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Author(s):	Chinedu Chimdi Adindu Susan Nnadzwa Yisa Saheed Olanrewaju Yusuf Joseph Kolawole Makinde Aliyu Muhammed Kamilu
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Knowledge, Adoption, Prospects and Challenges of Prefabricated Construction Method in Nigeria – An Empirical Study of North Central Geo-Political Zone

Chinedu Chimdi Adindu*, Susan Nnadzwa Yisa, Saheed Olanrewaju Yusuf, Joseph Kolawole Makinde and Aliyu Muhammed Kamilu

Department of Project Management Technology,
Federal University of Technology, Minna Niger State, Nigeria

Abstract

Despite the numerous benefits of prefabricated construction method, there is unfortunately limited knowledge and adoption of this method in Nigeria's construction industry. This study, therefore, seeks to assess the construction industry's stakeholders' level of knowledge and extent of adoption of prefabricated construction method in project delivery. It also evaluates the prospects and challenges of prefabricated construction considering the government's huge annual investment in the nation's construction industry sector. The methodology used in this study was descriptive survey involving a structured questionnaire administered to major construction industry stakeholders including the government, consultants, contractors, building material merchants, and construction financiers with practices in Nigeria's north central geo-political zone. The study showed a low level of knowledge (MMS: 2.32) and low level of adoption (MMS: 2.13) of prefabricated construction method in Nigeria in general. It also revealed 'Better Supervision' (MS: 4.02) and 'High Initial Costs' (MS:3.62) as the highest prospects and challenges of prefabricated construction method among other identified factors. The study concluded that the low level of adoption arising from the low level of knowledge of prefab system in the nation's construction industry was responsible for the myriad of delays in meeting project timelines, hence the prevalence of construction time–cost overruns. The current study recommends a review of the academic curriculum of built environment and professional development programmes to expand and deepen the prefab system training content. It also recommends wide adoption of prefab system considering their prospects of ensuring quality as a result of better supervision and suggests outsourcing on critical areas of organisations' logistic weaknesses to minimize the problem of higher initial costs.

Keywords: construction, industry, method, Nigeria, prefabrication

*Corresponding author: chinedu.adindu@futminna.edu.ng

Introduction

The construction industry constitutes a major portion of the economic activities of nations. It is responsible for 10% of Europe's gross domestic product (Loosemore, Dainty & Lingard, 2003). In Australia, it employs about 8% of the nation's workforce (Proverbs, Holt, & Olomolaiye, 1999). The Nigerian construction industry, since the advent of the British rule, has extensively aided the development of the nation's infrastructure (Osaba, 1993). Additionaly, the industry is pivotal to the socioeconomic emancipation of Nigeria, especially in the area of job creation (Ogunsemi & Jagboro, 2006). The construction industry has also contributed over N4.53 billion to Nigeria's GDP, representing close to 60% of the nation's capital investment (Ajanlekoko, (1990). Quite a number of the nation's construction projects have experienced time and cost overruns in the course of their execution (Aje, Odusami & Ogunsemi, 2009). Often, their performance is measured on the basis of time, cost and quality criteria (Ogunsemi & Jagboro, 2006). The use of prefabricated construction method is a veritable tool in reducing the incidence of time and cost overrun risks. Prefabricated construction system, according to Arif and Egbu (2010), offers advantages of prompt completion, quality assurance, minimum production costs and maximum efficiency in construction delivery. It ensures quick construction delivery, time savings, cost reduction and waste minimization. It also ensures the efficiency of construction processes that leads to improved quality, reduction of construction time and cost (Li, et al, 2011). There is a huge annual government expenditure on construction in Nigeria's north central geo-political zone. Thus, there is a dire need for the timely delivery of projects to justify the massive construction investment in this zone. An increased adoption of prefabricated buildings will expectedly meet the upsurge in demand for housing infrastructure in the said geo-political zone, considering its close proximity to Nigeria's federal capital city, Abuja.

Problem Statement

In Nigeria, there has been an increase in the number of construction methods used for work execution during the past 20 years. However, the adoption of prefabricated construction technique in Nigeria's infrastructure projects has been limited. Indeed, those organizations that do employ this technique in the nation's construction projects have exhibited a relatively slow pace in their undertakings in comparison with the developed economies. The potential benefits of prefabricated construction techniques are still farfetched considering the relatively long duration of construction project delivery in Nigeria.

This study, therefore, seeks to empirically investigate the knowledge, adoption, prospects and challenges of using prefabricated construction method in building infrastructure projects executed in North Central Nigeria, with the aim of proffering solutions through suitable recommendations.

The objectives of study are:

1. To assess the level of knowledge of prefabricated construction system among the stakeholders of construction industry.
2. To determine the degree of adoption of prefabricated construction system by the stakeholders of construction industry.
3. To evaluate the prospects of adoption of prefabricated construction system in North Central Nigeria.
4. To examine the challenges of prefabricated construction system in North Central Nigeria.

