



Comparison of mass housing schemes delivery strategies condition in Ilorin, Nigeria toward a sustainable mass housing delivery

S. B. Oladimeji¹ · A. T. Abubakar-Kamar¹ · O. O. Odunjo² · D. O. Adeoye²

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Abstract

In developing nations such as Nigeria, the housing industry lacks appropriate and highquality housing. One of the housing development concepts and shelter delivery systems in practice in developing nations Nigeria inclusive are public, private and public–private. These three delivery strategies involves in mass housing production, although the bulk of these mass housing are not sustainable. This study examines at the conditions of mass housing delivered by the public, public–private, and private sectors in Ilorin, Nigeria. Quantitative and qualitative research approaches were employed for the study and both primary and secondary data were utilised. Multistage sampling technique was adopted to sample 27% of the 4166 households' population. A set of questionnaire was administered to 1125 household heads, from 895 houses of the Public, 203 of public–private–partnership and 27 of private developers. Data were evaluated with descriptive statistics and multiple analyses of variance (MANOVA) to get the variation in housing elements condition based on the three-delivery strategy. According to the study, private had walls with highest percentage of very good (41.0%), good conditions (51.6%), and public had walls with 33.1% very good, 36.6% good conditions. However, 13.0% of PPP wall are in poor condition, and 80.1% of walls are only fair, comparisons of the condition of housing elements in the three strategies revealed that all the parameters of houses were found to have significant differences with p values reported for the comparison were observed to be less than 0.05 confidence level ($p < 0.05$). The study suggests among others that public–private partnership delivery strategy should be given more attention by the government to ensure good quality delivery and sustainability of mass housing.

Keywords Housing element · Condition · Delivery strategy · Public–private partnership

1 Introduction

The most visible manifestation of urban poverty, however, is the housing crisis [2, 5]. The most evident impacts of urbanization in underdeveloped nations are often the rapid deterioration in urban housing and living conditions. This is because urbanization causes tremendous population expansion, which is caused by a remarkable increase in people's quantitative housing needs. Because the bulk of the population lacks the means to afford suitable housing, these housing needs are not being met by effective demand. As a result, a substantial majority of city dwellers are destitute

and confined to inadequate, overcrowded, cold, and filthy shelters. Agbola [3] said that one reliable measure of poverty is housing. Many programs were launched in the country to address these issues. To name a few, the National Housing Policy of 1991, the National Housing Policy of 2001, the site and service program, the establishment of the National Housing Fund (NHF), and the foundation of the Federal Mortgage Bank of Nigeria (FMBN). However, an assessment of the programs' implementation and performance shows that they have had little impact on housing delivery in the country [2, 3]. The great hopes, noble commitments, large numbers of money, and goodwill that greeted the programs were insufficient to keep them from failing.

Various housing construction concepts and shelter delivery systems implemented by successive governments and private sectors in Nigeria have resulted in mass housing plans. These were repeating housing options that arose as a supplement to urban renewal to address the acute housing crisis in cities. This is because the National homes Policy of

✉ S. B. Oladimeji
Oladimeji.sb@unilorin.edu.ng

¹ Department of Architecture, University of Ilorin, Ilorin, Nigeria

² Department of Architecture, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

1991 mandated several levels of government to enable the development of low-cost homes for society's low-income segment. However, as many cities in Nigeria have grown in the last few decades, the aesthetic values of most mass housing schemes have changed from the initial design due to redesign, degradation, or non-maintenance. According to studies, mass housing initiatives designed to address Nigeria's housing need have failed to deliver solutions because of inadequate maintenance [4]. The rate at which many mass housing schemes deteriorate, moving towards decay and collapse, should be a serious worry for all building industry stakeholders.

The state of housing has long been thought to be one of the key factors influencing human health. According to [7], several variables affecting residential health are based on living and housing situations. In literature, housing is not considered the only factor that has an impact on health, but rather it is of much importance to environmental factors (WHO 2004). This is because housing conditions and environmental variables work together and the overall reflection is by the form and condition of the total environment. In consonance with these, housing quality has to do with the housing environment, which is the physical conditions of the housing unit in terms of ventilation, structural soundness or fitness, and the availability of basic amenities like water, power, a phone, a bathroom, and a kitchen, among others. It is said that due to inadequate or nonexistent access to basic amenities, housing quality in Nigeria is below standards [3]. The research carried out by WHO (2003) survey methods on housing and health determined health indicators such as indoor air or indoor environment, noise, annoyance, respiratory health, and other issues such as drinking water, sanitary and exposure to chemicals which are all detrimental to human health [7]. In research on adequate housing and health, the listed housing indicators include some of the pertinent potential health risks found in homes are indoor air quality, home safety, noise, humidity and mold growth, indoor temperature, asbestos, lead, and volatile organic compounds (VOCs). Other factors include crowding and a lack of hygienic supplies and sanitation equipment. All of these markers have an impact on one's social, mental, and physical health. Additionally, it was discovered in certain studies that some researchers interchanged environmental and housing factors.

