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EXAMINATION OF MAINTENANCE LEVEL OF FACILITIES IN PRIVATE HOUSING ESTATES IN ENUGU METROPOLIS, ENUGU, NIGERIA

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Abstract

Private housing developers complement government efforts in Nigeria and all over the world to address the problem of providing adequate housing to the people. There have been series of housing estate developments in Enugu since the creation of the state in 1991. Following established standards, the housing is supposed to be designed, constructed, and managed to ensure maintenance of the buildings and facilities. The objective of this study was to appraise the maintenance level of facilities in private housing estates with a view to making improvements required in the design of future private housing developments in Enugu and Nigeria. The methodology adopted for this research was survey design. The focus was on four private housing estates in Enugu metropolis randomly selected from the research population. After stratification, based on housing type, two hundred and fifty-six occupied housing units were randomly selected. Data was collected from primary sources using questionnaires and observation schedules. Analysis of Variance (ANOVA) tool was used to test the significance of the difference between the estates in the maintenance level of buildings and facilities. It was established that there is significant difference in the maintenance of facilities in the private housing estates in Enugu metropolis. Integrated action and co-operation of relevant professionals and all stakeholders involved in the development and management of private housing estates in Enugu are recommended to ensure adequate maintenance. The implication of these findings is that for improved maintenance levels, the lessons learnt from the better performing housing estates would be used for direction for realising better maintenance level in the estates that performed poorer.

Keywords: building design, building maintenance, facilities, housing estates

INTRODUCTION

During the pre-colonial era, in Nigeria, housing was mainly comprised of groups of shelters for accommodating family members in compounds. Subsequently, in the colonial era, quarters were introduced in towns by the colonial masters (in form of housing estates) to house their employees near their places of work. When Nigeria gained independence, governments as well as private

and public organizations, continued with this trend, and expanded the number and structure of housing estates. However, Nigeria as a developing country has been challenged with scarce resources for establishment of infrastructure, and housing developments which are essential for developmental purposes (Uma, Obidike & Ihezukwu, 2014). Partly to fill the gap this creates, private entrepreneurs have joined the pool of housing providers and have increased access to housing. However, the quality of housing provided and user satisfaction have continued to be issues of concern. As such, Fakere, Arayela and Folorunso (2017) posited that to achieve improved housing quality, and increased user satisfaction, residents' participation in housing provision is vital. Furthermore, the state of repair of buildings has been noted to be a vital determinant of the habitability of buildings, as this influences the resident's level of satisfaction, well-being and safety (Umeora, 2020). This situation can be directly attributed to the maintenance culture of those responsible for the structures.

Bamgboye (2006) noted that maintenance is the art of bringing back the working condition of an item into regular functioning state at a minimal cost capable of enhancing the life span of the item. The necessity for a housing maintenance culture, which incorporates the provision of means for suitable care of the housing developments and infrastructure, has yet to gain ground in the consciousness of housing providers, as well as users. Consequently, dilapidated buildings and facilities, on the brink of collapse, can be seen in housing estates. Some of these were caused by little problems that could have been corrected early. The resultant remedial actions needed means greater amounts of scarce resources must be used to restore habitability. It is noteworthy, that the essence of maintenance is to return or keep buildings or infrastructure in a functioning or operational condition, and that the culture of adequate maintenance enhances the life span of items (Maduka, 2021). However, the habit of keeping things available for normal use in their designed life span is greatly lacking in Nigeria, hence the poor state of infrastructure.

For residents in any housing scheme, to carry out different activities such as resting, working, and relaxation, the housing should offer them a safe, conducive, and secured environment (indoor and outdoor). To realize this, housing should be designed, built, and managed based on established standards. However, sometimes, the professionals do not stick to these standards and this leads to dissatisfaction (such as complete desertion of housing by some residents, leading to voids and desolation in the estate, widespread need for remodelling of buildings and unsatisfactory housing condition) during housing occupation stage (Meir, Garb, Jiao & Cicelsey, 2009). These negative responses have been shown to cause waste of energy and resources, inadequate maintenance of the buildings, damages to the surrounding environment and reduced regard for architects (Nwankwo, Diogu & Nwankwo, 2014; Mitterer, Kuznel, Herkel & Holm, 2012).