Theoretical Framework

Overview of Construction Industry in Nigeria

Nigeria's construction sector has recorded a phenomenal growth over the years due to the upsurge in demand for housing infrastructure required to support a growing population and the need to provide critical infrastructure to foster national and transnational economic investments. Consequently, this has vigorously opened up the construction market, especially real estate sector (Umar, 2015). Many policy changes in Nigeria's economic dynamics have tended to benefit the construction subsector the most. The industry is composite in nature with several players as stakeholders. It comprises indigenous and foreign firms operating at different scales in terms of size, manpower, equipment holding, financial capacity, and geographic boundaries. A large chunk of industry operators comprises foreign companies with close to 95% market holding, with a paltry 5% left for the small indigenous firms (Oladapo, 2007). According to Sanusi (2009), Nigeria's construction industry drives most of the nation's economy and contributes about 5% increase in GDP growth. Other sectors of the national economy, such as health, education, and transportation heavily depend on the construction industry's products. The growth of economic and infrastructural development of Nigeria has been attributed to its construction industry (Ismaila & Adegenga, 2018). Construction industry in Nigeria contributes 2% to the nation's GDP, annually (Federal Office of Statistics, 1997). The industry also employs about 8 million people representing about 20% of Nigeria's workforce (National Bureau of Statistics, 2015). Globally, the construction industry is growing continuously. The sector is distinguished from

other sectors as it is characterized by planning, design, construction, maintenance and repair and its operations transform various resources into constructed facilities (Isa, Jimoh & Achuenu, 2013). A major criticism of the Nigerian construction industry is the increasing rate of delays in project execution (Mbamali, Aiyetan & Kehinde, 2005; Aibinu & Jagboro, 2002). Generally, the performance of the nation's construction industry is a source of worry to the public and private sector clients, as well as other stakeholders. Quite a number of the nation's infrastructure projects have suffered several setbacks and some have been abandoned at various stages of completion owing to operational challenges, leading to difficulties in budgetary control (Okuwoga, 1998). Lack of local skilled labour, power shortage, unavailability of materials, and unethical practices are some of the common challenges ravaging the construction industry despite its performance (Sanusi, 2009). Nigeria's construction industry is also characterized by delays, time and cost overrun, project abandonment, dearth of skilled local labour, power shortage, material unavailability, corruption, unethical practices, and lack of execution capacity (Aibinu & Jagboro, 2002; Sanusi, 2009; Kolo & Ibrahim, 2010). The issue of delays in construction delivery has become a cankerworm, hence the need for increased awareness about its debilitating effects on construction productivity and performance. The problems of time and cost overruns are well known as the most common causes of delays in projects (Aibinu & Jagboro, 2002). New technologies such as prefabricated costruction can be introduced into Nigeria's construction industry to reduce some of these challenges.

Industrialization and the Prefabricated Method of Construction

Through the years, industrialization in construction has resulted into the designing and manufacturing of more complicated building systems made up of a number of standardized and well-documented building elements. The system also enables project monitoring and experiential learning from the designing, manufacturing, and erection of the building system as a process for continuous improvement (Lessing, 2015). Thus, extensive and modernized knowledge of industrialized construction systems is not restricted to prefabrication and off-site manufacturing only, rather it is also inclusive of organized and controlled building elements notwithstanding whether these elements are produced in a factory or physically produced on site (Niclas & Jerker, 2017). Babic, Peter and Danijel (2010) opine the use of automation in industralization to facilitate the processes of construction delivery.

Benefits of Prefabricated Construction System

Many scholars and industry practictioners have severally identified certain benefits of prefabricated construction method. According to Li (2011), the benefits include reduced time and cost of construction, improved productivity and the quality of construction processes. Also, Tam, Tam, Zeng and William (2007) identified early stage frozen design, improved supervision, reduced construction cost, minimum construction time, better environmental performance, waste minimization, building design and construction integrity, and better aesthetic appeal as advantages of prefabricated construction. Additionally, Chen Okodan and Riley (2010) noted shortened construction time, improved quality, enhanced occupational health and safety, less construction site waste, less environmental emissions, and reduction of energy and water consumption as some other benefits of prefabricated construction. Arif and Egbu (2010), Taylor (2010), and Jaillon and Poon (2010) identified further benefits of prefabricated construction such as less impact on surroundings, less defects, low wastage in manufacturing, easy transportation, and efficiency of material and labour resources. It is important to state that most of the benefits of prefabricated construction have turned out to be the drivers themselves. Typical drivers include an easy accessibility to prefabricated materials, decentralisation of supply of raw and finished building material, and the availability of technical assistance in the production and assembly of prefab elements (Stallen, Chabannes & Steinberg, 1994). Additionally identified drivers of prefabricated construction include reduced on site work, less coordination of multiple trades, reduced waste, improved building quality, improved building performance and sustainability (Stallen et al., 1994).

Challenges of Prefabricated Construction System

Despite several identified benefits prefabricated construction system has over the traditional method, it also poses challenges such as a higher initial cost, inadequate communication in the supply chain, and difficulties in altering the design at various stages of construction (Lei, Zhongfu, Long & Yunli, 2018). Other identified challenges include design problems, production problems, transportation problems, installation process problems, and lack of experience regarding prefabricated construction techniques (Blismas, Pendlebury, Gibb & Pasquire, 2005). Since the components are produced by several parties, they are often prone to design errors and installation difficulties. Another major setback of this method is that the components are quite difficult to correct in the event of mistakes and this often results in rework, time, and cost overruns.