This is a result of the fact that “whatever that makes for housing also makes for the environment and vice versa”. In other words, good housing in a bad environment is still shelter and an environment will not be considered to possess quality when the housing components are in a state of disarray or disparity. In tune with this position, Olotuah [16] used certain housing and environmental indicators and these are put together as Nearness to a public facility, source of water supply, age of the building, number of

households in the building, type of toilet, use of the toilet, type of kitchen, use of kitchen, regularity of electricity supply, mode of refuse collection and frequency of collection of refuse. It could be said and generalized that the general score of these is generally low in a typical Nigerian urban center.

On the other hand, objectively measured housing quality has been demonstrated to have an impact on mental health in both cross-sectional and longitudinal research. After controlling for parental income, parental education, parental mental health status, the child's sex, and the family's length of stay in the home [11], studied two Canadian samples (one in Quebec and one in British Columbia) using an adaptation of the housing quality scale and discovered that the quality of the home's exterior, interior, and neighborhood predicted children's socio-emotional health as rated by their parents.

The standard technique of controlling for socioeconomic class obscures a significant relationship: children from low socioeconomic backgrounds are more likely to be exposed to a variety of physical and social environmental stressors. According to [11], children who are repeatedly exposed to potential stressors are more likely to experience physiological stress responses, emotional regulation, elevated cardiovascular and neuroendocrine parameters, increased body fat deposition, and a higher summary index of the total physiological demands to maintain homeostasis.

According to [3] to have decent, safe, high-quality, and livable housing, at least four requirements must be met. These include the needs for physiology, psychology, injury prevention, and illness prevention. Nigeria faces massive and intricate housing and quality issues, with clear and distinct regional variations. According to reports, Nigerian housing is of lower quality than average due to inadequate or nonexistent facilities. However, several factors influence housing quality, with wealth being the most important one [6]. Delivering a sizable number of dwelling units for a particular population or, occasionally, the whole public is known as mass housing. According to [1], mass housing projects are those in which residential units are built utilizing mass production techniques. Mass housing is a construction paradigm that maximizes quality, time, and cost while having a high level of technical, managerial, and economic viability. To address the severe housing scarcity, particularly in large cities, mass housing—a dense, repeated kind of housing—has arisen as an adjunct to urban renewal initiatives. Building the same model of a house in the same neighborhood, town, or city is known as mass production. Therefore, the purpose of this article is to carry out a comparison analysis of the three acceptable delivery systems of mass housing schemes in terms of the condition of the houses and make a viable recommendation to improve the delivery system for the mass production of quality housing.

1.1 Literature review

1.1.1 Housing delivery system in Nigeria

The housing delivery system in Nigeria is a combination of many interrelated processes. These processes are affected by several endogenous and exogenous variables that is, two main systems of housing delivery are discernible in Nigeria: the public and the private delivery sectors. The need for public intervention in the housing delivery system stems from the peculiar imperfections in the private housing market and the policies and programs of the public housing delivery system as borne out by lessons of experiences, are half-hearted and haphazard and have not contributed in any significant way to the amelioration of the deplorable housing condition of the people which the public intervention programs are meant to help [3].

The housing delivery system is the process that allocates housing to Nigerian households. Such a process consists of the production of new houses, the renovation or rehabilitation of the existing units, and the distribution of both the new and existing units to those who need them. Thus, the housing delivery system is a combination of production mechanisms, public and private actors, and institutions that affect the housing supply. The housing delivery system comprises five components: policy development and sponsorship, finance, infrastructure and service provision and shelter construction. Each component interacts with the other, but each is not a sufficient part of the total system. Thus, both the public and the private sectors have been given the task of ameliorating the housing problems of the country.

The popular traditional method of housing delivery through self-help in Nigeria before the arrival of colonial masters in the country was through the communal housing provision efforts where families, peer groups, friends, and relatives come together and make use of traditional building materials such as mud and stone etc. to produce housing for their use. These were based on mutual understanding. The project owner together with these groups most often agreed on a day to assist the project owner in the task of construction, while the project owner takes care of their feeding and other needs for the period.

However, some communities especially rural communities still practice this method to date; though, not as popular and common as it used to be in the time past due to civilization that has taken the better part of our tradition in recent times. The housing problem in Nigeria has manifested in increasing housing shortage, rising house rents, and increased overcrowding resulting in slum and unhygienic conditions which made successive governments came up with programmes and proposals aimed at alleviating the housing shortage in the country.

(a) Public housing delivery

Public provision of housing services for the economically disadvantaged segment of the population or the low-income people usually takes many forms. These include direct housing construction, provision of serviced land, availability of mortgage finances at below-market interest rates, and tax relief on substantial rehabilitation programmes. In Nigeria, the most noticeable and popular of these methods is direct housing construction [3]. The first known government intervention in urban housing in Nigeria was in 1928 with the outburst of the bubonic plague of 1928–1929 in Lagos (NHP 1991). The public housing effort has its roots in the colonial days in which public housing efforts were limited to the creation of Government Reservation Areas (GRAs) and the erection of European-type structures for the colonial staff and a few lucky high-placed Nigerians. In 1946, Urban Councils were created as the first public institutions to maintain law and order, control the erection of private buildings and ensure that they do not interfere with public buildings and institutions [17]. The Lagos Executive Development Board (LEDB) was established in 1928 and was the premier government agency responsible for the construction of public housing in the early 1950s. There was the African Staff Housing Scheme which was to grant housing loans to African colonial civil servants. As if to complement these efforts, the Nigerian Building Society was established in 1956. The establishment of Regional Housing Corporations in 1959 marked the first active involvement of the public in housing in Nigeria.

