International Journal of Advanced Scientific Research | IJASR
International Journal of Scientific Research in Technology, Applied Sciences & Health Studies | IJSRTASHS
ISSN Print: 2579-1036 | ISSN Online: 2579-1044
Volume 3, Number 1, June, 2018

Industrial Prefabrication as an Effective Approach to Solving Housing Problems in Nigeria

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Abstract

Shelter as one of the basic needs of man, is also an indicative factor for measuring the standard of living of any country. Nigeria, like other developing countries is contending with accumulated acute housing deficit due to inconsistent planning, defective administrative policies, and petty corruption, among others. A review study carried out indicated a scaring fact that Nigeria currently has a housing deficit of well over 17 million housing units. To consolidate the fears, the United Nations monetised Nigeria's housing shortage to about Sixty Trillion Naira, which will take the country at least 17 years to solve, if one million housing units are to be constructed every year. To solve the problem, experts identified some factors militating against effective housing provision in Nigeria to include inadequate finance, rigid housing policies, non-implementation of periodic housing plans, as well as slow pace of housing construction, among others. A survey conducted also confirmed the dearth of houses in Nigeria, the need for construction of houses in large numbers and very importantly, the use of Industrial Prefabrication Technology to construct atleast one million housing units annually.

Keywords: *Industrial prefabrication, Construction, Housing problems, Shelter, Nigeria*

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Background to the Study

Shelter can be seen as one of the basic needs of man, just as adequate qualitative housing is one of the active indices of measuring the wealth and living standards of any nation (Diogo 2004). Nigeria has been grappling with huge housing deficit for the better part of the last century. The turn of the new century, however, has been a story from bad to worst (Arayela 2002). The country's housing shortfall, according to the Minister of Housing, Lands and Urban Development in 2012,stood at about 17 million units (Enoghase, 2015), which according to 3Invest (2015), 60 percent of the deficit resides in the low income housing market.

Today, it is ironic that Nigeria with a population of about 170 million people is currently facing a national housing deficit of over 17 million units, which according to Gounna (2013), requires a minimum of additional one million housing units per annum, to reduce the national deficit in order to avert a chronic housing crisis in the country. If the country is able to construct one million units of houses, it will take 17 years to effectively solve Nigeria's present housing needs. This figure excludes the new housing challenges that might arise in those 17 years, which may take up to 30 years all together as provided in the 2014 National Infrastructure Master-plan (Real Estate Information Centre, 2015). It can therefore be deduced from the above estimates that Nigeria's present housing deficit in 2015 may be up to 20 million.

The implication of this, as Enoghase, (2015) asserts, is that the country is fighting an uphill battle in reducing the housing deficit. As more housing units are constructed, an increasing population could erode these accomplishments if Nigeria's housing programme is not robust enough to outgrow the population growth. Housing in Nigeria will become a recurring "chicken and egg" decimated problem if the federal and federating states fail to make more proactive efforts to construct well over one million housing units annually.

Financial Implication of Nigeria's Housing Deficit

While The World Bank has peg the estimated cost of bridging Nigeria's 17 million housing deficit as at 2012, at 59.5 Trillion Naira or 330 Billion Dollars at an exchange of about 180 Naira per Dollar (starconnect Media, 2014), the Federal Mortgage Bank of Nigeria, at a conservative construction cost ofN3.5million per unit, has put the total cost required to adequately meet the housing needs of Nigeria, at a marginal difference of about N56 trillion Naira or 300 Billion Dollars at an exchange of about 180 Naira per Dollar (Ogunwusi, 2013).

With an annual increment of about 780 000 units as asserts by Kolawole (2015), Nigeria's present housing deficit, as at 2015, might well be up to 20 million units which may require upto 70 trillion Naira to solve satisfactorily.

Whichever way we take, this is a colossal amount which cannot be funded only through the National Housing Fund (NHF) alone, but requires urgent injection of funds from

both government and private sector. But as it is, government at both the federal and state levels seem to be doing one dismal thing or the other as it relates to addressing some of these needs, same with the private sector (starconnect Media, 2014).

