

DEVELOPMENT OF AN INCLUSIVE SUSTAINABLE ADOPTION SUPPORT FRAMEWORK (ASF) FOR OPTIMIZING PREFABRICATION ADOPTION IN NIGERIA'S HOUSING DEVELOPMENT INDUSTRY

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HTTPS://DOI.ORG/10.30572/2018/KJE/140306

ABSTRACT

The Nigerian housing development industry can contribute to Sustainable Development Goal 11, through innovative construction adoption, for optimizing affordable housing. This paper presents a framework developed through a mixed research methodology. Using a purposive sampling technique, 397 private developers, and members of the Real Estate Developers Association of Nigeria (REDAN) in Lagos and Abuja were selected. Technology Acceptance Model (TAM) and Innovation Diffusion Theory (IDT), were integrated to develop a conceptual framework, used to generate a questionnaire. An Adoption Support Framework (ASF), which is an inclusive diagrammatic representation of a five-stage innovation-decision process model, showing relationships between housing stakeholders -social structures and driven by the exchange of technical data through communication channels in a social system, was developed from data analyzed using nonparametric test, descriptive statistics, regression analysis and SPSS version 22. The ASF is characterized as being transferable, and having the capacity for abstraction and theoretical generalization.

KEYWORDS: Adoption, Affordable Housing, Construction, Innovation, Private Developers, Sustainable, Technology.

1. INTRODUCTION

The Sustainable Development Goals (SDGs) and the New Urban Agenda (NUA) are becoming a fabric of our global community, gradually being embedded and enshrined in the basic structure of life and society, both formally and informally, consciously and subconsciously, weaving itself into all sectors of life. They act as the catalyst for expanding social, economic and environmental opportunities, which is aimed at uplifting the quality of life and providing a sense of belonging. The need to approach the strategies for development through the lens of partnership, inclusivity and participatory measures has become imperative for the success of the SDGs and the NUA. The Nigerian housing construction industry has struggled with the challenges of providing affordable housing for its populace, with a housing deficit of over 20 million. Several reasons could be attributed to this phenomenon, such as; scarcity of long-term funds, property registration and title documentation, the land use act, infrastructural inadequacy, the high cost of building materials, construction methods, and collaboration issues (Adebayo, 2019).

Despite the critical role innovation plays in the long-term prosperity of companies and societies through economic growth and increased productivity (Martin, 2012) and the fact that only through human ingenuity will it be possible to develop new solutions that will help in achieving the SDGs (WIPO, 2022), the construction sector is conservative and slow to adopt innovations that necessitate changes in the project network (Tatum, 1988; Gann and Salter, 2000; Blayse and Manley, 2004). Collaboration and partnerships that would foster sustainable developments are inadequate and the fragmented nature of the housing sector is glaring.

This paper recognizes the asymmetrical relationship between identified key stakeholders in the Nigerian housing development industry, while investigating the perspectives of private developers on the adoption of prefabrication for affordable housing, thereby leading up to the development of an inclusive sustainable Adoption Support framework (ASF) that fosters participation amongst stakeholders in the built environment intending to optimize the adoption of prefabrication for sustainable housing delivery, and achieving SDGs goals. The ASF is a framework with a new method of building partnerships to drive innovative and integrated approaches.

2. OVERVIEW OF HOUSING CHALLENGES IN NIGERIA

Granted, Nigeria is today Africa's largest economy with a GDP of \$510 billion with Lagos state contributing 30% of the country's Gross Domestic Product GDP with \$136 billion. Yet, her housing development sector still accounts for only 3.1% of her GDP. The demand for housing that is affordable in Nigeria is considerable and increasing, given the significant shortfall that currently exists, with a lack of presently available measures to address the disparity. The shortage of housing is currently estimated to be as high as 17 million and is increasing by 20 per cent annually (World Bank, 2018). The formal housing sector's production is estimated to be between 100 000 and 200 000 units per year, which is only a small proportion of the minimum requirement of 700 000 units per year to accommodate the continuously increasing population and urban migration. Additionally, the majority of newly constructed housing is designed for affluent households, whereas lower-income urban households have the greatest demand for affordable housing. The greatest need for affordable housing is in lower-income households in urban areas. Almost 50% of Nigeria's population lives in cities and about 80% of this urban population lives in substandard conditions (World Bank, 2018). Unfortunately, the country produces below 300 000 housing units yearly, which represents a combination of government and private sector development efforts. It is worth noting that for some of the major urban centres such as Lagos, housing demand is growing at about 20 per cent per annum (Okonjo-Iweala, 2014). Despite various laudable housing development scheme attempts by the government and private sector to bridge this gaping deficit, housing availability is still a mirage for most Nigerians. The housing development industry must build faster and more efficiently to meet the increasing needs of the Nigerian affordable housing market.

