

## **HOUSING STAKEHOLDERS' PERSPECTIVE ON OFFSITE MANUFACTURING IN NIGERIA**

**Shaba James Kolo <sup>1</sup>, Farzad Pour Rahimian <sup>1\*</sup>, and Jack Steven Goulding <sup>1</sup>**

<sup>1</sup> *Grenfell-Baines School of Architecture, Construction and Environment, University of Central Lancashire,  
Preston PR1 2HE, UK*

*\*Corresponding author ([fpour-rahimian@uclan.ac.uk](mailto:fpour-rahimian@uclan.ac.uk))*

### **ABSTRACT**

Despite several mitigation attempts, Nigeria is still facing a deficit of 17 million houses. Seminal literature argues that this problem is predominantly due to a myriad of issues, including high construction costs, skills shortages, slow pace of construction, lack of infrastructure and logistics, poor quality of available housing stock etc. Offsite manufacturing has been proffered as an innovative method for addressing such issues. This paper reports on the findings of a feasibility study, which investigated the Nigerian stakeholders' perceptions on the needs, promises and barriers of adopting offsite manufacturing in Nigeria. To achieve this, in-depth interviews were conducted with experts directly involved in housing delivery. Data gathered from the experts were analysed using exploratory thematic analysis. Nvivo software was used to transcribe and analyse research data. Findings from the in-depth interviews showed that the housing deficit in Nigeria is on the increase and nothing significant is being done at the moment. Stakeholders also posited that although OSM could improve housing delivery efforts in Nigeria, it is still considerably low; and this is as a result of a myriad of issues, such as negative local perception about OSM, client's resistance, lack of infrastructure and skills shortage. This study concludes that for OSM to be adopted in Nigeria, there is a need for proper sensitisation, collaboration and encouragement from government. This study presents additional understanding of OSM in Nigeria based on expert opinion, the results of which will become a stepping-stone for the development of a roadmap for the adoption of OSM in Nigeria. It is proffered that adopting OSM can help support housing delivery efforts in Nigeria, and may also leverage wider benefits to the construction industry and associated supply chain.

**Keywords:** *Offsite Manufacturing, Housing Delivery, Stakeholders, Nigeria*

### **INTRODUCTION**

Nigeria has a population of over 173 million (PRB, 2013), which is increasing at an annual growth rate of about 3.2% (Ayedun and Oluwatobi, 2011). This has caused a very large and ever-increasing housing deficit which currently stands at about 17 million (Okonjo-Iweala, 2014). This housing deficit was a result of a myriad of issues. The problems of housing delivery in Nigeria have been identified in seminal literatures (e.g., Makinde, 2014; Femi and Khan, 2014) underpinning several attempts to improve housing delivery efforts. Some of these attempts were on locally manufactured building materials as a means to improve housing delivery efforts (Olayiwola and Adedokun, 2014), others also investigated the proper ways of implementing the Nigeria National Housing Policy (Makinde, 2014), whilst some others investigated the ways to improve mortgage system in Nigeria (Olayiwola and Adedokun, 2014). Although all these attempted to proffer solutions to the various problems of housing delivery in Nigeria, researchers have not adequately proffered solutions to the issue of slow pace of construction in Nigeria, that Femi and Khan (2014) identified as one of the major problems of housing delivery in Nigeria. This paper reports on a market needs analysis study to underpin a doctoral research, which aims to develop a roadmap for the adoption of offsite manufacturing (OSM) in Nigeria. The current research investigated stakeholders' views on offsite manufacturing in relation to housing delivery in Nigeria. It built upon the theoretical findings of previous research, which advocated the opportunity for OSM in the Nigerian housing sector especially due to the large housing deficit in Nigeria. The underpinning theoretical framework covers the issues from current problems of housing delivery in Nigeria (as per reported in Kolo *et al.*, 2014a), and the potentials of OSM for supporting Nigerian housing sector based on the experiences of other countries (as per reported in Kolo *et al.*, 2014b).

