

# Awareness and Adoption of Prefabrication Construction: A Tool for Housing Delivery

Akanbi A. O<sup>1</sup>, Alagbe. O. A.<sup>2</sup>

<sup>1</sup>Department of Architecture, Lead City University, Ibadan, Nigeria<sup>1</sup>

<sup>2</sup>Department of Architecture, Caleb University, Imota, Ogun State, Nigeria<sup>2</sup>

(akeemakanbi91@gmail.com)

Corresponding Email: akeemakanbi91@gmail.com

**Abstract** Recent technological advancements, heightened awareness of environmental pollution, persistent shortages of affordable housing for low- and middle-income earners, and various environmental challenges have prompted research into innovative construction methods. These factors have shaped global perspectives on housing delivery. This study employs a narrative review to assess knowledge, awareness, barriers, drivers, and the adoption of prefabrication as a strategy for mass housing delivery. The review draws on peer-reviewed sources, including articles, books, and grey literature, sourced from Google Scholar, Scopus, Semantic Scholar, and JSTOR. Through a systematic inclusion and exclusion process, the selection was refined from over 76 papers to 38 relevant studies. The findings reveal an increasing housing shortfall. Contributing factors include rapid population growth, rural-urban migration, restrictive land-use policies, high costs of land and building materials, inadequate financing, limited involvement of the real estate sector, inconsistent policies, slow construction processes, and insufficient awareness and adoption of prefabrication. The study recommends enhanced collaboration, awareness campaigns, and incentives among professionals in the built environment, academia, the private sector, and government to promote the adoption of prefabrication in Nigeria's construction industry and address the housing deficit.

**Keywords:** adoption, awareness, conventional building system, housing delivery, prefabrication.

## 1.0 Introduction

The global housing crisis remains a significant challenge for both urban and rural populations, primarily due to rapid urbanization (Wang et al., 2020). Housing supply has consistently failed to meet demand, as population growth is exponential (Shittu et al., 2022). The resulting crisis has left many individuals living in uninhabitable conditions, lacking adequate hygiene and sanitation (Dash, 2018). Housing is essential for individuals and nations, serving as an economic activity with a multiplier effect; thus, the provision of adequate housing is of paramount importance.

Nigeria's housing deficit was estimated to be between 17 and 28 million, with an estimated 21 trillion naira required to counterbalance the deficit. (Musa & Maina, 2024). This housing shortage, which will take the country at least 17 years to solve, if one million housing units are to be constructed every year, has been monetized to be about 60 trillion Naira by the United Nations (Boafo et al., 2016; Terna et al., 2018). Therefore, the Vision 2020 National Technical Working Group on Housing (2009) document has stated that one of the ways to improve the supply of housing significantly is to move from the traditional mode of construction to modern construction techniques (Ikechukwu et al., 2017; Adebayo & Kayode, 2017)

According to the United Nations data on the world population, the world is getting bigger; it is therefore expected that the population of the world will double from the present 3.8 billion to 6.2 billion in 2050, while the expected growth is from the developing countries, such as Nigeria (Lojanica et al., 2019). In developing countries, poor housing delivery has been attributed to inadequate mechanisms and systems of land allocation, funding, mortgage, institutional infrastructure, poor performance of its construction methods, non-awareness, and adoption of new mode of construction to mention a few.

Meanwhile, Prefabrication construction has been used by the construction industry in developed nations as a strategy to improve construction quality and productivity, reduce health and safety risks, and address the skilled labour shortage. This implementation has recorded success by the governments of several emerging nations, including Malaysia and Singapore, as well as developed nations like the United States, Sweden, China, and Hong Kong (Bello et al., 2023; Tam et al, 2007; Aigbavboa et al., 2018). It was therefore recommended that developing countries need to embrace radical thinking to switch from traditional building techniques, which is labour-intensive and time-consuming among their characteristics, to move to inventive housing processes (Shibani et al., 2021; Rahimian et al., 2017).