The situation in Enugu, Nigeria, is not different from the general scenario in Nigeria as pilot survey for this study confirmed overwhelming evidence of the deplorable conditions of

buildings, and facilities, in private housing estates in the area. The condition of many buildings is deplorable, thus requiring some level of repairs to bring them to a good standard of structural quality. The reason for the inveterate situation is attributed to the challenging situation facing the housing sector as a result of inadequate maintenance, extensive adoption of ad-hoc and reactive maintenance management practices, as well as wrong maintenance approaches. Some of the building fabrics and facilities often show evidence of inadequate maintenance and repair since they were constructed. This research sought to assess the state of the facilities and maintenance operations in the private housing estates in the study area to see how the maintenance problems could be ameliorated. The variables that were examined include drainage facilities, playground/relaxation areas, street lighting, buildings and roads within the estates. The data presented in this paper was drawn from a bigger research project designed to assess level of residents' satisfaction in private housing estates in Enugu State, Nigeria. Though the need to appraise the maintenance level of the buildings' facilities in estates is germane, it has become more pertinent with the increase in housing developments, particularly, the series of private housing estate developments in Enugu since the State was created. The aim of this study, therefore, was to examine the maintenance level of facilities in private housing estates in Enugu, with a view to providing critical feedback for the design of future private housing developments. A null hypothesis was put forward which is that there is no significant difference in the maintenance of facilities in the private housing estates in Enugu metropolis.

LITERATURE REVIEW

The life of living and non-living things necessary for life sustenance call for regular maintenance in order to sustain their usefulness (Uma, Obidike & Ihezukwu, 2014). This view is corroborated by Hsieh (2008), as cited in Okoye, Olotuah and Ezeji (2021), which noted that the study of maintenance conditions of residential buildings and facilities stemmed from the need to document the problems of residential buildings, proffer solutions to the identified problems, as well as put forward outlines for future building maintenance programmes. Maintenance, therefore, sums up positive efforts and activities aimed at sustainability of the life of any structure. The healthy existence and use of these structures (housing estates inclusive) is a necessary requirement for improving the well-being of any nation.

Chohen, Che-Ani, Memon, Tahir, Abdullah and Ishak, (2010) noted that professionals design and construct buildings that they often never use, and so their views on liveability should be considered less than the views of the residents who occupy them. This view has particular application to maintenance of the buildings and facilities. As such, the views of residents are important in investigating the performance of building components to meet the needs and expectations of the residents. This is because users give their views and feelings about buildings-in-use based on their experience and interactions with buildings.

It has also been noted in literature that, in Nigeria, most housing estates, whether privately or publicly owned or rented, were very poorly maintained, mainly due to poor preventive methods, poor building maintenance culture and fairly high cost of maintenance (Usman, Gambo & Chen, 2012). Similarly, Waziri and Vanduhe (2013) identified some factors that led to poor maintenance conditions in buildings and facilities as follows; aging of the buildings, use of substandard materials for maintenance works, moisture problems from leading to leakages, lack of trained/skilled maintenance team, poor communication in maintenance process and poor preventive methods, among others.

Maintenance theory jungle which guides building assessment and maintenance was adopted for the study. The concept of a 'Management Theory Jungle' was introduced by Harold Koontz (Deryk , 2015). The original "jungle" referred to the apparent tangle of different approaches to management theory at the time Deryk published it in 1961. It is argued that there are similarities between the characteristics of the 'management jungle' proposed by Koontz and the state of maintenance management theory at that time. These similarities concerned with environmental and the contextual characteristics of the 'jungles'. It is, therefore, proposed that there is a similar jungle of approaches to maintenance and maintenance management. This is referred to as 'The Maintenance Theory Jungle' (Deryk , 2015).

There six identified schools of maintenance theory: (i) The Process School (ii) The Mathematical (iii) The Reliability School (iv) The Quality School (v) The Work Management School (vi) The Condition Based School

In the context of this study, the Condition Based School of thought approach to maintenance management was adopted to undergird this study. It focuses on the identification and measurement of parameters which can be used to identify or predict the onset of failures in buildings. The study adopted this focus to ensure optimum performance for buildings and facilities in private housing estates in Enugu, Nigeria. The Condition Based School includes reference to Condition Monitoring, Predictive Maintenance, or "Just-In-Time" Maintenance. The Condition Based School gives insight to the actual condition of the component or building assessed. The school is concerned with the identification and measurement of parameters that can be used to identify or predict the onset of building failure. This is used to correct condition of the building before or after the failure actually occurs.

