Factors Predicting the Adoption of Prefabrication Construction in Oyo State, Nigeria

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Abstract

The main aim of this study is to identify the factors that predict the adoption or ineffective usage of prefabrication construction in building construction industry. The study identified 26(twenty - six) factors that predict the adoption of prefabrication construction by professionals in the built environment in Oyo state through a comprehensive review of relevant literatures and experts opinions. The decision to choose one building technique over another is dependent on a variety of composite considerations. These factors were identified and grouped into policy factor, cost factor, market factor, management factor, and technical factor. The study employed a survey research where a structured questionnaire was developed. A total number of 123participants were randomly drawn from architects, builders, engineers and quantity surveyors. Of the 136 questionnaires, 92 were completed and returned (68 %responses), and analysed using statistical package for social sciences (SPSS) software. The findings presented in this paper will help the government propose practical policies and measures to advance prefabrication and modularization in the housing delivery process. It also provides stakeholders with relevant information about the factors involved, which will be helpful in formulating appropriate strategies for the wider usage of the technologies. It also suggests that periodic workshops and seminars be held for stakeholders, including contractors, clients, and professionals in the built environment to discuss the necessities and advantages of applying prefabrication and modularization technologies.

Keywords: adoption, building industry, modularization, prefabrication, professionals.

Introduction

Prefabrication is a generic term used to describe a range of construction techniques that are different from traditional onsite forms of construction. It is carried out at a specialized facility other than a construction site by assembling various materials to form components of a structure, transporting and followed by installation on site (Gallo et al., 2021)to improve efficiency, predictability, and productivity in terms of quality, cost, and time. The adoption of any new technologies and innovations in the building industry can be viewed from various perspectives and is dependent of many factors.(Ma, 2008). Many variables predict the adoption of new technologies and innovations in the building industry, these variables include design complexity, site conditions, project schedule, local codes, sustainability requirements, transportation conditions, user perceptions of technology, and budget, to mention few. (Hamza et al., 2023).

One of the initial thoughts about adopting modularization / prefabrication is to have a paradigm shift from the conventional construction method to a more industrialized housing production system,(Aigbavboa et al., 2018). This is, to alleviate the challenges identified by scholars such as

challenges in time overrun, cost overrun, waste, delay and other problems which cumulated to housing deficit (Bobai et al., 2022) (Babalola, 2019).

Although, both on-site and off-site construction methods are widely employed in the construction sector, onsite construction is primarily preferred (Arowoiya and Oyefusi, 2023) which entails a lot of cast-in-situ work, which is slow, inefficient and brings great burden to the environment in respect of visual intrusion, air pollution, waste pollution, social welfare,(Liu, Dong, et al., 2020; Xiahou et al., 2018). But the decision to introduce new methods of construction is a major challenge for construction professionals due to change resistance and also the knowledge required to make the decision is fragmented and partially owned by individual experts which slows down adoption (Obi, 2017).(Built, 2021).

Overview of Prefabrication.

The Sweet Track, an old causeway constructed in England, was the oldest recorded example of prefabrication, dating back to 3800 BCE. This was the inception of the concept known as "off- site manufacturing." However, the first documented instances of prefabricated housing was dated back to 1624 (Alagbe, 2019). Prefabricated buildings evolved during the late European colonial period due to the urgent need for rapid deployment of temporary structures, especially for medical purposes and mass accommodation of military personnel during World Wars II and I.

However, the oldest recorded example of prefabrication in Nigeria was built in 1884 by the British colonial masters as the old residency buildings.

Factors Influencing the Adoption

Adoption is described as having knowledge and understanding of existence of a practice, event or occurrence of something while awareness, according to (Rogers 2003) has been identified as the first stage in the adoption of innovation. Some scholars have identified variables influencing prefabrication and modular construction, which include decreased repair and maintenance costs (Shibani et al., 2021). Architectural design flexibility (W. Jiang et al., 2020), improved quality control (Nnadzwa and Makinde, 2020), reduced waste (W. Jiang et al., 2020), fewer site violations, enhanced sustainability, increased productivity. (Nduka et al., 2019), reduction in conflicts during Construction (C. Aigbavboa et al., 2018), cost savings, improved construction site safety (Lu et al., 2018), shortened building periods (Almutairi, 2015), economies of scale derived from bulk procurement, mass production, and standardization (Kayode, 2013).