Government housing efforts in the first development plan (1962–1968) did not differ from those in the colonial period, providing only staff quarters to government officials. Although, the first plan intended to develop and produce staff houses for sale at less than market prices for the low-income group and with cost payable over twenty years through monthly charges, none of these was realised. During the second development plan, government intervention took a more serious step. The National Council on Housing did not relent with the establishment of National Housing Council thus, the government established the Federal Housing Authority to execute the 59,000 housing units' targets set for the plan period, 15,000 of which were to be built in Lagos. The third plan came out boldly in favour of housing because of the acute shortage of desperately needed housing units. Government involvement became very pronounced. Housing was attaining the status of merit good. A sum of N2.6 billion was allocated and a target of 202,000 units was set for the plan period. Building Society was converted to a Mortgage bank and endowed with N150 million with a charge to increase loan disbursement at a 3% interest rate. The fourth development plan anticipated the direct construction of 200,000 units, developments of staff quarters as well

as development of site and service schemes etc. A total sum of N2.7 billion was earmarked for this.

With the termination of the second republic in December 1983, the period 1984–1993 witnessed perhaps the most dramatic development in the housing sector. The most remarkable of these is the evolution of a National Housing Policy (NHP), a policy that has eluded the nation since independence. However, the high hopes, noble pledges, huge sums of money and goodwill which welcomed the various public intervention programmes were not sufficient to prevent their failure. For example, in the third development plan, out of the anticipated 202,000 housing units, only about 20,950 units were completed [3], a success rate of only 13.3%. So colossal was the failure of each successive public housing programme that experts spared no pains at advancing reasons for their poor performance. The following reasons can be adduced: the excessive and unnecessary delays in the planning, execution and construction of housing project. These invariably add to housing costs, speculation and subsequently limit the number of units that can be built with the same capital. There is also the disregard for alternative avenues of housing provision rather than direct construction. Site and services, core housing and the like were part of the explicitly stated housing policy objectives of the third and fourth plans, only a handful of states experimented with them. Even where those houses were built, shreds of evidence abound to show that many remain inhabitable and unoccupied. The target population, taste and preferences were not articulated; standard, stereotype designs that have no relation to the cultural environment were adopted. These among other reasons account for the colossal failure of housing in Nigeria. It is not surprising, therefore, that the contribution of the public sector to the total stock of housing units is only about one-quarter [3]

(b) Housing delivery system in the private sector

The private sector housing is that which is conceived, planned and constructed through the customary and modern institutional channels and subsequently offered for sale, lease or rent. Research by the Nigerian Institute of Social and Economic Recovery (NISER) in 1981 shows that the private sector was making four times the efforts of the public sector in the production of more housing units. There are four types of private housing developers that supply housing through the private housing delivery system. These are:

(i) Merchant builders

Merchant builders are usually wealthy industrialists who want to achieve an economy of scale in housing production. They have similar designs for the numerous units of houses they want to build, employ a single contractor and buy the materials in bulk. They are thus

able to achieve some economies of scale. The houses are sold as soon as they are finished since the developer does not want to retain ownership. This type of builder is common in Nigeria. In the socioeconomic milieu of Nigeria, real estate is a significant asset that confers honour and prestige to those who have it. Currently, the Lagos State Property Development Corporation (LSDPC) is active in this regard.

(ii) Builder investors

Builder investors are also similar to merchant builders in that they also want to achieve economies of scale by building a group of houses at one given time. This category of investor, however, differs from the former in several ways. One, the number of units built is invariably less than those of merchant builders; secondly and most importantly, they retain the ownership and management of such estates. Although the numbers of builder investors are few, they have made a significant contribution to the increase in the total housing stock. Examples in the Ibadan Metropolitan Area include Adetunji housing estate with 48 dwelling units and the Salami estate with 20 units.

(iii) On-site builders

This is perhaps the largest group in Nigeria. It consists of a wide variety of individuals which cut across the socioeconomic strata of the Nigerian society. Each individual acquires a plot of land, goes through all the developmental processes and then build the house to his taste. Owner-participation is very common in this type of building process. Usually, he rents or leases the entire house out, while he might live in a section and rent some sections out.

(iv) Land developers

Land developers are very important to the private housing delivery system. Land developers acquire large tracts of land, subdivide it into varying building sizes and service it with amenities, mainly roads, sometimes water and electricity. They then sell the land either in plots or by hectares. Available shreds of evidence show that land developers more than any single body of developers have contributed significantly to the provision of housing units in Ibadan metropolis. Between 1960 and 1976 for example, there were 2587 registered layouts in the metropolitan area of Ibadan occupying a total acreage of 48,620 ha. If there are 14 plots in a hectare, a total of 680 plots would have been available for housing development in the city. This is no mean achievement when it is realised that the public sector contributed about 6000 buildable plots, while a single land developer built 10, 000 plots within the same period [3]

(c) Housing delivery system in public–private–partnership (PPP)

Chen and Zhang [9] defined public–private partnership as arrangements where development is undertaken with a combination of not-for-profit, private and public participation of programs. It is opined that public–private partnerships (PPPs) play an important role in bringing the private sector competition to public monopolies in infrastructure development and service provision. The PPP model also assists in merging resources of both public and private sectors to better serve the public.

