which rent or mortgage costs do not exceed a specific percentage usually 30 percent of the gross annual household income". This definition ran the risk of stigmatizing both the affordable housing product and its process. 'Low income' may be misconstrued as being low quality housing. 'subsidized' too makes it appears as housing being paid for, at least partially, by someone else for whoever wants to use it. These definitional shortcoming can be avoided, affordable housing is viewed as simply housing that is within a household capability (HUD, 2004), or even better as "that range of house for which the total monthly repayment costs fall within the monthly capability of the average household in that income group" (Idoro, 2007).

The fundamental problem in housing consumption is its inadequacy. The right to adequate housing is universally guaranteed by the united Nation under charter 25. The charter confers on housing consumers the right to adequate housing which it defined as "housing that is decent, available accessible, safe and affordable" (Musa-Haddary, 2011).

Housing which does not satisfy any of these parameters can be regarded as inadequate housing (Adeyemi, 2000). For housing to be adequate it has to be affordable not to those who supply it or to the government (Musa-Haddary, 2011), that is concerned with its development, but rather, to the end users who eventually pay for and enjoy its services. Meeting all the parameters poses a great challenge to the stakeholders in the housing arena. Because extra cost is required in satisfying these parameters "the gulf between the need for and cost of housing is matched only by a growing inability to meet such need" (Ojo, 2009).

This gully can only be reduced if radically new concepts and non-conventional solutions are discovered (Adeyemi, 2007). Such solutions should enable households to consume adequate housing that they are able to conveniently pay for (Ajator, 2004).

MODEM METHODS OF CONSTRUCTION (MMC).

Modem Methods of Construction (MMC) are defined as those which provide an efficient product management processes to provide more products of better quality in less time. It has been defined in various ways: prefabrication, offsite production and off-site manufacturing (OSM). In OSM part of the production process that is carried out away from building site in factory conditions that can be further classified to involve, Panel building system, Volumetric (modular) construction, hybrid (semi volumetric) and sub-assemblies and components. For Non-off site manufacture there are basically two types, Tunnel form and Thin-joint Masonry.

Other significant areas include carpet reinforcement and load bearing faced systems through to process and schedule improvements, such as metal shutters, core jump systems, double jumping cores, edge protection systems, service wall and light weight facades.These systems of building construction are explained below as: moladi, modular and hydraform technologies.

As is variously averred "... nothing is permanent except change..."; frontier engineering sciences increasingly breed innovations. These innovations are driven and amplified by globalization, closed loop resource utilization, transformation of technological potentials, environmental and demographic challenges.

Essentially the drivers towards modem methods of construction generally are;

- Government and professional bodies' **policy contextualization**.
- Construction industry **available skills** and training by the **technological institutions**.
- **Housing quality** for a healthy environment and excellent liveability.

While the barriers that must be overcome towards a technologically innovative construction industry amongst others includes;

- Cost factor management.
- Demand status.
- Rate of projects delivery that are feasible.
- Design Considerations'
- Tenders and Insurers (as adapted from Burnwood and Jess, 2005)

Contemporary global construction technologies are varied and are uniquely applicable for attainment of sustainable development under the various socio-cultural, economic and environmental realities of each people and theft society at large.

Environmental Preoccupations

The natural and built environment is greatly influence by the nature and type of technology adapted in the human development activities. For Nigeria's current development strides to be sustainable, the contemporary technological innovations must be proactive and need base. Examples of useful technological innovations available in the real estate sector (construction industry) amongst others include;

The Moladi Technology

Here the system involves erection of plastic form works, on the plan line after laying the raft foundation. Mortar is then pumped inside the form works and left to dry for 15 hours after which the form works are dismantled and removed leaving a solid wall smooth on both sides. The Moladi Technology system was borne, out of the need to reduce the cost of building houses, thereby, making ownership of homes easily accessible by the low income earners. In addition to cost benefit, the technology also ensured **better quality**, with such **timely delivery** that ridiculed the conventional system of building, Qurix (2012). Botes (2012) also explained that other considerations such as fire resistance, heat absorption and burglary were already taken care of by the technology. Furthermore it reduces the cost of building homes as well as creates jobs for youths who did not have the privilege of becoming graduates.

The Modular System

According to Uroko(2010) Modular System promotes building mass housing which brings building cost down by 30% and speed up construction by 50%. It is usually of high quality concrete finish, produced to accurate tolerance and verticality. the superior (machine) tolerance of the finish means no further plastering is required. The panels are light weight and construction skills and technology can be easily learned through training; hence the need for built environment training institutions to identify these technologies and adapt their training of personnel accordingly. For Nigeria to be set for any meaningful development there must be a transformation of the housing provision in the country towards provision of liveable habitations.

The Hydraform Technology

Hydraform specializes in using soil cement Compressed Earth Block (CEB) technology to produce interlocking dry stacked Soil Cement Blocks (SCBs). The areas of global focus of Hydraform team has made possible the construction of houses, schools, universities, community projects, factories, mosques and churches by NGOs, United Nations Aid (UNAID) agencies, property developers, business people and entrepreneurs across the world. Environmentally Hydraform wide itselves on creating

and utilizing eco-friendly building systems with low embodied energy. These green systems are cost-effective, labour-intensive, fast to use and equally ideal for both remote rural areas aid high-density urban areas.
Considering the various problems facing Africa as a developing continent, Adebayo (2002), suggested that for sustainable construction to take place there has to be an understanding of the political, economic, social and developmental issues of a place, making it clear that sustainable construction is an integral part of sustainable development.

THEORETICAL FRAMEWORK OF THE STUDY

This study, which aims at promoting housing affordability, is premised on the synthesis of two separate concepts of affordability and sustainability, thus seeks to investigate perceptions held in the environment of research regarding the problems of housing affordability.The subject of perception in literature often refers to the way an object or issue or personality appears in the eyes of the beholder. Perception is the way man gives interpretations to sensory stimuli, Hodgets, (1984) .
The perception of an object depends on the object, the beholder and the environment (Wilson and Hanna, 1990; Robbins, 1998). Some factors often combine to determine how an issue or object is perceived and those factors include the experience of the beholder, the expectation of the beholder, and the environment or context of the situation, and the object itself. As a consequence, no two perceptions can be same. Perceptions can be subjective and individualistic impressions formed over time; yet man's decisions and reactions on issues is a function of perception. Some authors have opined or hinted that perceptions influence decision making (Prapatpaow and Ogunlana, 2002).