Conversely, factors impeding the adoption of prefabrication construction include attachment to traditional construction methods, fear of adapting to new techniques, resistance to change, concerns over high initial costs, lack of client awareness regarding long-term benefits, negative market and public perception were noticed. Lack of knowledge, shortage of specialized/skilled labour, increased transportation and logistical challenges related to size, weight, and route restrictions, site topography, lack of plant and equipment, and limited research and collaboration were also mentioned (Ayoola and Aghimien, 2017).

Some of these factors have been identified as critical success factors encouraging adoption, while others act as barriers limiting the uptake of prefabrication in the construction industry. These factors are Policy Factor, Cost Factor, Market Factor, Management Factor, and Technical Factor.

Materials and Methods

Oyo State, Nigeria, the research area, is renowned for having a large amount of building activity and a large number of construction specialists employed there. The size of Oyo State is approximately 28,454 square kilometers. Oyo State shares borders with Kwara State to the north,

Osun State to the east, Ogun State, and the Republic of Benin to the southwest. By 2016, the population had surged to an estimated 7,840,864, reflecting the area's rapid growth and urban expansion.

One hundred and seventy eight (178) professionals from the public and private sectors make up the study population. The information about these individuals were acquired from the relevant professional associations. Of the seven Built environment professionals (Architect, Builder, Engineer, Estate Surveyor, Land Surveyor, Town Planner, and Quantity Surveyor according to National Building Code (NBC), four representatives were chosen, namely architects (53), builders (42), structural engineers (38), and quantity surveyors (45), who are primarily in charge of design production and estimation of construction projects.

Using Yamane's (1967) formula for calculating sample size, the data obtained is analyzed by:

$$n = \frac{N}{1 + N\,(e)2}$$

Where **n** is the sample size, **N**is the actual population, and **e**" is the level of significance (taken as

0.05) with confidence level of 95%, while, considering the fact that the sample size calculated is a minimum value, the sample population is calculated to be 123 professionals with poll conducted in Oyo state. Members of professional bodies were given the questionnaires to complete and return for the purpose of this study. The Statistical Package for the Social Sciences (SPSS) software program was used to evaluate the data that were gathered. Descriptive statistics were applied to the collected data, resulting in the computation of MIS, percentages and frequency distribution. Tables and charts were used to display the findings.

Table 1: Population and Sample Size

Population				
Architects	Builders	Structural Engineers	Quantity Surveyor	Total Population
53	42	38	45	178
Sample Size				Total Sample Size
37	29	26	31	123
41	32	29	34	136(10% of sample size)

Data Source; NIA, NIOB, NIQS, NSE), 2025

A survey research design was employed, using a quantitative research methodology. The questionnaire used for the study was designed in two sections, with the first section designed to harness information on the background information of the respondents. The second section gathered information about the factors predicting the adoption of modular/prefabrication construction technique with respondents been asked to rate certain identified variables and measures using A 5 point Likert scale. A total number of 123participants (sample size) were drawn from architects, builders, engineers and quantity surveyors. Of the 136 questionnaires, 92 were completed and returned (68%responses), and analyzed using IBM SPSS Statistics. The data used for the study was collected and analysed between April and July 2025.

From Table 1: As earlier mentioned, 136 questionnaires were administered to architects, builders, engineers and quantity surveyors in the study area, 92 questionnaires were completed and returned. The response rate of 68% is considered reasonable to obtain a reliable result and analysed using statistical package for social sciences (SPSS) software

Results and Discussion

Profiles of Respondents

Table 2: Respondent's profile

Characteristics	Frequency (n=136)	Percentage (%)
Gender		
Male	73	79.4
Female	19	20.6
Age(interval)		
20-30	2	2.2
31-40	16	17.2
41-50	28	30.1
51-60	40	43.0
60 and above	6	6.5
Highest qualification of the participants		
Doctoral (phD)	4	4.3
Masters (Msc)	53	57.6
Degrees (Bsc)	20	21.7
Diploma(HND)	15	16.3
Profession of the participants		
Architect	34	36.9
Builder	24	25.8
Engineer (civil)	14	15.1
Quantity surveyor	20	21.7
Years of experience in the Profession		
1-3	1	1.1
4-6	3	3.3
7-9	7	7.5
10yrs and above	81	88.4

