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African Journal of Educational Management, Teaching and Entrepreneurship Studies
VOL.15 (2), May-August, 2025 https://ajemates.org

EFFECT OF CONSTRUCTABILITY PRACTICES ON THE DELIVERY OF ROAD INFRASTRUCTURE PROJECTS BY INDIGENOUS ROAD CONSTRUCTION FIRMS IN ABUJA, NIGERIA

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ABSTRACT

Most public projects in Nigeria including road infrastructural projects are classified as failed projects. This is due to lack of implementation of constructability practices by Nigerian Indigenous Road Construction Firms (IRCFs). Therefore, Nigerian IRCFs' road infrastructure projects executed are faced with challenges of untimely completion, more or less expensive than delayed completion. This necessitates the assessment of potential effect of constructability practices on the delivery of road infrastructure projects by IRCFs in FCT, Abuja with a view to enhancing the delivery of road infrastructure projects. This study adopted the quantitative research approach through the use of a survey research design. Population for the study included professionals of IRCFs actively involved in road infrastructure projects in FCT, Abuja and are registered with Bureau of Public Procurement (BPP). Purposive sampling technique will be adopted to select the respondents. The criteria for the selection are active participation of a professional road infrastructure projects; respondents' years of professional experience; and respondents' educational qualification. Data collection was undertaken with the use of structured questionnaire. Analysis of data collected was undertaken with the use of both descriptive and inferential statistical techniques. For the descriptive analysis, percentage and Mean Item Score (MIS) were used. For the inferential analysis, Principal Component Analysis (PCA) was used. Percentage was used to analyse respondents' profile. MIS was used to rank respondents' perception to address the research objectives. PCA was used for data reduction in order to remove redundancy or duplication from a set of correlated variables. Findings from the study revealed that the most important area of constructability practices in road infrastructure projects is "Evaluating the various design configurations to optimize owner requirements" (MIS = 4.36). The most significant driver for the adoption of constructability practices by the IRCFs is "Emphasizing early cost influence to your project" (MIS = 4.26). The most severe barrier to the adoption of constructability practices by the IRCFs is "Delays in payment to contractors" (MIS = 4.22). The influence of constructability practices on cost and time delivery of road infrastructure projects by IRCFs in Abuja is significant (average MIS = 4.07; r = 0.379 – 0.661; p = 0.000 – 0.007). The most effective measure for enhancing the adoption of constructability practices in road infrastructure projects is "Project coordination meetings" (MIS = 4.33). It was concluded that the potential effect of constructability practices on the delivery of road infrastructure projects by indigenous road construction firms in FCT, Abuja, Nigeria is significant. The study recommended

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that the management of IRCFs should create a constructability task force, develop a constructability policy, provide training and education, encourage collaborations and communication, implement a constructability checklist, and monitor and evaluate performance. By implementing these mechanisms, management can ensure that the adoption of constructability practices is successful and leads to improved cost and time delivery of construction projects within the IRCF.

Keywords: Effective, Constructability, Infrastructure, Projects, Nigeria.

Introduction

Infrastructure development is a critical prelude to economic growth and development on a global scale. According to Okpalaoka (2021), most emerging economies with infrastructure deficits have little chance of establishing a sustainable route to national growth, as attracting Foreign Direct Investment (FDI) and advancing essential and noncritical sectors of the economy are near-impossible. Nigeria is trapped in this heinous predicament. Over the years, various administrations have failed to prioritize the building of critical infrastructure. Budgeting has frequently prioritized recurrent expenditures over infrastructure development, leaving the country in a dismal and awful condition of infrastructural presence (Okpalaoka, 2021. Infrastructure refers to the fundamental physical and organisational elements that enable a society to function, such as roads, bridges, health services, governance, industries, and buildings.