From the on-going, it can be seen that the financial implication of Nigeria's housing is quite enormous and equally requires a decisive policy of government to encourage robust participation by all stake holders concerned.

Policies of Housing Provision in Nigeria

Policies put in place to provide adequate housing in Nigeria started with the provision of Staff Quarters and Government Reserve Areas during the colonial period, through the formation of Nigerian Building Society in 1960s and the composition of National Housing Council in 1971, to the establishment of Federal Ministry of Housing, Urban Development and Housing in 1975 and renamed Ministry of Lands in 1999 (Diogo, Okonkwo, 2004 & Arayela 1996).

The National Housing Council in turn recommended the establishment of Federal Housing Authority (FHA) in 1973 which was saddled with the responsibility of preparing and executing a National Housing Programme for the country (Ogunwusi, 2013). But as has been acknowledged by the minister in 2012, the agency has failed to deliver on its established mandate, which compels many stake holders to call for its restructuring (Gounna, 2013).

At present, what government is doing is basically through the NHF which requires workers to contribute 2.5 percent of their monthly income to qualify for loan up to 90 percent of the cost of the house to be acquired payable at 6 percent interest rate for a period of upto30 years. It is hoped that under the NHF scheme, Nigerians will be able to own a home by accessing up to loans from mortgage or other commercial banks (starconnect Media, 2014).

With an aim to ensure that all Nigerians are able to own a home, the Federal Government is also using three other strategies – land swap initiatives, affordable and mass housing schemes and accessible mortgage finance (Kolawole, 2015). In addition to unveiling the Nigerian Mortgage Refinance Corporation (NMRC), the federal government also launched a national N960 billion housing scheme for labour union members which are still in the pipeline as at May, 2015. (Real Estate Information Centre, 2015).

It can be deduced from the above submission that policies from colonial to the present time entails provision of housing at individual subsistence level rather than in industrial scale.

Efforts in Tackling Housing Problems in Nigeria

Through the National Housing Council of 1971, the Federal Housing Authority (FHA) was established in 1973 and saddled with the exclusive responsibility of preparing and

executing a National Housing Programme for the country (Ogunwusi, 2013). The agency, according to the minister of Housing, Lands and Urban Development, as at end of 2012, has built only 37,000 houses across the country since its inception more than 40 years ago, a discouraging average of less than 1,000 houses per annum (starconnect Media, 2014).

The Nigeria's Federal Capital Territory (FCT), on its part, has laid a foundation for the construction of 40,000 housing units for workers in Abuja in 2012 to reduce housing deficit. (Enoghase, et al 2015). These proposals are still not energised due to slow pace of manual construction and may take many years to accomplish.

In another direction, the private sector also continues to deliver a few thousand housing units for the luxury and high-income bracket. It is estimated that the formal and informal private sector will provides over 80 percent of the housing stock in Nigeria in due time. Though there is insufficient data on the proportion of private, government and individual contributions to the housing stock, it is a general knowledge that the incremental building by individuals on land purchased by private land owning families is the most prevalent, particularly with respect to housing low and medium income groups (Kolawole, 2015).

While Nigerians are waiting for the Federal Government to deliver on this housing scheme, the Babatunde Fashola-led government of Lagos State took the bull by the horn by launching what it called "mass housing" for residents of the state with 1,104 completed homes while another 3, 156 homes are at various stages of completion, in his eight year administration. (starconnect Media, 2014). Other states in Nigeria too are beginning to construct "mass houses" in their domains, but on what Enoghase, et al (2015) called a modest scale of a few hundreds.

Impediments to Effective Housing Provision in Nigeria

Concerned housing stake holders in both government and private sectors, have identified some factors militating against effective provision of adequate housing in Nigeria as follows:-

i. Rigid Land Use Act

Stakeholders, however, have identified the rigid Land Use Act of 1978 which resides exclusive ownership of land to the federal government to be administered by state governors, and a cumbersome property registration process, as major barriers to housing development and home-ownership, leading to the country's huge housing deficit. (Enoghase, et al 2015). There are also other issues of policy inconsistencies, poor administration, corruption among several factors that militate against affordable houses for Nigerians that even private developers have been expressing their difficulties in navigating through this web of challenges (Gounna, 2013).

