Building Defects and Maintenance Needs in Transformed Kabuga Public Housing Estate Kano, Nigeria

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ABSTRACT

As the ancient city of Kano grows and is being transformed to a cosmopolitan city, its peripheral housing estates over the years are constantly facing challenges of habitable built environment. The inability of government to meet up with the maintenance needs of these houses and provision of basic amenities has affected the standard and comfort ability of those estates' streets and environs. The paper aimed at assessing building defects and the maintenance needs in transformed Kabuga public estate, Kano. Data for the study were obtained from field survey using questionnaire. The respondents were selected using simple random sampling. A total of hundred and sixty (160) structured questionnaires were administered. The data were analyzed using Mean Score and ranking model. Lack of preventive adequate maintenance plan and insufficient funds were the major factors influencing maintenance in the housing estate. The paper recommends needs for participatory and proactive measures by all stakeholders as a routine check will curb further proliferation of negative externalities in order to improve household satisfactorily and sustainable environment.

Keywords: Building Defect, Maintenance-need, Transformation, Public estate, Kabuga-Kano

1. INTRODUCTION

The need for assessing building defects and maintenance in transformed public housing are on the increase in core estates across Nigeria. Studies on public housing show high level of neglect owing to lack of maintenance of the building fabrics and facilities there in (Unah and Ibrahim 2021; Olotuah 2015). The efficiency of human activity in an urban area depends on the provision of effective infrastructural facilities (Unah 2022; 2021 and 2020) and its maintenance services and adequate maintenance of same Olagunju, 2011). Fadairo and Taiwo (2009); Olagunju (2012) posits that buildings cannot remain new throughout their entire life, hence, the significance of building maintenance in a public housing estate such as the transformed Kabuga housing estate cannot be over emphasized. Maintenance problems start to creep in once building projects are completed and the need for maintenance becomes necessary in order to sustain the performance of the buildings and keep them in good condition. The needs for maintenance of residential building are a major factor of housing inefficiency in many cities in Nigeria (Olagunju 2012), which emphasized the needs on its habitable conditions remain a great problem (Olagunju 2011). Therefore, building maintenance should be carried out over a period of time after the building has been occupied in order to sustain and preserve its functionality. Ahmed (2000) and Odediran et al. (2012) opined core buildings have not received much attention in the past as the emphasis has always placed on the development of new properties.

Maintainability of building has been identified as one of the key areas in which the built industry must achieve significant improvement (Olagunju 2011). The physical appearance of

public housing constitutes the basis upon which the society makes their initial judgment of the quality of services been offered in given a place. Unah and Muktar (2020) scored the fact that informal Spontaneous settlement can provides affordable good accommodation without housing layout and neighborhood infrastructures attributes how much more a core housing estate in the built environment. This is because housing does not only affect occupants directly but all aspects of human endeavor including occupant's health, social, economic, political and their productivity at workplace (Olotuah 2016; Leong 2009). Atamewan and Effanga (2017) posited that the conditions of housing and the environment in which people live determines to a large extent the level of growth and development of that place. Thus, the state of housing and its environment is an indicator of the level of development and condition of the citizens. The United Nations Commission on Human Settlement UNCHS (1995 and 1996) stated that in spite of national and international efforts aimed at developing appropriate policies and strategies, no effective remedy has been found to cure housing ills. Maintenance of buildings therefore became necessary in order to enhance durability, improve quality of life, protection of human health and the environment. Consequently, achieving all these benefits and to maintain acceptable physical, functional and economic life span of the building and the associated infrastructural facilities make building maintenance inevitable.