In the light of the above background, it has been reported that, in terms of road infrastructure, Nigeria has the largest road network in sub-Saharan Africa with an estimated 195,000km of road 67.5% of which is untarred, while the paved sections are mostly in deplorable conditions (Pison Housing Company, 2013; National Planning Commission, 2015). Consequently, the Nigerian government is foreseeably going to make increasing investments in road infrastructure given the noted link between roads and economic development (National Planning Commission, 2015; David-West, 2015; Pison Housing Company, 2013).

Statement of the Research Problem

It has been established that roads remain the major tool for facilitating the mode of moving goods and people across the country to accelerate economic and business activities. Modern businesses, industries, trades and general activities depend on transport and transport infrastructure, the movement of goods and services from place to place becoming vital and inseparable aspects of global and urban economic survival (Afolabi *et al*., 2018). Despite this, in developing countries such as Nigeria, majority of projects embarked on by the government, including road infrastructure projects, are classified as failed projects due to lack of implementation of constructability practices by Nigerian IRCFs (Hanachor, 2013; Eja and Ramegowda, 2019).

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Previous studies have also noted that the Nigerian IRCFs have considerable technical and financial weaknesses and are also noted to be inexperienced, incompetent and poor project planners (Oladimeji and Ojo, 2012; Ibrahim *et al*., 2014; Ugochukwu and Onyekwena, 2014). These raise questions on the ability of IRCFs to undertake proper constructability reviews of road projects at the pre-construction stages as well (Mbamali *et al*., 2005; Trigunarsyah, 2007; Akpan *et al*., 2014; Aina, 2015; Amade, 2016; Oke *et al*., 2018). In line with this, it has been revealed by Ikpeazu and Aaron (2019) and Oluwajana *et al*. (2022) that due to lack of implementation of constructability practices by Nigerian IRCFs, road infrastructure projects executed are faced with challenges of untimely completion which is much less expensive than delayed completion. If roads can be completed at the appropriate time, then the overall cost of constructing roads is less.

Objectives of the Study

i. To identify the core areas of constructability practices in road infrastructure projects.

ii. To examine the level of awareness, readiness, and adoption of constructability practices by the IRCFs in FCT, Abuja.

iii. To ascertain the drivers and barriers to the adoption of constructability practices in the execution of road infrastructure projects by the IRCFs.

iv. To determine the influence of the adoption of the constructability practices on the cost and time delivery of road infrastructure projects executed by IRCFs.

v. To develop measures for enhancing the adoption of constructability practices in the execution of road infrastructure projects by the IRCFs.

Literature Review

Core Areas of Constructability Practices in Road Infrastructure Projects in the Construction Industry

In a study conducted by The Construction Industry Research and Information Association (CIRIA, 1983), seven concepts for implementation during the design phase were identified. These include: conduct a thorough investigation and design; plan for essential site production requirements; plan for a practical sequence of operations and early enclosure; plan for simplicity of assembly and logical trade sequences; detail for maximum repetition and standardization; detail for achievable tolerances; and specify robust and suitable materials. In line with this, research by Adam (1989) identified the following early phase constructability concepts: Investigate thoroughly; Consider access at the design stage; consider storage at the design stage; design for minimum time below ground; design for early

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enclosure; use suitable materials; design for the skills available; design for simple assembly; plan for maximum repetition and/or standardization; maximize the use of a plant; allow for sensible tolerances; allow for a practical sequence of operations; avoid return visits by trades; plan to avoid change to work by subsequent operations; design for safe construction; and communicate clearly.

According to Griffith and Sidewell (1995), the American Society of Civil Engineers (ASCE) suggested six (6) principles of constructability: These include: evaluating the various design configurations to optimize owner requirements; knowing the various project systems and their interface requirement with other project components; understanding trade skills and practices; construction methods, materials, labour and sub-contract resources, and plant and equipment; appreciation of local climatic conditions; evaluating site conditions both above and below ground and realizing their possible implications upon construction; and finally determining availability of space and access routes on site.