Methodology

The methodology used was descriptive survey with structured questionnaires administered to major construction industry stakeholders in Nigeria's federal capital territory Abuja and most of the states in the north central geo-political zone, namely Benue, Plateau, Kogi, Nassarawa, Kwara, and Niger states. The stakeholders chosen for the study included government ministries, departments and agencies (MDAs), construction industry consultants, building contractors, building material merchants, construction labour organizations, and construction financiers.

The population of the study was 160 and this population was purposively chosen through a regimented 3-stage process. Also, the questionnaires were structured in a manner that enabled several enquiries to be sought from the population on matters that ranged from the drivers (prospects) of prefabricated construction to the constraints (challenges) of prefabricated construction. This study was completely zonal in nature as all and only the seven (7) states that comprise the north central geo-political zone participated in the research. For the purposes of identification and classification of data, the following convenient codes were adopted for each participating state of the zone, viz., FCT for Federal Capital Territory; BEN for Benue; PLT for Plateau; KOG for Kogi; NAS for Nassarawa; KWA for Kwara; and NGR for Niger. The population of the study was obtained through a systemic apportionment technique with cognisance of the differing economic status of the participating states and their consequential impact on stakeholders' availability levels. The study approximated the sample size to the population size. As such, 160 questionnaires were duly distributed for survey and 148 were returned. 12 questionnaires were discarded for several reasons including but not limited to non-completeness, wrong data entry and placement, cancellations, as well as confusing and disjointed information. As such, 136 questionnaires representing an 85% response rate were deemed valid and considered credible for the purpose of data analysis.

Data Analysis

Responses on items of survey questionnaire were measured on Likert's 5-point scale for the ease of data analysis. Statistical Package for Social Sciences (SPSS-version 10.0) was deployed in the study to generate both descriptive and inferential statistics. A high Cronbach's alpha coefficient of 0.91 was achieved confirming the internal consistency and reliability of the survey instrument.

Data Presentation

Table 1

Analysis of Respondents by Gender

Gender	Frequency								Percentage							
	Fct	Ben	Plt	Kog	Nas	Kwa	Ngr	Total	Fct	Ben	Plt	Kog	Nas	Kwa	Ngr	Total
Male	43	18	8	12	5	9	10	105	82.7	85.7	61.5	75	71.4	64.3	76.9	77.2
Female	9	3	5	4	2	5	3	31	17.3	14.3	38.5	25	28.6	35.7	23.1	22.8
Total	52	21	13	16	7	14	13	136	100	100	100	100	100	100	100	100

Source: Authors' Field Survey, 2019

Table 2

Analysis of Respondents by Age

Age Group	Frequency								Percentages							
	Fct	Ben	Plt	Kog	Nas	Kwa	Ngr	Total	Fct	Ben	Plt	Kog	Nas	Kwa	Ngr	Total
20 – 24	2	3	1	2	-	1	-	9	3.8	14.3	7.7	12.5		7.1		6.6
25 -29	4	2	2	1	-	2	2	13	7.7	9.5	15.4	6.3		14.3	15.4	9.6
30 – 34	6	4	4	3	3	2	4	26	11.5	19.0	30.8	18.8	42.9	14.3	30.8	19.1
35 – 39	19	4	3	4	2	5	3	40	36.5	19.0	23.1	25.0	28.6	35.7	23.1	29.4
40 – above	21	8	3	6	2	4	4	48	40.4	38.1	23.1	37.5	28.6	28.6	30.8	35.3
Total	52	21	13	16	7	14	13	136	100	100	100	100	100	100	100	

Source: Authors' Field Survey, 2019

Table 3

Analysis of Respondents by Level of Education

Educational Level	Frequency								Percentage							
	Fct	Ben	Plt	Kog	Nas	Kwa	Ngr	Total	Fct	Ben	Plt	Kog	Nas	Kwa	Ngr	Total
SSCE, NCE, ND, Trade Tests	9	5	2	3	1	1	3	24	17.3	23.8	15.4	18.8	14.3	7.1	23.1	17.6
HND/BSc/BEng/BTech	28	7	5	7	4	6	5	62	53.8	33.3	38.5	43.8	57.1	42.9	38.5	45.6
MSc/MEng/MTech	5	4	3	2	2	4	2	22	9.6	19.0	23.1	12.5	28.6	28.6	15.4	16.2
PhD	4	1	1	1	-	2	-	9	7.7	4.8	7.7	6.3		14.3		6.6
Others (e.g. Professional Certs)	6	4	2	3	-	1	3	19	11.5	19.0	15.4	18.8		7.1	23.1	14.0
Total	52	21	13	16	7	14	13	136	100	100	100	100	100	100	100	100

