

Increasing the Performance of Physical Infrastructure: An Architectural Perspective

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Abstract—Infrastructure development is the source of determining the performance of democratic leaders and it is the substance of good democratic power. Sufficiency of the physical infrastructure is paramount for economic integration and development. This study aims to investigate the efficiency of physical infrastructure from an architectural perspective through public buildings performance evaluation. The paper observes previous studies which have identified valid problems relating to the performance of physical infrastructure especially in public buildings. Using secondary data from literature and existing conditions of two public buildings in South-west Nigeria, this paper examines observations on the selected buildings. Each building was visited and the spaces observed were public spaces within the buildings as access to all parts were restricted. Respondents were the occupants and building users within these public spaces. Questions were asked to the respondents and the answers were recorded by the researcher. The building condition rating scale provided the framework for observations. The finding shows that the challenges in the public buildings are abundant and comprise of funding, technology for development, maintenance and design. The study concludes that Nigeria Government has the power to put the buildings in place and providing good infrastructure will brand our environment as habitable for the end users. Infrastructure development in democratic power or governance involves ascertaining the veracious development, executing feasibility and sustainability studies and implementing the physical development of the project. Based on the findings, it is recommended that sustainability, inclusivity and technology should be prioritized in all national sectors in order to brave the efficiency challenges of the 21st century society.

Keywords— *Building performance, Democratic governance, Infrastructure challenges, technology and sustainability*

I. INTRODUCTION

Today's building industry has complex global socio-economic and environmental connections, which brands it as one of the popularly studied subjects in academia [1]. By way of openly addressing basic human needs within a city (portable water, a consistent supply of electricity, suitable plumbing and other services), infrastructure is a chunk of this course relating

between these impending questions and architectural "answers" [2].

In the sustainability discourse a recent debate is on how to make buildings and infrastructures more eco-efficient with help of technology while integrating the social-cultural and aesthetic dimensions and considering the lifestyles and interests of different stakeholders [1]. There are a lot of good new building projects taking form nowadays, devaluing the performance level of more typical construction developments, and provoking us to question the length to which our regular buildings are dwindling below the standard [3].

In a bid to promote the building performance, and energy usage of public buildings, the rising problem of actually expressing what constitutes high performance is yet to be addressed properly. Other problems relating to promoting the performance of buildings in the future are present but defining what high performance is and attempting to rate its performance and profits is the focus here [4].

The larger cities get, the more practitioners in design fields tussle to understand and reposition the effect made by infrastructure on the urban sphere. Aimed at architects specifically, the definition of what might establish an *architectural* approach to infrastructure is still unanswered since the effects of infrastructure at the architectural scale are almost absent from modern-day conversation and understanding at the urban scale and frequently emphasizes on the fading implication of form and boundaries [2].

This study aims to investigate the efficiency of physical infrastructure from an architectural perspective through public buildings performance evaluation. The approach builds on research of improving building performance and reciprocally reducing carbon dioxide emissions both in existing and new buildings, thereby pushing forward a more sustainable system.

II. INFRASTRUCTURE DEVELOPMENT IN DEMOCRATIC GOVERNANCE

In reply to burdens in Nigeria in lieu of improved governance and primary infrastructure, institutions that support

inclusion and promote accountability and fiscal progress can only be built on the firmest fundamentals of fair, clear and able governance and organizations run by the government—for example, reinforcement of the abilities of legislators, the mass media and domestic people societies [5]. Infrastructure development in democratic governance involves ascertaining the veracious development, executing feasibility and sustainable studies and implementing physical development of the project.

All team members that are part of the project sourcing and construction development can learn from building performance evaluation, chiefly the client (usually government) that gives better brief structure, architects that prescribe better design solutions to performance and engineers who cognize the makings of a comfy, energy proficient and dynamic building. The crucial goal is aimed at building performance being addressed in the procurement, design and construction levels [6].

The relationship among architect, clients, consultants, and end-users brings forward more important questions and a variety of conceivable answers. The aptitude to process various qualitative data to proper answers — to reason architecturally — is an essential strong point of architectural approach, free from the type and magnitude of the answer [2]. Several evolving African nations is supposed to be able to fund infrastructural developments needed if the nation capital and budget is appropriately and judiciously used [7].

III. THE EFFICIENCY OF PHYSICAL INFRASTRUCTURE FROM AN ARCHITECTURAL PERSPECTIVE

Africa still has colossal infrastructure necessities. It devotes merely 4% of its Gross Domestic Product in infrastructure, paralleled with 14% in China. Tying the infrastructure breach could upsurge Gross Domestic Product growth by a probable 2% points annually [5]. Infrastructure acts as the bridge among social life and the architecture that houses it, that is, architects work by blending an incongruent range of data in order to yield physical form [2].