To make housing more affordable in Nigeria, as noted by Enoghase, et al (2015), the government should start taking-off the huddles and hitches in getting land and the issuance of Certificate of Occupancy. It is hoped that the continuous reassessment of the

Land Use Act, which has been on the floor of the National Assembly, will bring the needed improvement and growth to both the housing and mortgage industry in the country **(**Ogunwusi, 2013).

It is rather contradictory and ironical that housing is grossly lacking in Nigeria, the government through its agencies, are busy demolishing some carefully laid houses due to some conflicting policies, instead of producing housing en-mass to reduce the housing deficit.

ii. High Cost of Land and Building Materials

Another major impediment to the construction of housing units in Nigeria, as Kolawole, (2015), puts it, is the high cost of land and materials. To meet Nigeria's need of 17 million housing units would require at the minimum about 17 million plots of land. When converted to a more common unit of measurement, square kilometre, that would amount to approximately 11,470 square kilometre, roughly the size of Rivers State, or three times the size of Lagos State (Enoghase, etal 2015). The cost of building material such as cement and aggregates as well as other manufactured materials are high due to the high cost of production, high tax, bad transportation and communication networks, among other restrictive policies and conditions.

The lands in most urban centres in Nigeria are quite expensive, and a little bit beyond the reach of an average modest worker. It will be logical to infer that since all land belong to government and reasonably beyond the common man, the government can as well mass produce houses to be delivered to its citizens.

iii. Inadequate Finance

The Federal Housing Authority (FHA), was established in 1973 and saddled with the responsibility of preparing and executing a National Housing Programme for the country. But the FHA built only 37,000 houses across the country since its inception about 40 years ago, a discouraging average of less than 1,000 houses per annum due to lean financial provision (starconnect Media, 2014).

Apart to what Gounna (2013), called its “perceived” inadequate funding, the agency's staff have also been severally accused of criminal neglect of their duties, poor revenue generation as a result of bad corporate governance, irrational debts, among others. Even their subsidiary, FHA Homes and Savings Limited which performs the function of Primary Mortgage Institution, that handles savings and mortgage loan accounts for customers who indicate interest to own personal houses, has been scored low for its crass failure over the past decades to meet up with its responsibility (starconnect Media, 2014).

As a complement, the Federal Mortgage Bank of Nigeria (FMBN) launched its Informal Sector Cooperative Society Loan Scheme In 2013, designed to enable informal sector participants to access the benefits of the National Housing Scheme (Kolawole, 2015). Since the finance needed to tackle housing deficit in Nigeria is quite high, it will be equally proper to make corresponding conscious provision of finance to neutralise the problem.

iv. Non-Implementation of Housing Policies

The United Nations Conference on Human Settlements (Habitat) was held in Vancouver, Canada in the year 1976. Delegates of the conference put the housing need of Nigeria then at merely 5,591,000 units and recommended an annual construction rate of 8 to 10 housing units per a thousand populations. This recommendation as laudable as it seemed, according to Arayela (2002), was not followed to the letter.

Also, at the numerous National Development Plan phases, huge sums of money have been spent with little or no commensurate results due to insincerity of government, politicizing of the exercise or lack of adequate research and coordinated study of the housing problem, among other reasons (Diogo 2004).

Since the problem of housing provision in Nigeria is aggregated partly due to long time abandonment, it has reached a critical abysmal stage where conscious industrial mass production will be the most viable option.

v. Relatively Young Real Estate Sector

Real estate and financial experts who agree with the World Bank's submission also add that the relatively young real estate sector remains a viable option for investors seeking guaranteed returns on investments as several opportunities exist in the sector.(Enoghase, et al 2015).The Real Estate sector offers a great potential source of growth for Nigeria which until now, the understanding of its prospects and growth has been somewhat limited to its required use in Nigerian National Accounts. (Proshare, 2015). The World Bank also observed that for now, Nigeria's mortgage industry remains underdeveloped with interest rates on mortgage funds ridiculously high, making the mortgage business in Nigeria unattractive (Enoghase, et al 2015; Ogunwusi, 2013).