Therefore, for any existing building(s) to attain sustainable standard within the built environment, such buildings must be constantly being maintained and free from all defects. This Olagunju, et al. (2013) opined is to ensure that the building efficiently fulfils the purpose for which it was designed at every given point in time particularly ensuring the users' or occupant's satisfaction. Despite the pivotal roles of housing in the socio-economic development of a nation and the life of its citizenry, majority of the public housing in Kano fringing settlement are in deplorable condition and state of disrepair. Building / housing infrastructural amenities and services has failed in Kabuga estate, where most of the occupants cannot keep up with the state of transformation and their building redevelopment Unah and Ibrahim (2021) associated with the estate. In addition to the rising level of urban poverty among the occupant, there is a considerable negligent of the urban physical environment manifesting in worsening waste management, deplorable housing, inadequate spaces with poor neighborhood social amenities and absence of basic infrastructure services (Unah, n.d.). The study of Abubakar et al., (2015) posits that core houses that have gone through several transformations by a particular household need routine check in order to subsequently defect from further maintenance so as guarantee user satisfaction. This according to Iyagba and Adenuga, (2003) is impossible to produce buildings which are maintenance free, but maintenance work can be minimized by good design and proper workmanship experts or competent craftsmen using suitable codes of installation, requisite building materials and methods. The residential buildings in Kabuga, show dare need for maintenance because only few occupants demonstrated well character in redevelopment their housing units using responsible designs with modern construction materials. The choice of study was informed by the need to create awareness on the impact of housing and neighborhood deterioration; building environment and defects and the need for maintenance as pancreas for resident's improved quality of life in the formal settlement. The study is crucial towards improving housing condition in transformed public housing of Kabuga estate where an important criterion was evaluated in maintenance of the building as assessing the residential needs (Olotuah 2015).
Therefore, the paper set to contribute to achieving this gap in addressing building maintenance needs using Kabuga housing estate since it one of the oldest residential areas within the Kano Metropolis in the northern Nigeria (Unah 2022). The spontaneous maintainability with basic objectives of identifying the nature and causes of building defects and strategies for addressing housing maintenance needs using data presentation, analysis and discussion using (a)

demographic information of respondents (b) factors responsible for building defects and (c) factors influencing maintenance of buildings sustainability.

2. LITERATURE REVIEW

The transformation of core public housing contributes to sustainability of the environment, human development and wellbeing. Atamewan and Effanga (2017) posited that buildings, usually are expected to provide healthy, safe and conducive environment for the occupants' performance of daily activities and comfort, which is a measure of its functionality. When the components of a building begin to deteriorate, urgent measure and attention have to be taken to ensure that such building retains its usefulness and investment over a long period of time (Waziri and Vanduhe, 2013). Building maintenance is a vital aspect of construction project management which cannot be neglected. Building maintenance ensures that the building infrastructure in any built environment remains in their healthy conditions structurally, functionally and aesthetically throughout the expected lifespan of the buildings. Thus, urban centers and fringe settlements which showcase deplorable housing conditions and deteriorated environment which people live in, accounts for poor health, poverty, poor academic performance, high crime rate with negative consequences on a country's economy and development (Unah and Muktar 2020).

Periodic Evaluation and assessment of building performance is important in all spheres of life as this foster's improvement in nation's future endeavors (Zubairu, 1999; Olagunj et al., 2013). In spite of this however, professionals in the built environment such as Architects and Engineers rarely carry out evaluation of completed buildings or even receive useful feedbacks about the performance of completed building projects. Olanrewaju and Anifowose (2015) and Atamewan and Effanga (2017) opined that housing sustainability is a function of the habitability level of such buildings in any sustainable built environment. This mean that for building to be habitable and livable, the core characteristic of the building is to be fit for human habitation which can only be achieved through adequate maintenance. Zubairu (1999) opted that the whole essence of carrying out maintenance on buildings is to ensure that the building is in a safe and healthy condition in accordance with specified standards for the users or occupants. Adejimi (2005) described building maintenance as the activity carried out to preserve buildings in their initial functional, structural and aesthetic states. In the words of Kiong and Akasah (2012), building maintenance refers to activity or action(s) carried out in order to preserve or restore a building to an acceptable condition but excluding any enhancement other than those necessitated by failure to replace outdated materials or components. Housing maintenance and neighborhood quality in the residential environment has caught the attention of many researchers, as they are seen as a vital determinant of quality-of-life and well-being (Pacione, 2003, Flynn et al., 2002). This therefore presents the need for studying caustic factors and agents of building defects with the view to proffering relevant solutions. Oladapo (2005) posits that the extent to which buildings provide the required environment for human comfort and activity is a measure of the functionality of the building. Ofide et al., (2015) posit that the dimensions of maintenance problems have increased the interest of various researchers to promote an awareness on maintenance. They further opt that effective maintenance policies are not by any means the norm, the efficient utilization of scarce resources is beginning to be approached in a more informed way and the fundamental relationship of the condition of a building's fabric to its total performance is examined more critically.