METHODOLOGY

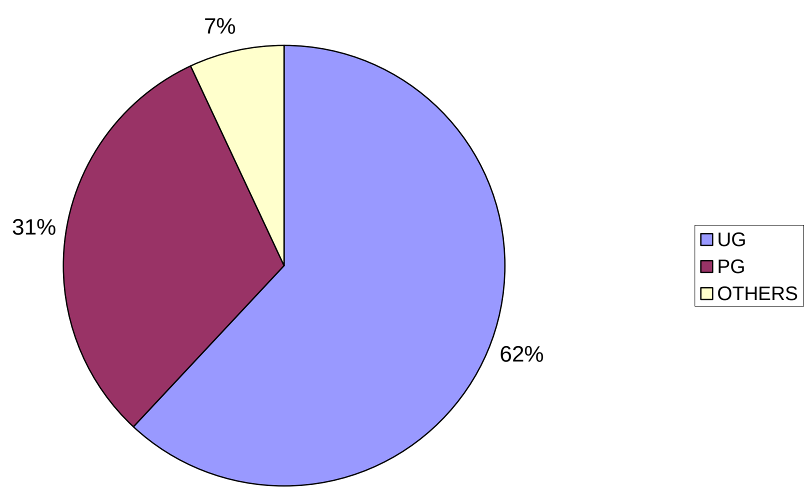


Fig. 2: Pie-chart showing category of respondents

The study carried out in-depth literature review on the theory and practice of contemporary global MMC technology contractual and cost benefit analysis among other variables were used. Interviews, consultations with key stakeholders were conducted and structured questionnaire was used to sort information from the stakeholders comprised of End-users; Professional in the Construction Industry (Consultants) and Developers, to assess their various perceptions on the research problem. This was done to ascertain the corporate understanding of the research problem and what should be done to solve it.

The respondents were three categories End-users 62%, Professionals 31% and Developers 7% as shown in figure 2. A total of 150 questionnaires were distributed to the respondents in capital cities of Kaduna, Kano, Gombe states and Federal Capital Territory Abuja. A total of 138 questionnaires were returned correctly filled.

RESULTS AND DISCUSIONS

A list of options was given which were derived from the outcome of the research by Plessis *et al* (2001) and the respondents were required to select three options which they deemed fit to achieve sustainability. This result may be seen in Table 3 below which gives further a clearer depiction of the outcome.

Table:4 Methods of delivering sustainable construction

OPTION	PERCENTAGE(%)
Introducing sustainability into university syllabus for construction disciplines	14.7%
Innovation in building materials (finding alternatives to regular construction materials)	16.8%
Modernizing Traditional methods of construction	7.4%
Patronizing local suppliers and manufacturers	6.3%
Stricter enforcement of government policies	16.8%
Higher standards of planning and building regulartions	10.5%
Higher taxation/business rates on inefficient buildings	6.3%
Incentives/grants/tax allowances to encourage renewable energy sources	6.3%
Establish new procurement route which support sustainability	10.5%
Improve supply chain management	4.2%

Table 4 depicted that about fifteen percent (14.7%) of the respondents suggest the introduction of sustainability into university syllabus for construction disciplines, about seventeen percent (16.8%) of the respondents suggest innovation in the area of building material which may act as alternatives to regular construction materials, about seven percent (7.4%) of respondents suggest that modernising traditional methods of construction may be a suitable method of delivering sustainable construction, about six percent (6.3%) of the respondents suggest that patronage of local suppliers and manufacturers will be a suitable method of delivering sustainable construction, about seventeen percent (16.8%) of the respondents suggest that stricter enforcement of government policies could deliver sustainable construction, about eleven percent (10.5%) of the respondents suggest that higher standards of planning and building regulations could be a method of delivering sustainable construction, about six percent (6.3%) of the respondents suggest that higher taxation rates on inefficient buildings may be a suitable approach to achieving sustainable construction, about another seven percent (6.3%) of the respondents suggest that the provision of incentives, grants or tax allowances to encourage renewable energy sources can be a method of attaining sustainable construction, about eleven percent (10.5%) of the respondents suggest that the establishment of a new procurement route which support sustainability will be a method of achieving sustainable construction and about four percent (4.2%) of the respondents suggest that an improvement in supply chain management may be a method of delivering sustainable construction to the Nigerian construction Industry.

Table 5: Factors Hindering Affordability of Housing

Factors	Strongly agreed	Agreed	Not agreed	St
Land Administration	73.4%	26.6%	00.0%	
Registering property	82.1%	17.9%	00.0%	
Stable macroeconomy	80.0%	20.0%	00.0%	
Lack of capacity	94.7%	5.3%	00.0%	
Taxes	69.3%	30.0%	00.7%	
Enforcing contracts	49.6%	50.4%	00.0%	
High cost of building materials	97.6%	2.4%	00.0%	
Non proactive Procurement methods	88.7%	11.3%	00.0%	
Cost factor management	91.3%	8.7%	00.0%	
Demand status	00.0%	9.6%	90.4%	
Design considerations	49.0%	51.0%	00.0%	

Table 5 presents respondents responses on the parameters Strongly agreed, agreed and not-agreed. About 73 percent (73.4%) indicated strongly agreed and about 27 percent (26.6%) indicated agreed, while non disagreed on the issue of land administration being a hinderance to affordable housing, for instance, Land Use Act of 1978 which vests all land in the government is an obstacle to making land available for housing development. Developing Countries should therefore, amend Land Use Act to make land transactions easier and make land available for all who want to genuinely invest in their countries. About 82 percent (82.1%) indicated strongly agreed and about 18 percent (17.9%) indicated agreed, while non disagreed on the issue of registering property. 80 percent (80.0%) indicated strongly agreed and 20 percent (20.0%) indicated agreed, while non disagreed on the issue of stable macro-economy, this signal a serious problem because a stable macroeconomic environment is necessary to providing affordable housing. About 95 percent (94.7%) indicated strongly agreed and about 5 percent (5.3%) indicated agreed, while non disagreed on the issue of lack of capacity showing that there is a shortage of skilled manpower that can take the mortgage industry to the next level. About 69 percent (69.3%) indicated strongly agreed and about 30 percent (30.0%) indicated agreed, while about 1 percent (0.7%) disagreed on the issue of taxes but it is obvious that one of the greatest barriers to large-scale provision of affordable housing is the tax burden. The
imposition of value added tax (VAT) at various levels of the housing-development process adds
significant costs as much as 35 percent to the cost of a house, even before titling fees and stamp duties are taken into consideration. About 50 percent (49.5%) indicated strongly agreed and about 50 percent (50.4%) indicated agreed, while non disagreed on the issue of enforcing contracts, this confirms the ascertion according to the Doing Business in 2007 report, that there are 23 procedures taking an average of 457 days and account for 27 percent of the claims to be received in enforcing

contracts in Nigeria. The absence of a foreclosure law has been cited by some investors and local banks as the reason for not investing in the housing sector. Though the incidence of foreclosure in most countries (especially with regard to low-and middle-income families) is generally quite low.