### **HOUSING IN NIGERIA AND OPPORTUNITY FOR OFFSITE MANUFACTURING**

Nigeria has a housing deficit of about 17 million (Okonjo-Iweala, 2014) and Azman *et al.* (2010) identified OSM as a key driver to boost housing delivery. Besides leveraging housing delivery in Nigeria is in terms of quantity and quality (Kabir and Bustani, 2009), OSM requires less operatives compared to conventional construction. This helps also to address the issue of skills shortage which has been identified as another major barrier for delivering adequate dwelling in Nigeria (Kolo *et al.*, 2014a). Notwithstanding the identified several

benefits associated with OSM, it is noteworthy to know that there are also barriers hindering its use/adoption in several countries. Some of these barriers are: negative image, perceived high cost and perception of stakeholders. For OSM to be adopted/used in Nigeria, it is important to learn from countries like UK, USA, Australia, Malaysia, Japan etc. that have already incorporated OSM into their construction processes (Kolo *et al.*, 2014b). Moreover, research and development in the area of improving housing delivery efforts should be encouraged in Nigeria and there should be proper collaboration among all the stakeholders involved in housing delivery in Nigeria.

Kolo *et al.* (2014b) identified some barriers that might hinder the uptake of OSM in Nigeria based on the experiences of these countries. Some barriers that were identified included high cost, manufacturing capacity, negative perception and few codes and standards. Findings by Kolo *et al.* (2014b) suggested that, in some developed countries where, OSM is well established, several measures were put in place for OSM to thrive; e.g., the establishment of organisation to encourage the use of OSM, building of factories and the use of visualisation and simulation techniques.

## **RESEARCH METHODOLOGY**

After identification of background problems with regards to housing delivery in Nigeria and identification of OSM as a driver to address some of these issues, it was essential to get the views of Nigerian stakeholders involved in the provision of housing on the origin of these issues and the feasibility of adaptation of offsite manufacturing in Nigeria. As such, a qualitative research approach using in-depth interviews as the instrument for data collection was adopted to engage profoundly with stakeholders, get their views and opinions, and capture their tacit knowledge about the nature of these issues. These stakeholders include real estate developers, banks and multilateral institutions; e.g., Federal and State Government institutions like the Federal Ministry of Finance, the Federal Ministry of Lands, Housing and Urban Development, the Central Bank of Nigeria, and the Federal Mortgage Bank of Nigeria. The interviewees for the study included; 9 participants from the real estate developers, 5 participants from the government's housing provider 7 participants from banks and 5 participants from the Federal Ministry of Lands, Housing and Urban Development. These stakeholders were chosen, since they are the main players involved in the delivery of housing in Nigeria and also because of the years of experience of the participants; their experiences in the housing sector ranged from 10 years to 25 years. The interviewees identified were Architects, Builders, Quantity Surveyors, Engineers and Urban Designers. The interview questions were developed based on the following constructs: 1) The problems of housing in Nigeria; 2) How offsite manufacturing can be adopted in Nigeria; and 3) Barriers to the use of offsite manufacturing in Nigeria. These constructs were identified from seminal literature review conducted throughout the research. Prior to conducting the actual interviews, pilot interviews were conducted and this helped the researcher in shaping the actual interview questions. The final interviews included 26 sessions with domain experts from the aforementioned entities and interview was conducted in a 15-minutes face-to-face meeting. Data gathered from the interviews were analysed using exploratory thematic analysis and the interviews were transcribed and analysed using Nvivo software.

## **RESULTS AND DISCUSSIONS**

### **4.1 Nigerian housing sector in relation to offsite manufacturing**

As demonstrated by the seminal literature, despite the various invaluable attempts, the problem of housing deficit in Nigeria is continuing to remain. From the interviews conducted, it was affirmed that a large housing deficit exists in Nigeria. This research found that this problem is likely to be even more serious than what has been officially reported, as per intimated by many respondents. For instance, one of the interviewees said “...you talked about a housing deficit of 17 million, I think it is far more than that...”. The respondents also argues that even though there is a large housing deficit in Nigeria, nothing significant is being done to reduce the deficit, and this is largely due to lack of collaboration among stakeholders, corruption and greed. This highly concurs with the findings of Olayiwola and Adedokun (2014).

With regards to OSM, an interviewee asserted that “...if I want to put it in percentage, I will say it is non-existent, non-existent in the sense that if you have a 100% to score and someone scores 5%...”. Similarly, another interviewee mentioned that “...I can tell you confidently that prefabrication has not been accepted formally or even informally...”. Many of respondents of this study were of the opinion that OSM was either not used at all in the Nigerian housing sector or it was used at a minimal level. It was also stressed that prefabricated construction existed in Nigeria in the 1970s and 1980s. However, it gradually disappeared due to the minor demand for housing at that time, and the fact that in was only the government demanding for prefabricated houses during that period. The stakeholders interviewed in this study also argued that prefabrication is vastly used in some civil engineering projects carried out by large construction firms in Nigeria, but not in the housing

sector. This study therefore argues that, with Nigerian housing stakeholders calling for dry construction to be used in solving the issue of housing in Nigeria (see Ashkin, 2013), it is paramount for OSM to be adopted in the Nigerian housing sector to help improve housing delivery efforts.