2.1. Factors Influencing Building Defects and Maintenance

Building defects and maintenance has had serious influence on housing habitability? Many researchers (Atamewan and Effanga, 2017; Waziri and Vanduhe, 2013; Olagunju, 2012;

Zubairu, 1999) attribute to rarely building services performance, deficiencies in design process, construction, commissioning, tenancy work and maintenances changes in alteration of existing structures contravention (Ibrahim and Unah, n.d.), construction problem, workmanship, plants and equipment as well as materials usage inspection/supervision of construction (Stephen 2002, Adejimi 2005). However, Zubairu (2001) posit that the factor responsible to building defects is extent at which building problems contribute to various maintenance factors in government office buildings in Nigeria includes inadequate architectural design, inadequate structural design, inadequate electrical design, inadequate mechanical design, poor construction, use of poor quality components and materials, natural deterioration due to age and environment and misuse by occupants. Olagunju (2012) emphasized the factors that influencing building condition variables and the maintenance of residential building standards, are structural, roof, interior walls surface condition, sanitary and electrical fittings, discharge of waste water component and walkway within the building premises. Olotuah (2015) assessed residential building maintenance needs on three basic criteria of low, middle and high income, which have impact upon quality of housing. Ibrahim and Unah (n.d.) assessment of Kano built environment find out that building contravention has influence planning for housing and setting standards for the regulation of building construction. Unah (2019) agreed that the implication of redevelopment of residential housing configuration by the second occupant to suite their social needs are enormous and is due to demand of land for socio-economic growth. Other according to Waziri and Vanduhe (2013), it includes lack of communication between maintenance contractors and clients, preventive maintenance and faulty workmanship (use of sub-standard materials), non-availability of replacement parts and technological change. The factors according to Adejimi (2005) and Usman, et al., (2012) are design resolution, skill maintenance personnel and plants, structural strength and material specification, maintenance manual and safety measures, environmental factors, quality control factors and post construction usage are the necessary factors need in building sustainability . While Assaf (1996) and Waziri and Vanduhe (2013) identified the need to adhered to civil and architectural design, consultant's firm's administration and staff, construction drawings inspections and materials specifications as design defects in maintenance practicability and adequacy. To evaluate the factors responsible for building defects, Addleson (1977) concluded that natural factors can be summarized into four group of dampness, movement and chemical and biological change, errors, oversights, lack of care and fallibility of people that initiate, design, construct and maintain.

The study of Atamewan and Effanga (2017) posit that not all residential buildings are habitable even with the least minimum standard. This is also identified in the study of Unah and Ibrahim (2021) in assessing of Kabuga housing estate established that building redevelopment is in the increase and has effect on the contravention as transformation and quality of the built environment. The need of easement, and steady increased in erection of wall on property line and contravention of building set-back, has seen run-off water causing dilapidation on building as well due to blockage of drains. This has serious consequences on building maintenance due to the second home owner resident's transformation of their houses. Muktar and Chinyio (2021) found out that management related issues and non-compliance to safety regulation, carelessness and poor coordination of workers on site are responsible for early building maintenance. They attribute this to lack of supervision by the relevant authority and oversight of inadequate construction measures and finishes fittings as the main factors responsible for building defects.

3. METHODOLOGY

The research method involved a field survey of (Janbulo) - Kabuga housing estate, which uses mixed methods of both quantitative and qualitative techniques. The study developed a set of

criteria derived from the literature on three variables of key performance indicators (KPI's) on building defects (Zubairu, 2001; Adejimi, 2005; Olagunju, 2012; Waziri and Vanduhe, 2013; Olotuah, 2016) as follows: identify and specify level of defects observed in the buildings structure, infrastructure maintenances services defects, as well as functional and technical criteria. However, residents' demographic and peculiar issues of privacy and local security, related criteria were excluded (Ilesanmi, 2012) and outside the scope of this paper. A systematic random sampling was adopted where every 5th block on a particular street were selected. A total of about 1560 housing units were counted and 312 were assessed using direct physical observational schedule checklist and penalty scores assigned to the relevant variables (table 1). A Likert scale of 1-3 based on their significance (Vanduhe, 2012) were used in terms of the degree of defects resulting in three grades performance: poor (PMD = two or more major defects… x1); fair (FMD = at least one major defect …x2); and good (GMD = no major defect… x3). The data collected were collated and subjected to univariate analysis using descriptive and inferential statistics while Relative Importance Index (RII) was used to analyses the respondents' scores of the basic maintenance factors given by equation (1).