Area of study

Enugu metropolis is the capital town of Enugu State, located in south-eastern part of Nigeria. It is located approximately between latitudes 60 21" N and 60 30" N of the equator and longitudes 070 26' E and 70 37" E of the Greenwich Meridian. The city was the administrative headquarters of the Eastern provinces and the regional capital (between 1939 and 1967). Enugu metropolis comprises the following local government areas: Enugu East, Enugu South and Enugu North as

seen Figure 1. The estimated population of Enugu urban area in 2023 is between 809,423 and 847,000 (Population stat, 2023; Macrotrends, 2023). This estimate represents the urban cluster of Enugu, which typically includes population of Enugu and that of surrounding suburban areas.

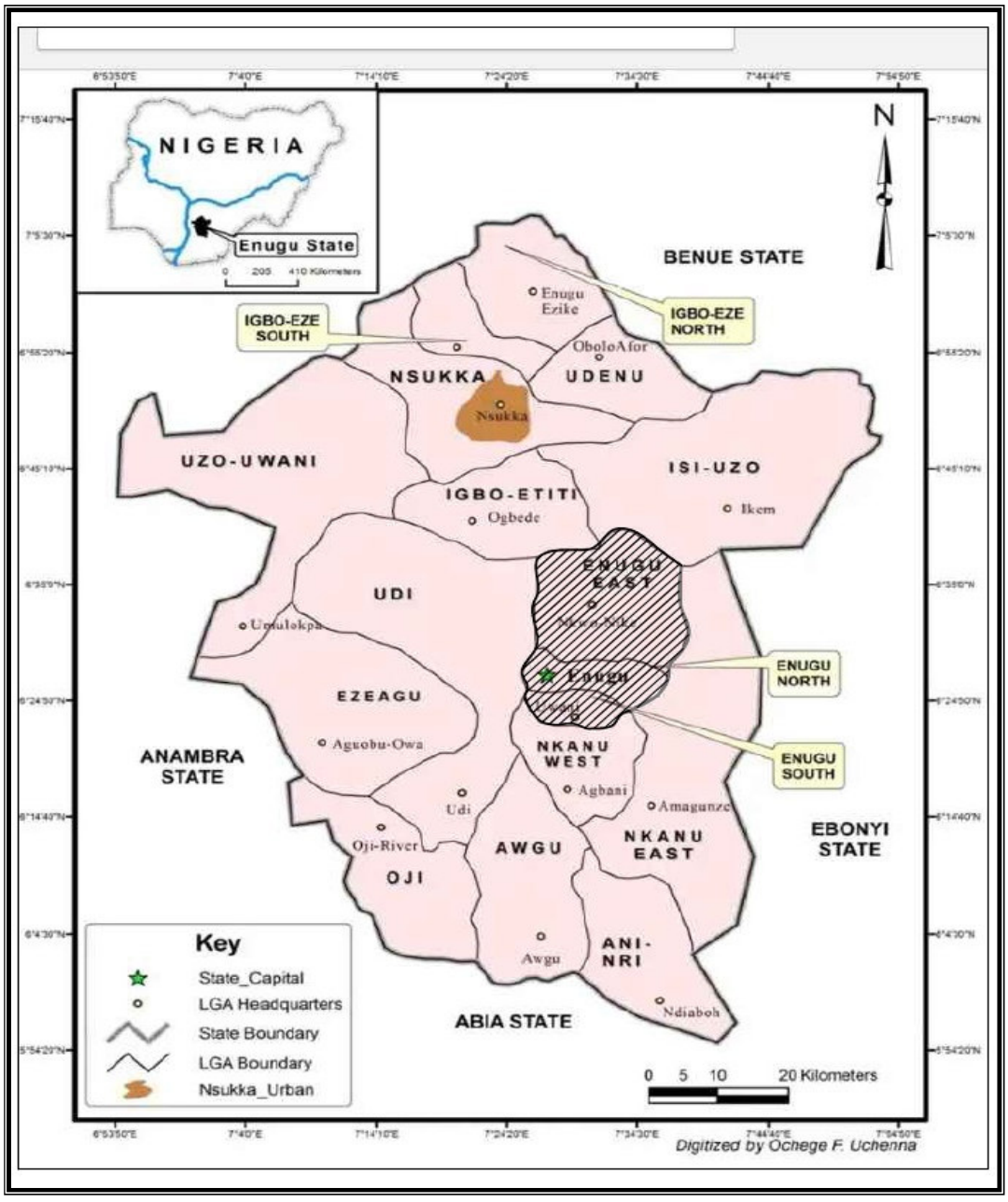

Figure 1: Map of Enugu state presenting Enugu Metropolis
Source: Ochege (2018)