About 98 percent (97.6%) indicated strongly agreed and about 27 percent (2.4%) indicated agreed, while non disagreed on the issue of high cost of building materials, while About 89 percent (88.7%) indicated strongly agreed and about 11 percent (11.3%) indicated agreed, while non disagreed on the issue of non proactive procurement methods. Also About 91 percent (91.3%) indicated strongly agreed and about 9 percent (8.7%) indicated agreed, while non disagreed on the issue of cost factor management.

Interestingly, on the issue of demand status non of the respondents indicated strongly agreed, about 10 percent (9.6%) indicated agreed while about 90 percent (90.4%) disagreed. This an indication that respondents believe there is a big market in Nigeria for housing. 49 percent (49.0%) indicated strongly agreed and about 51 percent (51.0%) indicated agreed, while non disagreed on the issue of design consideration. In this case respondents believe design consideration is afactor hindering affordability of housing.

Table 6: Respondents preference of modern construction technology in provision of housing

Description	No	%
Proficient facility delivery	23	17
Proficiency in facility management	30	22
Provision of Quality/mass Housing	27	19
Low cost of housing	58	42

Table 6 presents respondents preference of Modern construction technology in provi

housing, 17 percent have the perception that MMC technology offers procient faci 22 percent of the respondents indicated that MMC offers proficiency in facility mma goes further to suggest the ability of MMC in supporting sustainable housing delivr indicated that MMC provide quality housing and in mass quantity in less time comp of conventional methods and 42 percent of the respondents believe that MMC will c of housing.

CONCLUSION

The literature reviewed showed that there is the need for alternative technologies t by developing countries in the provision of affordable housing. To ensure susta factors hindering its achievement must be eliminated. The results showed these fac others as perceived by the stakeholders as;

1) High cost of building materials having 98% and 2% strongly agreed respectively
2) Lack of capacity 95% and 5% strongly agreed and agreed respectively
3) Cost factor management, 91% and 9% strongly agreed and agreed respective

4) Non proactive procurement methods 89% and 11% strongly agreed and agreed respectively

5) Registration of property 82% and 18% strongly agreed and agreed respectively

6) Stable macroeconomic environment 80% and 20% strongly agreed and agreed respectively

7) Land administration 73% and 27% strongly agreed and agreed respectively.

Therefore, inorder to achieve sustainable development in providing affordable housing government and developers of the housing products must factor out these hinderances by replicating them with policies that encourage new innovative ideas in the supply chain in housing delivery systems.Thus it is save to conclude that by the perception of the stakeholders it is confirmed that latest technolgies if adopted and put to proper use will make ownership of housing affordable. Hence this study recommend that;

1) Developing countries should adopt modern methods of construction technologies and in earnest implement their use.

2) Governments should establish viable housing finance infrastructure and making use of creative financing instruments that enable families buy these houses

3) A moladi school for training skill workforce (for skill capacity) should be open

4) A high powered commitee should be inaugurated to check and ensure that the products are acquired by the targeted group and not high jacked by rich in the society.

REFERENCES

Adebayo .A (2002) Sustainable Construction in Africa: Agenda 21 for Sustainable Construction in Developing Countries. Africa Position Paper.

Ajator, U. (2004). “Value Management and Buildability Assessment As Indispensable Tools for Efficient, Cost Effective Building Production” The Quantity Surveyor Journal of the Nigeria Institute of Quantity Surveyor Vol.48, July – Sept. pg. 2-9.

Association of Researchers for Construction Management (ARCOM) Sustainability in the Built Environment. Doctoral Research workshop. Rolle Building 201 and 202, University of Plymouth, 16 November 2009

Bala, K. (2000). The professionals’ perception of successful project management parameters. Unpublished PhD Thesis Submitted to Department of Building, A.B.U Zaria.

Botes Hennie (20W). New Building Technology Arrives in Nigeria. The Punch Newspaper, Monday, March 8, 2010. Retrieved on 25 October, 2012 from http://propergatepk.com/News/n..Jmi1ding-technology-arrives-in-nigeria.html

BREEAM (Building Research Establishment Environmental Assessment Method). www.products.bre.co.uk/breeam/index.html. Accessed on 20th June 2010.

Burnwood Simon and Jess Paul (2005). Modern Methods of Construction: Evolution or Revolution. A BURA steering and Development Forum Report.

Carillion (2007) Sustainability at the University of the West of England. A presentation at the University of the West of England. University resources.

Chartered Institute of Builders (CIOB). http://www.ciob.org.uk

Chartered Institute of Architects (CIAT) Sustainability Policy. Available at ttp://www.ciat.org.uk/en/the_institute/Regulations/Institute_policies/sustainability_policy.cfm sourced on October 25th 2010.

Dania, A. et al (2010). Sustainable Construction Education: Assessing the Adequacy of Built Environment Professionals Training. WABER Accra, Ghana 2010.

Du Plessis .C. (2005). Action for Sustainability: Preparing an African Plan for Sustainable Building and Construction. Building Research and Information, 33(5) 1-11

Du Plessis .C. (2002), Agenda 21 for Sustainable Construction in Developing Countries. CIB Information Bulletin Nr.2/01

Egan. J (1998). Rethinking Construction. UK Government, DETR

Federal Register (1996). Executive Order 13010- Critical Infrastructures Protection. Federal Register, July 17, 1996, Vol. 61.No. 138. Pp. 37347-37350.

Hadjri, K. and Onyango J. (2007). Dubai Revisited: Are New Planned Communities More Sustainable? XXXVIAHS World Congress on Housing Science, Melbourne.

Kim, J.(1 998). Sustainable Architecture Module: Introduction to Sustainable Design. 430E University Avenue. Ann Arbor, MI: National Pollution Prevention Centre for Higher Education.

Latham, M (1994). Constructing the Team. Constructing Excellence

Lanthing, R (1995) Sustainable Development **and the future of Construction. CIB W82**

Lock, D (2001), The Essentials of Project Management. Gower Publishing Company U.S.A.

Munasinghe, M. (1992). Environmental Economics and Sustainable Development Paper presented at the United Nation Earth Summit, Rio de Janeiro, Environment Paper No.3, World Bank, Wash. DC, USA.

Musa-Haddary, Y.G. (2011),Enhancing Provision of Affordable Housing for Low-income Civil Servants in Abuja, Nigeria. An unpublished PhD thesis presented to post graduate school, ABU, Zaria.

