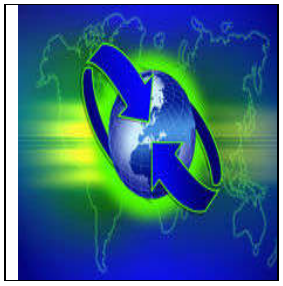

The Application of Environmental Sustainability Approach (EIA) to Infrastructural Development in Federal Capital City (FCC) Abuja, Nigeria

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Abstract

Sustainable construction is becoming a major approach to urban infrastructural development. However, there is inadequate research in Nigeria to evaluate the application of the principles of sustainability in infrastructural projects development for environmental sustainability. Thus, this study aimed to assess the application of environmental sustainability approach (EIA) in infrastructural development in Federal Capital City (FCC) Abuja, Nigeria. The objectives were to: investigate the socioeconomic characteristics of respondents; examine the level of integration of sustainability in infrastructure construction in FCC Abuja and to identify factors that constrain sustainability integration into infrastructural development in FCC Abuja. Data were collected using questionnaire, interview and focus group discussion. Purposive and stratified sampling techniques were used to select 382 professionals from FCDA and six construction companies in FCC. Data were analyzed using descriptive statistics and Factor Analysis and presented in tables. Results show that Majority of the construction firms carry out EIA on large construction as over three quarter (78.31%) affirmed that EIA is carried out in large project. Only few (10.24%) disagree, while 11.15% don't have ideas about the application. Challenges of sustainable construction are related to knowledge/capacity (34.56%), Concept (25.88%), Finance (23.42%) and interest (16.13%). It was concluded that application of Environmental Impact Assessment (EIA) in infrastructural development is not the issue, but the implementation and monitoring. Effort on sustainability integration into infrastructural development should be channeled towards implementation of environmental management plans.

Keywords: Infrastructural development, environmental sustainability integration, environmental impact assessment, environmental management plan and sustainable construction

Introduction

Environmental integration approach has emerged as a guiding paradigm to create a new kind of built environment. Therefore, there should be new thinking in infrastructural provision and attention should be directed to sustainability. The design of infrastructure should shift from the norm to more integrated actions that will mitigate the emerging climatic and population growth challenges. Since the 1990s, activist/environmentalist approach to planning has grown into the Smart Growth movement, characterized by the focus on a variety of approaches have been developed to translate sustainable construction requirements to actionable tasks for the construction sector. Environmental

Impact Assessments (EIA) ranks amongst some of the earliest and relevant tools used for assessing the sustainability of development projects (Wood, 1995). However, EIAs are thought to be limited in achieving sustainability due to poor implementation of Environmental Management Plan (Lenzen *et al*., 2003; Nwokoro, 2011).

Environmental Management Plan (EMP) is a living document that must consider predicted impacts to the environment, monitoring data and programs, and means for compliance to applicable guidelines and regulations. Once infrastructural project commence, monitoring is an integral part of evaluating the effectiveness of the plan and planning process. Monitoring and analysis of monitoring results promotes infrastructural sustainability. To utilize EIA as a tool for sustainability, implementation of management plan, monitoring and professional involvement are critical.

It is considered a good practice to integrate sustainability in infrastructural development.Thus, increasing interest among architects and planners in designing environmentally friendly buildings has generate concepts like sustainable construction, Green Infrastructure (GI), Integrated Infrastructure among others (Islam *et al,* 2013). Sustainability of urban environment, amidst infrastructural development requires integration of environmental factors. This is crucial especially in combating climate change effects on infrastructures and the entire environment. Infrastructures are sensitive to weather and climate change and failure to integrate such factors in planning, implementation and use of infrastructures will lead to significant damage, with high cost implications, and should be incorporated early into infrastructure development projects.

Though, there is increasing awareness on integrating environmental sustainability in infrastructural development and sustainable construction is becoming a major approach to infrastructural development. Rapid urbanization has led to great demand for infrastructure and provision of infrastructure and other human needs in every aspect of human activities are among the contemporary challenges globally. Thus, the United Nations has acknowledged that advancing sustainability knowledge and actions are the only solution. Whereas this knowledge declaration became necessary; this is because people in most part of developing countries particularly Nigeria

suffer inferior life because of poverty, inadequate and unsustainable infrastructure development including roads, airports, railways, water supplies, bridges, sewage and information systems (Zavrl and Zeren, 2010).