A public–private–partnership is a legally binding contract between government and private sectors for the provision of assets and the delivery of services that allocates responsibilities and business risks among the various partners¹. The main objective of PPP is to encourage private sector participation in the provision of housing and to encourage the private sector to plough back some of their profits into the very critical areas of national need.

This initiative generally involves more direct government intervention than incented private development. The housing authority becomes an active partner in development, rather than functioning as a passive, regulatory actor. In a PPP, the private developers often build housing units on public land, with finished units sold directly by the private partner or allocated by government to buyers

or tenants. The primary role of government is to de-risk the development and create the right contractual and legal framework for private players to bid on projects and join the partnership. The tools of incented private development may also be used in a PPP [12, 15, 19].

1.1.2 Mass housing schemes in the Ilorin

Mass housing schemes in the Ilorin metropolis, historically started in 1975 with the state government intervention in housing supply, to meet up with the challenges of the growing population of the city. A total number of 257 units (Kulende housing estate) were completed and allocated to the residents and this marked the beginning of mass housing schemes in the state. The year 2008 ushered in a joint partnership between private investors and the state government. The three major popular mass housing delivery strategies in the Ilorin metropolis are private, public (state and federal government), and private–public–partnership (PPP). All these three delivery strategies are spread across the three local government areas of Ilorin metropolis as shown in Table 1.

Table 1 Mass housing schemes in Ilorin metropolis between 1975 and 2016. Source: Authors' field survey (2022)

S/N	Year	Owner	Name of estate	No of unit	Remarks	LGA
1	1975	Public	Kulende Estate	257	Completed	Ilorin East
2	1978	Public	Adewole Phase I	582	Completed	Ilorin West
3	1979	Public	Agba Dam Estate	20	Completed	Ilorin South
4	1981	Public	Low-Cost Estate	25	Completed	Ilorin West
5	1992	Public	Adewole Phase II	32	Completed	Ilorin West
6	2002	Public	Irewolede Housing Estate	250	Completed	Ilorin West
7	2004	Public	Mandate I Estate	150	Completed	Ilorin West
8	2005	Public	Mandate II Estate	200	Completed	Ilorin West
9	2006	Public	Mandate III Estate	250	Completed	Ilorin West
10	2008	PPP	Royal Valley Estate	250	Completed	Ilorin East
11	2009	PPP	Harmony Estate	150	On-going	Ilorin East
12	2009	Private	Ismail & Associate Estate	500	Under construction	Ilorin West
13	2010	PPP	Greenaco	275	On-going	Ilorin West
14	2010	PPP	Mandate Luxury Estate	93	On-going	Ilorin East
15	2010	Private	Dansaki Estate	250	Under construction	Ilorin South
16	2011	Private	Evergreen Estate	179	Under Construction	Ilorin South
17	2012	Public	Judges Quarters	16	Under construction	Ilorin South
18	2012	Private	Forte Marina Estate	144	Under construction	Ilorin West
19	2012	Private	Sky View Estate	44	Under construction	Ilorin West
20	2012	Private	Kam Abioye Estate	250	Under construction	Ilorin West
21	2013	Private	Las Vegas Estate	124	Under construction	Ilorin West
22	2013	Private	Comics Garden City	200	Under construction	Ilorin East
23	2015	Public	Legislative Quarters	40	Completed	Ilorin South
24	2016	Public	Maigida Estate	499	Completed	Ilorin South

Govt government, *PPP* public–private partnership, *LGA* local government area

1.2 Sustainable housing development

The most widely accepted definition of sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It could also be regarded as the capacity of a project to continue to deliver its intended benefits over a long time (World Bank/UNDP 2000) [18], refer to sustainability as the maintenance of an acceptable level of services throughout the life of a [13, 14] opined that the key objective of sustainable development is the minimisation of consumption of matter and energy over the whole life cycle of consumption while at the same time, satisfy human needs and aspirations with sensitivity to the cultural context, and avoiding negative environmental impact.

Housing development goes a long way in determining the behavior of residents. According to Kil [8] as well as [10], few researchers have discussed sustainable housing development. Thus, it is not only for houses to be provided, but sustainability should be ensured in the provision of the various components of the housing units. Thus, this study is being carried out to know the extent that which sustainability can be achieved in the mass housing schemes in Ilorin metropolis in terms of facilities, infrastructure and neighbourhood amenities among others.