NPC (201l). The Transformation Agenda 2011-2015. Summary of Federal government Key priority Policicies, Programs and Projects. A National Planning Commission Publication. Abuja-Nigeria.

Office of Government Commerce (OGC), Achieving Excellence Guide 11: Sustainability Crown copyright 2007

Okparaocha, Chukwuma (2012). NIOB Pursues Transformation Agenda, Building Production Management in Nigeria. Retrieved on October, 2012 from http://www.tribune.com.ngljndex.php/propcrty-a-envjronmcnt/46545-nioh-pursues-transformation-agenda-building-production-management-in-nigeria.

Olusegun, A. E. and Michael, A. O. (2011), Abandonment of Construction Projects in Nigeria: Causes and Effects. Journal of Emerging Trends in Economics and Management Sciences (JETEMS) published by Scholarlink Research Institute Journals, at jetems.scholarlinkresearch.org.

Oyegoke, A. S. (2006) Managing Client's expectation in project delivery: a comparative study of delivery systems. 22nd Biennial conference of the Nigerian Institute of Quantity Surveyors, titled, quantity surveying in the 21st century agenda for the future, held on 22nd-25th November 2006 , Calabar, Nigeria.

Rashid, R. A; Taib, I. M; Ahmad, Wan B. W. A; Nasid, Md. A; Ali, Wan N. W. A. and Zainordin, Z. M. (2006), Effect of Procurement Systems on the Performance of Construction Projects.

Royal institute of Chartered Surveyors (RICS). Student Construction Journal 2010.

The American Heritage® Dictionary of the English Language, Fourth Edition copyright ©2000 by Houghton Mifflin Company. Updated in 2009. Published by Houghton Mifflin Company.

The public procurement act (2007), procurement procedure manual for public procurement in Nigeria, issued by the bureau for public procurement.

Ugwu, O. and Haupt, T (2007). Key Performance Indicators and assessment methods for infrastructure sustainability – A South African Construction Industry Perspective. Published Article Building and Environment 42 (2007) p665 – 680.

United Nations Conference on Environment and Development (UNCED), Agenda 21, 1992.

United Nation. Report of the world summit on sustainable development, Johannesburg, South Africa, 26 August – 4 Septe mber 2002, United Nations, New York, 2002. pp173.

Uroko, Chuka (2012). New Technology for Mass Housing Delivery Arrives Nigeria. Business Day, Tuesday 19th October, 2010. Retrieved on 25th October, 2012 from http://www.businessdayonline.com/NG/index.php/homes-a-property/ 15574-new- technology-for-mass-housing-delivery-arrives-nigeria-

World Commission on Environment and Development (WCED,1987). Our Common Future. Oxford, UK: Oxford University Press.

Yang Jay (2012). Editorial: Promoting Integrated Development for Smart and Sustainable Built Environment. Smart and Sustainable Built Environment 1(1). Pp.4 - 13.

FACTORS MITIGATING THE IMPLEMENTATION OF TOTAL QUALITY MANAGEMENT (TQM) OF CONSTRUCTION COMPANIES IN LAGOS STATE, NIGERIA

O.M. Ajayi[1] , O. Oyeyipo[2] and B.A. Mafimidiwo[3]
[1,2]University of Lagos, Faculty of Environmental Science, Department of Building, Akoka-Yaba, Lagos Nigeria
[3]Yaba College of Technology, Yaba, Lagos, Nigeria

Total Quality Management (TQM) evolved from a continuous improvement philosophy with a prime focus on quality of the products and/or services which is considered as the main dimensions of business in any organisations. It is essential for construction companies to provide more consistent quality and value to their owners/customers. Hence the purpose of this study is to identify the factors necessary to install and maintain a quality system by implementation of TQM for producing quality buildings in Nigeria construction industry. A structured questionnaire was used as the main instrument for collecting data from respondents. A total of fifty (50) questionnaires were drawn from small, medium and large construction companies in Lagos state using simple random sampling technique. Thirty (30) were completed and returned representing a 60% response rate. Frequency, percentage and mean item score were used in analysing data collected for the study via SPSS 17th version. Cross sectional research survey is adopted for the study. Responsibility for quality performance, coordination among professionals involved in project design, implementation of strategies focused on quality, determination of improvements in client's satisfaction are the most significant factors which affect the implementation of total quality of a contracting organisation. In conclusion contractors should increase their reputation in the construction industry by acquiring technical competencies and capabilities in the area of quality as these qualities have become important considerations in assessing contractors' competitiveness and key indicators of successful outcome of construction projects. Finally, contractors should make adequate assessment of the nature and complexity of construction projects, identify the risk elements associated with such projects, and decide an appropriate total quality practice.

Keywords: company, contracting organisation, quality, TQM

INTRODUCTION

Construction industry is an industry in which the output is normally highly visible, which gives it a political appeal, as well as having a strong backward and forward linkages with other industries which makes it a powerful tool for economic growth. Similarly, construction is usually one of the major sources of employment in an

[1] seyiajayi71@yahoo.com
[3] delemafimidiwo@gmail.com

Ajayi *et al.* (2014) Factors mitigating the implementation of total quality management (TQM) of construction companies in Lagos State, Nigeria *In:* Laryea, S. and Ibem, E. (Eds) *Proceedings 8th Construction Industry Development Board (cidb) Postgraduate Conference,* 10-11 February 2014, University of the Witwatersrand, Johannesburg, South Africa, 593-604.

economy, and so policy decisions on the construction sector not only have an important effect on the performance of the economy but also on the levels of employments. The construction industry plays a vital role in the social and economic development of all countries.The construction industry can be defined as the production, alteration, renovation, maintenance, facility management, demolition and recycling of building and civil engineering works, including the supply of resources. Construction works in Nigeria is categorized into two major groups namely; building works which comprises of construction works and civil engineering works that encompass construction works in highways, bridges, dams, airports, seaports, jetties to mention but a few. In recent times, quality has come under the spotlight in Nigeria. This is due to various factors including increased globalization, which opened the markets to Nigerian contractors. There is increased awareness of senior executives, who have recognized that quality is an important strategic issue, which is reflected as an important focus for all level of the organization (Cheung et al, 2010). The construction industry needs to regard quality as one of the main fulcrum of any construction projects, which will ultimately lead to clients' satisfaction. Baidoun (2003) states that to improve competitiveness, organizations are looking for a higher level of effectiveness across all functions and processes and are choosing total quality management (TQM) as a strategy to stay in business. The increased competition will force growth down and this coupled with decreasing contract periods will cause quality to suffer. According to Joubert (2002), it is a well-known fact that if either time or cost comes under pressure, quality is usually the first constraints of a contract to be sacrificed.Idrus and Sodangi (2010) describe TQM as a management system which requires a change of attitude and priorities of day-to-day operations. TQM can also be likened as a management philosophy, a paradigm, a continuous improvement approach to doing a business through a new management model (PHCC Education foundation; 1996). Idrus and Sodangi (2010) advocate TQM as a philosophy of management that must be tailored for a particular environment. Gunning and McCallion (2007) suggests that the major components of a TQM management system are: customer focus; the critical role played by leadership; and the importance of widespread employee involvement. Baidoun (2003) opines that top management commitment and leadership, people management, quality policy and strategy, partnership and resource management and management of processes are generally considered as the initial inputs to the implementation.Haupt and Whiteman (2003) highlighted that the most significant success criteria which affect the implementation of TQM to include; top management criteria, top management involvement. Customer focus on well-developed planning, participative management style, continuous improvement measures, and workers trained in TQM amongst others. This study endeavours to shed lights on the efforts necessary to install and maintain a quality system by implementation of TQM for producing quality buildings in Nigeria construction industry.