Deficiency in infrastructure constrain economic activities such as farming, trade and services and to promote trade, services and manufacturing activities, it is vital to develop a sustainable infrastructure that will enhance economic development. Therefore, the provision of infrastructure projects to meet the growing population in different cities across the world; the built environment and construction activities are increasingly causing environmental damage (Daramola and Eziyi, 2010). Therefore, the effort of the federal government in infrastructure provision to meet demand must take sustainability into consideration. Construction of road networks, bridges, water supplies amongst various other infrastructure systems must meet the needs of both the present and future generations in a sustainable manner of social, economic and environmental friendliness. Infrastructural projects provided within the FCC are not only inadequate but 'unsustainable'. Although the extension of infrastructure development has been proposed, environmentalist demand that "environmental sustainability should be integrated in infrastructure projects to preserve the natural resources and the environment, reduce carbon dioxides emissions and improve pollution while promoting the efficient and effective use of financial resources to guarantee quality life for the people" (Ehikioya, 2017).

Integrating sustainability in infrastructural projects planning and executing process will enhance utilization especially when all stakeholders including the beneficiaries are involved (Robichaud and Anantatmula, 2011). Lack of teamwork between the projects stakeholders has been identified a factor responsible for the failure of construction projects (Choi, 2009; Muldavin, 2010; Grevelman and Kluiswara, 2010; Wu and Low, 2010). Similarly, delays in project executions have been attributed to the lack of awareness and knowledge of sustainability (Choi, 2009; Zainul, 2009).

Though there is yet no consensus on sustainable construction, compliance with sustainability principles in both developed and developing countries demonstrate that it is feasible

to initiate, plan, execute and maintain infrastructure in a style that suitably manage any probably negative health, environmental safety, social outcomes and problems (Daramola and Eziyi 2010). The concept of sustainability in infrastructure projects is more than the combination of techniques, designs and materials, it denotes the broader idea that strives to realize completely and throughout the life cycle of the built projects (Isa, 2015). Similarly, obtaining the right process at the right time becomes imperative in infrastructural projects and the planning process has been considered the best stage for integrating sustainability (Hayles, 2004; Wu and Low, 2010). While these assertions are based on the premise that sustainability is fundamentally a best practice process leading to sustainable success outcomes (Muldavin, 2010); equally, its integration into the project executing process and the other processes groups becomes imperative in the broader idea that strives to realize sustainability throughout the life cycle of the projects.

However, whether sustainability integration into infrastructure projects is being done remain not clear in the context of the Nigerian built environment and the Federal Capital City (FCC)Abuja is not an exception. Thus, this study assessed the application of environmental sustainability approaches in infrastructural development in FCC Abuja in order to ascertain sustainability in infrastructure development in the Federal Capital City Abuja, Nigeria. The objectives of this research therefore are to:

i. Examine the level of integration of sustainability in infrastructure construction in FCC Abuja
ii. Identify factors that constrain sustainability integration in infrastructural development in FCC Abuja

Methodology

This study employed survey design and data were collected from both primary and secondary sources. Data were obtained from using questionnaire, interview focus group discussion and observation primary sources. The questionnaires were structured to contain both the close and open-ended questions. Purposive and stratified sampling techniques were used to select sample. Firstly

purposive sampling technique was used to select, FCDA Engineering Services department and six construction companies (Julius Berger Nigeria PLC, Gilmo Nigeria LTD, Dantata *and* Sawoe Construction Company (Nigeria) Ltd, Ceezali Nigeria Limited, Arab Contractors and Kaakata Nigeria Limited) in FCC for sampling based on their outstanding involvement in infrastructure project in FCC. After which, three hundred and thirty-two (332) respondents were selected from among the infrastructural development professionals. Samples were stratified into seven based on number of firms and further into different professions (engineers, architects, surveyors, artisans and others) to allow equal representations and reduce bias.

Moreover, focus group discussion was also conducted with thirty (30) construction professionals and experts among the chief executives officers (CEOs) of the six construction companies. The choice of this caliber of people was to get information from experienced construction professionals. Data were analysed using descriptive and Factor Analysis.

Results and Discussion

Integration of Environmental Sustainability Approach in Infrastructure Construction in FCC Abuja

Although many construction stakeholders were aware and have a basic knowledge of sustainable construction, implementation is a major issue. Respondents were asked if their company conducts EIA, implementation Environmental Management Plan (EMP) and monitor projects. Table 1 presents the response for application of EIA for infrastructural development.