The demand for adequate housing in Nigeria is unmet by both the public and private sectors, particularly for the lower strata of society. At least 1 000 000 units are needed yearly to bridge the 17 to 20 million housing deficits by the government's target date of 2033 (if the population continues at its annual growth rate of 3.5 per cent). Unfortunately, Formal housing production is at approximately 100 000 units per year and this is highly inadequate because the projected cost to alleviate the ongoing housing shortage is estimated at 363 billion dollars, with expectations of continued growth in the future (CAHF, 2018). The groups most impacted by this insufficiency in housing are specifically those who are economically disadvantaged, from low-income backgrounds, and vulnerable members of society.

Housing development approaches that are innovative and sustainable, effectively bridge the current housing gap experienced by developing cities globally. Industrial approaches like

prefabrication, save cost and time by moving critical construction processes off-site or using advanced on-site (in situ) techniques that make construction more like manufacturing. Ironically, despite the availability of innovative approaches, developers, both public and private, have disregarded the potential of prefabrication to effectively reduce the housing deficit grappling the country.

The fragmented nature of the Nigerian housing industry is a major factor that inhibits innovation adoption and ultimately the achievement of the SDGs. Stakeholders within the industry lack a systematized coalition towards tackling a common threat-homelessness. This paper shed more light on the relationship currently existing amongst key stakeholders in the Nigerian housing Industry and presents a developed Adoption Support Framework (ASF) which optimizes not only prefabrication adoption but also participation and inclusion amongst stakeholders.

3. STAKEHOLDERS' RELATIONSHIP IN THE NIGERIAN HOUSING DEVELOPMENT INDUSTRY

The housing industry relies on a supply chain comprising multiple actors (private developers, contractors, lenders, architects, engineers, consumers, etc.) that tend to promote adversarial relationships, a lack of trust, and an aversion to risk due to the various contracts that bind them (Farmer, 2016). The current supply chain model lacks the necessary elements of collective risktaking and collaborative work required to foster innovation. As the existing industry model primarily prioritizes the commercial interest of private developers, there exists little motivation to prioritize speed or scalability, as doing so may potentially reduce prices and subsequently decrease profits. With private developers continuing to make financial gains from the existing operating model of the industry, there is little motivation to shift towards innovations that will require changes to the current ways of working and that will align with the SDGs. With this characteristic, private developers who are dominant power actors since they produce approximately 90% of urban housing, tend to boycott collaborative efforts by government and housing agencies that would promote affordable housing for consumers. Equally, when housing projects are initiated to target low-income earners, consumers are ignored in decisionmaking, and the outcomes are inaccessible to housing. Private developers are not considered to be end-user driven, but rather profit-driven, hence continually ignoring the obvious, would lead to long-term negative effects like the rejection of innovation outputs of housing delivery.

The housing construction sector also involves multiple loosely coupled actors like inadequate coordination between academia and the industry, in which the industry complain that academic research is not practically relevant (Lavikka, Seppänen, Peltokorpi, & Lehtovaara, 2020). The

challenge from the company's point of view is that scientific knowledge cannot usually be applied as such in business operations (Gann, 2001). The new knowledge first has to be interpreted in the current context, but company representatives rarely have the absorptive capacity necessary to do so (Gann, 2001). A partnership between industry and academia accelerates innovative construction methods and enhances end-user access to adequate housing. A realization of the commercial value of academic housing research coupled with its rapid and efficient utilization by industry should be the major propelling force towards a defragmented industry.

The ability to give and receive support from stakeholders and harmoniously work together to develop innovative business solutions determines the success of stakeholder engagement (Olander, 2005). Negligence in a coherent participatory role would further inhibit the sustainable advancement of the Nigerian housing industry, especially at the advent of the Fourth Industrial Revolution (4IR). Therefore, an independent collaborative approach of a quadripartite industry-academia-government-consumer partnership must be developed for stimulating research on high-priority housing issues. The ASF is a partnership relationship model in which interaction amongst these four entities is ongoing concurrently while considering each other as a source of complementary expertise and future engagements.