QUALITY MANAGEMENT

According to Ahmadinejad et al, (2006), TQM is widely recognised as an enabler for performance improvement in the construction industry. The last three decades have witnessed innovative studies on improving quality performance of construction projects. Arditi and Gunaydin (1997) emphasized that the management of quality is an important issue in the delivery of construction projects. Lau and Tang (2009) stated that quality management systems provide the framework in which the participants' expectation can be achieved. The reasons for initiating TQM as suggested by Ahmadinejad et al, (2006) include:

- Time and cost overrun has engendered an adversarial relationship between the client and the contractor.
- Building projects have gone larger and more complex; clients are therefore increasingly demanding higher standards for their delivery.
- The ever increasing challenging and onerous environmental and safety requirements have also exacerbated the need to change the management culture towards TQM.
- Parties to projects have differing traditions and often opposing interests – resources are spent on defending the parties positions, which are better spent on achieving customers' satisfactions.

The quality management systems (QMSs) currently being implemented by contracting organizations worldwide are based on the ISO 9000 series of standards, and are becoming increasingly important to customers who have developed a growing aspiration to procure qualified and professional construction firms, capable of meeting their specification requirements and giving better customer satisfaction through successful project delivery (Willar et al; 2010). According to Munting and Cruywagen (2008) in their study realized that documentation of quality management is lacking in the architectural firms in South African and a great deal of negativity exists in ISO 9000 certification. Quality management systems had contribute to the mitigation and elimination of rework/non conformances; enhance client satisfaction; performance, and provides the catalyst for the synergy relative to the project parameters such as client satisfaction, cost, quality, and time (Smallwood, 2002). Establishing the project requirement for quality begins at project inception. Alwi, et al (2001) stipulated that a careful balance between the owners requirement of the project costs and schedule, desired operating characteristics, materials of construction and the design professionals' needs for adequate time and budget to meet those requirements during the design process is essential. Hence quality management should be an organizational obsession in meeting or exceeding customer expectations to the point that customers are delighted. Understanding the customers' needs and expectations is essential to winning new business and keeping existing business (Alwi et al, 2001). All this evidence leads to a conclusion supporting and recommending that a QMS needs to be developed and fully implemented in any construction company that wishes to be a sector leader (Willar et al, 2010). Though it has been said that quality management also has its drawback; Bubshait and Al-Atiq (1999) reckon that it is evident that there is a lack of a definitive methodology for the deployment of the associated constructs, in particular, the practice and its underlying tools and techniques regardless of TQM implementation.

TOTAL QUALITY MANAGEMENT

Total quality management is a developing method adopted for continually improving products, processes and services to achieve continuous quality (Pheng and Teo, 2004). BSI (1992) cited in Wahid and Corner (2009) defines TQM as the management philosophy and company practices that aim to harness the human and material resources of an organization in the most effective way to achieve the objectives of the organization. TQM can also be defined as a philosophy and a set of guiding principles that represent the foundation of a continually improving organization. TQM is a management-led process to obtain the involvement of all employees, in the continual improvement of the performance of all activities, as part of the normal business to meet the needs and satisfaction of both the internal and external customers (Pheng and Teo, 2004). Haupt and Whiteman (2004) reiterate that TQM as a management system has not been effective in the construction industry as much as it has been in other industries because of lack of adequate budget, failure to plan for quality, inadequate training at all levels except for top or senior management positions, and little recognition given to those who strive for quality improvement on their projects. Contractors have failed in setting out adequate funds required for the accomplishments of improving and maintaining the requisite quality expected of construction products and services.

According to Willar et al (2009), the all-encompassing management philosophy, termed total quality management (TQM) has generated a tremendous amount of interest and has emerged in the forefront as a major management movement, influencing many sectors of the economy worldwide. The subject matter has churned up some commitment on the part of management of most contracting organizations, thereby increasing the level of quality culture available in those organizations.TQM consists of management principles aimed at achieving quality performance in all aspects, i.e. product, service, process, profit and productivity (Sodangi et al, 2010). The fundamental difference between the QA/QC (Quality assurance/Quality control) approach and TQM is that the former is a “top-down” approach, whereas the latter is a centralized approach which makes TQM consists of management principles aimed at achieving quality performance in all aspects, i.e. product, service, process, profit and productivity. .The principles of TQM have been widely used by the manufacturing and service industries, and they have seemingly been welcomed by the construction industry as an opportunity to improve construction quality management (Sodangi et al; 2010). The success of applying TQM to the construction industry would be felt in the nearest time. Considerable research has been directed at implementing TQM in the construction industry. Most of which deals with specific building blocks of TQM (e.g. service quality, continual improvement), with some attention focused on identifying opportunities, barriers to and procedures for implementing TQM in construction firms.