Source: Authors' Field Survey, 2019

Table 4

Analysis of Respondents by Construction Stakeholder Group

Stakeholders	Frequency								Percentage							
	Fct	Ben	Plt	Kog	Nas	Kwa	Ngr	Total	Fct	Ben	Plt	Kog	Nas	Kwa	Ngr	Total
MDAs	4	2	3	2	1	2	3	17	7.7	9.5	23.1	12.5	14.3	14.3	23.1	12.5
CICs	8	10	4	4	3	5	4	38	15.4	47.6	30.8	25	42.9	35.7	30.8	27.9
BUCs	27	8	3	3	3	4	3	51	51.9	38.1	23.1	18.75	42.8	28.6	23.1	37.5
BMMs	6	1	2	4	-	2	1	16	11.5	4.8	15.4	25		14.3	7.7	11.8
CLOs	3	-	-	1	-	1	1	6	5.8			6.25		7.1	7.7	4.4
CFIs	4	-	1	2	-	-	1	8	7.7		7.7	12.5			7.7	5.9
Total	52	21	13	16	7	14	13	136	100	100	100	100	100	100	100	

Source: Authors' Field Survey, 2019

Table 5

Analysis of Respondents by Discipline

Discipline	Frequency								Percentage							
	Fct	Ben	Plt	Kog	Nas	Kwa	Ngr	Total	Fct	Ben	Plt	Kog	Nas	Kwa	Ngr	Total
Civil Engineer	7	5	3	1	2	3	2	23	13.5	23.8	23.1	6.3	28.6	21.4	15.4	16.9
Quantity Surveyor	5	4	2	2	1	2	2	18	9.6	19.0	15.4	12.5	14.3	14.3	15.4	13.2
Architect	11	4	2	1	1	2	2	23	21.2	19.0	15.4	6.3	14.3	14.3	15.4	16.9
Builder	7	4	3	5	1	3	3	26	13.5	19.0	23.1	31.3	14.3	21.4	23.1	19.1
Project Manager	4	2	1	3	1	2	2	15	7.7	9.5	7.7	18.8	14.3	14.3	15.4	11.0
Allied Construction Disciplines	18	2	1	2	1	1	2	27	34.6	9.5	7.7	12.5	14.3	7.1	15.4	19.9
Others	-	-	1	2	-	1	-	4			7.7	12.5		7.1		2.9
Total	52	21	13	16	7	14	13	136	100	100	100	100	100	100	100	100

Source: Authors' Field Survey, 2019

Table 6

Analysis of Respondents by Professional Experience

Professional Experience	Frequency								Percentage							
	Fct	Ben	Plt	Kog	Nas	Kwa	Ngr	Total	Fct	Ben	Plt	Kog	Nas	Kwa	Ngr	Total
1 – 5	12	3	2	4	1	2	-	24	23.1	14.3	15.4	25.0	14.3	14.3		17.6
5 – 10	7	4	1	2	2	5	1	22	13.5	19.0	7.7	12.5	28.6	35.7	7.7	16.2

Professional Experience	Frequency								Percentage							
	Fct	Ben	Plt	Kog	Nas	Kwa	Ngr	Total	Fct	Ben	Plt	Kog	Nas	Kwa	Ngr	Total
10 – 15	18	3	3	2	1	2	5	34	34.6	14.3	23.1	12.5	14.3	14.3	38.5	25.0
15 – 20	10	6	4	5	2	2	5	34	19.2	28.6	30.8	31.3	28.6	14.3	38.5	25.0
Over 20	5	5	3	3	1	3	2	22	9.6	23.8	23.1	18.8	14.3	21.4	15.4	16.2
Total	52	21	13	16	7	14	13	136	100	100	100	100	100	100	100	100