2 Materials and methods

2.1 Method of collection of data

The coordinates of Ilorin are latitude 80.30 N and longitude 40.35' E. It is located north of the forest zone and on the southern edge of the savanna, forming the Guinea savanna grassland belt of Nigeria's middle belt. In the Ilorin-West Local Government area, the capital city of Kwara State, Nigeria, lies Ajikobi, Alanamu, Oloje, and Ogidi, in that order. Figure 1 shows that the area of these locations is approximately 100 km³. They are located on latitudes 8°24' N and 8°36' N and longitudes 4°10' E and 4°36' E. The Asa, which flows from south to north, is the principal river of Ilorin. It splits Ilorin in two: the Government Reservation Area (GRA) is located in the eastern portion, while the western portion represents the core or indigenous area. The population of Ilorin has grown quickly in recent years. Ilorin's population was 36,343 according to the first census conducted in 1911, and 40,994 according to the census conducted in 1953. The town's population was reported as 208,546 in the 1963 census and 532,088 in the 1991 census. Ilorin's population was predicted to reach 1,193,299.25 in 2022, with an annual growth rate of 3.5%.

The population consists of all the mass housing schemes or the estates in Ilorin metropolis, while the unit of analysis is the house. All the houses constructed under the mass housing programme in the three local government areas of Ilorin, inclusive of Federal and State governments, public–private–partnership (PPP) and Organised Private Developers constituted the population for the study. Ilorin city is selected because it is the capital of Kwara State which the State Government has given the highest priority in its mass housing programme.

However, the sample frame consists of houses completed (and occupied) by each of the stakeholders in the provision of housing. The total number of houses sold amounts to 4166 which is the sample frame for the study. A multistage sampling technique was employed and the first stage was the stratification of the metropolis into local government areas. These are Ilorin West, Ilorin South and Ilorin East. The second stage involved the identification of mass housing schemes in each of the local government areas. According to Kwara State Housing Corporation and a reconnaissance survey carried out, the Federal government has two estates, which are the Low-cost estate and the Ministerial housing estate. Kwara state government has eleven, PPP has four, while the Private sector has a total of eight estates.

In the third stage, information was collected on the details of the mass housing projects from the PPP and the private sector and in the last stage, the sample size was selected. To have a good representation of each of the housing delivery strategies, (27%) of the houses were randomly sampled from the sample frame leading to a total of 1,125 samples for consideration. Since there are different house types in the area, to ensure that the samples selected are representative of the population from which they are drawn, the Equal Probability of Selection Method (EPSEM) was applied. The 27% sample from each of the housing delivery strategies was applied to the different house types in each estate or mass housing project. A sample was then randomly taken by drawing papers scripted with the number of houses contained in hats for each house type and in each housing delivery strategy. Thereafter, others were systematically selected at an interval one after the other. Thus, the breakdown of the samples from each three delivery strategies was 895, 207 and 27 for the public, public–private partnership and private respectively as shown in Table 2.

2.2 Method of data analysis

Data obtained were analysed using descriptive statistics such as frequency counts and percentages to compare the condition of housing elements of each of the delivery strategies. This is done by attaching ratings of very good, good, fair, poor and very poor. Also, the variation in the housing condition in the mass housing schemes of