4. PREVIOUS STUDIES OF FRAMEWORKS TOWARDS SUCCESSFUL ADOPTION OF PREFABRICATION

Frameworks towards prefabrication adoption have been presented in several researches globally, like in the United Kingdom, Malaysia, New Zealand and Australia. However, no robust framework within Nigeria and Sub-Saharan Africa exists. Rahimian et al. (2017) did develop a roadmap which lacked a robust research approach, based on the findings of the literature review investigating the needs, promises and barriers of adopting prefabrication in Nigeria, seminal literature elaborating on prefabrication construction in the industry, and additional understanding of pre-fabrication based on expert opinion. These results were analyzed using thematic analysis and Nvivo software to code and analyze the research data. Fig. 1 presents a framework based on the findings from Rahimian et al. (2017). This roadmap provides a concise overview of the factors that influence the adoption of prefabrication in Nigeria, including both the drivers and barriers involved. Initially, this roadmap was constructed based on existing literature and was subsequently enhanced through the active involvement of five (5) key stakeholders in Nigeria. The roadmap was a commendable output as no literature previously existed that illustrated a framework concerning the stakeholders and

their opinions on the barriers and drivers of prefabrication for housing construction. However, Rahimian et al. (2017), suggested that the model presented was vague and showed no clear relationship between barriers or actions with the identified stakeholders. The framework fails to show the relationship between identified stakeholders and poorly represents the social entity or system within which these identified stakeholders exist, the variables which foster the partnership and a defragmented relationship. Communication channels that help disseminate information and act as a link between stakeholders is nonexistent, thereby limiting a symmetric relationship. The outlined framework presented in this research embeds the views and opinions of several high-level stakeholders and respondents but failed to group the opinions according to each social structure represented as stakeholders. The framework's scope was very limited as it only identified two independent variables (drivers and barriers) that influence prefabrication adoption. Failure to develop an adoption framework on the precept of theoretical frameworks like Innovation Diffusion Theory (IDT) and Technology Acceptance Model (TAM) provided little data to provide a more robust and realistic roadmap towards adoption. However, Rahimian et al. (2017) acknowledged that the framework needed to be refined and populated in more detail with specific, measurable, achievable, realistic and time-framed (SMART) objectives so that clear priorities and directions can be established.



Fig. 1. Roadmap for the Adoption of Offsite Manufacturing in the Nigerian Housing Sector

Source: Rahimian et al. (2017).

5. RESEARCH METHOD

A mixed-methods research approach, combining quantitative and qualitative methods, was utilized in this study. A purposive sampling technique was employed to select a total of 397 private developers affiliated with the Real Estate Developers Association of Nigeria (REDAN) IN Lagos and Abuja. Two theoretical frameworks, Technology Acceptance Model (TAM) and Innovation Diffusion Theory (IDT), were integrated to develop a Conceptual Framework as seen in Fig. 2, through which variables influencing the adoption rate were identified and used to develop the research questionnaire. Data obtained from the questionnaire and in-depth semi-structured interviews were analyzed using nonparametric tests, descriptive statistics, regression analysis and SPSS version 22.



Fig. 2. Conceptual Framework.

Data analysis was carried out on the responses of the data collected. A descriptive statistic was done on all variables in the questionnaire, working with nominal and ordinal data. Different analytical techniques were used to determine the direction of the study using Survey Monkey, SPSS version 22 and Excel. The descriptive statistics for the variables used included frequency of occurrences, simple percentages (%) and charts. A reliability test was also carried out on the Likert scales in the questionnaires to ascertain the internal consistency of the responses in the

questionnaire. The Cronbach Alpha value was used to measure the internal consistency of the variables. The inferential statistical method of analysis included non-parametric statistics and reliability tests. Also, the Wilcoxon signed-rank test was employed. These analyses were conducted to explain the objectives of this study to determine their relevance or otherwise, reveal possible relationships, differences, contributions, and dependencies between the variables and ascertain if the results obtained were significant in the study. All these informed the development of the Adoption Support Framework (ASF). Fig. 3 shows the summary of the research process.



Fig. 3. Summary of Research Process.