Source: Authors' Field Survey, 2019

Figure 1

Gender

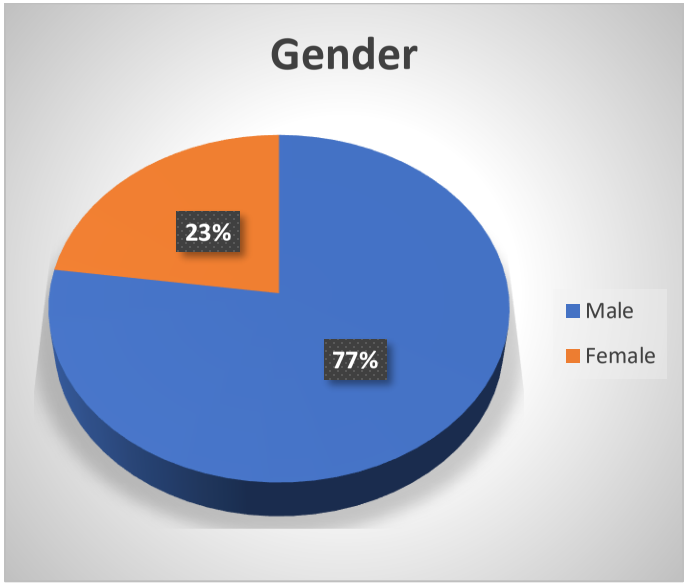


Figure 2

Age Distribution

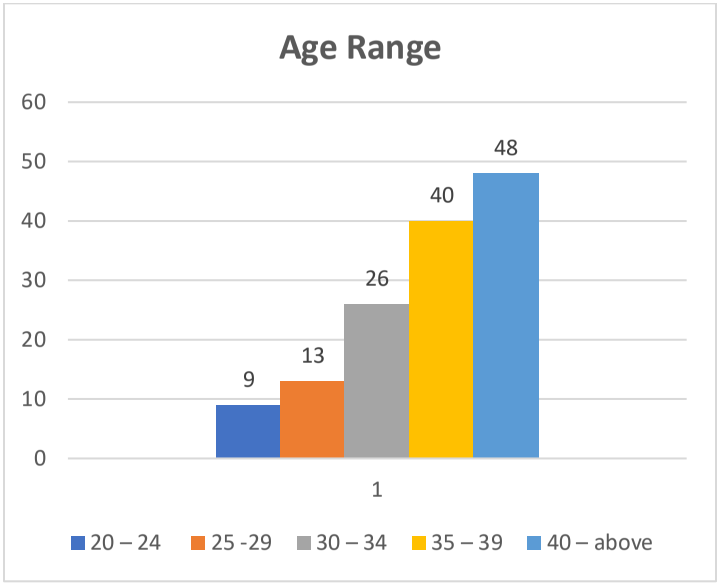


Figure 3

Level of Education

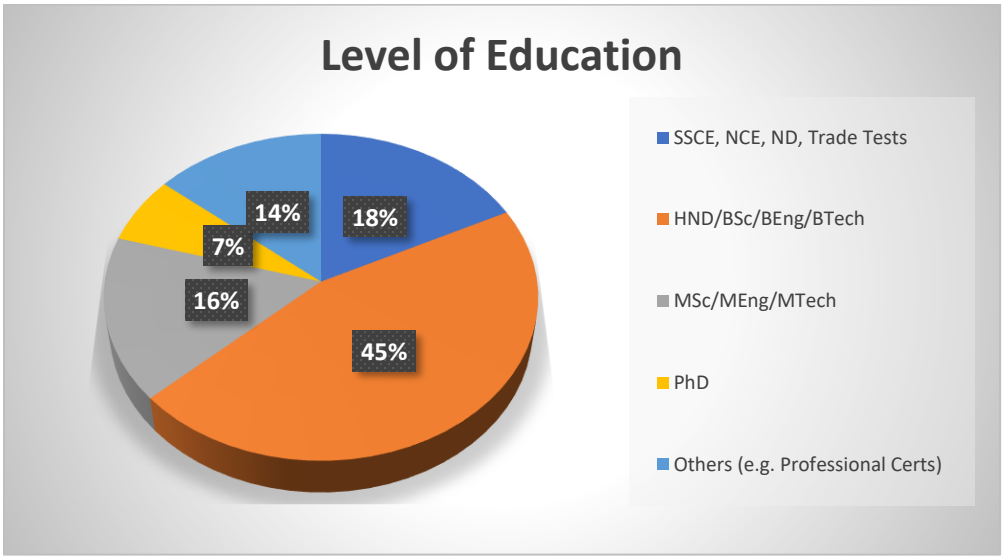


Figure 4

Construction Stakeholder Group

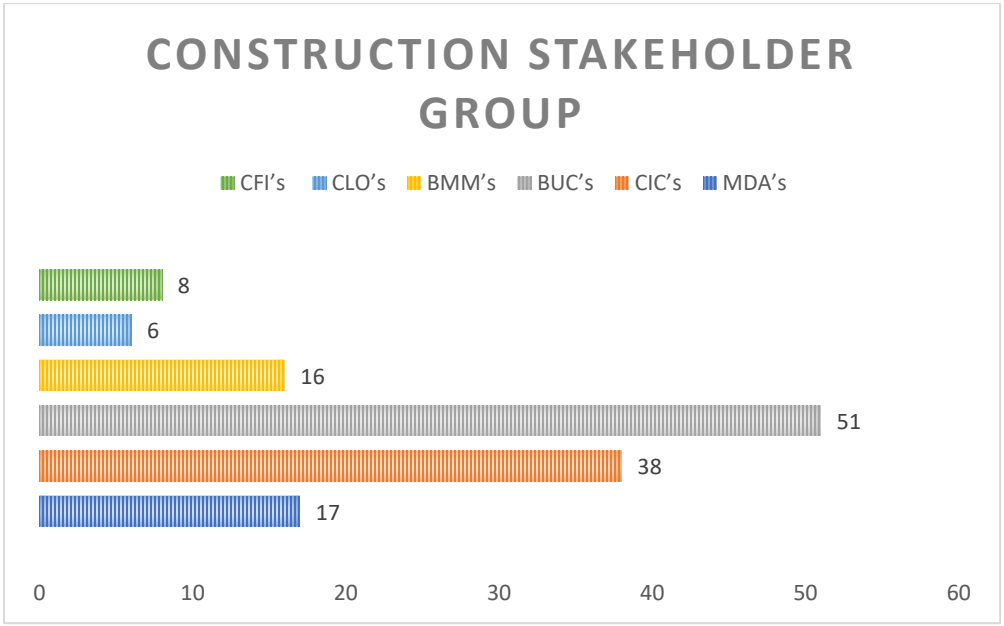


Figure 5

Discipline

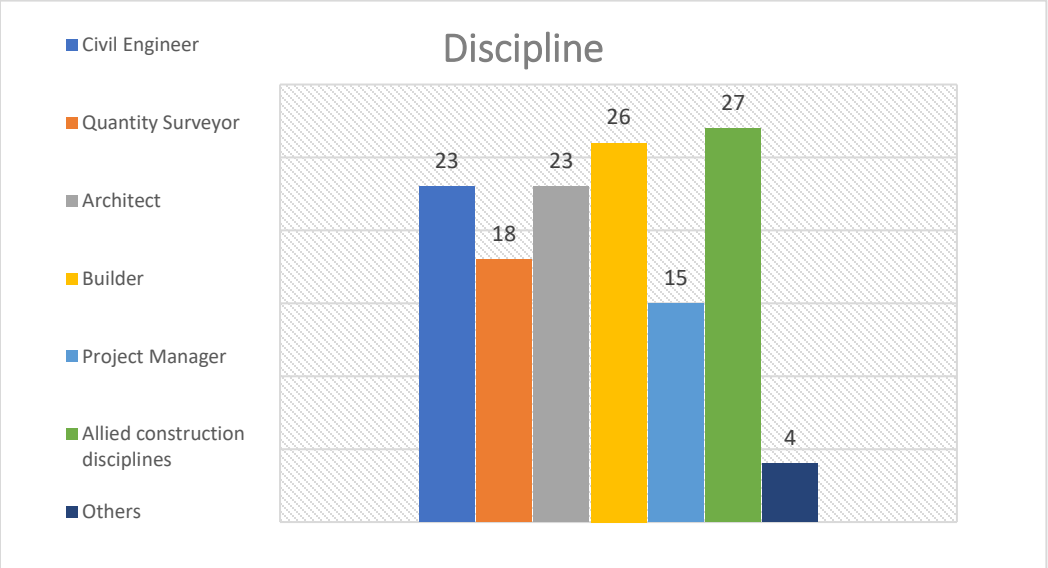
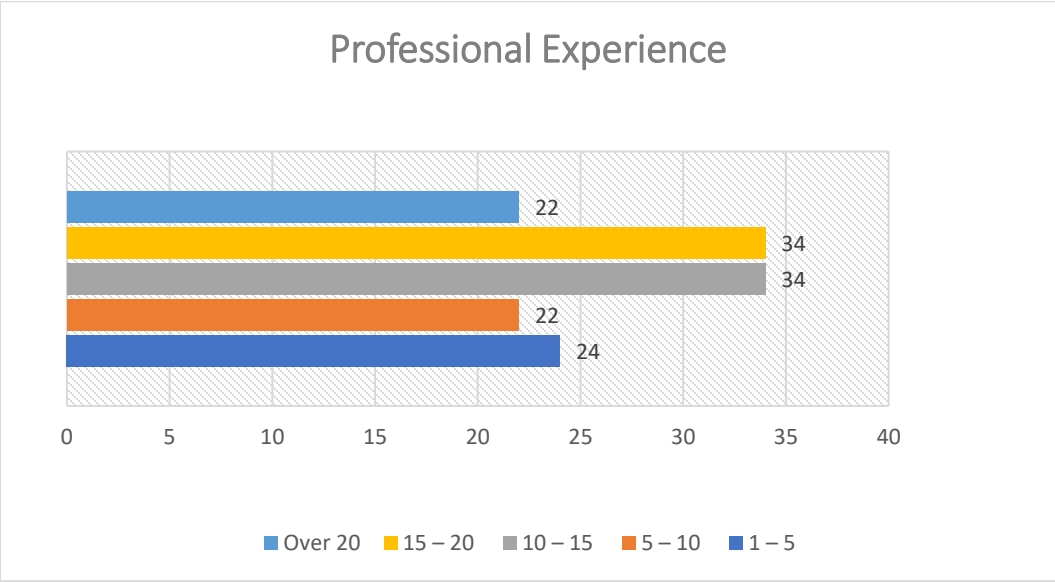


Figure 6

Professional Experience



Results and Discussion

Table 1 and Figure 1 show that a total of 105 males and 31 females, corresponding to 77.20% and 22.80% of the sample respectively, participated in the survey. Table 2 and Figure 2 show that respondents over 30 years of age constituted 83.80% of the total respondents, while the results depicted in Table 3 and Figure 3 revealed that over 82.40% of respondents possessed a minimum of HND/BSc qualification. Furthermore, the analysis of respondents in terms of construction stakeholder group depicted in Table 4 and Figure 4 showed that Ministries, Departments, and Agencies (MDAs) comprised 12.5%; Construction Industry Consultants (CIC) comprised 27.9%; Building Contractors (BUC) comprised 37.5%; Building Material Merchants (BMM) compised 11.8%; Construction Labour Organizations (CLO) comprised 4.4%; and Construction Finance Institutions (CFI) comprised 5.9% of the total.

Also, the analysis of respondents by discipline depicted in Table 5 and Figure 5 showed that civil engineers comprised 16.9%; quantity surveyors comprised 13.2%; architects comprised 16.9%; builders comprised 19.1%; project managers comprised 11.20%; allied construction disciplines comprised 19.9%; and others comprised 2.9% of the total.

The analysis of respondents by professional experience depicted in Table 6 and Figure 6 revealed that over 66.2% of respondents had construction industry experience spanning over 10 years. Thus, the respondents to the items of the survey showed diversity in terms of sex, age, level of education, stakeholder group, discipline, and professional experience. These findings showed that the respondents were reasonably educated as over 82.40% possessed a minimum of HND/BSc qualification. The survey also revealed that the respondents also had a satisfactory level of experience as over 66.2% had worked in the construction industry for upwards of 10 years.