METHODOLOGY

The research design adopted for this study was survey method; this was done through use of questionnaire and interview guide to obtain data from respondents in the area of study. The research population for this study included completed private housing estates within Enugu city, built and inhabited before the year 2016. They are: Bethel Estate, Central Bank Staff Quarters, Cosco Estates, Elim Estate, Goshen Estate, Refiners Estate and Nwannedinamba Housing Estate. Stratified random sampling of the estates based on building type was the adopted sampling method for the study. The building types in the estates were: 1-bedroom and 2-bedroom bungalows combined, 2-bedroom blocks of flats and 3-bedroom blocks of flats combined, 1-bedroom, 2-bedroom and 3-bedroom bungalows combined as shown in Table 1.

Table 1: Private estates in Enugu metropolis stratified by housing type existing in them

S/N	1-BEDROOM AND 2-BEDROOM BUNGALOWS	1-BEDROOM, 2-BEDROOM AND 3-BEDROOM BUNGALOWS	1-BEDROOM AND 2-BEDROOM FLATS	2-BEDROOM AND 3-BEDROOM FLATS
1	Nwannedinamba estate	Goshen estate	Elim estate	COSCO estate
2		Bethel estate		Refiners Estate
3		Elim estate		Central Bank quarters
4				Elim estate

Source: Field work (2018)

Following this stratification, random sampling by balloting was done and the following estates were picked to represent the different building types:

i. *1-bedroom and 2-bedroom bungalows*: - Nwannedinamba estate
ii. *1-bedroom, 2-bedroom and 3-bedroom bungalows*: - Bethel estate and Elim estate
iii. *1-bedroom and 2-bedroom terrace flats*: - Elim estate
iv. *2-bedroom and 3-bedroom flats*: - Central Bank quarters

Sampling size was derived using Cochran formula for finite population:

$$n = \frac{Z^2 \times \sigma^2_p \times N}{(N-1)\, e^2 + Z^2 \times \sigma^2_p}$$

Where n = size of sample for finite population; N = research population = 766 housing units; σp = standard deviation of population assumed = 0.5; e = significance level (precision/acceptable error) chosen = 0.05; Z = standard variate at a given confidence level (1.96) for a confidence level of 95% (Kothari, 2004). A sample size of 256 respondents was derived and distributed to the estates in ratio of their contribution as shown in Table 2.

Table 2: Respondents Population in Sampled Estates

NUMBER	NWANNEDINAMBA ESTATE	BETHEL ESTATE	ELIM ESTATE	CBN QUARTERS	TOTAL
Existing	50	131	324	261	766
Sampled	17	44	108	87	256

Source: Field work (2018)

RESULTS AND DISCUSSION

Descriptive summary measures and frequency distribution for each of the variables studied were done. ANOVA test of analysis was also conducted to test significant difference from the research data using Statistical Package for Social Sciences.

Analysis of characteristics of roads within the estate

Data analysis on characteristics of roads within the estates showed that a majority of the roads are tarred but were in disrepair. A small percentage (7.6%) stated that the roads were not tarred but in good condition (see Table 3). The state of the disrepair is as a result of inadequate maintenance of the roads.

Table 3: Aggregated data on characteristics of roads within the estate

VALUE LABEL	FREQUENCY	VALID PERCENT	CUMULATIVE PERCENT
Untarred and dilapidated	18	22.0	22.0
Untarred but in good condition	52	7.6	29.7
Tarred but in disrepair	114	48.3	78.0
Tarred without drainage	25	10.6	88.6
Tarred with drainage	27	11.4	100.0
Total	236	100.0	

Source: Field work (2018)

Analysis of state of drainages within the estate

The state of drainages was investigated and the results show that drainages with minor blockage had the largest percentage (56.8%) while drainages with major blockage were less (6.4%). This is further shown in Table 4. The drainages with major or minor blockages implied that they are not been maintained (i.e regular cleaning). This leads to flooding within the estates when it rains, provides breeding ground for insects among other effects which contribute to poor conditions for human inhabitation.