$$\text{Relative importance index} = \frac{\sum w}{AN} \qquad \text{(i)}$$

Where w is the weighting given to each factor by the respondents, ranging from 1 to 3, A is the highest weight (i.e., 5 in the study) and N is the total number of samples. The rating of all the factors for degree of significance was based on the value of their respective relative importance index (RII). The guide for the rating is given in Table 1.

Table 1. Guide to degree of impact and significant

Degree of Impact	Rating Weighted Value	Rating	Interpretation
High Negative Impact	0.60 - 0.79	1	Most significant
Negative Impact	0.50 - 0.59	2	significant
Less Negative Impact	0.30 - 0.49	3	Less significant

Source: Vanduhe (2012)

3.1. Study Area

Kabuga estate Kano state is located between latitude 11o59' to 12o 02' N and longitudes 8o33' to 8o40'E with a total urban land area of 137Km2 and 499Km2 metropolitan area. It has 44 Local Government Area, with Kano metropolis as its capital city. Kano metropolis is about 481 meters (or about 1580 feet) above sea level. The climate is a hot, semi-arid type with an annual average rainfall of about 690mm (27.2 in) and of savannah vegetation. Kabuga estate is a low cost owner-occupier housing estate built for high, medium and low income earners, purposely for Kano State civil servants. The development of the housing estate started in phases of layout, formerly known as Yamadwa area, and popularly called "Janbulo quarter' meaning red bricks", is located in Dorayi along Gwarzo-road and Bayero University old site. Established in 1987, under the then Military regime of Gen. I.B. Babangida (rtd) through then Military Administrator of Kano State, Col. Idris Garba (rtd). Kabuga housing estate is bordered by Bayero University old campus to the East, Dorayi mass housing, Emir's lodge and existing Lecturers' development area by the South; Afforestation (Garden), new Abuja and Iman Wali general hospital by the west and new subway Abuja green belt area by the north, (now existing Tudun - Yola quarters). Kabuga housing estate was built in phases with Red Bricks (Janbulo) and phase black bricks (Bakin - bulo) phase. Unah, (2022) shows that Kabuga is one of the high brown residential housing settlements in the metropolitan Kano that provide accommodation to the timid population of workforce.

4. RESULTS AND DISCUSSION

The interpretation of the results obtained based on the Likert scale calculation is based on the range of scale stated in table 1. The mean score for each variable was calculated as shown in table 2.0 and table 3 respectively. The decision on the variable was based on the range of score stated in the interpretation of the Likert scale. The variables were then ranked from the *High Negative Impact, Negative Impact and Less Negative Impact* accordingly.

From Table 2: the study presents the analysis of the 11 variables affecting the building structure defects that required maintenance. These factors have been identified and ranked according to their relative importance Index (RII). The result is presented in Table 2.

Table 2: Factor affecting building defects

VARIABLES	Rating and Weighted Values			SWV	MWV	STD.D	R.I.I	Rank	Interpreting
	HPI (x1)	PI (x2)	MI (x3)						
BUILDING STRUCTURE DEFECTS									
Shallow Building sub-structure	101	112	95	610	1.955	0.00626	0.651	1st	Most significant
DPC below Natural Ground Level	105	122	85	604	1.935	0.00620	0.645	2nd	Most significant
No Over Site Concrete	125	101	88	591	1.894	0.00607	0.631	3rd	Most significant
Broken floor slab	115	131	66	575	1.842	0.05090	0.614	4th	Most significant
Sub-structure dampness	181	71	60	563	1.804	0.00578	0.601	5th	Most significant
Crack on Walls	116	142	54	562	1.801	0.00577	0.600	6th	Most significant
Peeling of Plaster	158	90	72	554	1.774	0.00568	0.591	7th	significant
Broken Parapet walling	146	112	54	532	1.705	0.00546	0.568	8th	significant
Sagging Roof	164	118	30	490	1.570	0.00503	0.523	9th	significant
Position of Door and Window	192	164	32	449	1.449	0.00464	0.483	10th	Less significant
Construction on Fences	148	20	44	256	0.821	0.00263	0.273	11th	Less significant