RESEARCH METHODS

The population entails small, medium and large construction companies in Lagos state, Nigeria. Simple random sampling technique is used for the study. It shows that all the respondents have equal chance of been selected. A cross sectional research design is adopted for the study. A total of 50 questionnaires were distributed and 30 were duly filled and returned for the purpose of analysis. It shows an average response rate of 60%.SPSS 17th version is used for the analysis of data. All nominal data are analysed using descriptive statistics using percentage, bar chart and pie chart. To identified the factors for implementation TQM, the respondents were told to rate the factors in 5 likert scale of 1= not importance, 2=of little importance, 3=moderately importance, 4=importance, 5=very importance. The factors were categories into management commitment factors, role of quality department ,training and education, employee involvement, suppliers partnership, project design ,quality policies and clients’ satisfaction Relative importance index (RII) was used to analyse the data using this formula

$$RII = \frac{5n5 + 4n4 + 3n3 + 2n2 + n1}{5(n5 + n4 + n3 + n2 + n1)}$$

Where:

N_5=no of respondents with very importance

N_4= no of respondents with importance

N_3= no of respondents with moderately importance

N_2= no of respondents with of little importance

N_1= no of respondents with not importance

That is: 5-very importance, 4- importance, 3- moderately importance, 2- of little importance, 1- not importance

ANALYSIS OF DATA AND RESULTS

Biographical information of respondents

Fig 1 is a graphic representation of the position of the respondents in form of bar chart. Project managers constitute the highest proportion of the respondents, with 14 out of the total population of 30 (47%), which indicate their high involvement in the total quality management in contracting organisations in the construction industry. It is follows by engineers (27%), architect (10%), builders (10%) and quantity surveyor (7%).It shows that Project manager take active part in the total quality management of most contracting organizations.

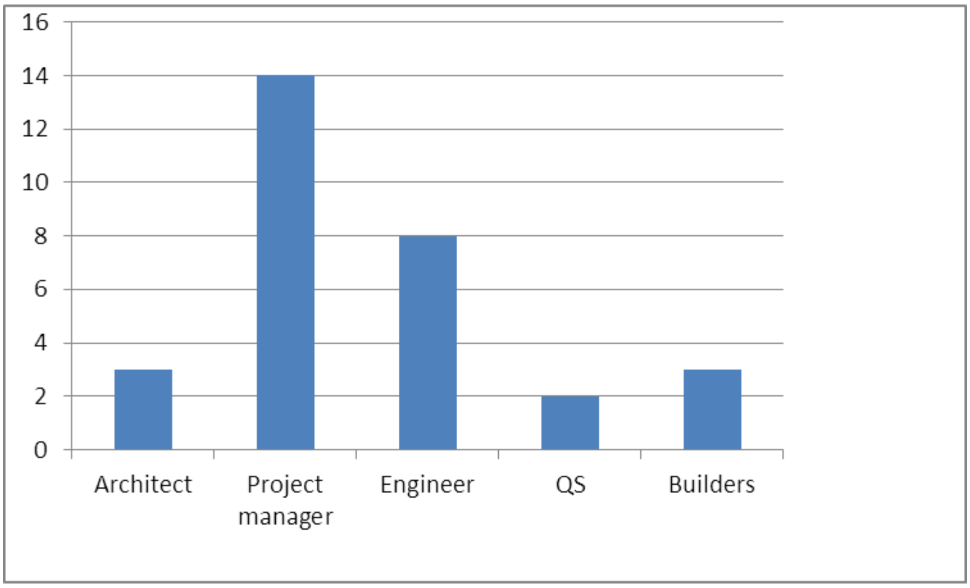


Fig 1: Position of the respondents

The pie chart below depicts the age categories of the respondents who give responses to the survey. The fig 2 below reveals that 56.7% of the respondents are within the age bracket of 31 and 40 years of age, while 30% of the total population is within 21-30 years, with the remaining of the respondents falling into the 41-50years. About 70% of the respondents are well above the 30years, which confirms the fact that responses are from matured professionals
Table 1 displays the highest academic qualification of the respondents. From the table it shows that majority of the respondents are Masters holders (43%).It is follows by Bachelor of science degree(B.Sc.) with 40%.It shows that the respondents are well knowledge hence they are competence to fill the questionnaire.

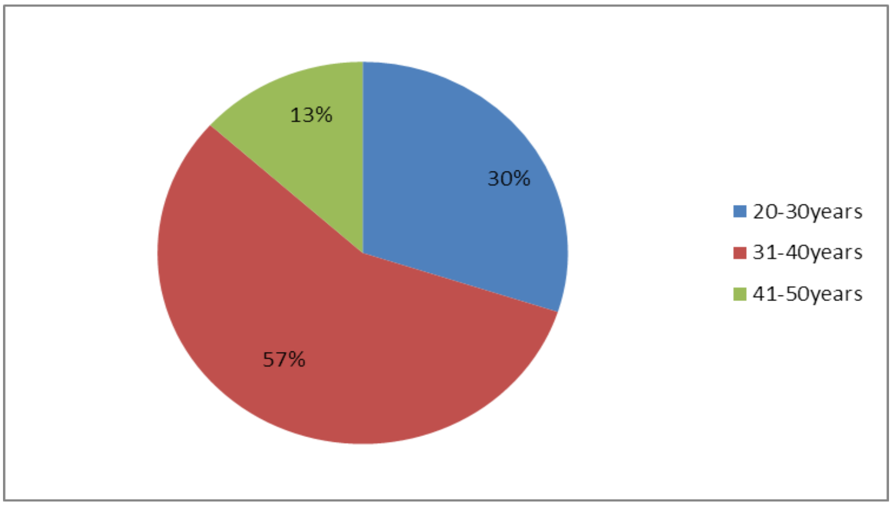


Fig 2: Pie chart representative of age distribution of respondents

Table 1 Highest academic qualification of respondent

	Frequency	Percent (%)	Cumulative Percent
HND	1	3	3.3
B.Sc	12	40	43.3
PGD	2	7	50.0
M.Sc/MBA/MPM	13	43	93.3
Others	2	7	100
Total	40	100	

HND-Highest National Diploma, PGD-Postgraduate Diploma

Table 2 presents the type of Construction Company of the respondents. It shows that majority of the respondents are from indigenous contracting organisation (73%), 6% are fully expatriate contracting organisation and 3% are from government agency and from combination of indigenous and expatriate contracting organistaion. It is clear that a greater percentage of contractors operating within Lagos are fully indigenous in its ownership and management system.

Table 2: Organization ownership and management

	Frequency	Percent (%)	Cumulative Percent
Fully indigenous	22	73.3	73.3
Fully expatriate	6	20.0	93.3
Government agency	1	3.3	96.67
Both fully indigenous and fully expatriate	1	3.3	100
Total	40		

The bar chart below represent the year of experience of respondents in the construction companies.Fig 3 shows that 47% of the respondents have spends between 3-6years in the construction companies. This confirms that the respondents have adequate experience within the construction companies to be able to provide information on the total quality management of contracting organisations.