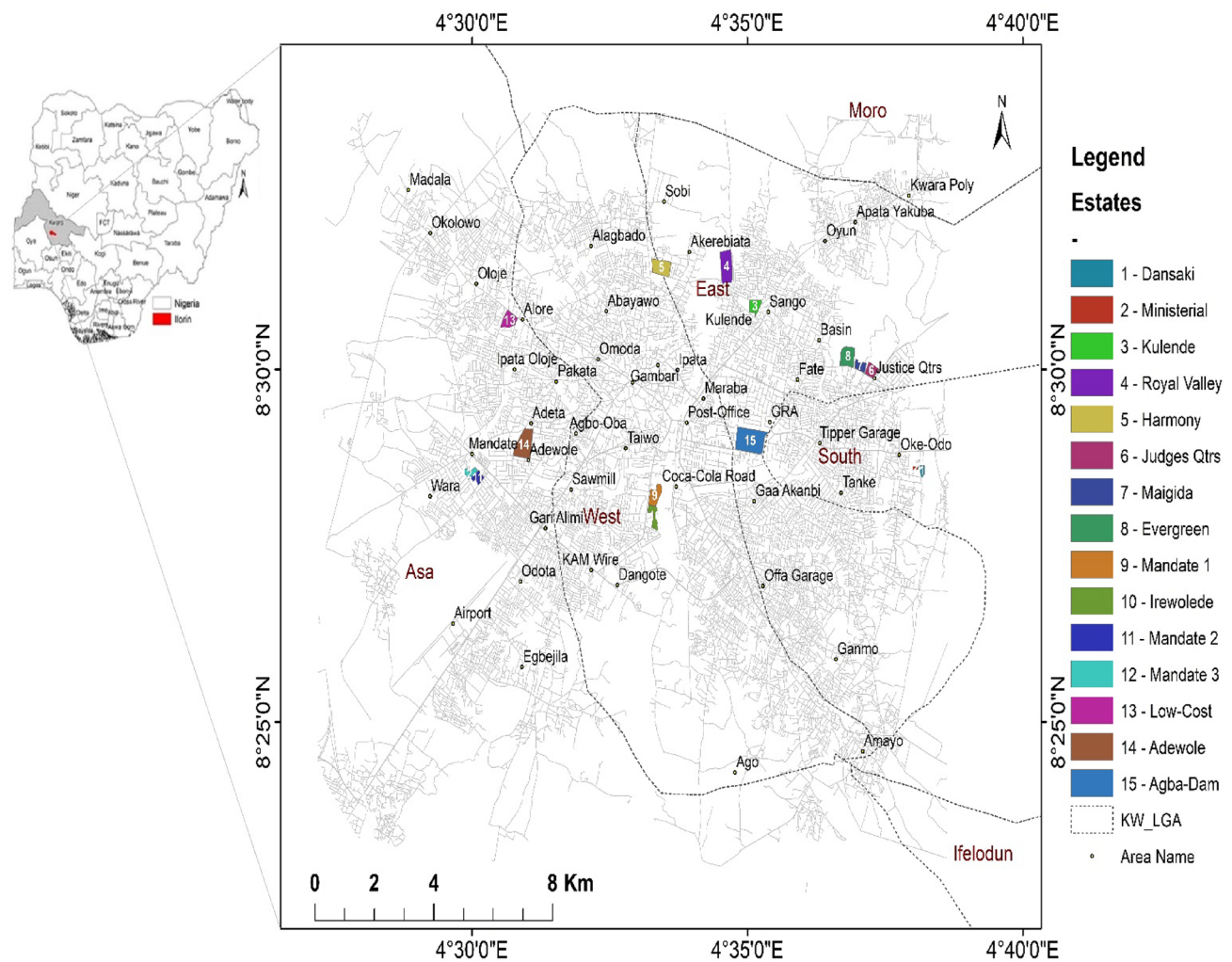


Fig. 1 Map of Ilorin metropolis. Source: GIS Laboratory, Urban and Regional Planning Department, LAUTECH (2021)

Table 2 Samples from the three delivery strategies of mass housing. Source: Authors' field survey (2022)

Delivery strategy	Total no of units completed and occupied	Total no of sample (27%)
Public	3,316	895
Public-private partnership	750	207
Private	100	27
Total	4166	1125

Ilorin metropolis based on the three popular delivery strategies was statistically analysed using multiple analyses of variance (MANOVA). The condition of housing was subjected to a two-way analysis of variance (MANOVA) to test whether or not the condition of houses varies within the housing estate.

3 Result

3.1 Housing element condition of the mass housing schemes by the three popular delivery strategies

A comparison of the delivery strategies of the mass housing schemes about the condition of buildings is carried out. This is intended to establish the differences in the state of housing conditions at different levels of delivery strategies. Some of the housing elements used for the assessment include the major components of the house which are: the condition of the wall, the condition of the roof, condition of painting/tile and condition of floors among others. This is as presented in Table 3.

The study shows that walls of mass housing schemes delivered by the private organisation had the highest

Table 3 Delivery strategy and housing element conditions. Source: Author's Fieldwork (2022)

Variables	Percentage distribution					Remark/implication
	V. good	Good	Fair	poor	V. poor	
Wall						
Public	33.1%	36.6%	26.6%	0.0%	0.0%	36.6% of wall conditions is good
Private	41.0%	51.6%	2.9%	0.0%	0.0%	51.6% of wall conditions is good
PPP	3.8%	3.1%	80.1%	13.0%	0.0%	80.1% of wall conditions is fair
Roof						
Public	31.1%	36.2%	21.5%	11.2%	0.0%	36.2% of roof conditions is good
Private	39.0%	58.1%	2.9%	0.0%	0.0%	58.1% of roof conditions is good
PPP	25.1%	30.4%	28.0%	16.5%	0.0%	30.4% of roof conditions is good
Floor						
Public	25.7%	49.3%	21.1%	3.9%7	0.0%	49.3% of floor are in good condition
Private	39.6%	56.8%	3.8%	0.0%	0.0%	56.8% of floor are in good condition
PPP	22.2%	43.6%	30.0%	4.2%	0.0%	43.6% of floor are in good condition
Painting/tile						
Public	25.2%	44.0%	17.3%	14.5%	0.0%	44.0% of painting/tile are in good condition
Private	38.0%	58.4%	3.6%	0.0%	0.0%	58.4% of painting/tile are in good condition
PPP	21.2%	38.8%	23.8%	23.8%	0.4%	38.8% of painting/tile are in good condition
Door						
Public	29.2%	55.6%	12.5%	2.3%	0.4	55.6% of door are in good condition
Private	41.0%	55.4%	3.6%	0.0%	0.0%	55.4% of door are in good condition
PPP	5.4%	81.6%	13.0%	0.0%	0.0%	81.6% of door are in good condition
Window						
Public	29.4%	58.2%	8.9%	3.4%	0.0%	58.2% of window are in good condition
Private	34.1%	62.3%	3.6%	0.0%	0.0%	62.3% of window are in good condition
PPP	4.6%	82.2%	13.1%	0.0%	0.0%	82.2% of window are in good condition

percentage of wall in very good (41.0%) and good conditions (51.6%) while, the public mass housing schemes had 33.1% walls as very good and 36.6% as good. However, 80.1% of walls in PPP mass housing delivery strategies is just fair and 13.0% are in poor condition.