Most of the actors in the real estate business in Nigeria are still recouping capital to be plough back into the venture. It will also be disastrous for government to rely almost exclusively on the capitalist entrepreneurs for its housing, hence the need for provision of mass housing in Nigeria.

vi. Slow Construction Process

Nigeria's housing deficit which is estimated to be over 17 million units is also growing at about 780 000 units yearly, due to slow construction process. Of the 17 million unit deficit, Lagos State alone is estimated to have a deficit of one million (Kolawole, 2015).

Enoghase, et al(2015), quoted a professor of Estate Management with the University of Lagos, as saying:

> *Nigeria has identified the housing problem but had failed to resolve the problems many years after. We can't get anywhere with the gradualism, incremental and progressive approach that take years to build one house. The Cost of construction and labour input, are almost 40 per cent higher when kept*

in the field for almost a year thereby incurring enormous cost. There is therefore need for houses to be built in large numbers and that efforts should be made to reduce cost of building and time of construction. The Federal Government can tap into the opportunities provided by technology to speed up the level of housing construction in the country. There are modern methods of construction, it has been industrialised so that construction time on site has been reduced to a few weeks.

Since the government had agreed that Nigeria has about 17 million housing deficit which was acknowledged 15 years ago and a target was set to house all Nigerians before the year 2000, all resources and efforts required to achieve the target should be pooled together to evade the impending housing disaster, through mass housing.

Industrial Prefabrication of Housing

Industrial Building System also known as Prefabrication is the practice of manufacturing or assembling high degree standardised components of a structure in a factory and transporting complete assemblies to the construction site where the structure is to be located (Ching2011; The Free Online Dictionary 2015; CIOB 2002). The construction method also called panelised or modular home, is used to distinguish this process from the more conventional construction practice of transporting the basic materials to the construction site where all assembly is carried out (Wikipedia, 2015).

Types of Industrial Prefabrication Systems

Both Gniadzik (1984), and Reza (2012), concurred that there are two basic types or groups of Industrial Prefabrication Systems, which include:-

i. **Light Prefabricated Block Structures:** All the produced parts that weigh less than two tons and up to 10 square metres in area are amongst this group. The blocks are suitable for manual assembly and quite cost-effective when it comes to machinery costs. The factories that produce them are rather smaller and the parts are produced horizontally such as walls, floors, staircases or roof structure, among others. Because of their light weight they can be sent to farther distances and the production lane is faster.

ii. **Heavy Prefabricated Panel Structures:** These are prefabricated elements of buildings and structures made from large factory-produced slab elements or panels that are assembled on-site. They include the parts produced that are more than two tons in weight and more than 10 square metres in area. Due to the larger size and volume of the parts, more powerful machineries are used which in turn are more expensive. They can only be sent to a close distance and their assembly requires precision and heavy machinery. Heavy panels may come with finished doors, windows, finishes, among others.

Methods of Joining and Articulation

Reza (2012) identified two methods of industrial product articulation as Closed and Open prefabricated systems.

i. Closed Prefabricated Systems consist of uniquely customised parts which in turn are made of joints and packages only applicable to its specific system.
ii. Open Prefabricated Systems on the other hand are more varied compared to their closed counter parts, thus the assemblers are free to put the products in a verity of slots consequently building a system. In this system a unique standard is followed and all the parts are produced by a pre-defined module which in each project, parts can be provided from different companies. Overall in this system the produced parts are interchangeable.

Advantages and Advantages of Industrial Prefabrication

The advantages and disadvantages of industrial prefabrication as identified by CIOB (2002), and Wikipedia (2015), are as follows:

a. Advantages of Industrial Prefabrication

The advantages of prefabrication are generally seen to be higher and heavier than can be achieved on site, particularly in larger mass construction. The advantages include:-

1. Shorter construction time - less than half of conventional cast-on-site construction.
2. High capacity - enabling the realization of important projects.
3. Programme savings due to the ability to progress work as a parallel operation in a factory and on a construction site.
4. Factory tolerances and workmanship is of a higher quality and consistency to that achieved on site.
5. Environmentally friendly way of building with optimum use of materials, recycling of waste products, less noise and dust, among others.
6. Independence from adverse weather and winter working conditions during construction.
7. An alternative means of production where there may be shortages of local skilled labour.
8. Access to cheaper labour markets. For instance two hundred prefabricated timber lodges for short holiday lets in Pembrokeshire were sourced from Eastern Europe.
9. Reduction in learning curves.
10. The factory environment can allow better safety than the construction site.
11. Opportunities for good Architectural identity, symbol or landmark.