Early humans were predominantly nomadic, constantly searching for a new location to settle temporarily. Dwellings were made out of tree trunks, branches and twigs, leaves, animal furs, and skins; the most common materials used in their prefabrication were sticks and stones. It has existed for at least 2000 years (Gibb 1999) with evidence of Roman pre-fabricated fort buildings in the UK, and off-site timber cruck buildings in Britain in the 12th century (Robinson, 2017). The earliest prefabricated cases were recorded in 1624, when houses were prepared in England and sent to the fishing village of Cape Ann, known today as a city in Massachusetts (Lojanica et al., 2019), while a similar system was erected in Freetown, Sierra Leone, and the Eastern Cape Province of South Africa some years later (Boafo et al., 2016).

The earliest forms of prefabrication recorded in Nigeria were the old residency buildings constructed by the British colonial masters. Boats and Ferries were used to ship various building parts from Britain down to Nigeria to their various sites. Most of the prefabricated buildings built were residences and offices for the colonial masters and their families. An example of such a building is located in Calabar, called the old residency building for the consulate. The building was made from wood and transported in parts through the sea to Old Calabar, and was built in 1884. The building was a Residential storey building. It remains one of the best examples of the early British colonial architecture in Nigeria and hence was among the Listed Buildings in Nigeria (Ogeye, 2014)

In the year 1913, Henry Ford introduced the assembly line concept at his automotive factory, which is also known as the Just-In-Time [JIT] Philosophy or Toyota Production System. (Zhang et al., 2018), His revolutionary idea was to reduce the construction and production time while maintaining high quality and control at each phase of the process, and this enhanced the use of prefabrication significantly.

Several studies have used varied terms for the prefabrication construction technique, as no single term has specifically been used to define the concept. Such terms include: modularization, pre-assembly, off-site manufacturing (OSM), off-site production (OSP), off-site construction [OSC], "modern methods of construction" (MMC), industrialized building system [IBS], non-traditional, prebuilt construction (Boafo et al., 2016; Nduka et al., 2019; Wang et al., 2020). The basic idea of prefabrication is to transfer a certain proportion of the construction work from the traditional sites to factory or other manufacturing sites to reduce time, save cost, and reduce wastage (Zhang et al., 2018; Lu et al., 2018). The prefabricated units may be part or whole or combined to form complete components, while the traditional methods of construction [of cement and mortar] are slow and inefficient, which brings a great burden to the environment, e.g., visual intrusion, air pollution, waste pollution, and social welfare (Liu et al., 2020).

Traditional methods of construction have yet to provide a reliable solution regarding solving the huge housing problems despite having been applied for more than centuries. It has been identified as the slowest procurement method for building projects.

## 1.1 Challenges of Housing Delivery.

The impediments to effective housing project delivery, which include but are not limited to the Rigid Land Use Act, High cost of land and building materials, Inadequate finance, Real Estate section, Summersault policies, and Slow process of construction methods, etc., had been identified from the literature. In furtherance to the identified impediments, it was ascertained that Nigeria has identified the housing problem but had failed to resolve the problem many years after(Terna et al., 2018). Some of the identified challenges are as follows;

Somersaulting policies; Due to politicizing of the policies, the insincerity of the government, lack of adequate research, and coordinated study of the housing problem, several National Development Plans on housing programs had yielded no tangible results with the somersaulted polices despite huge sums of money spent.

Rigid Land Use Act; The Land Use Act of 1978, which grants exclusive ownership of land to the federal government, which is to be administered by state governors, is a major barrier to housing development and home-ownership, and has a cumbersome property registration process.

Inadequate finance; The Federal Housing Authority (FHA), FHA Homes and Savings Limited, the Federal Mortgage Bank of Nigeria (FMBN), and other agencies had been scored low on the provision of housing due to poor revenue generation, irrational debts, and bad corporate governance, among others.