3.2 Variations in housing condition in the mass housing schemes of Ilorin metropolis based on the three popular delivery strategies

In line with the above discussion, the dependent variable is the condition of houses measured on a ranking scale. They are the condition of wall, roof, floor, painting, ceiling, door and windows. The independent variables (factors) are the three popular housing delivery strategies, measured on a nominal scale. The results of MANOVA are contained Table 4 below:

Observations from the Box's test of equality of covariance matrices, in the sig. row as shown in Table 4. This indicates that the assumption of homogeneity of covariance has been met. In order words, the assumption of homogeneity of covariance for housing condition has not been violated as informed by p values which were found to be less than 0.05 (i.e. $p < 0.05 = 0.000$) for the condition of wall, condition

Table 4 Levene's test of equality of error variances^a. Source: Author's computation, 2022

	F	df1	df2	Sig
Condition of wall	87.838	2	934	0.000
Condition of roof	36.392	2	934	0.000
Condition of floor	2.457	2	934	0.086
Condition of painting/tile	31.904	2	934	0.000
Condition of ceiling	35.317	2	934	0.000
Condition of door	44.728	2	934	0.000
Condition of window	43.124	2	934	0.000

Tests the null hypothesis that the error variance of the dependent variable is equal across groups

^aDesign: Intercept + q2

of roof, condition of painting, condition of ceiling, condition of door and condition of windows respectively, except the condition of floor which has $p > 0.05 = 0.086$, which is more negligible. Moreover, the non-violation assumption of homogeneity of covariance is indeed instructive and thereby gave impetus to continue with the analysis to establish the significant effect of condition of housing in the Ilorin mass housing schemes.

Table 5 is the multivariate test of condition of housing in the study area. According to the table, with Pillai's trace of $F = 36.070$, $df = 14$, $p < 0.05$, it is observed that the overall interaction of the predictor variable (Delivery strategy) with the criterion variables (condition of wall, condition of roof, condition of painting, condition of ceiling, condition of door, condition of floor and condition of windows) is significant at $p = 0.000$. In other words, statistically, there is a significant difference between the independent groups or levels of the categorical predictors' variable.

The multiple comparisons of condition of housing in the mass housing estates of the study area according to the three popular delivery strategies as indicated in Table 6 revealed that condition of housing for all the parameters/components of houses was found to have significant differences. This is manifested in the fact that all the p values reported for the comparison of the three delivery strategies were observed to be less than 0.05 confidence level ($p < 0.05$).

4 Discussion

4.1 Housing element condition of the mass housing schemes by the three popular delivery strategies

Since the housing element circumstances are one of the factors influencing the quality of housing, an examination of the mass housing plans by the three widely used delivery methodologies was conducted. This implies that the bulk of the PPP dwellings' walls require maintenance. In their research, Zayyanu and Foziah [21] linked the deficient circumstances of the public–private partnership housing delivery strategy to Nigeria's opaque and poorly managed procurement process, as well as the division of duties among the partnership's stakeholders.

Furthermore, Yakubu et al. [20] confirmed that the majority of PPP homes were not properly supervised by the government as specified in the Memorandum of Understanding, as a result of the government losing control of the project because it was unable to fulfill its obligation to pay the land compensation.

4.2 Variations in housing condition in the mass housing schemes of Ilorin metropolis based on the three popular delivery strategies

This implies that it is possible to generalise that there are significant inter and intra-urban variations in the condition of housing in the mass housing schemes of the Ilorin metropolis. It can, however, be inferred that there is evidence of a significant main effect in the variations of the condition of housing across and between the sixteen housing estates using the three popular delivery strategies in Ilorin metropolis.

Based on multiple comparisons of the condition of housing elements in the mass housing estates of the study area according to the three popular delivery strategies. The study revealed that there is variation in the condition of housing elements across the three delivery strategies.

5 Conclusion and recommendation

This study has shown the condition of mass housing schemes delivered by the three delivery strategies in Ilorin metropolis, Nigeria. It has revealed that walls of mass housing schemes delivered by the public and private organisations are in good condition while walls in PPP mass housing delivery strategies are in poor condition.

Thus, to improve the living condition of the housing units, there is a need for the involvement of the intending residents

Table 5 Multivariate test of condition of housing in the study area multivariate tests. Source: Author's computation (2022)

	Value	F	Hypothesis df	Error df	Sig.	Partial eta squared	Noncent. parameter	Observed power ^a
Pillai's trace	0.427	36.070	14.000	1858.000	0.000	0.214	504.986	1.000
Wilks' lambda	0.580	41.497 ^b	14.000	1856.000	0.000	0.238	580.953	1.000
Hotelling's trace	0.711	47.088	14.000	1854.000	0.000	0.262	659.232	1.000
Roy's largest root	0.693	91.915 ^c	7.000	929.000	0.000	0.409	643.407	1.000

Each F tests the multivariate effect of delivery strategy. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means

