

Nigerian Construction Professional's Education and Deficiencies in the Area of Project Management

*Oko John Ameh and Koleola Tunwase Odusami

Abstract: This study examined the extent to which Nigerian construction professional groups are equipped with relevant degree-specific knowledge in project management practice. A survey was employed, in which 60 construction project managers based in Lagos, Nigeria were selected using the snowball sampling technique. Data were analysed using descriptive statistics. The findings indicate that construction project managers are proficient in construction technology, project planning and control and contract administration, while they are deficient in information technology, marketing, accounting and finance and human and industrial relations. The quantity surveyors' group and the builders' group are the most equipped, whereas the civil engineers' group is the least equipped in terms of background education to practise project management. The study can be used as a guide by clients when engaging built environment professionals to aid in construction project management. The current study provides insight into proficiency and highlights the deficiencies of the various built environment professionals in the management of construction projects.

Keywords: Construction, Education, Project manager, Knowledge, Skills

INTRODUCTION

A project can be considered to be a set of specific objectives, which have definite start and end dates, involve a series of activities and tasks that consume resources and must be completed within a predetermined specification. Projects in the construction industry cover several areas of specialisation such as buildings, roads, bridges, electrical power generation and transmission, and telecommunication. The complexity of modern construction necessitates specialisation and, consequently, the proliferation of new disciplines. Project management as a discipline is the application of knowledge, skills and techniques to execute projects effectively and efficiently. It is a strategic competency for organisations, enabling them to tie project results to business goals and, thus, better compete in their markets. The project managers' responsibilities span a broad spectrum, covering entire areas of project management including project planning, cost management, time management, quality management, contract administration and safety management. Project management-related degree programmes within the built environment disciplines in Nigeria include Architecture, Building/Building Technology, Civil Engineering, Estate Management and Quantity Surveying. Each of these disciplines has their own professional organisation. Professional organisations in the Nigerian construction industry include the Nigerian Institute of Architects (NIA), the Nigerian Institute of Building (NIOB), the Nigerian Institute of Quantity Surveyors (NIQS), and the Nigerian Society of Engineers (NSE), which has various divisions such as an Institution of Civil Engineering. However, as observed by Russell and Stouffer (2003), Dulaimi (2005)

Department of Building, University of Lagos, Akoka, Yaba, Lagos, NIGERIA
*Corresponding author: oameh@unilag.edu.ng

and Arcila (2006), many construction and engineering degree programmes designed to produce construction professionals are not specifically tailored to educate students to become effective and skilful project managers as they tend to emphasise technical skills. However, the study by Odusami (2002) revealed that decision-making, leadership and motivation and communication skills are the most important in the context of effective construction project leadership.

Out of 106 universities in Nigeria, none offer an undergraduate degree programme in construction project management. At the postgraduate degree level, only one university offers a construction project management programme. The project management programme of the University of Lagos, which started in the 2001/2002 academic session has so far produced over 400 graduates. Thomas and Mengel (2008) argued that traditional training and even education focusing solely on a transfer of knowledge and intellectual competency does little to prepare project managers to understand and cope with the level of ambiguity and uncertainty that today's projects almost inevitably present them with. Despite the shortcomings in the background education of construction professionals in the project management-specific knowledge area, most consultants in the Nigerian construction industry combine project management practices with their primary responsibilities without additional training in project management. In view of the perceived notion that project managers' leadership style and competencies are contributing factors to project success, the motivation for this study, therefore, is to assess the profile of the different professional groups in terms of the relevance of the specific knowledge from their background degree to project management knowledge areas or practices. Therefore, this study hypothesised that "There is no variation in the background education of built environment professionals practising project management".