Source: Author field research 2021

Factor affecting building defects were examined at the neighborhood and defects variable were rank as presented in Table 2, revealed that during the fieldwork, the road shown inadequacies and lack of construction of drainages work that has exposed most buildings at the foundation stage are been too low. The first most important factor responsible for structure defects is low- Sub-structure of building foundations (shallow building foundation), where over time the damp proof course (DPC) is exposed to effect of erosion as a result of the low-rise natural ground level (N.G.L.), with RII of (0.651). This attribute much maintenance as most resident owner could explored the service of a local trade artisan in construction of their building. In the order of rating of the building structures defects, damp proof course below natural ground level was rated with RII (0.645) if check from the height of the road, are found to be level-low. No over-site concrete with RII (0.631), broken floor slab with RII (0.631), sub-structure dampness with RII of (0.601) and crack on walls with RII of (0.600) these were the "Most Significant" defects in building structures and are all attributes of poor workmanship. This are key performance indicator as find out in Table 2. Erection of wall on property line and building set-back with RII of (0.481and 0.389) ranked 11th and 12th respectively are seen as less significant, but are very unique in the functional services maintenance of buildings.

Table 3: present factors that affecting building services infrastructure and maintenance study presents the analysis of the 12 variables affecting the building services infrastructure defects that required maintenance. These factors have been identified and ranked according to their relative importance index (RII). The result is presented in Table 3. The finding of residential building services infrastructure maintenance scored on the degree of importance are as follows: uncover drainages has RII (0.764) been rate1st with the "Most Significant" maintenance defect and building set-back with RII of (0.389) being rated 12th with "less significant". Other key performance indicators are ranked as follows: broken sewer RII (0.657) ranked 2nd, exposed manhole and chambers with RII (0.6250 ranked 3rd, roof drain construction

with RII (0.648) ranked 4th, stagnant drainage water with RII (0.620) ranked 5th, broken water supply / waste pipes with RII (0.618) ranked 6th are been interpreted as "most significant" as variables which affects services infrastructure maintenance of residential buildings in Kabuga.

Table 3. Factor Rating 0f Residential Building Services and Infrastructure Maintenance

VARIABLES	Rating and Weighted Values HPI (x1)	PI (x2)	MI (x3)	SWV	MWV	STD.D	R.I.I	Rank	Interpreting
Services Infrastructure Maintenance									
Uncover drainages	65	91	156	715	2.292	0.00734	0.764	1ST	Most significant
Broken Sewer	95	131	86	615	1.971	0.00631	0.657	2nd	Most significant
Exposed manhole/ chambers	25	75	112	611	1.958	0.00627	0.625	3rd	Most significant
Roof drain construction	107	115	90	607	1.945	0.00620	0.648	4th	Most significant
Stagnant drainage water	84	113	8	581	1.862	0.00596	0.620	5th	Most significant
Broken water supply / waste pipes	123	111	78	579	1.855	0.00594	0.618	6th	Most significant
Exposed sanitary fittings	163	180	177	520	1.666	0.00534	0.554	7th	significant
Easement of water drainage	45	258	114	517	1.675	0.00531	0.552	8th	significant
Improper waste disposal	175	95	42	491	1.573	0.00504	0.524	9th	significant
Easement access way	157	264	69	490	1.570	0.00503	0.523	10th	significant
Erection of wall on property line	195	95	42	451	1.445	0.00460	0.481	11th	Less significant
Building set-back	265	41	6	365	1.169	0.00374	0.389	12th	Less significant

