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INDUSTRIALIZED BUILDING SYSTEMS: PROSPECTS AND PROBLEMS WITHIN THE NIGERIAN CONSTRUCTION INDUSTRY

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The growing demands for affordable housing, use of more systematic and mechanized technologies, concern for energy-efficient buildings and need to be competitive in an increasingly global market have prompted construction players to move from the traditional method of construction to Industrialized Building System (IBS). This study is aimed at highlighting the prospects and problems of IBS with a view to developing strategies for its application in Nigeria. The study examines factors inhibiting the development and application of Industrialized Building System, evaluates problems and prospects of IBS, and appraises the level of awareness of IBS in the construction environment. The data for the study was collected in Owerri, Imo State, Nigeria with the aid of a structured questionnaire which was administered to the various professionals in the built environment i.e. Architects, builders, engineers, quantity surveyors, estate valuers working in construction sites in the state. The data retrieved from the questionnaire was analyzed by means of descriptive statistics such as frequency tables, percentages and 4-point Likert scale. From the analysis, the study revealed low level application of IBS in Nigeria. It further revealed that the factors inhibiting the application of IBS in Nigeria include initial start up cost, inadequate facilities for manufacturing, adaptation to standards and government policy,. The study concludes that IBS is a paradigm shift from the traditional construction methods, and its application in Nigeria construction environment is inevitable. The study recommends that construction workforce skills need to be upgraded to be involved in IBS, more informative and awareness programs should be organized to enlighten both the private and public sectors on its benefits and government should use IBS in its projects as well as find a way to assist construction firms in the initial start up cost which is a major inhibition.

Keywords:building, construction industry, housing, sustainable development

INTRODUCTION

The construction industry is undergoing a change from the use of conventional technology to the use of more systematic and mechanized technologies.

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Industrialized building system or Pre assembled systems also known as prefabricated components in the case of concrete(precast concrete) is one of such alternative construction methods. The extensive programme of rebuilding and reconstruction that followed the end of the Second World War coincided with shortage of traditional building materials and a depleted labor force which was inadequate for the scale of the project work. In this event, a substantial part of the building programmes was met by the use of concrete in the form of precast frames, cladding units and wall frames.

In developed and some developing countries of the world, there has been a tremendous transition in the construction industry from the traditional method to industrialized building System (IBS). Manufacturing and productivity have moved from being project based to product based. No doubt, the implementation of prefabrication in construction industry has enhanced productivity and improved quality as well as several other benefits.

In Nigeria, with the huge defect in housing delivery and unprecedented growth which has put pressure on the existing infrastructure, there is need to breech the gap in infrastructural development by the use of the Industrial Building System (IBS).

Aim

This study is aimed at highlighting the prospects and problems of the Industrial Building System (IBS) in Nigeria with a view to developing strategies on improving the application of the Industrial Building System (IBS) in Nigeria.

Objectives

1. To identify factors inhibiting the development of the Industrial Building System (IBS) in Nigeria.
2. To critically evaluate the prospects and problems of Industrial Building System (IBS) in Nigeria.
3. To appraise the level of IBS in Nigerian construction sector.
4. To identify the role of Government in establishing legislative frame work for Industrial Building System application.

LITERATURE REVIEW

According to Zakari, Abdul Awal, Zakaria, Abdullah and Zakaria Hossain (2017), in Nigeria, organized building practices date back to the 1930's when the very few construction activities of significance were handled by the Public Works Department (P.W.D) and Royal Army Force which was later transformed to the Nigerian Army Engineers. Direct labor was the mode of construction and project delivery at this time. Construction contracting in Nigeria began in the 1940's with few British and Italian companies coming into operation. Nigerian Independence in 1960 brought an upward trend in construction activities and until the late sixties, most of the available construction organizations were over-stressed with contracts. The "oil boom" that followed ten years after independence led to an upsurge in construction and demand for construction services, as the country at that period opened up to foreign and local investments and the obvious need for infrastructure to drive the economy.

With Nigeria's current population of over 186 million and the dire need of housing and other building development, to be able to meet the need of housing for its teeming population, industrialized building production has to be embraced.

In Malaysia, Hong Kong, and Singapore amongst others, the Industrial Building System (IBS) has become a major part of construction technology for production of high volume of houses at affordable cost especially low cost houses.