Respondent's profile Table 2 : indicates 79.4%, are male, 20.6% are female, while respondents' fields of specialization indicates 36.9% were architects, 25.8% were builders, 21.7% were quantity surveyors, and 15.1% were engineers. In addition, 57.6% of the respondents were Master's degree holders, 21.7% were Bachelor degree holders, and 16.3% were Diploma and 4.3% of the respondents being PhD holders. Their years of experience shows that those who have spent 1-3 years in the profession are (1.1%), 4-6 years are (3.3%), 7-9 years are (7.5.0 %), and 10years above (88.4%). The high number of respondents with high academic qualification and years of professional inputs prove that respondents were well equipped to provide the necessary answers required for the research.

Table 3: Factors inhibiting adoption of modular construction
(Mean Item Score, (MIS) Standard Deviation (SD) valuesand Ranking)

VARIABLES	MIS	SD	R
Impaired aesthetics	2.60	1.58	1
Inflexibility in early design	2.51	1.31	2
Lack of policy statement	2.48	1.48	3
Perceive limitation in small project	2.45	1.08	4
Negative perception of Government	2.41	1.21	5
Lack of legal backing	2.41	1.42	6
insufficient previous experience	2.23	1.01	7
Insufficient knowledge of modular system	2.23	1.08	8
Lack of promotion of the technique	2.20	1.22	9
Long design time	2.15	1.20	10
Difficulty in achieving economy of scale	2.09	1.10	11
Initial attachment to traditional system	2.03	1.20	12
Initial high cost	1.95	0.95	13
Lack of manufacturing industry	1.90	1.10	14
Negative perception of client	1.86	1.08	15
Resistance to innovation	1.84	0.93	16

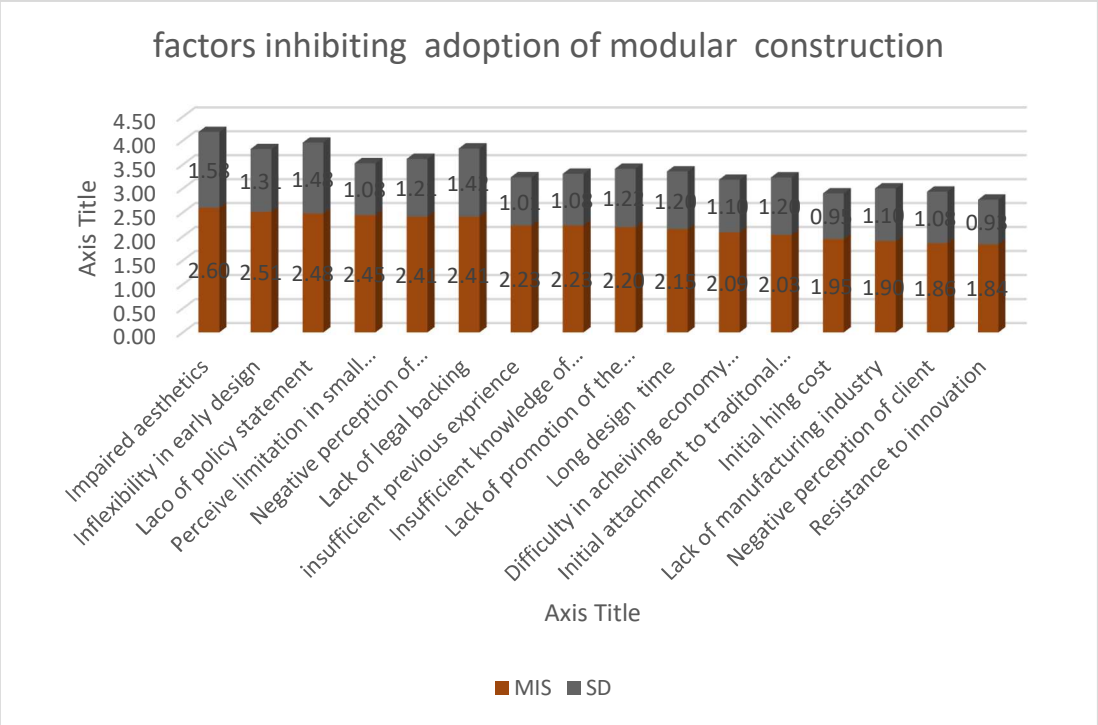

Figure 1: Factors inhibiting adoption of modular construction

Table 4: Factors enhancing adoption of modular construction
(Mean Item Score, (MIS) Standard Deviation (SD) values and Ranking)