LITERATURE REVIEW

Project management is a complex process that aims to achieve multiple objectives. Project management competency is just as complex, requiring the acquisition of a variety of knowledge and skill sets that often cut cross areas of expertise. Skills development is a function of knowledge input gained in a diverse professional discipline. Gareis and Huemann (2000) defined competence as sufficient knowledge and experience for the performance of a business process. In addition to project management knowledge and experience, they suggested that a project manager must have product, company and industry knowledge and, for international projects, cultural awareness and language knowledge. The Project Management Competency Development Framework outlined three dimensions of competence: knowledge, skill and behaviour (Project Management Institute, 2002). According to Crawford (1997), for project managers to be judged competent, they must possess the "right" combination of knowledge (i.e., what they know about project management), performance (i.e., what they are able to do and accomplish while applying their project management knowledge) and personal competence (i.e., how the individual behaves when performing the project or activity; their attitudes and core personality traits).

Project management comprises a wide range of roles and responsibilities, and this must be reflected in the educational programmes of construction and

engineering disciplines. The project management knowledge required by individuals differs according to the different project roles to be filled. Gareis and Huemann (2000) listed roles to be performed by project managers in the project management function as follows:

1. *Project start process*: Know-how transfer from the pre-project phase into the project, development of adequate project plans, design of adequate project organisation, performance of risk management, and design of project-context-relations, etc.
2. *Project control process*: Determination of the project status, re-definition of project objectives, and development of project progress report, etc.
3. *Project discontinuing management process*: Analysis of the situation and definition of ad-hoc measures, development of project scenarios, definition of strategies and further measures, and communication of the project discontinuity to relevant project environments, etc.
4. *Project close-down process*: Coordination of the final contents work, transfer of know-how into the base organisation, and dissolution of project-environment relations, etc.

Mengel and Thomas (2004) observed that there was no recognised development path for project managers, based on the Project Management Competency Development Framework (Project Management Institute, 2002), which is a comprehensive list of knowledge and performance indicators that includes personal competencies crucial for project management success in addition to the application of project management knowledge. They argued that despite the extensive approach to identifying project management competencies, how these skills, competencies and characteristics were to be acquired, learned and developed was not addressed (i.e., when, at what level, or for what kind of project).

Project Managers Education and Required Skills

Different authors hold divergent views with regards to project management education. For example, the project management programmes in the Engineering School, the Business School, the Institute of Management Development and the Centre of Adult and Continuing Education at the American University in Cairo reflected tremendous variations in objectives and content (El-Sabaa, 2001). Many are of the opinion that students need to be trained as generalists rather than specialists, with the industry providing the necessary additional training on the job. Bresnahan (2000) (cited in Ogunsemi, Oyediran and Ekundayo, 2008) identified the training needs of a competent project manager and organised them into the following groups: Technical training (time, cost, quality, risk, procurement and project integrity management); Business/Financial training (accounting principles and practice, financial management, business process analysis and financial management control); and Human Resource training (leadership, stakeholders management, communication, team building and negotiation skills). Edum-Fotwe and McCaffer (2000) suggested that acquiring the knowledge input that is related