Development of the industrial building system (IBS) in Nigeria

Initial Cost is one of the factors that inhibit the development of IBS in Nigeria - Many small contractors are reluctant to adopt IBS system and prefer to continue using the conventional method of construction. This is due to the fact that small contractors are already familiar with the conventional system and for them the technology suit well with small scale projects and therefore not willing to switch to mechanized based system. Furthermore small contractors lack financial backup and are not able to set up their own manufacturing plants as it involves very intensive capital investment (Kamarul, Mustafa& Zuhairi, 2009).

Adaptation of standards is another factor that inhibits the development of IBS in Nigeria – The use of Industrial Building System requires standardization of components and spaces; also joints and connection details need to be standardized. This requires tremendous education and training efforts. Warsawski, 1999 observes that modular co-ordination and standardization are among prerequisite characteristics underlining the successful implementation of IBS. It therefore becomes necessary that to accomplish the requirements of modular co-ordination, all components need to be standardized, implying that standard plans and standard component drawings are required, particularly to aid the production process. This is cited as one of the principal hindrances to the use of modular coordination. Otherwise, even partial introduction of IBS components such as lintels or staircases is not looked upon favorably and is therefore rarely used for the construction project due to a lack of standardization of modular coordination.

Government policy and Incentives is another factor – There is no government policy or incentive for use of IBS as against the conventional traditional construction method. For the change to be feasible the government has to put more attractive incentive systems, benefits and create awareness on the advantages of using the Industrial Building System.

Inadequate manufacturing facilities is also a factor inhibiting the development of IBS- Presently the level of manufacturing facilities for IBS is not available because it has not been fully embraced.

Prospects and problems of industrial building system (IBS) in Nigeria

With the world being a global village and sustainable housing being a topical issue which is being provided through modern construction technology like IBS, Nigeria has to embrace this technique. This industrial building system has prospects and problems in the Nigerian society.

The prospects are: Economic benefits through savings in site labor and minimization of construction waste as compared to the conventional methods. Reduction of construction time on site. It will bring about commitment and

cooperation between the public and private sectors. Meet the housing need of Nigeria within the framework of sustainable development. Increase the stock of buildings in supply within the construction sector of the nation's economy. Provision of a more skilled workforce and upgrading of the skills of mass construction workforce.

According to Zakari et.al, (2017), there are problems faced in the implementation of IBS in Nigeria. The construction requires: high initial investment capital purposely for machineries, steel mold, foreign technology, Transportation and the wages of skilled workers for the installation process. Other problems of IBS are: lack of knowledge and expertise in IBS, it requires more skill from the workers when compared to the conventional According to Zakari et.al, (2017), the following barriers were summarized: Research and educational courses on IBS unavailable, not economic for small rise buildings and small projects, unfamiliarity, insufficient manufacturers. Resistance to change from traditional method to other methods, high capital cost, high payment of skilled labor, transportation access, lack of technology reference, construction methods and also requires the education and training of human resource in the construction industry.

Level of industrial building system (IBS) in Nigerian construction sector

Aladeloba,Okesoto and Olawale (2015) opined that the country is one of the most populated in the continent of Africa, suggesting that the country is in dire need of housing and other building development to meet the requirements of its teeming population. The decline in the country's Gross Domestic Product (GDP) through the building sector can only be arrested, if the nation embraces industrialized materials in building production. This will accelerate the growth in the industry and promote rapid growth and development of the building and construction sector.

Currently, the industrial building system in Nigeria has been applied in few projects such as Coca-Cola industry in FCT Abuja, Benue brewery industry in Benue state and Benue Cement Company in Yandev Gboko, Federal Housing Authority Lugbe, Mass Housing Construction FCT Abuja, and residential building in FCT Abuja and Kano state.

Compared to the level of work going on in the construction industry in Nigeria, this is very minimal.