#### **4.2 The problems of housing delivery in Nigeria**

From the seminal literature (e.g., Makinde, 2014), a good number of issues concerning housing delivery in Nigeria were identified. The conducted interviews in this study also raised similar issues concerning housing delivery in Nigeria. Some of the problems identified included high cost of infrastructure, over reliance on imported material and cement, poor government policies, skills shortage, slow pace of construction. These are some of the problems associated with housing delivery in Nigeria and research has shown that some of these problems can be mitigated using OSM based on the benefits obtainable from the use of OSM.

#### **4.3 Barriers to the use of offsite manufacturing in Nigeria**

Research shows that OSM has been used in a good number of countries, especially in the area of housing delivery. This area seeks to clearly identify barriers that might hinder the use of OSM in Nigeria. One of the barriers identified was negative perception about OSM. Negative perception in this regard had to do with an opinion that OSM was not solid for the construction of buildings. An interviewee pointed out that “...people have a negative perception of OSM components not being strong...”, whilst some others argued that the maintenance of OSM buildings might be an issue because the services are fitted into the various building components. Other barriers identified also included skills shortage, lack of adequate infrastructure, client’s resistance, cultural issues, design flexibility. Even though barriers similar to those identified in other countries were mentioned by the interviewees, this research sought for solutions to some of these issues raised. One proffered solution was adequate sensitisation and awareness among all stakeholders about OSM. An interviewee clearly said that “...we need proper awareness and sensitisation among all the stakeholders...”. Some of the interviewees also mentioned that the awareness and sensitisation should come from professionals, whilst some others opined that it should come from the government; e.g., “...government has to come in; in-terms of finance, awareness...”. Furthermore, training, research, prototype buildings and simulation (e.g. BIM) were also mentioned as possible solutions to some of the barriers identified.

#### **4.4 How offsite manufacturing can be adopted in Nigeria**

For OSM to be adopted in Nigeria, proper foundation needs to be laid. As stated by some of the interviewees, trade schools in Nigeria should be reintroduced because, currently there are only a few trade schools in Nigeria. An interviewee asserted that “...make sure all the trade schools are working and make sure the right curriculum is being used in the universities, polytechnics and every level.” Aside from having trade schools, there is also the need for the right curriculum to be used in higher institutions in Nigeria to ensure that the graduates being turned out are in tune with innovative construction techniques. The results also highlighted that there is a need for research to be carried out on the various aspects of OSM with respect to people, process and technology. Nigeria needs research in the area of building materials. Building materials for offsite should be sourced locally to reduce the overall cost of construction and reduce the carbon footprint. Some other interviewees opined that there should be research in the area of what the people really want with regards to offsite manufactured houses. One major thing that was mentioned by a good number of the interviewees was the fact that the government had a major role to play for OSM to be adopted in Nigeria. Some interviewees stated that “Government should introduce a method whereby they take the lead in the use of prefab by building some of its own offices, health centres...”. Whilst, another interviewee said that “...if government says they want to try prefab, government should help in subsidising maybe the machineries or by establishing the factories...”.

From a comparison of the views of the various stakeholder groups, all the stakeholders interviewed identified high cost and poor mortgage systems as problems of housing delivery but other issues were peculiar to particular stakeholder groups. The real estate developers and the federal ministry identified wrong government policies as a stumbling block to housing delivery. Concerning the barriers of OSM, all the stakeholder groups identified negative perception about OSM as a major barrier. Design flexibility was identified by the real estate developers and the bank as a barrier. Lastly, the large housing deficit in Nigeria was identified as a factor that makes the adoption of OSM feasible in Nigeria. Also, there is an opportunity for the Nigerian housing sector to combine OSM with conventional construction, this will make its adoption easy and the opportunity to learn from other countries was identified as a factor that makes OSM adoption feasible in Nigeria.

OSM is a technology used in some countries especially in the area of housing. Kamar *et al.* (2009) noted that, the Malaysian government came up with various initiatives to encourage OSM (e.g. the setting up of the Construction Industry Development Board). In some other countries like UK (Buildoffsite, 2006), USA

(Goulding *et al.*, 2015) and Australia (Blismas *et al.*, 2010), different bodies were also established by the government responsible for driving the change needed in the construction industry; i.e., seeing construction as a manufacturing process and also promoting the use of OSM. From the responses of some of the interviewees, the Nigerian government needs to come up with initiatives that will also drive the change needed in the industry.