Table 1: Respondents' opinion on the Application of EIA in Infrastructural Development

Environmental Integration Approach	Options	FCDA	Julius Berger	Gilmo Nigeria LTD	Dantata & Sawoe Ltd	Ceezali Nigeria LTD	Arab Contractors	Kaakata Nigeria LTD	Total	%
Firm Carries out EIA	Yes	143	19	20	18	21	22	17	260	78.31
	No	6	7	3	8	4	3	3	34	10.24
	No idea	10	4	5	2	5	4	8	38	11.44
Implement EMP	Yes	78	16	13	10	14	12	11	154	46.39
	No	41	6	4	5	6	4	3	69	20.48

	No idea	40	8	11	13	10	13	14	109	32.83
Monitor Project	Yes	98	12	11	10	9	10	8	158	47.59
	No	37	9	6	6	7	4	7	76	22.89
	No idea	24	9	11	13	14	15	14	98	29.51

Table 2 shows that two hundred and sixty (260) which is 78.31% of respondents agreed that their firms carries out EIA on large construction projects, thirty-four respondents which is 10.24% disagreed while thirty eight respondents which is 11.15% don't have idea of application of EIA on large infrastructural project. Thus, majority of the firm carries out EIA on large infrastructural projects.

This suggests growing awareness and application of EIA in infrastructural project. However, in term of implementation of Environmental Management Plan (EMP) in EIA report, one hundred and fifty-six (256) respondents which is 45.18% agreed that EMP are implemented by their firm, sixty- nine (69) respondents which is 20.48% disagreed while one hundred and nine(109) respondents which is 32.83% don't have idea of implementation of EMP by their firm. This suggests poor implementation of EMP and low involvement of construction workers on environmental management plan. Monitoring of project were also low as less than half (47.59%) agreed that their firm monitor project after construction.

During the Focus group discussion, it was found that majority of the respondents attested to the poor monitoring of activities of construction works by the relevant government agencies, while minority explained that the monitoring activities of construction works are very effective. Similar, sentiments were also shared by professional interviewed on monitoring of construction activities by the relevant government agencies. The ineffectiveness of the relevant government agencies in this perspective might be responsible for the poor implementation of infrastructure management plan by firm.

Focus group discussion in relation to integration of environmental sustainability approach in infrastructural construction in FCC Abuja shows that theories are yet to match with actions.

Participants were asked to mention programme/actions by their firm to promote sustainability in infrastructural development. Participants from the FCDA mentioned programmes like implementing the Green Building Concept, removal of illegal development/shanties in the city. Some also explained that their firm uses GIS to conduct Suitability Analysis of a proposed infrastructure project. All Participants agreed that their firm conduct Environmental Impact Assessment on large infrastructure project. However when asked about firm's green credentials and sustainability model, there was a bit silence before some participant pointed that there is no proper and organized system to encourage and drive sustainability noting that no organization yet to accredit infrastructure as green in FCC Abuja .

Factors that Constrain Sustainable Integration of Infrastructure in FCC Abuja

Infrastructure development stakeholders are diverse and area of interest in sustainability may differ making sustainable construction somehow complex. Many barriers have been identified in literature as the challenges needing to be overcome by stakeholders in the sustainable integration of infrastructures. Result shows that challenges of sustainable construction are mainly related to, interest, concept, government policy, knowledge/capacity and finance. Using factor analysis, these challenges were resolved to five main factors: interest, concept, government policy, knowledge/capacity and finance (Table 2)

Table 2 shows the group of challenges under each factor that constrain sustainable integration of infrastructure in FCC Abuja. It shows the factors as follows:

Interest

Challenges such as unwillingness to adopt new construction methods, lack of expressed interest from different project stakeholders and lack of demand for sustainability in construction by clients had 328(63.94%), 87(16.94%) and 98(19.10%) frequencies/percentages respectively. In general, interest had a total of 513 affirmations which is 16.13%. Therefore, 16.13% sees interest in sustainable construction as a barrier to its integration in construction of infrastructure. To increase the likelihood that societies will adopt new approaches to infrastructural development would not

only need to have knowledge, finance and policy but both clients and contractors must express an interest in sustainability in the first place.