to the project manager's particular area of specialty should be a base skill. Furthermore, Edum-Fotwe and McCaffer (2000) opined that apart from technical skills, modern project management practices demand additional knowledge in general management because projects generally form part of a functional organisation. They suggested subject areas such as finance and accounting, sales and marketing, strategic planning, tactical planning, operational planning, organisational behaviour, personnel administration, conflict management, personal time management and stress management. Chan et al. (2002) suggested that the curricula to educate aspiring construction project management professionals should adopt a multidisciplinary and an integrative-professional approach and that this approach should not be limited to the undergraduate curricula, but should extend into the continuing professional education of practitioners as well. Carbone and Ghoston (2004) reviewed several curricula of graduate courses in project management and found many of the course descriptions regarding the following subjects: introduction to project management, project planning and schedule, organisation, management and leadership, project cost management, risk management, procurement and contract management, financial management, economics, probability and statistics, legal and ethical issues, conflict management and project communication. The Masters of Project Management program at the University of Lagos, Nigeria comprises the following courses: (first year) Business Environment, Business Economics, Accounting and Finance, Organisational Behaviour, Human and Industrial Relations, Industrial and Labour Law, Quantitative Methods and Simulation Studies, and Value Engineering; and (second year) Design Management, Nature and Content of Project Management, Computer Application/Information Technology, Procurement Methods, Development Economics, Time Management, Contract Law, Cost Management in addition to two electives from Negotiation, Resource Management, Quality Assurance and Buildability. In another related study, Ogunsemi, Oyediran and Ekundayo (2008) listed personal and interpersonal skills, business skills, information technology, professional practice and law under basic competence, construction contract practice, construction technology, construction economics/cost control, procurement methods, financial management, contract administration/project control and marketing and accounting principle under core competence, and dispute resolution procedure, development appraisal, facilities management, property investment funding and valuation under optional competence. The consensus is that the educational curriculum for training potential construction project managers should inculcate team skills, organisational skills, communication skills, technical skills, coping skills and leadership and building skills (Meredith, Samuel and Mantel, 1995). Goodwin (1995) added conceptual skills, negotiation skills and human skills as essential skills required by project managers. Strang (2003) believed that the ability to manage a project successfully requires a mixture of skills including interpersonal ability, technical competencies and cognitive aptitude along with the capacity to understand the situation and people involved and then to dynamically integrate appropriate leadership behaviour. Pant and Baroudi (2008) observed that the focus of most project management training in the context of universities has been on the technical skills deemed essential to achieve the optimal project time, cost and quality performance. Ogunsemi, Oyediran and Ekundayo (2008) opined that the essential skills that often become

relevant to construction project managers are leadership, communication, negotiating, influencing, team building, problem solving and decisiveness skills.

A poll revealed that civil engineers were not commonly seen as project leaders (Russell and Stouffer, 2003). In the context of the construction industry, a similar situation prevailed for other professionals who also tended to be well-versed in the technical aspects of their respective domains, but lacked the managerial and leadership facets of knowledge. Kerzner's (2006) observation that people-related issues played a crucial role in project performance underlined the importance of a project manager's competence in managerial skills and behavioural skills as well as technical skills. The scope of knowledge areas required for managing projects will be influenced by the context of the industry in which the project managers work as well as the requirements of professional institutes (e.g., the Chartered Institute of Building [CIOB] and the Institution of Civil Engineers [ICE]).

1. Managerial skills: The project manager should have sound general business skills. These should include the following:
 - a. An understanding of the organisation and the business.
 - b. An understanding of general management, marketing, contract work, purchasing, law, personal administration and the general concept of profitability.
 - c. An ability to translate business requirements into project and system requirements.
 - d. A strong active continuous interest in teaching, training and developing subordinates.
2. Behavioural skills: Project managers need strong behavioural and interpersonal skills. In particular, they must have the following attributes:
 - a. Be an active listener, active communicator and able to capitalise on informal communication channels.
 - b. Master the art of questioning to provide clarity and paraphrasing to ensure verbal messages are understood.
 - c. Know how to build trust, promote team spirit and reward communication through praise and credit.
3. Technical skills: To make informed decisions, project managers must be able to grasp the technical aspects of the project. Although project managers seldom perform technical analysis, they must be technically qualified and have the ability to formulate and make technical judgements. The project manager must be capable of both integration and analysis, and must understand the rigorous training of professional technologists, which emphasises analysis and sometimes impairs their integrative ability.

In view of the above discussion, 16 courses that are pertinent to project management education and take into consideration behavioural skills, managerial skill and technical skill of construction professional groups were identified and subjected to empirical investigation. They included accounting and finance, construction technology, construction economics, contract

administration, estimating and cost control, human and industrial relations, information technology, land management and development, legal aspects, marketing, management principles and practice, organisational behaviour, procurement methods, project planning and control, quantitative methods, structural analysis and design.