In sum, going by the above statistics, it could be said that the respondents had a background that would reasonably support this research in terms of dependability and reliability of information and data obtained.

Objective 1: To assess the level of knowledge of prefabricated construction system among the stakeholders of construction industry.

Table 7

Extent of Knowledge of Prefabricated Construction System among the Stakeholders of Construction Industry in North Central Nigeria

Statement of Variable Factor	Unsure	Combined Response Rate (%) Minor Extent…… Major Extent					Weighted Point Total	MS	Rank
		1	2	3	4	5			
Civil Engineers	1	7	5	6	3	1	52	2.36	4
Quantity Surveyors	1	4	7	3	2	1	40	2.40	2
Architects	1	5	8	4	3	2	55	2.50	1
Builders	2	9	7	6	1	1	50	2.10	5
Project Managers	-	5	3	4	1	2	37	2.50	1
Allied Construction Disciplines	4	9	4	4	4	2	35	2.39	3
Others	-	2	1	-	1	-	30	2.00	6
Total	9	42	35	27	15	9	MWPT= 42.71	MMS = 2.32	

Source: Authors' Field Survey, 2019

The study examined the extent of knowledge of prefabrictaed construction method among the identified stakeholders of construction industry. The results (Table 7) revealed that both architects and project managers secured the first position with a mean score of 2.50 each and Weighted Point Totals (WPT) of 55 and 37, respectively. Quanity surveyors and allied construction disciplines had a mean score of 2.4 (WPT 40) and 2.30 (WPT 35) and they occupied second and third positions, respectively. Civil engineers secured the fourth position with a mean score of 2.36 (WPT 52). The results in Table 7 also revealed the existence of a generally limited knowledge of prefabricated construction method among the construction personnel as their respective mean scores were far less than the maximum mark of 5.00. The implication is that the construction industry personnel lack adequate knowledge of prefab construction method and as such do not usually lend their practice to this construction system, hence its low adoption.

Objective 2: To determine the degree of adoption of prefabricated construction system by the stakeholders of construction industry.

Table 8

Extent of Adoption of Prefabricated Construction System by the Stakeholders of Construction Industry in North Central Nigeria

Statement of Variable Factor	Unsure	Combined Response Rate (%) Minor Extent…… Major Extent					Weighted Point Total	MS	Rank
		1	2	3	4	5			
Civil Engineers	1	8	6	5	1	2	49	2.27	1
Quantity Surveyors	-	6	4	6	2	-	40	2.22	3
Architects	2	6	9	4	-	2	46	2.19	4
Builders	3	8	7	3	3	2	53	2.30	2
Project Managers	1	4	8	1	-	1	28	2.00	5
Allied Construction Disciplines	5	6	13	2	1	-	42	1.91	6
Others	-	2	1	-	1	-	8	2.00	5
Total	12	40	48	21	8	7	MWPT=38.00	MMS=2.13	

Source: Authors' Field Survey, 2019

The study sought to determine the degree to which prefabricated construction system was adopted in projects executed by different construction industry personnel. The results (Table 8) showed that civil engineers were more involved in projects that adopted prefabricated construction method than any other discipline. They recorded a mean score of 2.27 (WPT 49) and secured the first position, despite their fourth position regarding the knowledge of prefabricated system among other disciplines. This calls for a critical upgrade of their knowledge base to competently cope with their career expectations. Other disciplines such as builders, quantity surveyors, and architects ranked second (MS 2.30, WPT 53), thrid (MS 2.22, WPT 40), and fourth (MS 2.19, WPT 46), respectively. This implies that although archiects and quantity surveyors are more knowledgeable in prefab construction

method as per study resuls in Table 7, unfortunately they have failed to adopt it as much as civil engineers and as such do not bring their knowledge to bear in order to take advantage of the competency needed for better performance of projects in North Central Nigeria.

Objective 3: To evaluate the prospects of adoption of prefabricated construction system in North Central Nigeria.

Table 9

Extent to which Identified Factors Constitute Prospects for the Adoption of Prefabricated Construction System in North Central Nigeria

Statement of Variable Factor	Unsure	Combined Response Rate (%) Minor Extent…… Major Extent					Weighted Point Total	MS	Rank
		1	2	3	4	5			
Frozen Design at Early Design Stage	3	11	18	22	44	38	479	3.60	4
Better Supervision	6	7	12	15	28	62	498	4.02	1
Reduced Overall Construction Cost	9	6	31	19	28	43	452	3.56	7
Shortened Construction Time	7	6	16	36	36	35	465	3.60	4
Better Environmental Performance	4	19	13	38	23	39	446	3.38	13
Improved Waste Minimisation	3	19	43	27	20	31	421	3.01	16
Integrity of Building Design and Construction	5	12	15	41	23	35	432	3.43	12
Better Aesthetic Quality	11	6	24	30	18	36	396	3.47	9
Enhanced Occupational Health and Safety	6	9	27	22	40	32	449	3.45	10