b. Disadvantages of Industrial Prefabrication

The disadvantages of prefabrication are generally seen to be lesser and lighter than can be achieved on site, particularly in larger mass construction. The disadvantages include:-

1. Large prefabricated sections require heavy-duty cranes and precision measurement and handling to place in position.
2. Transportation costs may be higher for voluminous prefabricated sections than for the materials of which they are made, which can often be packed more efficiently.
3. Daytime traffic restrictions in city centres and the need for police escorts.

4. Height restrictions under bridges, tunnels and canals during transportation to site.
5. Copious space and building elements held back for access/installation routes.
6. A mistake in the mass production of prefabricated elements ahead of the measurable site work is a serious risk.
7. Leaks can form at joints in prefabricated components.
8. May lead to monotony of landscape or landmark vista of a settlement, town or city.

History of Industrial Prefabrication

Prefabrication has been used since ancient times where prefabricated timber sections were brought to the site from some local workshops and assembled on-site (Wikipedia 2015). However, an early version of industrial prefab home was made from England and sent to America in the 1600s containing all the house kits or parts and were assembled by the owners themselves or some hired people (How Stuff Works, 2015).

Subsequently, Large scale Industrial prefabrication experiments were consciously carried out in the Eighteenth century, during the industrial Revolution, in the United Kingdom. Industrial prefabrication housing was however most fertile during and after the first and second World Wars, where there was great need for shelter and an acute shortage of man-power (Architecture Week, 2012). It was however at the close of the Twentieth Century that Industrial Prefabrication reached its most productive crescendo. According to DRM Investments Ltd (2013), McDonalds used prefabricated structures for their buildings, and set a record of constructing a building and opening for business within 13 hours on pre-prepared ground.

It can be deduced from the foregoing that prefabrication had existed in one form or the other at the various stages of human development. It is the industrial version of the concept that seems to become common use in the Twentieth Century. Also, Industrial prefabrication has proven over the years to be an effective tool in solving acute housing shortages in developed countries, as well as a high prospect in some viable developing independent economies.

Prospects of Industrial Prefabrication in Nigeria

As the Population of Nigeria, as well as other Africa countries is growing, conventional method of construction seems to be failing to keep up with the housing demands. African continent is home to more than 1 billion people, in its cities less than 10 per cent of people live in decent housing. According to UN reports, 7000 new homes a day are needed in Africa to cope with its housing needs and prefabrication method is the way to resolve the shortage of housing in Africa (DRM Investments Ltd, 2015a).

While Ghana with a population of over 25 million people has housing deficit of slightly more than 2 million, South Africa has a deficit of over 3 million, Zambia has about 1.5 million, the whole of East Africa is estimate to have a housing deficit of 12 to 16 million

homes, Nigeria alone is estimated to have more than 17 million housing deficits (DRM Investments Ltd, 2015b).

If Nigeria's more than 17 million housing deficit is to be neutralised in the proposed 17 years plan, it then means that more than one million housing units are to be constructed in each year. That also means about 83,333 units must be erected in a month, and about 2,777 housing units are to be constructed in a day! This clearly exposes the acute housing deficits which must be solved with Industrial Prefabrication of housing units.

Survey on Industrial Prefabrication Of Housing

A minor descriptive qualitative survey was also carried out to obtain the subjective experiences, view or opinions of generality of Nigerians concerning the availability or otherwise of satisfactory housing, the need to construct more houses and whether the manually available local methods of construction are sufficient to tackle the housing problems or a more proactive mechanical and industrial method of building erection should be pursued. A total of 52 survey questionnaires were returned completed and their responses were presented and analysed as follows:-

Table 1: Whether Houses in Nigeria Are Not Enough

Response	Frequency	Percentage
Agree	48	92
Disagree	0	0
Not Sure	4	8

Source: Field Work 2018

On the issue of whether housing accommodation in Nigeria is sufficient or not, a whopping 96 percent of respondents agreed with the UN analysis that houses were in acute deficit. This probably falls into the educated group of Nigerians that were aware of the UN report as well as are up-to-date with some current issues. While none of the respondents expressly disagreed with the UN finding, eight percent of the respondents claimed they were not sure whether there is serious housing shortage in Nigeria or not. From the respondents, it can be clearly seen that there is acute housing shortage in Nigeria.