RESEARCH METHOD

A structured questionnaire was the instrument used to collect primary data for the study. The target population of built industry professionals included architects, builders, civil/structural engineers, estate surveyors and quantity surveyors who have once acted as project managers or are presently engaged as project managers in Lagos, Nigeria. Lagos is located in the south-western part of Nigeria. Being a former federal capital and now the commercial centre of the country, Lagos hosts many of the reputable construction and consulting companies operating in Nigeria. Lagos is listed as one of the 25 megacities of the World with an estimated population of about 17 million in 2007 and a growth rate (3.2%) which has an attendant pressure on its infrastructure. There are numerous construction projects in Lagos that are executed by both the private and public sector to meet the housing, economic and infrastructure requirements of the emerging megacity.

A non-probabilistic sampling technique termed "snow ball" was adopted for the selection of the project managers. The rationale for adopting this sampling technique was the unavailability of a sample frame of practising project managers from which an accurate sample size could be drawn. Sixty project managers, who offered project management services and were either a corporate member or fellow of their respective professional institutions, participated in the study. A mini case study was made for each project manager.

The questionnaire used for the survey included (among other items) 16 courses for the respondents to choose from. The project managers were asked to indicate the extent to which certain courses pertinent to project management were covered in the undergraduate curricula and post qualification education. About 16 of such courses were identified from literature and from knowledge of courses taught at the master's level in universities around the world. Each project manager was asked to gauge each course on a scale of 1 (not covered) to 5 (well covered). The total score for each course was computed with a maximum possible score of 25.

RESULTS AND DISCUSSION

A summary of the demographic information obtained from the respondents is given in Table 1.

Table 1. Demographic Characteristics of the Project Managers

	Frequency	Cumulative Frequency	%	Cumulative %
Professional Group (N = 60)				
Architects	12	12	20	20
Builders	12	24	20	40
Civil engineers	12	36	20	60
Estate surveyors	12	48	20	80
Quantity surveyors	12	60	20	100
Age in years (N = 60)				
21–30 years	4	4	7	7
31–40 years	34	38	56	63
41–50 years	16	54	27	90
51–60 years	6	60	10	100
Level of Education (N = 60)				
Higher national diploma	4	4	7	7
Professional diploma	5	9	8	15
Bachelor's degree	17	26	28	43
Postgraduate diploma/Master's degree	32	58	53	96
Doctorate degree	2	60	3	100
Professional Qualification (N = 60)				
Corporate member	54	54	80	90
Fellow member	6	60	10	100
Industrial Experience (N = 60)				
Less than 10 years	10	10	17	17
10–19 years	35	45	58	75
20–29 years	12	57	20	95
30–39 years	3	60	5	100
Above 40 years	0	60	0	100
Educated Overseas (N = 60)				
No	48	48	80	80
Yes	12	60	20	100
Level of Education (N = 60)				
Low	1	1	2	2
Moderate	32	33	53	55
High	27	60	45	100

Demographic Characteristics of the Project Leaders

The study sought to find out the professional backgrounds of the project managers. Five types of construction-related professionals who acted as project managers were identified. They included architects, builders, civil/structural engineers, estate surveyors and valuers, and quantity surveyors. Any of these professionals can be engaged as a project manager on a building project. All five professionals were equally represented in the survey. A breakdown of the age distribution of respondent project leaders in years indicated that 7%, 56%, 27% and 10% fell within the below 30, 31 to 40, 41 to 50 and 51 to 60 categories, respectively. From this analysis, it can be inferred that project leadership is practised among professionals who are between the ages of 31 and 60 years. At the age of 60 years and above, professionals either go into other ventures that are less stressful or retire from practice. The academic qualifications of the respondents depicted that about 75% of construction industry professionals had a first degree or its equivalent and those having a diploma certificate accounted for only 15% of the total. This implied that the project managers were well educated academically. Further, there was a predominance of professionals with between 10 and 19 years of working experience. As observed, 58% of the respondents fell in this group. About 10% of those surveyed had below 10 years of experience and 20% had 20 to 29 years of experience.