Table 4: Aggregated data on state of repair of walls

VALUE LABEL	FREQUENCY	VALID PERCENT	CUMULATIVE PERCENT
Major blockage	15	6.4	6.4
Minor blockage	134	56.8	63.1
Clean	87	36.9	100.0
Total	236	100.0	

Source: Field work (2018)

Analysis of state of repair of buildings

Data for this variable showed that greater proportion of the buildings in the study area requires minor repairs while a few needs major repairs and 32.6% were good to be considered as sound. These results are shown in Table 5. The buildings requiring major repairs need to be worked on, to get the buildings to a level of structural integrity as they were risky for human inhabitation.

Table 5: Aggregated data on state of repair of buildings

VALUE LABEL	FREQUENCY	VALID PERCENT	CUMULATIVE PERCENT
Requires major repairs	18	7.6	7.6
Requires minor repairs	141	59.7	67.4
Sound	77	32.6	100.0
Total	236	100.0	

Source: Field work (2018)

Analysis of functionality of street lights and signage

Shown in Figure 2 are the data on functionality of street lights and signage in the estates as reported by the respondents. The results show that a greater percentage (87.3%) of the respondents stated that there were no functional street lights and signage within the estates. The street lights stopped being functional because poor maintenance activities on them. They need to be fixed to improve security surveillance at night given the security situations in the country now.

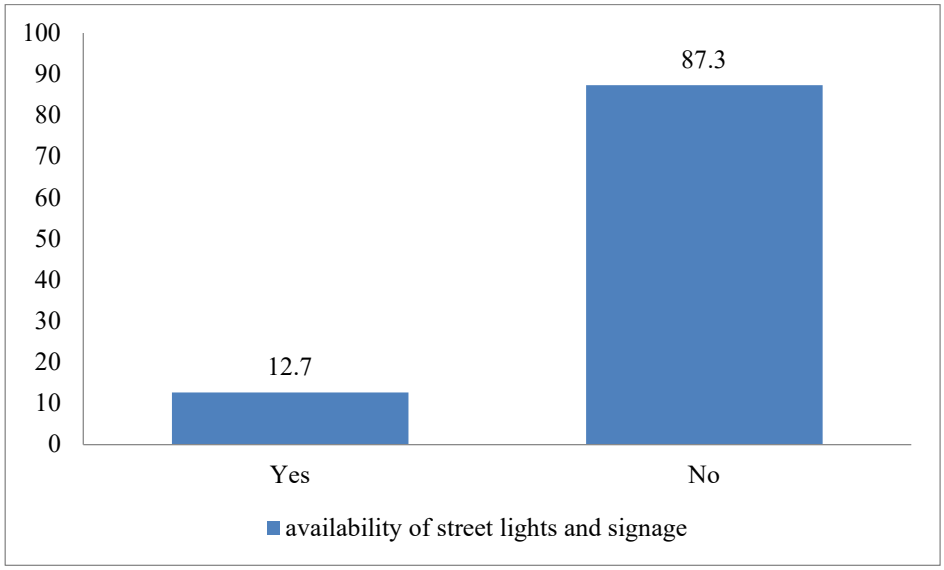

Figure 2: Availability of street lights and signage
Source: Field work (2018)

Analysis of organisers of facilities maintenance in the estate

The aggregated results from the analysis show that facilities maintenance in the estates was majorly done by the residents as shown in Table 6. This result implied that residents undertake maintenance of facilities, sometimes they do this reluctantly as they reported in private interviews in the course of administration of questionnaire. That could be the reason why some of the facilities are in poor state.

Table 6: Aggregated data on facilities maintenance in the estates

VALUE LABEL	FREQUENCY	VALID PERCENT	CUMULATIVE PERCENT
Estate Managers	12	5.1	5.1
Residents	160	67.8	72.9
Both parties	64	27.1	100.0
Total	236	100.0	

Source: Field work (2018)

Test of Hypothesis

The hypothesis: 'there is no significant difference in the maintenance of facilities in the private housing estates in Enugu metropolis was tested. Table 7 shows the one-way ANOVA test results for the differences between the estates in maintenance of facilities. The results show a significance value of 0.011. It implies that there is a significant difference between the four groups in maintenance of facilities in the private housing estates. The null hypothesis is thus, rejected and the alternate hypothesis accepted; which is that: 'there is significant difference in the maintenance of buildings and facilities in the private housing estates in Enugu metropolis'