## CONCLUSION

Findings from the exploratory analysis indicate that there is a very large housing deficit in Nigeria. Currently, there is nothing significant being done to address this. OSM has been proffered as a potential solution. However, several issues (barriers) to OSM adoption have been presented. Notwithstanding this, low-impact construction methods (such as OSM) are viable methods for improving sustainability and also housing delivery efforts considering the large housing deficit in Nigeria and the opportunity to combine OSM and conventional construction. In pursuance of this, the ultimate goal of this research will be to develop a roadmap that will facilitate OSM adoption in Nigeria. This paper presented a series of underpinning steps based on the views of various stakeholders on the issues regarding these housing challenges, and the possibility of OSM adoption. Whilst OSM barriers have been highlighted within the Nigerian context, there is an exigent need to investigate these issues further, as it is important to proffer solutions to this environment e.g. infrastructure and local suitable materials for OSM. For this to be achieved, it is imperative that these issues are studied further, cognisant of experience garnered in other contexts and this will be useful in developing the action plan for the successful adoption of OSM in Nigeria.

## REFERENCES

- Ashkin, R. 2013. Innovative Building Technologies – The Social Housing Angle. *Housing Africa 2013*. Abuja, Nigeria.
- Ayedun, C. A. & Oluwatobi, A. O. 2011. "Issues and Challenges Militating against the Sustainability of Affordable Housing Provision in Nigeria." *Business Management Dynamics*, 1(4), 1 - 8.
- Azman, M. N. A., Ahamad, M. S. S., Majid, T. A. & Hanafi, M. H. 2010. Perspective of Malaysian Industrialized Building System on the Modern Method of Construction. *11th Asia Pacific Industrial Engineering and Management Systems Conference*. Melaka, Malaysia.
- Blismas, N., Wakefield, R. & Hauser, B. 2010. "Concrete prefabricated housing via advances in systems technologies: Development of a technology roadmap." *Engineering, Construction and Architectural Management*, 17(1), 99 -110.
- Buildoffsite 2006. Vision, Mission, Metrics & Goals. *October*. UK: Buildoffsite.
- Femi, A. B. & Khan, T. H. 2014. "Bridging the Gap between Housing Demand and Housing Supply in Nigerian Urban Centres: A Review of Government Intervention So Far." *British Journal of Arts and Social Sciences*, 18(2), 94-107.
- Goulding, J., Rahimian, F. P., Arif, M. & Sharp, M. D. 2015. "New offsite production and business models in construction: priorities for the future research agenda." *Architectural Engineering and Design Management* 11(3), 163-184.
- Kabir, B. & Bustani, S. A. 2009. A Review of Housing Delivery Efforts in Nigeria. *ISA International Housing Conference*. University of Glasgow, Scotland.
- Kamar, K. a. M., Alshawi, M., Hamid, Z. A., Nawi, M. N. M., Haron, A. T. & Abdullah, M. R. "Industrialised Building Systems (IBS): A review of experience in UK and Malaysia construction industry." 2nd Construction Industry Research Achievement International Conference (CIRAIC), 2009 Kuala Lumpur, Malaysia.
- Kolo, S. J., Rahimian, F. P. & Goulding, J. 2014a. "Offsite Manufacturing Construction: A Big Opportunity for Housing Delivery in Nigeria " *Procedia Engineering*, 85, 319-327.
- Kolo, S. J., Rahimian, F. P. & Goulding, J. 2014b. "Offsite Manufacturing: The Way Forward for Nigeria's Housing Industry." *ALAM CIPTA, International Journal of Sustainable Tropical Design Research and Practice*, 7(1), 35 - 40.
- Makinde, O. O. 2014. "Housing Delivery System, Need and Demand." *Environment, Development and Sustainability*, 16(1), 49 - 69.
- Okonjo-Iweala, N. 2014. Unleashing the Housing Sector in Nigeria and in Africa. *6th Global Housing Finance Conference*. World Bank Headquarters, Washington DC, USA.
- Olayiwola, L. M. & Adedokun, A. 2014. "Housing Problems in Nigeria: The Way Forward." *Swiss Journal of Research in Business and Social Sciences*, 1(2), 27 - 41.
- Prb 2013. 2013 World Population Data Sheet. In: BUREAU, P. R. (ed.) *World Population Data Sheet*. Washington DC, USA: Population Reference Bureau.