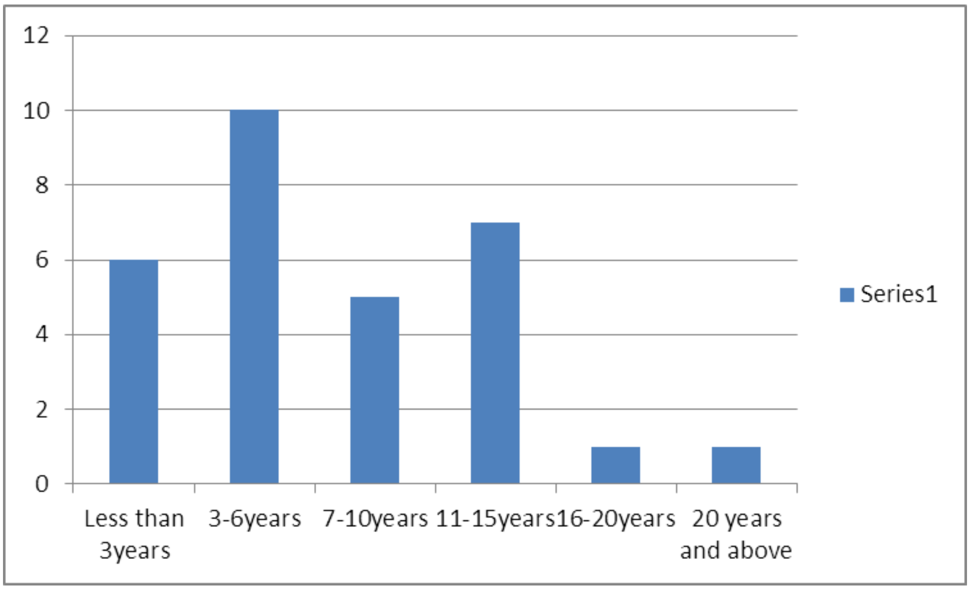


Fig 3: Bar chart representative of years of experience of respondents in construction companies

Factors affecting implementation of TQM

Table 3 presents the factors affecting the implementation of TQM.The identified factors are management commitment factors, role of quality department, training and education, employee involvement, supplier partnership, project design, quality policies, quality data reporting and clients' satisfaction orientation. Each of these major factors consists of sub factors as shows in the table below. For management commitment factors, the most significant factors are top management assumes responsibility for quality performance, acceptance of responsibilities for quality by departmental head and consistent communication of mission statements and objectives. Other significant factors according to the major factors are establishment of quality department, effectiveness of quality awareness and the department, Quality related training given to managers, supervisors and employees, Specific work skill training given to employee through the company Quality circle or worker involvement in type organisation, Use of supplier rating system, Coordination among professionals involved in project design, Implementation of strategies focused on quality, Extent to which quality data are available to managers and supervisors, Determination of improvements in client's satisfaction

Table 3: Factors affecting the implementation of TQM			
Variables	TO	RII	Rank
A. Management commitment factors			
Top management assumes responsibility for quality performance	30	0.93	1
Acceptance of responsibilities for quality by departmental head	30	0.89	2
Clear, consistent communication of mission statements and objectives	30	0.89	2
Top management supports long term quality improvement process	30	0.87	4
Degree top management considers quality improvement as a way to increase profits	30	0.85	5
Degree of comprehensiveness of the quality plan within the company	30	0.83	6
Specificity of quality goals within the company	30	0.82	7
Quality goals and policy are understood within the company	30	0.82	7
Importance attached to quality by the top management	30	0.81	9
Commitment of the top management to employees training	30	0.78	10
B.Role of quality department			
Establishment of quality department	30	0.88	1
Effectiveness of the quality awareness	29	0.82	2
Effectiveness of the quality department	30	0.81	3
Visibility of quality department	30	0.80	4
Quality department accesses to top management	30	0.79	5
Utilization of quality staff professionals as a consulting resources	29	0.79	5
Autonomy of the quality department	30	0.75	7
C. Training and education			
Quality related training given to managers, supervisors and employees	30	0.89	1
Specific work skill training given to employee through the company	30	0.85	2
Training in problem identification, solving skills and quality improvement skills	30	0.82	3
Programs to develop team work between employees	29	0.81	4
Training in the total quality concept	29	0.81	4
Quality awareness building among employees	29	0.79	6
Availability of resources for employee training	30	0.79	6
Training for employees to implement quality circle type program	29	0.78	8
Training in interactive skills	30	0.77	9
Employees are trained in statistical improvements techniques	30	0.69	10
Training in advanced statistical techniques in the company	30	0.66	11
D. Employee involvement			
Quality circle or worker involvement in type organisation	30	0.81	1
Recognition of employee for superior quality performance	30	0.78	2
Table 3 (contd.):Factors affecting the implementation of TQM			

variables	TO	RII	Rank
Participation in quality decision by non-supervisory employees	30	0.77	3
Involvement of lower level workers in decision making by top management	30	0.67	4
E. Supplier partnership			
Use of supplier rating system	30	0.83	1
Selection of the supplier based on quality instead of price	30	0.82	2
Clarity of specification provided by supplier	30	0.81	3
Technical assistance to improve the quality and responsiveness of suppliers	30	0.78	4
Involvement of the supplier in the project development process	30	0.67	5
F. Project design			
Coordination among professionals involved in project design	30	0.91	1
Analysis of client's requirement	30	0.89	2
Clarity of project design	30	0.88	3
Determination of quality standard	30	0.87	4
Design of the implementation system	30	0.85	5
G. Quality policies			
Implementation of strategies focused on quality	30	0.89	1
Self inspection of work by workers	30	0.87	2
Inspection, review and checking	30	0.87	2
Policy of preventive equipment maintenance	30	0.84	4
Clarity of work or process instruction given to employee	30	0.84	4
Use of acceptance sampling to acceptance lots of hatches of work	29	0.81	6
Zero defect as the quality performance standard	30	0.79	7
Use of statistical control charts to control process	30	0.75	8
H. Quality data and reporting			
Extent to which quality data are available to managers and supervisors	30	0.82	1
Extent to which quality data are used as tolls to manage quality	30	0.80	2
Extent to which quality data are available to employees	30	0.80	2
Extent to which quality data, control charts are displayed at employees' work site	30	0.76	4
I. Client's satisfaction orientation			
Determination of improvements in client's satisfaction	30	0.89	1
Commitments to clients through strengthening of polities	30	0.87	2
Comparisons of client's satisfaction with competitors and internal indicators	30	0.85	3

TO=Total number of respondents, RII=Relative Importance Index,

Factors responsible for the successful maintenance of total quality management in contracting organization

A total number of 18 factors which are responsible for the successful implementation of maintenance of total quality management in contracting organisations were highlighted in this research. These factors are considered separately with significantly different mean score assigned for the successful implementation of maintenance of TQM.