Statement of Variable Factor	Unsure	Combined Response Rate (%) Minor Extent…… Major Extent 1	2	3	4	5	Weighted Point Total	MS	Rank
Reduction of Energy and Water Consumption	3	7	31	32	38	25	442	3.32	14
Greater Efficiency in Use of Material and Labour Resources	7	8	23	21	39	38	463	3.59	5
Reduced on Site Work	4	11	16	20	29	56	499	3.78	2
Improved Building Quality	3	9	14	46	37	27	458	3.44	11
Accessibility to Prefabricated Materials	3	5	18	35	29	46	492	3.70	3
Decentralization of Raw Material Supply and Finished Building Material	5	13	21	32	21	44	455	3.47	9
Technical Support in Production and Assembly of Prefab Elements	8	9	14	49	13	43	451	3.52	8
Less Coordination of Multiple Trades	4	7	11	43	41	30	472	3.58	6
Improved Building Performance and Sustainability	8	15	29	32	29	23	400	3.13	15
Total	99	179	376	560	536	683	MWPT = 453.89	MMS =3.50	

Source: Authors' Field Survey (2019)

The study evaluated the prospects of the adoption of prefabricated costruction system in North Central Nigeria. Eighteen (18) identified variable factors (Table 9) that constituted the prospects of prefab system were evaluated and ranked to ascertain their level of agreement by the respondents. Better supervison ranked first (MS 4.04, WPT 498), reduced on-site work (MS 3.78, WPT 499) ranked second, and accessibility to prefabricated material (MS 3.70, WPT 492) ranked third.

The implication of this result is that better supervison of projects will result in better quality compliance. It also implies that sound knowledge (skills and competences) is crucial in the execution of projects invloving prefabrication system. Reduced on site work means that more time will be committed to contract administration than in building production and this will obviously improve the quality of deliverables. Accessibility to construction materials will reduce lag-time and construction delays substantially, especially with regard to critical activities in the material supply – delivery chain.

The overall benefit will translate into a quality project, executed at reduced costs, and at an ealier completion time. The aforementioned prospects constitute the hallmark of project performance. Thus, the results of the study clearly show that prefabricated construction has good prospects in Nigeria's construction industry.

Objective 4: To examine the challenges of prefabricated construction system in North Central Nigeria.

Table 10

Extent to which Identified Factors Constitute Challenges of Prefabricated Construction System in North Central Nigeria

Statement of Variable Factor	Unsure	Combined Response Rate (%) Minor Extent…… Major Extent 1	2	3	4	5	Weighted Point Total	MS	Rank
Higher Initial Cost	6	14	19	15	37	45	470	3.62	1
Inadequate Communication in Supply Chain	4	20	21	30	33	28	424	3.21	10
Difficulty to Make Changes to Design at	9	17	24	27	31	28	410	3.23	9

Statement of Variable Factor	Unsure	Combined Response Rate (%) Minor Extent…… Major Extent					Weighted Point Total	MS	Rank
		1	2	3	4	5			
Construction Stage									
Design Problems	3	15	18	32	52	16	435	3.27	8
Production Problems	8	12	14	29	34	39	458	3.58	2
Transportation Problems	5	15	17	33	43	23	435	3.32	7
Installation Process Problems	10	9	23	27	41	26	430	3.41	5
Lack of Experience in Prefabricated Construction	7	12	18	36	39	24	432	3.34	6
Susceptible to Faulty Design during Installation	13	11	9	40	44	19	420	3.41	5
Impossible to Correct Once Manufactured	11	8	14	38	34	31	441	3.53	4
Can Lead to Redoing Work, Schedule Delays, and Cost Overruns in the Event of Mistakes	5	17	12	26	30	45	464	3.57	3
Total	81	150	189	333	418	324	MWPT = 438.46	MMS =3.41	

Source: Authors' Field Survey (2019)

Conclusion

The current study revealed limited knowledge of prefabricated construction method among the construction personnel in general as their respective mean scores were far less than the maximum mark of 5.00. The implication is that the construction industry personnel lack adequate knowledge of prefab construction method and as such do not usually lend their practice to this construction system, hence its low adoption. The results also showed that civil engineers were more involved in projects that adopted prefabricated construction method than other disciplines, despite their lesser knowledge of this method relative to other disciplines. Better supervison, reduced on site work, and accessibility to prefabricated material ranked the highest among the identified prospects of prefabricated construction method. The study revealed that high initial cost, production problems, tendency for redoing work, schedule delays, and cost overruns in the event of mistakes ranked the highest among the identified challenges to prefabricated construction method in projects undertaken in North Central Nigeria.

Recommendations

Keeping in view the problem of this study, research objectives, findings, results and conclusion, the following points are recommended:

1. There is a need for a vigorous review of the academic curricula of the professions associated with built environment to lay a strong foundation for improved knowledge of prefabricated construction system. This will deepen the currently existing low level of knowledge of the construction industry professionals.
2. All professional institutions of built environment should emphasize prefabricated construction practice in their Continuous Professional Development (CPD) programmes to broaden the knowledge of practitioners.
3. Curriculum review and CDP should emphasize better work supervison, reduced on site work and accessibility to prefabricated material in order to maximize the benefits of prefabricated construction method.
4. The adoption of project outsourcing especially on critical activities and operations where internal capacity or expertise is lacking would substantially reduce the attendant's high initial cost, production problems, tendency for redoing work, schedule delays, and cost overruns in event of mistakes that often plague the prefabricated method of construction.

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