Legislative frame work for industrial building system (IBS) application

The role of Government in establishing legislative frame work for industrial building system (IBS) application cannot be overemphasized. The government has a major role to play. According to Kamarul et.al, (2009) IBS in Malaysia began in early 1960's when Ministry of Housing and Local Government of Malaysia visited several European countries and evaluated their housing development program. After their successful visit in 1964, the government started first project on IBS aimed at speeding up the delivery time and building of affordable and quality houses. The endorsement of IBS Roadmap 2003-2010 in Malaysia by the Malaysian Parliament on 29th October 2003 expressed the importance and urgency of IBS implementation in Malaysia. It is a systematic and coordinated blueprint of total industrialization of construction industry towards achieving total industrialized industry and promoting open system by the year 2010. Malaysia is still grappling

with this building system but has made successful progress because of their government effort.

Nigeria, can establish a legislative framework for the promotion of IBS by studying what obtains in countries like Malaysia, Finland, Sweden, Japan, Germany and Singapore where technologies had eventually modernized and improved the industry.

METHODOLOGY

This paper examined the prospects and problems of the Industrial Building System (IBS) in Nigeria with a view to developing strategies that will help improve the application of IBS in Nigeria. The data for the study was collected in Owerri, Imo State, Nigeria with the aid of a structured questionnaire which was administered to the various professionals in the built environment i.e. Architects, builders, engineers, quantity surveyors, estate valuers working in construction sites; these were selected based on their knowledge and involvement with the topic in question. The questionnaires were administered to 100 randomly selected professionals but 78 were retrieved. The data retrieved was analyzed using the descriptive statistics such as frequency tables and percentages respectively. The respondents were asked to rank the factors that inhibit the development of industrial building system (IBS), prospects of industrial building system (IBS) and barriers and problems of industrial building system (IBS) using 4-point Likert scale of:

1-Strongly Agree
2-Agree
3-Disagree
4- Strongly Disagree

which established a criteria mean of 3.00 and 75% percentage mean was adopted and served as basis of acceptance or rejection of the factors.

FINDINGS AND DISCUSSION

Table 1: Designation of respondents

Respondents	Frequency	Percentage
1. Architects	25	32
2. Urban Planners	10	13
3. Builders	25	32
4. Estate Surveyors	11	14
5. Engineers	7	9
Total	78	100

Source: Field Study 2019

Table 1: Shows the percentage representation of the respondents, 32% for Architects, 13% for urban planners & 32% for builders, 14% for Estate surveyors and finally another 9% for engineers. This result expresses the opinion of the professionals in the study area.

Table 2: Years in practice

Respondent	Frequency	Percentage
Above 5years	10	13
Above 10 years	18	23
Above 15 years	20	26
Above 20 years	30	38
Total	78	100

Source: Field Study 2019

Table 2: Shows the respondents' years of experience as professionals. With average working experience of 10 years, respondents are deemed experienced enough to supply reliable data for this research.

Table 3: Respondents opinion to awareness of Industrial Building System (IBS)

Are you aware of Industrial Building System (IBS)?	Frequency	Percentage
Yes	67	86
No	11	14
	78	100

Source: Field Survey 2019

From Table 3: 86 percent of the respondents were aware of Industrial Building System (IBS) while 14 percent were not aware. The result show that majority of the respondents were aware of IBS.

Table 4: Factors that inhibit the development of Industrial Building System (IBS)

S/No	Do these factors inhibit the development of the IBS in Nigeria?	Mean	Percentage Mean
1	Initial start up cost	3.44	86.2
	Adaptation of standardization of components and spaces, also joints and connection details	3.23	80.7
	Government policy and Incentives	3.11	77.8
	Inadequate manufacturing facilities	3.32	83

Source: Field Study 2019

Table 4: Shows the factors and their mean and percentage mean. It can be observed that all the factors are above 3.00 and 75% which is criteria to accept the factors, so all the respondents agree that these factors inhibit the development of the industrial building system (IBS) in Nigeria.

Table 5: Prospects of the Industrial Building System (IBS) in Nigeria

S/N	Do you Agree that the following are prospects of the industrial building system (IBS) in Nigeria?	Mean	Percentage Mean
	A. Reduction of construction time on site	3.29	82.4
	B. Commitment and cooperation between the public and private sectors.	3.25	81.4
	C. Meet the housing need of Nigeria within the framework of sustainable development	3.38	84.5
	D. Increase the stock of buildings in supply within the construction sector	3.46	86.6
	E. Economic benefits through savings in site labor and minimization of construction waste	3.48	87
	F. Provision of a more skilled workforce	3.44	86

Source: Field Study 2019

Table 5: Shows the Prospects of the industrial building system (IBS) in Nigeria. The responses are above 3.00 and 75% which is criteria to accept the factors, so they all agree that the above are prospects of the industrial building system (IBS) in Nigeria.