The principled quest to promote sustainability in developing nations is just as green infrastructure seeks to combine social struggles in providing answers through the development of infrastructure with the extra necessities of landscape. Fiscal advancement of African countries is measured by the degree of, and efficiency of the utilization of e-governance, e-technology to back infrastructural development ambition [7]. There's a massive claim for infrastructure in Africa and yet the cash and support coming from benefactors and administrations is not enough. As a consequence, African administrations need to consider innovative options to fund the infrastructure breach, plus being involved in more public-private partnerships (PPPs) [8].

IV. THE BUILDINGS PERFORMANCE OF PHYSICAL INFRASTRUCTURE AND ITS PROBLEMS

Building performance evaluation is a scheme for improving the performance of buildings from the initial phases of work. This includes pointing out issues such as energy use and user comfort. Building performance evaluation involves the method

of gaining data about building performance and exhausting responses to advance innovative structures and update the design of upcoming projects [6]. According to research by (Nigerian Society of Engineers (NSE), 2014), the problem of low performance in the design and construction of physical infrastructure supply in evolving nations stems from the small consideration of environmental conditions and maintenance demands.

Consequentially, frequent costs, disasters, depletions and low performance is the order of the day. Cooperation between public and private agencies for supply of physical infrastructure in developing countries is very poor and this affects national capacity for delivery in most developing countries. Hence the present effort of the Nigerian government to develop an integrated long-term infrastructure masterplan is to be applauded.

V. THE BUILDING CONDITION RATING SCALE AND ITS APPLICATION TO EXISTING CONDITIONS OF PUBLIC BUILDINGS IN SOUTH-WEST NIGERIA

The Infrastructure Concessioning & Regulatory Commission (ICRC) is burdened with the responsibility of improving infrastructural development in Nigeria and its capability to share such know-how with the state and other Africa countries would go a long way in guaranteeing sustainable and worthy infrastructure in Africa [7]. Infrastructure performance management involves quantifying the efficiency and effectiveness of infrastructure elements and their effect on user satisfaction. For this study, two areas have been identified that form a minimum basis for performance evaluation of buildings.

This is shown in Fig. 1 below and they are the physical and functional areas or strategies which work together with the input of the government.

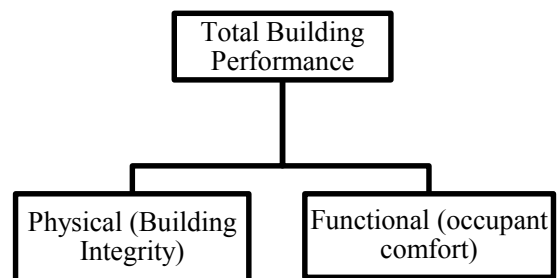


Figure 1: Building Performance Strategies

The physical area involves the protection of the physical structure by maintenance, design and construction methods. The functional area involves occupant comfort issues such as physiological, psychological, sociological and economic responses. Both areas work in relation to the other and their efficiency is determined by the presence and quality of the government participation or input in total building existence.

Much importance is presently set in evaluation factors that are related to planned, calculated, active and informational phases of the business that affect the society. Organization must track positive stages that will allow them have a sound performance measurement framework which include planning what to measure, choosing what to measure, determining how to measure, data utilization and implementation [9].

In order to have a building performance framework, first categorize diverse approaches and methods that will be used in measuring building performance. Recognized approaches and methods are then connected with structural and non-structural building facilities (which includes; physical, functional, financial and survey-based performance) to make a consistent building performance measurement conclusion.

VI. METHODOLOGY AND RESULT

Data for the study is collected based on observations on two selected public buildings in South-West Nigeria. Each building was visited and the spaces observed were public spaces such as the reception, conveniences, and circulation areas within the buildings as access to all parts were restricted. Respondents were the occupants and building users within these public spaces. Questions were asked to the respondents and the answers were recorded by the researcher. General physical observation on the buildings were also carried out. The building condition rating scale provided the framework for observations.

The finding shows that the challenges in the public buildings are numerous and include finance, technology for development, maintenance and design. Strategies and techniques linked with structural building facilities which include physical and functional performance are used in measuring building performance by rating the frequency of efficiency in percentages.

In the survey, the attributes are rated on a three point scale of efficiency measured by the amount of satisfaction or experience by the respondents and the author's observation.

A. Physical Performance Strategies

Result depicted in Table 1 showing, a higher rating in the inefficiency of resource consumption, adequacy of infrastructure and quality of space than in other areas.