In the early 1970s up till the late 1980s, the demand for construction professionals increased tremendously because of the oil boom that resulted in a high demand for construction products. As a result, many Nigerians travelled abroad to study construction related disciplines. This study sought to find the portion of project managers who benefited from overseas training. Only 20% of the project managers had overseas training, while 80% were trained locally. The amount of training received by project managers may likely be an indication of their knowledge in project management.

Education Proficiency in Project Management Knowledge Areas

The project managers were asked to indicate the extent to which certain courses pertinent to project management education and training were covered in the curricula of their post-secondary and post qualification training. About 16 of such courses were identified. Each project manager was asked to gauge each course on a 5-point Likert scale from 1 (not covered) to 5 (well covered). Figure 1 shows the overall score for each course for all the project managers surveyed. From Figure 1, it can be seen that the project managers were deficient in Information Technology (IT), which had a mean score of 13.30. This is followed by marketing (mean = 13.86), accounting and finance (mean = 14.00), and human and industrial relations (mean = 14.85). From the survey, the project managers were proficient in construction technology with the highest mean score of 21.20 followed by project planning and control (mean = 20.61) and contract administration (mean = 20.17). In the current era of IT, a project manager needs to be proficient in information technology to improve productivity, increase speed of project delivery and lower operational cost. Marketing is also very important for him to survive in business and for profitability.