Table 4 indicates that management committee with a mean score of 0.93 is the most important factor required for implementation of maintenance of TQM. The result shown in the Table 4 gives indication that the quality awareness and review is also considered very important for maintenance of TQM by contractors. Other important factors include develop a quality improvement plan, quality measurement and identify client's requirements amongst others. Establish an ad-hoc committee for zero defect programme, do it all over age and supervisor were not considered important for successful maintenance of TQM as they recorded the lowest mean rating of 0.74, 0.73 and 0.66 respectively.

Table 4: Factors responsible for the successful maintenance of TQM in contracting organization

Factors	*N*	*MIS*	*Rank*
Management commitment	30	0.93	1
Quality awareness and review	30	0.91	2
Develop a quality improvement team	30	0.87	3
Quality measurement	30	0.86	4
Identify client's requirement	30	0.85	5
Goal setting	30	0.85	5
Cost of quality	30	0.84	7
Analyse feedback	30	0.84	7
Define specification	30	0.83	9
Application of evaluation measurement	30	0.81	10
Error causes removed	30	0.81	10
Zero defect day in a year/month/week	30	0.81	10
Correction action	30	0.81	10
Recognition of people	30	0.79	14
Quality councils	30	0.76	15
Establish ad-hoc committee for the zero defect programme	29	0.74	16
Do it all over age	29	0.73	17
Supervisor training	28	0.66	18

MIS=MEAN ITEM SCORE

DIFFICULTY ENCOUNTERED IN THE IMPLEMENTATION OF TQM IN CONTRACTING ORGANISATION

Table 5 reveals that most respondents agree that lack of available quality system documentation, lack of understanding in the process requirement, high cost to implement and lack of planning are amongst the difficulties encountered in the implementation of TQM in contracting organisations

Table 5: Difficulties encountered in the implementation of TQM in contracting organizations

Difficulties	N	MIS	Rank
Lack of available quality system documentation	29	0.75	1
Lack of understanding in the process requirement	29	0.75	1
High cost to implement TQM	28	0.74	3
Lack of planning to implement TQM	30	0.74	3
Lack of TQM exposure	29	0.74	3
Lack of continuous professional development	29	0.73	6
Lack of documentation of suppliers, materials and services	29	0.72	7
Lack of awareness in benefit of TQM	29	0.71	8
Lack of support from the top management	28	0.71	8
Lack of understanding in the TQM	29	0.70	10
Difficulty of verbal communication	29	0.64	11
Lack of subordinate propensity to follow orders	29	0.60	12
Lack of time to implement TQM/time consuming	29	0.59	13

CONCLUSIONS

The findings of this study serve as a basis for making the following conclusions:
Top management assumes responsibility for quality performance, hence there is need to create quality department to ensure effective management of the quality performance of the organisation. Adequate training is therefore required at all time to the top management by creating quality policies for the organisation. Coordination among professionals involved in project design helps in obtaining high quality which meets the expectation and satisfaction of the clients. In addition, the management team will have to take active part in the implementation and maintenance of TQM to achieve the quality objectives of the organisation. ISO 9000 certification should be implemented to ensure the performance of the quality department of the construction companies with adequate management in order to conform to standard of the clients.

REFERENCES

Ahmadinejad, M., Keymanesh, M., Ayoubinejad, J. and Maghrebi, M. (2006). The Survey of Implementing Quality Management System in Iran Construction Industry". *International Civil Engineering Conference "Towards Sustainable Civil Engineering Practice"* August 25-26, 2006, 281-284.

Alwi, S., Hampson, K. and Mohamed, S. (2001). Effect of Quality Supervision on Rework in the Indonesian context. *Asia Pacific Building and Construction Management Journal*, 6, 2-6.

Arditi, D. and Gunaydin, H. M. (1997). Total Quality Management in the construction process, *International Journal of Project Management*, 15(4), 235.

Baidoun, S., (2004). The implementation of TQM philosophy in Palestinian organization: proposed non-prescriptive generic framework. The TQM Magazine, 16 (3), 174-185

Bubshait, A.A. and Al-Atiq, T.H., (1999). "ISO 9000 Quality Standards in Construction", *Journal of Management in Engineering*, 15 (6), 41–46

Cheung, S. O., Pang, H. Y., Tam, S. Y. and Chan, H. Y. (2010). Identity as a manifestation of organisational culture. *The Construction, Building and Real Estate Research Conference of the Royal Institution of Chartered Surveyors* held at Dauphine University, Paris, 2-3 September 2010

Gunning, J .G. and McCallion, E. M., (2007) .TQM in large Northern Ireland contracting organisations. In: Boyd, D (Ed) Proceedings *23rd Annual ARCOM Conference,* 3-5 September 2007, Belfast, UK, Association of Researchers in Construction Management, 577-578.

Haupt, T. C., and Whiteman, D. E., (2004), Inhibiting factors of implementing total quality Management on construction sites, *The TQM Magazine*, 16 (3), 166-173.

Idrus, B.I. and Sodangi, M. (2010).Framework for evaluating quality performance of contractors in Nigeria. *International Journal of Civil & Environmental Engineering,* 10 (1), 34-39

Lau, W.T. and Tang, S.L., (2009). A survey on the advancement of QA (quality assurance) to TQM (total quality management) for construction contractors in Hong Kong. *International Journal of Quality & Reliability Management,* 26(5), 410-425.

Muniting, Paul and Cruywagen, Hoffie (2008).Quality management in South African Architectural practices.*Building and Environment*, 23(4), 444-452.

PHCC (1996). Total Quality Management: A Continuous Improvement Process 1. *PHCC Educational Foundation.*

Pheng L. S. and Teo J. A. (2004). "Implementing Total Quality Management in Construction Firms", *Journal of Management in Engineering*, 20(1), 8-15.

Smallwood, J. J. (2002). Performance Improvement in South African Construction. *Cobra 2002, Proceedings of the RICS Foundation construction and building research conference*, Nottingham Trent University, 5-6 September 2002.

Sodangi, M., Idrus, A. and Khamidi, F. M. (2010) Measuring Quality Performance in Construction. In: *International Conference on Sustainable Building and Infrastructure* (ICSBI 2010), 15-17 June 2010, Kuala Lumpur

Wahid, R.A. and Corner, J. (2009). Critical success factors and problems in ISO 9000 maintenance. *International Journal of Quality & Reliability Management*, 26 (9), 881-893.

Willar, D., Coffey, V. and Trigunarsyah, B. (2010). Improving Quality Management System Implementation in Indonesian Construction Firms: Research Project Proceedings of the First Makassar *International Conference on Civil Engineering* (MICCE2010), March 9-10, 2010, 1-9.

INDEX OF AUTHORS

INDEX OF KEYWORDS