Source: Author field research 2021

5. DISCUSSIONS

The choice of study was informed by need to create awareness on the impact of neighborhood deterioration; building and environment and defects and the need for maintenance as pancreas of resident's improved quality of life in the formal core settlement. The study is crucial towards improving housing condition in transformed public housing of Kabuga estate where an important criterion was evaluated in maintenance of the building as assessing the residential needs (Olotuah 2015). The objective of the study was to identify the nature and causes of building defects, and factors influencing maintenance of buildings in Kabuga-Kano Nigeria. The discussion of the findings thus showed the result of the analysis found that the observational checklist survey scores shallow building sub-structure, damp proof course below natural ground level, no over site concrete, broken floor slab and crack on walls. This are most important building structures that has high negative impact as a result of either lack of proper supervision or inadequacies and lack of construction technical known-how. This was expected based on the fact that Janbulo were built long ago and as being plan settlement that everyone once wants to owned a house there-in (Unah, 2022). Olagunju (2012) showed that sustainability of residential building in Nigeria has to do with factor that influence maintenance of residential building standards. The study shown that the estate was largely constructed of poor building materials and signs of faulty workmanship as well as supervision during construction. Waziri1and Vanduhe (2013); Assaf (1996) and Adejimi (2005) seen faulty workmanship as the major factor responsible for building defects. Adejimi (2005) asserted that a poorly resolved building design eventually results in severe maintenance problems.

The building maintenance of public housing estate is very high and the needs of assessing the defects are shown to be most significant for sustainable habitant of the built environment. The result of this research supports several studies in the literature such as (Fadairo and Taiwo, 2009; Olagunju 2011; Olagunju, 2012; Olagunju, et al. 2013; Olotuah 2016, Leong 2009). Atamewan and Effanga (2017); Abubakar et al., (2015); Iyagba and Adenuga, (2003); Zubairu, (1999 and 2001); Adejimi (2005); Usman, et al., (2012); Waziri and Vanduhe (2013) stress that components of building begin to deteriorate, which requires

urgent measure been be taken to ensure that such building retains its usefulness and investment over a long period of time. This is achieved by referring to construction drawing and inspection of specification defects and maintenance. Adejimi (2005) confirmed that many buildings suffer serious maintenance problems due to the incompetence of those who maintain such buildings and recommend the engagement of qualified and skilled personnel at construction stage and in carrying out the maintenance need when time arises (Olagunju 2011). Therefore, building maintenance should be carried out over a period of time after the building has been occupied in order to sustain and preserve its functionality.

6. CONCLUSION

The results of the responses in the defects residential buildings were in conformity with the results of the structure defects and building services infrastructure maintenance. This are ranked factor of key performances indicators in physical investigation of these facilities. Thus, the results indicate that poorly constructed building without adequate over-site-concrete and hard core accounts for the highest causes of defects on the sub-structures units. These defects occurred in shallow building foundation, damp proof course (DPC) resulting in broken floor slab, causing dampness and crack on walls as the survey affirmed that most buildings were often below the motor able access road and water capillary action is quick to react and causes deterioration of the foundation, due to surface water run-off during the raining season. Similarly, the second overall most significant defect in the buildings are external services as discovered among uncover drainages, broken sewer, exposed manhole/ chambers and stagnant drainage water. Zubairu, (2001) and Olagunju, (2012) posited that persistent building maintenance problems, in abandoned and epileptic functioning facilities in Nigeria is a result of lack of maintenance culture and lack of appropriate tool for maintenance works.

The study revealed that residential buildings defects and maintenance is posing as a threat to the functional, structural and aesthetic conditions of these buildings. The study also revealed the poor workmanship and wrong maintenance policy right from construction stage as evidence in the use of materials such as hardcore, over-site concrete, laterite in-filled to required level. Thus, building maintenance is not optional or negotiable once building defects occurred and its absence are causing serious deterioration and dilapidation of existing houses in the study area.

From the study the following recommendations were made based non findings of the research:

- **i** Poor building sub-structures, substructures are below natural ground level, which requires the supervision of qualified and experienced building professionals
- **ii** Periodic (preventive) and corrective maintenance of buildings should be carried out in order to enhance the lifespan of buildings and prevent building failure.
- **iii** The buildings were discovered to shown signs of poor materials usage and faulty workmanship as well as supervision during construction which requires skill personnel to be engaged in the maintenance of buildings.
- **iv** The need for construction of a well-designed and constant maintenance of external works such as drainage system should be cleaning to prevent water runoff during wet seasons and stagnant waste to avoid building decay.
- **v** Government authority should participate in coordinating building construction and physical infrastructure development works.

Routine Checks should be carried out periodically in order to determine the conditions of the buildings for prompt maintenance to enhance sustainability.

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