TABLE 1: Physical Performance Strategies

Strategies	% Very Efficient	% Fairly Efficient	% Inefficient	Ranking
A. Resource Use (energy, water, and material)	-	-	35	1st
B. Adequacy of infrastructure	-	-	20	2nd
C. Quality of space (spatial, environment and amenities),	-	-	10	3rd
D. Quality and durability of the land base,	-	15	-	4th
E. Accessibility (site, location, and building design),	15	-	-	5th
F. Adequacy of building space to support the desired function	-	5	-	6th
Total (100%)	15	20	65	

Source: Author's Survey, 2016

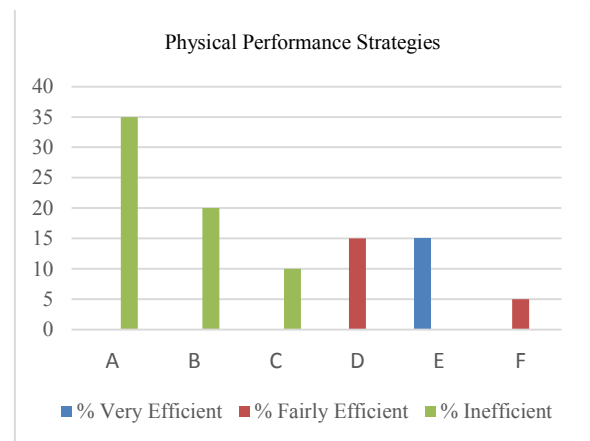


Figure 2: Bar Chart Showing the Percentages of Efficiency for Physical Performance Strategies

B. Functional Performance Strategies

Result depicted in table 2 showing standard that enhances building users with human and psychological comfort by the proficient supply of functional related structure strategies

TABLE 2: Functional Performance Strategies

Strategies	% Very Efficient	% Fairly Efficient	% Inefficient	Ranking
A1. Heating	-	-	35	1st
B1. Systems and technology	-	-	25	2nd
C1. Cooling	-	-	15	3rd
D1. Workspaces and Living areas	-	15	-	4th
E1. Lighting	-	10	-	5th
F1. Air distribution (artificial and natural ventilation)	5	-	-	6th
Total (100%)	5	25	75	

Source: Author's Survey, 2016

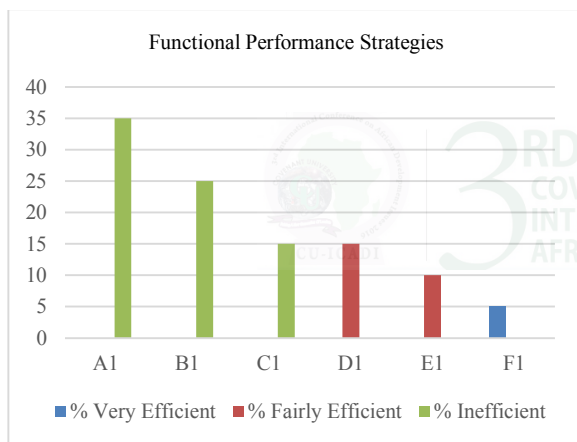


Figure 3: Bar Chart Showing the Percentages of Efficiency for Functional Performance Strategies

C. Government's Involvement in Building Performance

The knowledge of government's involvement in building performance is gotten from interview with public building users and national news publications.

/ N	Description	Yes (%)	No (%)
	Existence of building Insurance for Public Buildings	40	60
	Payment of Health and Safety Insurance to accident victims	40	60
	Compliance to Building Maintenance Plan	30	70
	Monitoring and periodical inspection of public building	50	50
	Positive efforts towards user comfort	80	20

VII. DISCUSSION

a. More than half of the respondent complained about the inefficiencies in energy provision and consumption

b. They have all witnessed or experienced indiscriminate fare collection by government officials meant for maintenance.

c. Majority of these buildings do not have any insurance in place for the users.

d. The performance of each area cannot be understood or estimated independently.

e. a design response to the physical performance required will alter the physical environment and thus the perceived function and level of comfort by occupants.

It may be concluded that effective building performance practices in Nigeria are yet to be fully activated.

VIII. RECOMMENDATIONS AND CONCLUSIONS

The study concludes that Nigeria Government has the power to put the buildings in place and providing good infrastructure will make our environment conducive for the users. If we invest in infrastructure that unlocks the potential of the private sector, championing community participation, it will help improve skills for competitiveness, ensuring that those skills better match the opportunities and requirements of local job markets.

Ensure that inclusive growth is sustainable, by helping Africa gradually transition to "green growth" that will protect livelihoods, improve water, energy and food security, and promote the sustainable use of natural materials for construction.

Based on the findings, it is recommended that sustainability, inclusivity and technology should be prioritized in all national sectors in order to brave the efficiency challenges of the 21st century society.

TABLE 3: Governments Involvement in Building Performance

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