Table 2: Whether Available Houses in Nigeria Are Expensive

Response	Frequency	Percentage
Agree	46	88
Disagree	4	8
Not Sure	2	4

Source: Field Work 2018

The issue of whether housing accommodation in Nigeria is expensive according to the UN standards, a bulk of the respondents (88%) were in affirmative, eight percent out rightly disagree and four percent still claimed ignorant of the issue in contention. The 88

percent respondents represent those that have stayed in the numerous capital cities or towns in Nigeria, where the prices of qualitative housing accommodation soars to the sky. The lesser percentage stands for those who live in their family homes or villages.
The response of the people also shows that housing accommodation in Nigeria is expensive beyond the reach of a common man, especially in urban cities.

Table 3: On Who is in a Better Position to Solve Housing Problem in Nigeria

Response	Frequency	Percentage
Government	36	69
Individuals	12	23
Not Sure	4	8

Source: Field Work 2018

The question of who is in a better position to solve housing problems in Nigeria was also asked. While a far majority (69%) of respondents gave the responsibility to the government, a significant number (23%) allotted the onus to private individuals, just as another lesser number (8%) seemed to be unsure of who is more positioned to effectively tackle the acute housing problems in Nigeria. It can also be deduced from the respondents that the far majority concurred that government is in a better position to solve the acute problem of housing in Nigeria.

Table 4: How Many Houses to be constructed in one year

Response	Frequency	Percentage
Many Houses	47	90
Few Houses	0	0
Not Sure	5	10

Source: Field Work 2018

On the number of houses to be constructed annually so as to effectively solve the problems of housing in Nigeria, majority (90%) of the respondents agreed that many number of housing units, running into hundreds of thousands or even millions of units should be built annually. The remaining 10 percent were not sure of the number of houses required annually to solve the problem. It can be seen that the respondents generally concurred with the government's proposal of constructing at least one million housing units every year.

Table 5: What Technology to be used in Construction of Houses

Response	Frequency	Percentage
Use of Machines	28	54
Use of Hands	19	36
Not Sure	5	10

Source: Field Work 2018

The technological approach to be adopted for constructing millions of houses in a year was also inquired. Majority of progressive respondents (54%) go for the use of machines, in the form of industrial prefabrication, for the construction of a million houses annually. Another high number of conservatives (36%) preferred manual use of hands, while the least 10 percent were not sure of which method will provide the needed number of houses. Generally, it can be inferred from the respondents that majority prefer industrial prefabrication to solving housing problems in Nigeria.

Conclusion

From the analysis of the housing shortage in Nigeria by the UN, through a study of some factors militating against effective housing provision, as well as the survey conducted, it can be deduced that there is acute shortage of qualitative housing accommodation in Nigeria, running into about 20 million housing units presently. The way forward is to construct well over one million housing units annually if the country is prepared to effectively get over the problem. The Industrial Prefabrication of mass housing units, used over the years to solve acute housing problems in other developed entities, is also identified as the most effective technological approach to the effective housing provision in Nigeria.

Recommendations

The study therefore recommends the following:-

i. Huge financial outlay to be consciously channeled to housing provision in Nigeria through provision of social housing, site and services or loans to prospective house owners.
ii. Governmental departments, agencies and ministries responsible for provision of housing in Nigeria should be better empowered and well restructured so as to attend to the huge housing deficit.
iii. Some laws and regulations governing acquisition and use of land need to be reviewed so as to make land available to prospective house owners for construction of houses.
iv. Government should adopt and encourage the use of Industrial Prefabrication Technology for provision of mass housing construction in Nigeria, as done in other African countries.

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