High cost of land and building materials; Global inflation, the high cost of production, high taxes, bad transportation, and other associated factors have made the cost of building materials shoot up unimagined. Lands are quite expensive, most especially in urban settlements.

Real Estate involvement: The slow involvement of the real estate business in Nigeria and the guarantee of returns of investment opportunities weaken the involvement of stakeholders in the industry, leading to the need for the provision of mass housing, although Real Estate offers a great potential source of growth in mass Housing.

Slow process construction methods; due to the slow method of construction, Nigeria's housing deficit was estimated to be over 17 million, despite various intervention strategies such as direct government production and self-help housing. Therefore, there is a need for houses to be built in large numbers, and efforts should be made to reduce the cost of building and the time of construction using prefabrication construction. The achievements of subscribing to automation housing research, to the housing design process, construction, and assembling of buildings besides customization, as augmented the sustainability of housing like modular and prefabricated housing, which create a real impact.

Past Efforts on Affordable Housing Delivery in Nigeria.

In Nigeria, the housing problem remains intractable, with various strategies for improving housing delivery proffered by private, public, political, social, and religious initiatives in the past, as many low and middle-income earners in the country do not have access to affordable housing(Makinde, 2014).

The policies on housing in Nigeria were first initiated and developed by the British colonial masters. The policies were formulated in the trajectory of British housing policies, but were not sustainable. The government has made many attempts to elicit and initiate national housing policies since the country's independence; unfortunately, the problem of housing persists, and it is on the rise.(Ankeli et al., 2017)

A communal system of housing Delivery was practiced up to 1928 (Ayodeji et al., 2016), which still lingers in some communities today. In 1964, Housing Corporations were established in three regions of the Federation, namely Eastern, Western, and Northern regions, these were followed by the establishment of Decrees and Policies on Housing by the Federal Government. Despite a series of government policies and schemes towards adequate housing delivery, the country could only achieve 4.2% of the requirement annually.

#### Drivers and Constraints of Prefabrication Methods

Numerous scholars and industry practitioners have identified several advantages of prefabrication construction methods over traditional systems. These benefits include improved sustainability through recyclability (Musa & Maina, 2024; Nduka et al., 2019), cost reduction, enhanced safety (Lu et al., 2018; Sun et al., 2020), reduced construction time (Nnadzwa & Makinde, 2020), improved quality control (Almutairi, 2015), decreased waste (W. Jiang et al., 2020), reduced site malpractices, increased productivity (Shibani et al., 2021), lower maintenance and repair costs (W. Jiang et al., 2020), ease of dismantling and rebuilding (Tavares et al., 2021), greater flexibility in architectural design (Aigbavboa et al., 2018), and a reduction in construction disputes (Zhang et al., 2018).

Despite the numerous advantages of prefabrication we still have the following constraints; higher initial cost, transportation, leakages, monotony, installation process problems, lack of experience with the techniques, precision measurement, planning, design process, early collaboration, difficulties in altering the design at various stages of construction, correction difficulty in the event of mistake, low level of awareness from Government .etc.(Chao et al., 2015, Sun et al., 2020, Blismas et al., 2005,R.) Jiang et al., 2018, Arowoiya & Oyefusi, 2023)

## 2.0 Methods and Materials

2.1 The paper made use of a narrative literature review. It follows a research methods that entail a literature review. In the first step, a literature review was piloted to provide a comprehensive understanding of the adoption and awareness of prefabricated construction. The authors searched representative papers from relevant journals and conference proceedings by using the Google Scholar search engine. The internet source includes peer-reviewed research materials, such as Articles, Books, and Grey literature. These selected materials were downloaded from Google Scholar, Scopus, Semantics, and Jstol, which is an academic search engine. The data [secondary] were mainly gathered from internet sources using an analysis of the document. Keywords used for searching included “prefab\*”, “new construction “““offsite” Industrialized building, offsite construction, prebuilt construction, and prefabricated building”. The title and abstract of each paper were screened to determine if they are related to the target topic. By doing inclusion and exclusion, 38 papers were qualified for review in this study, based on the authors’ perusal of these selected papers.