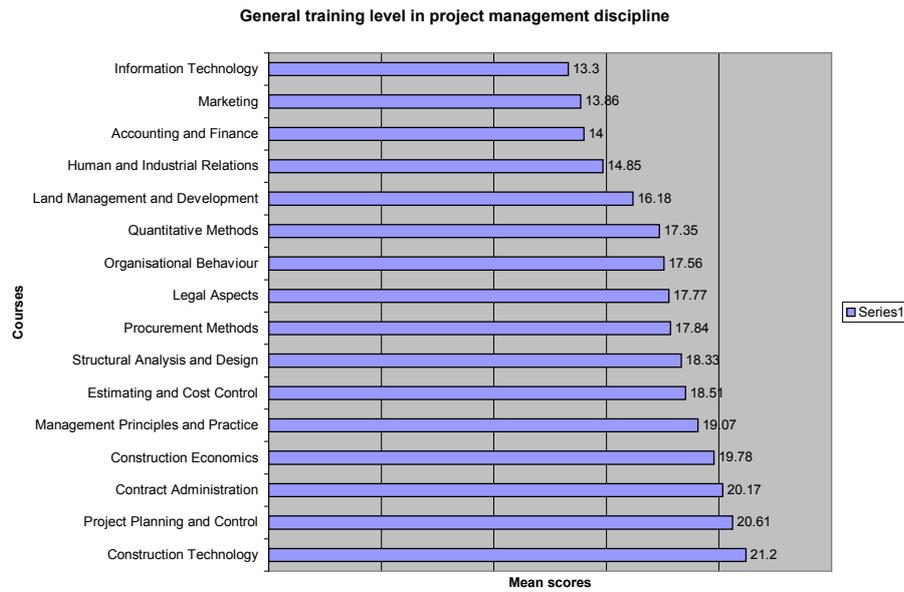


Figure 1. General Level of Education in Project Management Related Courses

Competency of Professional Group in Project Management Practice

The total scores for each course for each professional group were computed. These total scores were then divided by the sample size for each professional group to obtain the mean score for each course. The mean scores obtained were ranked in descending order from 1 to 5 to show the competency of each professional group in the project management related courses as presented in Table 2. The quantity surveyors' group scored the highest with a mean score of 76.89; the builders' group followed with a mean score of 73.86. The estate surveyors' group was third with a mean score of 71.05 and last, the architects' and civil engineers' groups had the lowest mean scores of 66.16 and 63.10, respectively, as shown in Table 2. These results compare favourably with to Ogunsemi, Oyediran and Ekundayo (2008), which compared the project management competence of Nigerian construction professionals in terms of basic competence, core competence and optional competence and concluded that the quantity surveyors group was observed to be the most competent in project management practice with 79% training in basic, core and optional project management competences followed by the builder and estate surveyor's group with 78% each. The architects' and civil engineers' groups trailed behind with 76% and 70%, respectively, in basic, core and optional training in project management competences. The low ranking of the civil engineering group is consistent with Russell and Stouffer (2003) survey, which concluded that civil engineers are not commonly seen as effective project managers.

Table 2. The Mean Score and Ranking of the Level of Education of Each Professional Group in Project Management Specific Knowledge Area or Practice

Courses	ARC	BLD	CE	ES	QS
Accounting and finance	2.42(4)	3.00(3)	1.83(5)	3.42(1)	3.33(2)
Construction technology	4.33(3)	4.92(1)	3.83(4)	3.67(5)	4.45(2)
Construction economics	3.67(3)	4.36(2)	3.50(5)	3.58(4)	4.67(1)
Contract administration	4.17(2)	4.00(3)	3.83(4)	3.50(5)	4.67(1)
Estimating and cost control	3.58(3)	4.09(2)	3.17(4)	3.17(5)	4.50(1)
Human and industrial relations	2.92(4)	3.18(2)	2.50(5)	3.25(1)	3.00(3)
Information technology	2.42(4)	2.55(3)	3.08(1)	2.33(5)	2.92(2)
Land management and development	2.92(3)	3.18(2)	2.30(5)	5.00(1)	2.75(4)
Legal aspects	3.17(4)	3.27(3)	2.83(5)	4.58(1)	3.92(2)
Marketing	2.08(4)	2.45(3)	2.08(5)	3.92(1)	3.33(2)
Management principles and practice	3.50(4)	3.91(3)	3.33(5)	4.00(2)	4.33(1)
Organisational behaviour	3.50(4)	3.64(2)	3.17(5)	3.75(1)	3.50(3)
Procurement methods	3.25(3)	4.09(2)	2.92(5)	3.33(4)	4.25(1)
Project planning and control	4.08(3)	4.36(2)	3.75(5)	3.92(4)	4.50(1)
Quantitative methods	3.17(4)	4.18(1)	3.50(2)	3.00(5)	3.50(3)
Structural analysis and design	3.75(3)	3.91(2)	4.83(1)	2.42(5)	3.42(4)
<i>Overall mean</i>	52.93	59.09	50.48	56.84	61.51
<i>Mean scores (rank)</i>	66.16(4)	73.86(2)	63.10(5)	71.05(3)	76.89(1)

ARC = Architect; BLD = Builder; CE = Civil engineer; ES = Estate surveyor; QS = Quantity surveyor

Overall Level of Education of Each Professional Group in Project Management-Related Courses

Table 2 shows the comparative overall levels of education of construction professionals in project management-related courses. In individual courses, the architects' group was deficient in the areas where it scored the lowest or the second lowest among the professional groups. These areas were (1) accounting and finance, (2) human and industrial relations, (3) information technology, (4) legal aspects, (5) marketing, (6) management principles and practice, (7) organisational behaviour, (8) procurement methods and (9) quantitative methods.

The builders' group was deficient in (1) accounting and finance, (2) contract administration, (3) information technology and (4) marketing.

The civil engineers' group was deficient in all the core project management-related courses, except information technology (moderately grounded), quantitative method and structural analysis and design (well grounded).

The estate surveyors' group was deficient in (1) construction technology, (2) contract administration, (3) estimating and cost control, (4) information

technology, (5) quantitative method, and (6) structural analysis and design. Wahab (1981) pointed out that course numbers 2, 3 and 6 are areas where estate surveyors are deficient.