^aComputed using $\alpha = 0.05$

^bExact statistic

^cThe statistic is an upper bound on F that yields a lower bound on the significance level

Table 6 Multiple comparisons of condition of housing in the mass housing schemes of the study area pairwise comparisons. Source: Author's computation, 2021

Dependent variable	(I) delivery strategy	(J) delivery strategy	Mean difference (I – J)	Std. error	Sig. ^a	95% confidence interval for difference ^a	
						Lower bound	Upper bound
Condition of wall	Private	Public	–0.416*	0.075	0.000	–0.564	–0.269
		Private–public	–1.407*	0.083	0.000	–1.569	–1.244
	Public	Private	0.416*	0.075	0.000	0.269	0.564
		Private–public	–0.990*	0.058	0.000	–1.105	–0.875
	Private–public	Private	1.407*	0.083	0.000	1.244	1.569
		Public	0.990*	0.058	0.000	0.875	1.105
Condition of roof	Private	Public	–0.467*	0.084	0.000	–0.632	–0.303
		Private–public	–1.631*	0.092	0.000	–1.813	–1.450
	Public	Private	0.467*	0.084	0.000	0.303	0.632
		Private–public	–1.164*	0.065	0.000	–1.293	–1.036
	Private–public	Private	1.631*	0.092	0.000	1.450	1.813
		Public	1.164*	0.065	0.000	1.036	1.293
Condition of floor	Private	Public	–0.390*	0.071	0.000	–0.529	–0.251
		Private–public	–1.121*	0.078	0.000	–1.275	–0.968
	Public	Private	0.390*	0.071	0.000	0.251	0.529
		Private–public	–0.731*	0.055	0.000	–0.839	–0.622
	Private–public	Private	1.121*	0.078	0.000	0.968	1.275
		Public	0.731*	0.055	0.000	0.622	0.839
Condition of painting/tile	Private	Public	–0.584*	0.087	0.000	–0.755	–0.414
		Private–public	–1.431*	0.096	0.000	–1.619	–1.243
	Public	Private	0.584*	0.087	0.000	0.414	0.755
		Private–public	–0.846*	0.068	0.000	–0.979	–0.714
	Private–public	Private	1.431*	0.096	0.000	1.243	1.619
		Public	0.846*	0.068	0.000	0.714	0.979
Condition of ceiling	Private	Public	–0.428*	0.080	0.000	–0.585	–0.270
		Private–public	–1.314*	0.088	0.000	–1.488	–1.141
	Public	Private	0.428*	0.080	0.000	0.270	0.585
		Private–public	–0.887*	0.063	0.000	–1.009	–0.764
	Private–public	Private	1.314*	0.088	0.000	1.141	1.488
		Public	0.887*	0.063	0.000	0.764	1.009
Condition of door	Private	Public	–0.253*	0.062	0.000	–0.375	–0.131
		Private–public	–0.468*	0.069	0.000	–0.603	–0.334
	Public	Private	0.253*	0.062	0.000	0.131	0.375
		Private–public	–0.215*	0.048	0.000	–0.310	–0.120
	Private–public	Private	0.468*	0.069	0.000	0.334	0.603
		Public	0.215*	0.048	0.000	0.120	0.310
Condition of window	Private	Public	–0.171*	0.061	0.005	–0.291	–0.051
		Private–public	–0.408*	0.067	0.000	–0.541	–0.276
	Public	Private	0.171*	0.061	0.005	0.051	0.291
		Private–public	–0.237*	0.048	0.000	–0.331	–0.144
	Private–public	Private	0.408*	0.067	0.000	0.276	0.541
		Public	.237*	0.048	0.000	0.144	0.331

Based on estimated marginal means

*The mean difference is significant at the 0.05 level

^aAdjustment for multiple comparisons: least significant difference (equivalent to no adjustments)

of the houses during the construction and production of housing units to ensure good quality. Also, the government must ensure that the quality of each element of the housing is strictly adhered to, this can be achieved by proper monitoring of all housing estates by the planning authority so that the developer and the contractor build according to specifications in the drawing. It was observed that in the mass housing schemes delivery strategies sampled that maintenance problems in Public private partnership have been influenced by lack or absence of a national mass housing maintenance policy just like we have national housing policy this help in preserving the existing mass housing schemes that serve as part of the solution to housing shortages.

Finally for mass housing schemes to be sustainable irrespective of the delivery strategy, all stakeholders must work in synergy to achieve sustainable development goal 11 of United Nations (UN) Habitat Global Housing Strategy framework. Also, Building professionals like Architects, Builders, Engineer and other allied professionals should ensure that mass housing schemes projects uses sustainable building materials that can provide insight into future maintenance needs and avoid unnecessary costs.

Author contributions S.B. Oladimeji—Conceptualization, Data curation, Formal analysis, writing original draft, review and editing. A.T. Abubakar-kamar—Validating, formal analysis, resources, visualization. O.O. Odunjo—writing review, editing, resources. D.O. Adeoye—Data curation, analysis, interpretation.

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Declarations

Conflict interest The authors declare that this manuscript has not been published in anywhere, any form before, it is a pure research work of all the authors. The we the authors declare that we have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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