6. RESULTS AND DISCUSSION

The Adoption Support Framework (ASF) is an inclusive diagrammatic representation of a fivestage innovation-decision process model that shows the relationship between identified housing industry stakeholders and social structures within a social system, driven by the exchange of technical data through communication channels, towards the adoption of prefabrication. The ASF re-frames how participation amongst stakeholders should look within a recognized social structure towards innovation advancement and the actualization of the SDGs. This ASF summarizes steps towards achieving sustainable prefabrication adoption and its commercialization amongst private developers in Nigeria, which would increase housing productivity and affordability within urban cities. The framework is transferable, and has the capacity for abstraction and theoretical generalization, having sufficient variation to apply it to other similar contexts within and outside Nigeria. It demonstrates an innovation relationship that enables the implementation of process innovations into the housing development sector, and at the same time, the conduct of scientific research in construction management. The ASF was developed from literature, and findings from the data gathered and analyzed in research. It is novel as frameworks towards prefabrication adoption have only been presented within the context of developed countries like the United Kingdom, Malaysia, New Zealand and Australia, and recently in developing countries like China (Hairstans, 2015; PrefabNZ, 2013; Luo, T., Xue, X., Wang, Y., Xue, W., & Tan, Y., 2021) However, there is lacking a robust adoption framework indigenous to Africa. The ASF reflects the African experience through an African lens and is a tool for initiating African policy interventions in the housing industry. The underlying theories of IDT and TAM, which form the basis of this research, generally explore individuals' responses to new products or processes and extend their application to various behaviours, including the factors that impact the adoption of innovations. They address behavioural patterns of people towards the adoption or rejection of innovative ideas or technology needs.

The ASF is driven by the exchange of technical information through communication channels, which are defined by Rogers (2003) as the process by which participants create and share information to reach a mutual understanding. A communication channel is how messages get from one individual or unit to another. The communication channels are both mass media (radio, television, newspapers,) and interpersonal (face-to-face exchange between two or more individuals) channels. All R&Ds within the framework are shown to be connected via

communication channels that disseminate empirical data and evidence of prefabrication, which are packaged for potential commercialization.

The ASF categorizes identified stakeholders under four groups; academia, government, industry and consumers. Consumers interact with academia through surveys and case study research approach, and the government interact through town hall meeting and at the industry level, through consumer or user-interface forums. These interfaces create a new balance for the existing social structures, building alliances that challenge dominant structures and redistribute power relations.

Some of the characteristics of the ASF are that it is true to the reoccurring reality of the current housing deficit in the Nigerian housing development industry, and is suited to the interactive processes in the social support structure and system, expressing the reality experienced by the stakeholders. Furthermore, the framework is designed to be easily comprehensible, clearly illustrating a repetitive interactive process within the social system and highlighting the interactions within the social structure through the diagram. This interactive process in the network, people, organizations, and flows, which converge towards facilitating the optimization of any innovation adoption. It is a total feedback and iterative process.

The ASF also presents the capacity for abstraction and theoretical generalization, and whether it is capable of being also used for the comprehension of other related innovation adoption situations experienced and social structures within the housing development industry. Thus, the framework is deemed sustainable and can be adjusted as situations and circumstances improve or decline over time. New and relevant variables may need to be evaluated. Fig. 4 shows the Adoption Support Framework and its relationship with relevant entities.



Fig. 4. The Inclusive Adoption Support Framework (ASF) For Optimized Partnership and Prefabrication Adoption.

7. CONCLUSION

The global theme, 'Leave no one behind' (LNOB) is the central transformative promise of the 2030 Agenda for Sustainable Development Goals, by the United Nations. This approach should be practised not only at the macro level, but also within micro social structures and systems. This theme especially in developing countries, must transcend the global stage because a successful development agenda requires inclusive partnerships — at global, regional, national and local levels. Developing countries have grappled with housing challenges for years. Also, recent developments have shown that there have been setbacks in sustainable housing advancement in recent years. Prefabrication as a system has had challenges in being adopted by stakeholders, despite its laudable innovative approaches to affordable housing. From the findings on the investigation of the perspective of private developers on the adoption of prefabrication for optimized housing production, the importance of partnership and inclusivity for the advancement of innovation, which was lacking in the housing industry is discovered.

This led to the development of an inclusive Adoption Support Framework (ASF), which diagrammatized the quadripartite industry-academia-government-consumer relationship through communication channels. Partnerships are positioned as critical for the achievement of the Sustainable Development Goals and the United Nations' transformational agenda for 2030 (Murphy,2021). This Global Partnership is intended to work alongside multi-stakeholder partnerships at global, regional, national or subnational levels that "mobilize and share knowledge, expertise, technology and financial resources to support the implementation of the SDGs" (United Nations,2015). This paper contributes towards this goal by developing an inclusive framework that will foster partnership and innovation.

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