The quantity surveyors' group, even though it had the highest overall mean score, was deficient in (1) human and industrial relation, (2) land management and development, and (3) structural analysis and design.

Test of Hypothesis

The hypothesis postulated for this study stated that "there is no variation in the background education (regarding project management-related courses) of different professional groups currently practicing project management". A one-way analysis of variance (F-test) was used to test for the significance of the differences in the level of education of different construction professional groups practicing project management.

Table 3 shows the one-way analysis of the variance of the level of education and the professional background of the project manager.

Table 3. One-Way Analysis of Variance on the Level of Education and the Professional Group of the Project Leader

Source	DF	SS	MS	F-Ratio	F-Tab	F-Prob.	Sig.
Between groups	4	1480.8854	370.2214	3.5370	2.55	0.0122	S*
Within groups	55	5756.9010	104.6709				
Total	59	7237.7865					

DF = Degree of Freedom; SS= Sum of Squares; MS = Means Square; *Significant at $p < 0.05$

For the variation in level of education, the observed value was $F = 3.5370$, while the table value was $F = 2.55$ with $N1$ (the degree of freedom between groups) = 4 and $N2$ (the degree of freedom within groups) = 55 at 5% significance level. As the observed value of F was greater than the table value of F , there were significant differences between the variance of the level of education of the professionals in project management-related courses. Therefore, the null hypothesis was rejected and the alternative, "There is variation in the background education (regarding project management related courses) of different professional groups practicing project management", was accepted.

CONCLUSION

Construction project managers are believed to be responsible for the overall success of construction developments within the given resource constraints and as such play a crucial role not only in the operational activities of consulting and contracting companies but also in the development of infrastructure in every country. Most consultants in the Nigerian construction industry combine project management practice with their primary responsibilities without additional training in project management. In view of the absence of a professional body charged with the responsibility of regulating Project Management practise in Nigeria, it was

necessary to review the current educational provisions of undergraduate programs in all relevant disciplines to ascertain the extent of coverage of the project management knowledge area. This study has established that there is variation in the background education of built environment professionals currently practising project management. The quantity surveyors' group was the most equipped with background education to practise project management, while the civil engineers' group was the least equipped. The project managers were well grounded in construction technology, project planning and control and contract administration, whereas they were deficient in Information Technology (IT), Marketing, Accounting and Finance, and Human and Industrial Relation courses.

The major limitation of the present study was the absence of a sample frame of practising project managers from which an accurate sample size could be determined and which would have guided in the choice of a sampling technique for selecting the respondents.

RECOMMENDATIONS

Having highlighted the areas of deficiency for each professional group in project management-related courses, it is also important to examine various means of acquiring knowledge in the areas identified. First, some of these courses can be included in the curriculum of studies of each discipline at the undergraduate level. Second, professional bodies like the NIA, NIOB, the Nigerian Institution of Estate Surveyors and Valuers, NSE and NIQS can include some of these courses in their professional competence examinations. The third option is for the would-be project manager to strive for the postgraduate diploma course or a master's degree in project management after graduation. Individual professionals can also seek knowledge in some of these courses through private studies under the Continuing Professional Development programme, which is mandatory for construction professionals and currently being organised annually by the regulatory bodies of Professional Institutes.

Presently, University of Lagos is the only university in Nigeria offering project management at the master's level for construction professionals. The Federal University of Technology, Owerri's master's programme in project management is relatively general and is being run under the title Business Administration. Other universities, especially first-generation universities like Ahmadu Bello University, Obafemi Awolowo University, University of Ibadan and University of Nigeria, Nsukka should also start a project management programme in either their Faculty of Engineering or Faculty of Environmental Sciences, specifically for construction professionals at the postgraduate level.