Variables	MIS	SD	RANK
Reduce substandard work	2.57	1.01	1
Reduce Transportation	2.54	0.84	2
Reduce waste	2.50	0.90	3
Reduce construction time	2.46	0.98	4
Reduce weather delay	2.40	0.89	5
Reduce environmental pollution	2.34	1.05	6
Reduce maintenance and repairs	2.23	1.06	7
Reduce skill shortage	2.11	1.04	8
Reduce hazard	1.98	1.04	9
Reduce construction cost	1.97	0.98	10

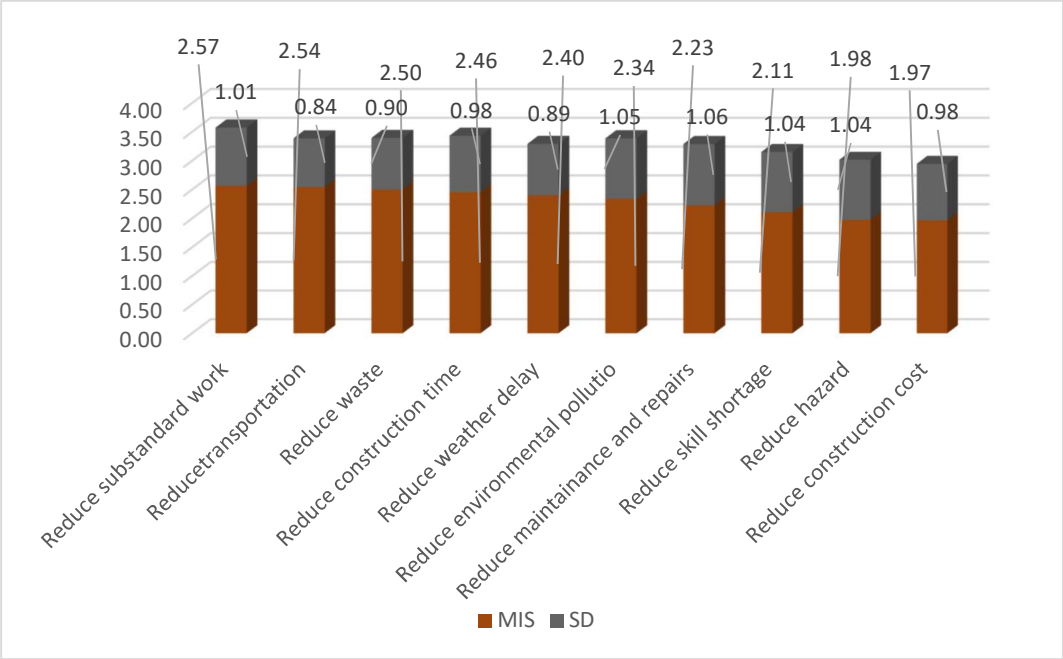

Figure 2: Factors enhancing adoption of modular construction

Table 3 and Table 4 summarize the findings with respect to the factors predicting adoption of prefabrication.

Conclusions

Based on the results presented earlier, two key conclusions can be drawn. The first deduction is that many of the professionals have a reasonable knowledge about prefabrication construction and what it can be used for. It is therefore recommended that professionals in built environment consider incorporating modular design/prefabrication construction techniques into their projects

focusing on detailed cost analyses against traditional methods due to the numerous benefits it offered.

The second deduction is that, impaired aesthetics is most significant in ranking of factors that impede the adoption of the technique; it is therefore recommended that workshops and seminars be organized from time to time for built environment professionals bodies and stakeholders (contractors, clients) on the needs and benefits derivable from the adoption of prefabrication/ modularization.

Additionally, the government should take the lead in advancing this technology by implementing incentive programs, as some developed and developing countries, including the United States, th e United Kingdom, Sweden, China, Hong Kong, Malaysia, Ghana, and Singapore, have done.Thi s study was limited to the Oyo state Built Environment Professionals and Data collected as such. However, the study was limited in the methodology, as quantitative data analysis was performed on the factors predicting the adoption of modular construction; further studies can conduct qualitative research from the professionals and experts to determine factors predicting the adoption of prefabrication construction in the country and other developing countries.

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