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An examination of the factors responsible for the elimination of existing vegetation in urban housing environment in Nigeria

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Abstract

The growth of urban population has placed huge demand on housing and many Governments in Nigeria are working tirelessly to address the shortfall. The development of mass housing schemes have become the norm in many Nigerian cities and this affects the vegetative cover of the city. The architects have been faced with the challenge of designing houses that meets the need of the people, in so doing the majority of the housing designs in the urban areas have often assumed the plot to be bare lands. The problem with this type of design assumption is that it allows for clearing of existing vegetation including trees thereby creating the need to plant new vegetation. The aim of this paper is to examine the integration of existing vegetative cover into the housing provision. The research method involves the use of observation schedule and questionnaire which was administered to the housing residents of selected urban areas in northern Nigeria and selected architects. The results showed that many architects assume the land is free when designing and that majority of the vegetative cover are planted after construction. The findings from the respondents showed that the need for introduction of new plants and clear space for building ranked highest as reasons for clearing of the site. This action affects the sustainability of environment where these houses are located which is a challenge for house owners and the community at large. The paper concluded that there is need for the architects and the house owners to seek ways of ensuring that their house designs are integrated with the existing vegetative cover.

Keywords: architects, design, housing, urban, vegetation

1. Introduction

One of the challenges of urban growth has been an increase in demand for housing and the deficit of provision of such houses (Jiboye, 2011; Ugonabo & Emoh 2013; Akinyode & Tareef 2014). The cost of housing has been on the rise in Nigeria with the nature of the economic growth or decline experienced in the country (Anugwom, 2001; Efina & FinMark Trust 2010). The urban poor and the low income group of urban dwellers are the ones most affected by the deficit of housing amongst the many challenges which affects their wellbeing (Adedayo, 2015). The involvement of the Government of Nigeria in housing both at the Federal and State levels has been towards large scale housing provision, through the provision of mass housing schemes. In other cases the government had served as enabler for the private sector towards meeting the housing demand through the Public Private Partnership (PPP) (Ademiluyi, 2010). In an attempt to meet this demand huge expanse of land is required. The provision of mass housing schemes and estates has seen large expanse of agricultural land and forest disappear giving way for the built-up areas with accompanying bare land problems (Haq, 2011). The housing deficit in Nigeria which has been put at 17 million by many researchers (Anugwom, 2001; Olotuah &Taiwo, 2013; Adedayo 2015; Gemade 2014; Asojo, 2010) has encouraged architects to focus on meeting the housing quantity demand and not the environmental

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requirements as much in many cases. In majority of the housing estates developments in Nigeria that the sites are usually stripped of all vegetation before commencement of the construction. This act is based on the architects' design which usually presumes the site is plain and empty, hence the need for a proper understanding of site analysis and its application to design in order to ensure a sustainable environment (Olotuoh & Ajemifujah, 2009). The usual plan in majority of the housing estates is to plants new trees and shrubs to counter the adverse effect of the clearing of the land. It is difficult to achieve the old vegetative cover considering how long it takes for these plants and trees to grow. In many cases the house owners deviated from the initial plan of the architect based on the nature of the housing transformation (Adedayo, 2013). This trend is also observable in informal settlements where the house owners are responsible for everything within their plot which usually focuses on the house itself and later consideration for the environment. The plot size is usually a major consideration for the house owners in terms of the design brief they provide for the architect. A study of the houses in the urban areas in Nigeria revealed that they are usually not designed and built in line with the environmental preservation (Anunobi, Adedayo and Adedokun 2017). It is common therefore to find buildings designs which create bare ground in the urban areas which are are finished with different floor finishes such as concrete, interlocking tiles and bare. These type of floor finishes usually comes with environmental challenges that make the house uncomfortable for the house owners, which increases the cost of running the house. It is the aim of this paper to examine how housing design decisions in mass housing schemes in urban areas have created bare lands that are not environmentally friendly.