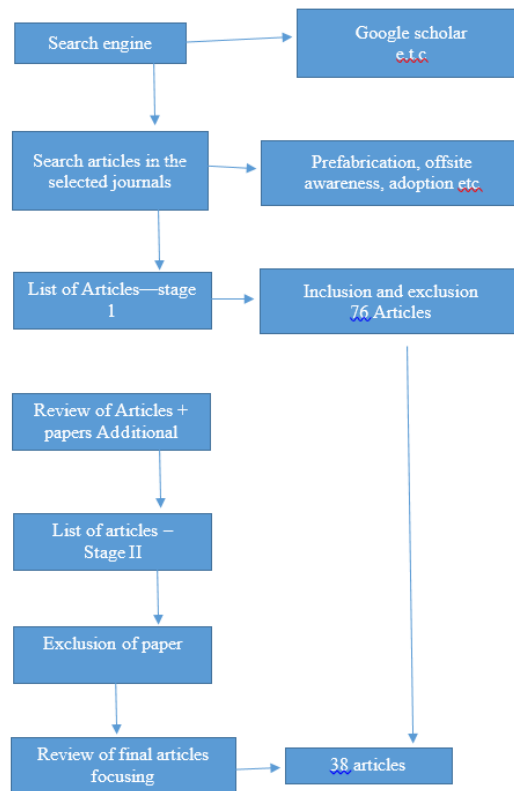


Fig.1systematic literature review (Inclusion and Exclusion)

### 3.0 Results and Discussion

**3.1.** The Vision 2020 National Technical Working Group on Housing (2009) document stated that one of the ways to improve the supply of housing significantly is to move from the traditional mode of construction to modern construction techniques (Ikechukwu et al., 2017; Adebayo & Kayode, 2017). It is observed from the literature review that the lack of knowledge, awareness, and adoption of the use of prefabrication construction has denied the country several benefits as compared with the traditional construction methods. Furthermore, it is established that the housing deficit is on the increase. Factors that affect include, but are not limited to, rapidly rising population and rural-urban migration to the city centres, rigid land use act, high cost of land and building materials, inadequate finance, real estate involvement, somersaulted policies, slow process of construction methods, and inadequate awareness of the use of prefabrication and its adoption.

The gap between housing supply and the upsurge of housing demand in connection to rapid urbanisation makes it imperative that the construction industry seeks innovative materials and technologies that can provide more high-quality housing using less construction time(Sun et al., 2020; Agenbag & Amoah, 2021)

### 4.0 Conclusions

The review looked at a brief history of prefabrication construction, past efforts towards housing delivery, the drivers and constraints of prefabricated construction compared with the Traditional building method. It was observed from the literature review that the lack of knowledge, awareness, and adoption of the use of prefabrication construction has denied the country several benefits as compared with the traditional construction methods. Furthermore,

it is established that the housing deficit is on the increase. Many factors that may affect include, but are not limited to, rapidly rising population and rural-urban migration to the city centres, rigid land use act, high cost of land and building materials, inadequate finance, real estate involvement, somersaulted policies, slow process of construction methods, inadequate awareness of the use of prefabrication, and its adoption. Bearing in mind the current crisis in housing sectors, it is therefore imperative that the significance of alternative construction technology need to be considered by the stakeholders with reference to the enhancement of health and safety factors in the construction industries. The study therefore recommends that the curriculum of higher institutions needs to be revised to accommodate prefabrication construction to conduct more research and change customers' undesirable perceptions through consistent advocating the adoption and benefits of prefabrication methodology. This collaboration, sensitization, and incentives/ encouragement among professionals in the built environment, academia, and government are needed to promote the positive adoption of prefabrication construction industry and mitigate the shortfall in housing delivery.

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