Research Methodology

Field survey research method was adapted to gainer information on the subject matter through the administration of questionnaires to relevant professionals in construction industry. This research is to have a national coverage with construction professionals in Abuja

The researcher presumes that the locations are true representative city for the country. A sample size of seven – eight (78) firms (consultancy and construction) situated in Abuja.

A total of seven- eight (78) questionnaires were administered randomly on selected firms within Abuja and Fifty-four (54) questionnaires were received and used for analysis. The study employed quantitative descriptive approach in collecting and analyzing the quantitative data, where facts and figure were used as techniques for data collection for the purpose from the respondents.

The collected data was quantitative analysed using percentage, frequency counts and Mean Item Score (MIS); and inferential statistics such as Principal Component Analysis (PCA) and Spearman Rank correlation through IBM SPSS for the descriptive analysis and inferential. The level of significance of test is set at 5% (95% confidence level). For significant linear relationships, the P-value must be less than 5% ($P < 0.05$) or otherwise.

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Analysis of Data

Table 4.1: Core Areas of Constructability Practices in Road Infrastructure Projects

Code No.	Core Areas of Constructability Practices in Road Infrastructure Projects	MIS	Rank	Decision
B1	Evaluating the various design configurations to optimize owner requirements	4.36	1st	Extremely Important
B18	Avoid return visits by trades	3.59	28th	Very Important
	Average MIS	***4.07***		***Extremely Important***

The table 4.1 shown that evaluating the various design configurations to optimize owner requirement (MIS 4.36)and also the least important of constructability is (MIS 3.59).The average of the identified core areas (average MIS 4.07) in Abuja**.**

Tabe4.2 Examination of Awareness, Readiness, and Adoption of Constructability Practices by IRCFs

Code No.	Level of Awareness of Constructability Practices by IRCFs	MIS	Rank	Decision
C1.1	Most of the professionals are not acquainted with the concept of constructability yet	3.76	1st	Very High
C2.3	Construction firms have no formal policies for the implementation constructability	3.40	4th	Very High
	Average MIS	***3.58***		***Very High***
C3.1	Constructability programme adoption in construction projects differs from one corporation to another	4.04	1st	Very High
C3.4	About half of the construction-related projects approved by Nigerian Government were awarded to indigenous firms and have failed	3.14	5th	Very High
	Average MIS	***3.64***		***Very High***

The table 4.2 shown that most of the professionals are not acquainted with the concept of constructability yet" (MIS = 3.76). The least number of the respondents agree

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that "there is complete lack of awareness by the IRCFs" (MIS = 3.76). On the average, all the respondents agree to low level of awareness of constructability practices by the IRCFs in Abuja (average MIS = 3.58). In readiness of constructability "there is dearth of knowledge concerning efforts to improve constructability t" (MIS = 3.76). The least number of the respondents agree that "construction firms have no formal policies for the implementation constructability" (MIS = 3.40). On the average, all the respondents agree that there is low-level readiness among IRCFs in Abuja to adopt constructability practices (average MIS = 3.58).

Table 4.3: Drivers for Adoption of Constructability Practices in Road Infrastructure Projects by IRCFs

Code No.	Drivers for Adoption of Constructability Practices in Road Infrastructure Projects by IRCFs	MIS	Rank	Decision
D1.9	Emphasizing early cost influence to your project	4.26	1st	Extremely Significant
D1.12	Resolving conflict based on project objectives	3.90	14th	Very Significant
	Average MIS	***4.06***		***Extremely Significant***

Table 4.3.1: KMO and Bartlett's Test 1

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.882
Bartlett's Test of Sphericity	Approx. Chi-Square	420.946
	Df	91
	Sig.	.000

The drivers for the adoption of constructability practices by the IRCFs in Abuja were subjected to Principal Component Analysis (PCA) using IBM SPSS Version 23.0. This was done to reduce the number of factors into manageable size and groups of correlated factors. This will aid policy implementation and decision making of the construction firms. Prior to the performance of PCA, the suitability of the data for PCA was tested. Inspection of the correlation matrix revealed the presence of

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many coefficients of 0.5 and above. The Kaiser-Meyer-Okin (KMO) value was 0.882, exceeding the recommended value of 0.6 (Pallant, 2013) and Bartlett's Test of Sphericity (Pallant, 2013) with the value of 0.000 reached statistical significance of $p < 0.05$, supporting the factorability of the correlation matrix.