1.1. Design Considerations for Housing Estates in Nigeria

The approach to housing design as it affects the house owner in the case of individual housing has been such that the house owner was the focus of the design and the design brief was centred on him. In the case of the housing estates the focus of design is quite different as a top-down approach is always applied, which ensures that a prototype design is developed and applied (Olotuah & Aiyetan, 2006). The issues that are considered in the case of mass housing include the number of bedrooms, the size of the spaces and the choice of finishes to be applied (Okechukwu, 2009). It is common to find that, there is always a generalised design for the house owners regardless of the location of the estate (Zubairu, 2006; Tipple, Owusu & Pritchard, 2004; Olayiwola, Adeleye & Ogunshakin, 2005). There is usually not count of the number of trees and area of vegetation that is cleared for such construction. The nature of the land available for the construction of the housing estates is never completely flat nor bare rather it contains varied site conditions which are not documented in the site analysis not captured by the house design since they are not specific. It goes to show that in places or regions where there are flat and bare lands the design suffices, in the context of the discussion however when you compare to areas that have high vegetative cover, there is problem of creating the required spaces for the construction of the building. It is important therefore to consider the site analysis undertaken by the architect towards achieving an environmentally friendly housing estates. According to Woodcraft, Hackett, & Caister-Arendar (2011), many architects and housing developers are developing houses that are at variance to the environment they are located in. The lifestyle of the prospective house owners is something that requires serious consideration as they are always different as some would love to spend time within their premises which could be encouraged with the principle of designing around site features. This would affect the type of land cover and vegetation that is left after construction and also how the building design is achieved.

1.2. Incorporating site features in housing design

An in integral part of any housing estate is the nature of the open spaces available within the estate, the open spaces is usually considered as the core of the housing estate according to Licka, Rode, & Bistricky (2013). It is expected that the open spaces are simply not just bare lands as created by the housing developers, but that the provision of vegetation is key in keeping the place functional and sustainable. Mensah (2014), opined that there has been consistent destruction of the urban green spaces with the nature of urbanisation of which is often directly linked to the volume of housing development as many of the housing settlement are built after a complete clearance of the site. It is opined by Gairola & Noresah (2010), that there is need to monitor the changes in land use in urban areas in order to ensure sustainability, this would help stem the problem mass housing schemes

designs which creates bare lands that negates environmental sustainability. To achieve this, the need for the integration of specific site features becomes apparent for the housing developer. This is necessary because it would reduce the negative effect that housing causes to the environment which makes it unsustainable as the environment becomes hotter due to the nature of the ground finishes and the destruction of the vegetative cover that is often attempted to be replaced by the house owners or developers however, it takes a longer period to achieve. According to Collins, Kinzig, Grimm, Fagan, Hope, Wu, & Borer (n.d), many cities are becoming more artificial as they develop because the buildings are not designed and built to fit into the immediate environment where they are located hence, the need for significant mechanical means of running the buildings including housing. The benefits of incorporating site features into housing designs is quite enormous as it ensures that the houses are environmentally friendly, sustainable and cheaper to run and maintain (Mugerauer, 2010; Haq, 2011; Super, Vellend, & Bradfield 2013). The challenge for the house owners and users is how to make their housing functional and also sustainable in terms of what they provide within their premises that could affect the overall success of the estate

2. Methods

A Post Occupancy Evaluation (POE) method was adopted in the study which according to Adedeji and Fadamiro (2012) is adequate for studies of this nature. In undertaking this study, a mixed method approach was used to elicit data from the respondents. A descriptive survey was adopted with the use of questionnaire and observation schedule which were administered by Postgraduate students who served as research assistants. The data on the individual houses were obtained with the observation schedule. A total of Six hundred copies of questionnaire and observation schedule were administered in six selected cities in Northern Nigeria which were randomly selected from the State Capitals in the study area. Research has shown that the mass housing schemes in Nigeria are often concentrated in the State Capitals. In doing this, each selected city (Minna, Kaduna, Lokoja, Ilorin, Lafia and Markurdi) was allocated one hundred copies each of the questionnaire and observation schedule. It was assumed in the study that the estates in the cities were similar to each other and reflected the similar characteristics hence four estates were selected from each city. Based on the housing population of not less than 50 units the respondents and the sampled house were selected using stratified sampling method and their result was aggregated. A total of 568 copies of the observation schedule was returned while 424 copies of the questionnaire was returned thereby giving a response rate of 94.67% and 70.67% respectively. The returned rated showed that it is adequate for analysis as stated by Porter, (2004); Carley-Baxter, Hill, Roe, Twiddy, Baxter and Ruppenkamp, (2009). The data was analyzed using descriptive statistics in SPSS, the results are presented in Tables, Charts and Plates. The respondents' perception of integration of site features in the building design was analyzed and the value was determined through Likert Scale calculation of the mean scores for each variable measured.