Table 7: One-way ANOVA analysis test results showing the difference between groups in the Maintenance of facilities in the estate

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Maintenance of facilities in the estate	Between Groups	3.036	3	1.012	3.817	.011
	Within Groups	61.506	232	.265		
	Total	64.542	235			

Source: Field work (2018)

The results were further exposed to a Tukey HSD post hoc test to determine the level of significance within the groups. The results are shown in Table 8. This meant that CBN quarters had a significant difference in maintenance of facilities with 'Nwannedinamba' estate. The outcome showed that showed that Nwannedinamba estate had a much higher maintenance of facilities than CBN quarters (.464), Bethel estate had a higher maintenance of facilities than CBN quarters (.164) and Elim estate also had a much lower maintenance of facilities than CBN

quarters (.064). It was found also that there was significant difference between Elim estate and 'Nwannedinamba' estate in maintenance of facilities. The implications were namely:

i. CBN quarters was inferior to other estates in the maintenance of facilities.
ii. 'Nwannedinamba' estate was superior to other estates in the maintenance of facilities.
iii. There seemed, therefore, to be additional regular effort by residents of 'Nwannedinamba' estate towards maintenance of facilities as the variable investigated suggests.

Table 8: Tukey HSD Post Hoc analysis test results showing the nature of difference between Maintenance of facilities in the estate

MULTIPLE COMPARISONS							
Tukey HSD							
Dependent Variable	(I) Housing estate	(J) Housing estate	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Maintenance of facilities in the estate	CBN Quarters	Bethel Estate	-.164	.100	.353	-.42	.09
		Elim Estate	-.064	.077	.838	-.26	.13
		Nwannedinamba Estate	-.464	.145	.008	-.84	-.09
	Bethel Estate	CBN Quarters	.164	.100	.353	-.09	.42
		Elim Estate	.100	.096	.727	-.15	.35
		Nwannedinamba Estate	-.300	.156	.221	-.70	.10
	Elim Estate	CBN Quarters	.064	.077	.838	-.13	.26
		Bethel Estate	-.100*	.096	.727	-.35	.15
		Nwannedinamba Estate	-.400*	.143	.028	-.77	-.03
	Nwannedinamba Estate	CBN Quarters	.464	.145	.008	.09	.84
		Bethel Estate	.300*	.156	.221	-.10	.70
		Elim Estate	.400	.143	.028	.03	.77

Source: Field work (2018)

CONCLUSION

The research has statistically proven that there is a significant difference between the private housing estates in Enugu metropolis, in maintenance of building facilities in the estates. Revealed also are the post hoc test results which additionally showed that 'Nwannedinamba' estate was superior to other estates in the maintenance of facilities. It was followed by Bethel and Elim estates and lastly by the CBN quarters in the variable investigated. Okoye (2020) stated that the maintenance of residential buildings (public or private) is imperative for any investor involved with buildings, and the ill consequences of not maintaining a building in a housing estate would be noticeable as soon as the building is occupied or put to use. So, this should be

taken into consideration while developing private housing estates. On prompt maintenance of facilities (in buildings or in the neighbourhood), promulgation of adequate legal provision to enable the managers enforce the maintenance is advocated

Umeora, Olotuah and Ezeji, (2019) established that average monthly income affects maintenance level of facilities in private housing estates. This implies that amount of money earned by residents affects their level of satisfaction with maintenance of facilities within the population of study. It was recommended that private housing rent be made affordable (30% of average monthly income), so that the residents can afford maintenance of facilities in the estate, thereby achieve satisfaction. This is because inadequate maintenance fund has been recognized as the major factor which hinders the effectiveness and efficiency of most maintenance programs (Maduka, Olotuah & Ezeji 2019). The implication, therefore, is that stakeholders in the housing sector should vigorously engage with the estate managers whose responsibility it is to run the estates to see the necessity to maintain facilities within the estates. Estate managers should also track performance by regular visits and interactions with the residents. The information gained through this feedback system would then be used for guiding them towards achieving effective management system. Policy guidelines and integrated action and co-operation of relevant professionals and all stakeholders involved in the planning, development and management of private housing estates in Enugu are recommended to ensure adequate maintenance level.

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