Table 6: Barriers and problems of the Industrial Building System (IBS) in Nigeria

S/N	Do you agree that the following are barriers, and problems with IBS?	Mean	Percentage Mean
	A. Not economic for small rise buildings and small projects	3.24	81.0
	B. Research and educational courses on IBS unavailable	2.96	74.0
	C. Unfamiliarity	3.03	75.9
	D.Insufficient manufacturers	3.29	82.3
	E. Resistance to change from traditional method to other methods	3.30	82.6
	F. High capital cost	3.49	87.3
	G. High payment of skilled labor	3.10	77.5
	H. Transportation	3.37	84.2
	I. lack of knowledge	3.42	85.5

Source: Field Study 2019

Table 6: Shows the barriers, and problems with IBS in Nigeria. The response on research and educational courses on IBS unavailable is 2.96 and 74.0 so that factor is not a barrier or problem but all the other factors are above 3.00 and 75% so they are accepted as barriers or problems of the industrial building system (IBS) in Nigeria.

Table 7: Respondents opinion to government establishing legislative frame work to improve the application of Industrial Building System (IBS) in Nigeria

Will Government effort through establishing legislative frame worl improve the application of industrial building system (IBS) in Nigeria?	Frequency	Percentage
Yes	20	25.6
No	58	74.4
	78	100

Source: Field Survey 2019

From Table 7: 74.4 percent of the respondents agree to government establishing legislative framework to improve the application of industrial building system (IBS) in Nigeria while 25.5 percent do not agree. The criteria established to accept a factor is 75% and this is 74.4%.

Based on the data which were collected through the administration of questionnaires to the 78 respondents involved in this study: various professionals in the built environment i.e. Architects, builders, engineers, quantity surveyors, estate valuers working in construction sites in Imo State, Nigeria, the followings findings were made;

1. Most of the respondents were aware of Industrial Building System (IBS). See Table 3
2. All the respondents agree that factors that inhibit the development of the industrial building system (IBS) in Nigeria are initial start up cost, inadequate facilities for manufacturing, government policy and adaptation to

standardization of components and spaces, also joints and connection details. As shown in Table 4.

3. All the respondents agree to all factors listed as prospects of the industrial building system (IBS) in Nigeria. See Table 5.
4. All the respondents agree to most factors listed as barriers and problems that try to inhibit the development of the industrial building system (IBS) in Nigeria but disagreed that educational courses on IBS is unavailable. See Table 6.
5. As shown in Table 7, all the respondents do not agree that government establishing legislative framework will improve the application of industrial building system (IBS) in Nigeria.

The above findings agree with the works of most of the authors like Aladeloba et.al (2015) Zakari et.al (2017):Kamarul et.al (2009) and Warsaki (1999) who agree that the country is in dire need of housing and other building development to meet the requirements of its teeming population and that the decline in the country's Gross Domestic Product (GDP) through the building sector can only be arrested, if the nation embraces industrialized materials in building production which will accelerate the growth in the industry and promote rapid growth and development of the building and construction sector.

CONCLUSION/ RECOMMENDATIONS

This paradigm shift from the traditional construction methods to IBS in Nigeria construction environment is inevitable. To encourage the adoption and application of IBS in the Nigerian construction industry, the following are recommended:

i. The construction workforce need to upgrade their skills to be involved in IBS
ii. More informative and awareness programs such as seminar, colloquiums and conferences or collaboration with higher institutions should be organized to enlighten the private as well as public sector on IBS and its benefits.
iii. Government should use IBS in the construction of mass housing and most projects thereby encouraging its adoption and should set up IBS manufacturing plants and also be willing to assist construction firms in the initial startup cost.
iv. Contractors should be encouraged to invest in IBS by setting up their own manufacturing plants.

All these will help to breech the gap in infrastructural development by the use of the Industrial Building System, meet growing demands for affordable housing, and need to be competitive in an increasingly global market also move the nation to a sustainable growth path.

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