Table 4.4 Determine of Influence of Adoption of Constructability Practices on Cost and Time Delivery of Road Infrastructure Projects

Code No.	Influence of Adoption of Constructability Practices on Cost Delivery of Road Infrastructure Projects	MIS	Rank	Decision
E1.1	The building process can be more efficient and economical	4.25	1st	Extremely Significant
E1.9	Lower cost of bidding	3.85	10th	Very Significant
	Average MIS	***4.07***		***Extremely Significant***
E2.6	Improved constructability leads to significant savings in time required for completing construction projects	4.19	1st	Extremely Significant
E2.8	Increased productivity	3.98	11th	Very Significant
	Average MIS	***4.07***		***Extremely Significant***

The table4.4 shown that the most significant influence of constructability practices on cost delivery of road infrastructure projects is "The building process can be more efficient and economical" (MIS = 4.25). The least significant influence of constructability practices on cost delivery of road infrastructure projects is "Lower cost of bidding" (MIS = 3.85). On the average, all the identified influences of constructability practices on cost delivery of road infrastructure projects by IRCFs in Abuja are extremely significant (average MIS = 4.07)

Table4.5 Development of Measures for Enhancing the Adoption of Constructability Practices in Road Infrastructure Projects

Code No.	Measures for Enhancing Adoption of Constructability Practices in Road Infrastructure Projects by IRCFs	MIS	Rank	Decision
F1	Project coordination meetings	4.33	1st	Extremely Effective
F11	Adoption of Fuzzy Quality Function Deployment system	3.57	21st	Very Effective
	Average MIS	***3.86***		***Very Effective***

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Table 4.5 shown that the most effective measure for enhancing the adoption of constructability practices in road infrastructure projects is "Project coordination meetings" (MIS = 4.33). The least effective measure for enhancing the adoption of constructability practices in road infrastructure projects is "Adoption of Fuzzy" (MIS = 3.57). On the average, all the identified measures for enhancing the adoption of constructability practices in road infrastructure projects by IRCFs in Abuja are very effective (average MIS = 3.86).

Results of Data analysis

The tables revealed that all the identified areas of constructability practices in road infrastructure projects in Abuja are extremely important (average MIS = 4.07). This agrees with findings from past studies

It was also revealed that the influence of constructability practices on cost and time delivery of road infrastructure projects by IRCFs in Abuja is significant (average MIS = 4.07; r = 0.379 – 0.661; p = 0.000 – 0.007). In line with this, past studies have also revealed that the application of constructability principles during the project life cycle is very important in order to reduce or prevent errors, delays, disputes and cost overruns.

IRCFs have significant positive connection. The findings from this analysis highlight the constructability practices in a typical construction project in construction organization. However, there are shortcomings in handling the practices and different dimensions of constructability practices found within IRCFs when it comes to delivery of road infrastructure projects in Nigeria. In accordance with the previous research, we found studies which connect constructability practices within IRCFs.

Conclusion

This study noted the important conclusions with regards to the objectives. This research shows that constructability practices on the delivery of road infrastructure projects by

Recommendation

A constant use of constructability practices is recommended, because it will increase the ability of IRCFs in delivery road infrastructure projects. To improve constructability practices, government should encourage IRCFs in subsequent adoption of constructability practices. The construction organisations stakeholders ought to establish development approach to encourage constructability practices within IRCFs.

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