Table 2: Factors that constrain Sustainable Integration in Infrastructure in FCC Abuja

Factors	Challenges	Frequency	%	Total	%
Interest	Unwillingness to adopt new construction methods	328	63.94	513	16.13
	Lack of expressed interest from different project stakeholders	87	16.94		
	Lack of demand for sustainability in construction by clients	98	19.10		
Knowledge/ Capacity	Poor knowledge of sustainable design	209	19.02	1099	34.56
	Inadequate awareness and knowledge of the concept of sustainability and benefits therein	211	19.20		
	Lack of technical know-how in sustainable construction	234	21.29		
	Lack of training/education in sustainable design/construction.	323	29.39		
	Incompetence of Contractor/Subcontractors	122	11.10		
Concept	Lack of well-developed framework of application for sustainable practices.	232	28.19	823	25.88
	Lack of an optimum project delivery structure to attain sustainability	212	25.76		
	Lack of sustainable construction model	145	17.62		
	Lack of Cohesion among stakeholders	234	28.43		
Finance	Fear of increase in cost	329	44.16	745	23.42
	Poor workmanship during construction	289	38.79		
	Budget constraint	127	17.04		

Knowledge/ Capacity

Challenges such as poor knowledge of sustainable design, inadequate awareness and knowledge of the concept of sustainability, lack of technical know-how in sustainable construction, lack of training/education in sustainable design/construction and incompetence of contractors had 209(19.02%), 211(19.20%), 234(21.29%), 323(29.39%) and 122(11.10%) frequencies/percentages respectively. Knowledge/ Capacity had a total 1099 affirmations, which is 34.56%. Therefore,

many recognized knowledge/ capacity as a constraint to sustainable integration of infrastructure. This finding is in line with the report of Nwokoro and Onukwube (2011). Nwokoro and Onukwube (2011) found that education and training ranked 2nd among factors considered for sustainable construction. They explained that implementing skills training and capacity enhancement will help the disadvantaged workers.

Concept

Challenges such as lack of well-developed framework of application for sustainable practices, lack of an optimum project delivery structure to attain sustainability, lack of sustainable construction model and lack of cohesion among stakeholders had232(28.19%), 212(25.76%), 145(17.62%) and 234(28.43%) frequencies/percentages respectively. Concept related challenges had a total of 823 affirmations, which is 25.88%. This show concept related challenges are significantly recognized among constrains to integration of sustainability in infrastructure construction in FCC Abuja. Despite universality and reputation of the concept of sustainable development, a fair amount of literature has criticized the concept. It has been seen as ambiguous concept and have been referred to the 'vicious circle of blame' between stakeholders (Cadman, 2000; Afolabi, 2016).

Finance

Challenges such as fear of increase in cost, poor workmanship during construction and budget constraint had 329(44.16%), 289(38.79%) and 127(17.04%) frequencies/percentages respectively. Thus, finance related challenges had a total of 745 frequencies which is 23.42%. Therefore, had almost one-quarter of the scores. Issues regarding to finance has been observed as a major challenge to achieving SC in developing countries and around the world. Ayarkwa *et al.* (2017) observed that financial issues are crucial barriers to the adoption of sustainable construction in Ghana. Miranda and Marulanda (2001) also submitted that a major challenge to sustainable

construction in Peru, is the fact that it is being perceived as a concept which would add cost to the project. Ametepey *et al.* (2015) also observed that the fear of higher cost in sustainable construction has proven to be a major challenge to its implementation. This assumption tends to create fear among construction clients. Focus group discussion participants emphasized inadequate fund, lack of boundary and sustainability model are the major constrains to sustainability integration of infrastructure. Inadequate training of staff to cope with current trends in the construction industry was also pointed out.

Conclusion

With growing demand of infrastructure due to population growth and urbanization, coupled with consequences of climate change such as flooding, erosion and wind storm integration of sustainability should be the way forward to overcome short supply of infrastructure now and in the future. The findings of this study are reliable as the socioeconomic characteristics of respondents indicate high level of education and experience in construction industry. Data from the survey shows that sustainability approaches like EIA is fairly applied in large construction project but implementation of environmental management plan is a major issue. Monitoring of project and some professional involvement are also poor. Factors that constrain integration of sustainability in infrastructural development in FCC Abuja are interest, concept, knowledge/capacity and finance.

Recommendations

Therefore, to achieve sustainability in infrastructural development, the following recommendations were made:

- There should be heavy penalties for contractors who fail to have registered professionals in supervisory capacity in major construction projects.
- Infrastructural development contractors should be conscious of their impacts on the environment and implement their management plan.

- Governments and advocacy groups can increase the interest of other stakeholders by modeling and advocating sustainability in infrastructure construction.
- Private organization should be involved in marketing sustainability in infrastructure to increase interest.
- Budgeting in infrastructural development should inculcate sustainability by increasing funding to reduce financial constraint.
- Government Agencies like FCDA in charge of infrastructure development should only give approval for developers that meet sustainability design.

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