As of now, there is no professional body that regulates the practice of project management in Nigeria. It is recommended that a professional body termed the Institute of Construction Project Managers (ICPM) should be established with legal backing from the National Assembly. Such an institute will regulate the practice of project management in the Nigerian construction industry. As an alternative, a larger body named the Institute of Project Managers, similarly to the Association for Project Management of the UK or the Project Management Institute of the USA, can be established with many divisions including

one for construction. This body will regulate the practice of project management in all the relevant industries including construction.

REFERENCES

- Arcila, J.H.L. (2006). How much construction should we teach in civil engineering programs? *Proceedings: CIB W107 International Symposium on Construction in Developing Economies: New Issues and Challenges*. Santiago, Chile, 18–20 January.
- Carbone T.A. and Ghoston, S. (2004). Project management skill development: A survey of programmes and practitioners. *Engineering Management Journal*, 16(3): 10–16.
- Chan, E.H.W., Chan, M.W., Scott, D. and Chan, A.T.S. (2002). Educating the 21st century construction professionals. *Journal of Professional Issues in Engineering Education and Practice*, 128(1): 44–51.
- Crawford, L.H. (1997). A global approach to project management competence. *Proceedings of the 1997 AIPM National Conference*. Gold Coast, Brisbane: Australian Institute of Project Management, 220–228.
- Dulaimi, M.F. (2005). The influence of academic education and formal training on the project manager's behavior. *Journal of Construction Research*, 6(1): 179–193.
- Edum-Fotwe, F.T. and McCaffer, R. (2000). Developing project management competency: Perspectives from the construction industry. *International Journal of Project Management*, 18(2): 111–124.
- El-Sabaa, S. (2001). The skills and career path of an effective project manager. *International Journal of Project Management*, 19(1): 1–7.
- Gareis, R. and Huemann, M. (2000). Project management competences in the project-oriented organisation. In J.R. Turner and S.J. Simister (eds.). *The Gower Handbook of Project Management*. Aldershot, UK: Gower Publishing Limited.
- Goodwin, R.S.C. (1995). Skills required of effective project managers. *Journal of Management in Engineering*, 9(3): 217–226.
- Kerzner, H. (2006). *Project Management: A System Approach to Planning, Scheduling and Controlling*. 9th Ed. New York: John Willey and Sons.
- Mengel, T. and Thomas, J. (2004). From know-how to know-why: A three dimensional model of project management knowledge. PMI Global Proceedings. Anaheim, CA: Project Management Institute.
- Meredith, J.R., Samuel, J. and Mantel, J. (1995). *Project Management: A Managerial Approach*. New York: John Willey and Sons.
- Oduami, K.T. (2002). Perception of construction professionals concerning important skills of effective project leaders. *Journal of Management in Engineering*, 18(2): 61–67.
- Ogunsemi, D.R., Oyediran, S.O. and Ekundayo, D.O. (2008). Construction professionals and project management competencies in Nigeria. *Journal of Construction*, 1(2): 6–11.
- Pant, I. and Baroudi, B. (2008). Project management education: The human skills imperative. *International Journal of Project Management*, 26(2): 124–128.

- Project Management Institute. (2004). *A Guide to the Project Management Body of Knowledge*. Upper Darby, USA: Project Management Institute.
- . (2002). *Project Manager Competency Development Framework*. Newton Square: Project Management Institute.
- Russell, J.S. and Stouffer, B. (2003). Leadership: Is it time for an educational change? *Leadership Management in Engineering*, 3(1): 2–3.
- Strang, K.D. (2003). Achieving organisational learning across projects. *Proceedings: PMI North America Global Congress*. Baltimore, USA, 23 September.
- Thomas, J. and Mengel, T. (2008). Preparing project managers to deal with complexity: Advanced project management education. *International Journal of Project Management*, 26(3): 304–315.
- Wahab, K.A. (1981). The roles of estate surveyors in project management. In K.A. Wahab (ed). *Building Technology Seminar Paper on Management of Building Project II*. Ife, Nigeria: Department of Building, University of Ile-Ife, 26–33.