3. Findings and Discussion

3.1 Adapting the Vegetative Features into Housing Design

In examining the different housing units and its premises it was observed from the data obtained, the architects made little attempt towards incorporating the vegetation into the house designs. This was evident as many stated that they preferred clear space, hence they were satisfied that the house designs catered for such need even if it involved doing away with the trees and shrubs originally on the site. It could be seen from Figure 1 that only 11% of the houses preserved some of the existing trees. It implied that the 89% who did not preserve their trees would need to spend more resources to provided and maintain the trees which would take longer time to mature. From Figure 2, it can be seen that only 21% of the respondents did not have their building site cleared during construction of the house while 79% created bare lands that required other forms of ground cover. In the creation of bare lands the major factor is the level of integration of the existing vegetative features in the building design. It was observed from Figure 3 that only 4% of the respondents had houses that incorporated the existing vegetation in its design. This act of maintaining existing land cover in areas outside the building ensured that the house fitted into the environment where the house was located hence reducing the challenges of sustainability regarding bare lands which agrees with (Mugerauer, 2010; Haq, 2011; Super, Vellend, &

Bradfield 2013). The usual practice when the existing vegetation has been cleared is to replace with other forms of floor finish which could usually be harmful to the environment. The use of the existing vegetative cover ensures that the destruction of the environment is minimal and that the plants can continue its normal growth. It also reduce the maintenance required for such plants and the challenges posed with time if the plants had to grow from scratch as is the case in many replanted vegetation.

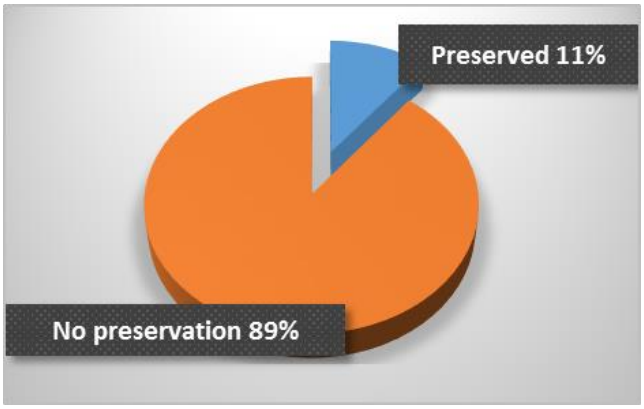

Figure 1: Distribution of trees preservation in premises

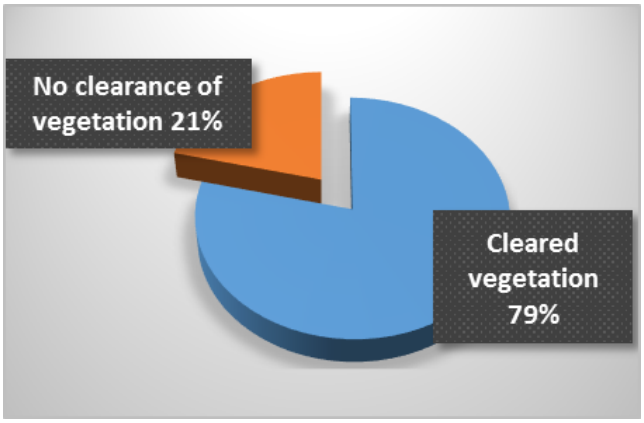

Figure. 2: Distribution of nature of vegetation in premises

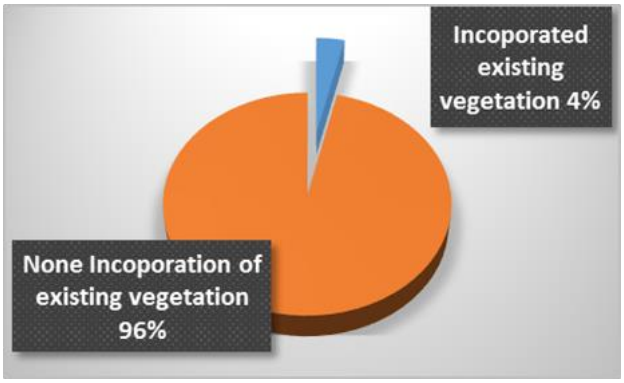

Figure 3: Level of incorporation of existing vegetation in house design

3.2 Basis for Clearing of Vegetation for Housing

In examining the essence of clearing the site and making it bare, seventeen questions possible reason were provided to respondents to rate using a four point likert scale. Each option had allotted score which ranged between 1 and 4, each respondent was expected to select a score that best suits his opinion regarding the variable. The allocation of the scores to the level of agreement is stated as follows:

Strongly Agree	1
Agree	2
Disagree	3
Strongly Disagree	4

In Table 1 the distribution of the respondents based on their rating as it affects each variable shows that the total number of respondents to each variable range between 412 and 424. This is considered adequate for the study as not all variables in the returned questionnaire were filled. Further analysis of the variables is undertaken using the likert scale calculation by multiplying each value of response as shown in Table 2.

Table 1: Distribution of respondents' opinion on basis for removal of existing vegetation

S/N	Item	SA	A	D	SD	Total
1	Clearing the vegetation allows for maximum plot space.	86	261	45	23	415
2	Removal of old trees will reduce risk of cracks	41	195	108	68	412
3	Removal of trees allows for free designs	178	108	79	59	424
4	Bare ground allows for expression of beauty	49	96	177	97	419
5	Removal of trees allows for effective building space	212	112	52	38	414
6	Removal of trees allow for planning of landscaping	50	274	51	47	422
7	Removal of vegetation allows for erosion control	21	86	102	215	424
8	Allows for introduction of new foreign plants	237	128	32	21	418
9	Allows for proper location of outdoor activities	71	182	104	58	415
10	Allow for gardening activities	65	197	71	91	424
11	Allows for aligning of buildings with other buildings	18	121	210	75	424
12	Clear allows for social gathering	186	132	85	21	424
13	Clearing reduces cost of adapting building to site	32	87	127	173	419
14	Allows proper planning for shading of building	97	229	54	42	422
15	Allows for provision of infrastructure	19	88	237	73	417
16	Reduction in frequency of cleaning the premises	43	112	201	57	413
17	Allow for equal plot space distribution within settlement	14	53	92	264	423

Table 2: Weighted score of respondents' opinion on basis for removal of existing vegetation

S/N	Item	SA (X1)	A (X2)	D (X3)	SD (X4)	Sum of Total
1	Clearing the vegetation allows for maximum plot space.	86	522	135	92	835
2	Removal of old trees will reduce risk of cracks	41	390	324	272	1027
3	Removal of trees allows for free designs	178	216	237	236	867
4	Bare ground allows for expression of beauty	49	192	531	388	1160
5	Removal of trees allows for effective building space	212	224	156	152	744
6	Removal of trees allow for planning of landscaping	50	548	153	188	939
7	Removal of vegetation allows for erosion control	21	172	306	860	1359
8	Allows for introduction of new foreign plants	237	256	96	84	673
9	Allows for proper location of outdoor activities	71	364	312	232	979
10	Allow for gardening activities	65	394	213	364	1036
11	Allows for aligning of buildings with other buildings	18	242	630	300	1190
12	Clear allows for social gathering	186	264	255	84	789
13	Clearing reduces cost of adapting building to site	32	174	381	692	1279
14	Allows proper planning for shading of building	97	458	162	168	885
15	Allows for provision of infrastructure	19	176	711	292	1198
16	Reduction in frequency of cleaning the premises	43	224	603	228	1098
17	Allow for equal plot space distribution within settlement	14	106	276	1056	1452

In determining the ranking and the decision of the variables that were measured, the means for the variables were calculated using based on the likert scale measurements. The range for determination of the decision per variable is stated as follows:

1.0 -	1.49	Strongly Agree
1.5 -	2.49	Agree
2.5 -	3.49	Disagree
> 3.5		Strongly Disagree

The decision on each variable is indicated in Table 3, where it can be observed that seven of the variables had the decision on as disagree. This implies that their aim as indicated in the variable could be achieved without necessarily clearing the whole plot. The introduction of foreign plants ranked tops and this can be understood because many house owners always love to beautify their house hence the choice of plants and shrubs that are often not native to that site which agrees with Collins, Kinzig, Grimm, Fagan, Hope, Wu, & Borer (n.d). The fact that plots sizes in the urban areas are usually fixed and could be expensive usually demand that the house owners have their plots maximised during the construction of their house, this was probably the reason why effective building space ranked second. The argument that bare lands would allow even plot distribution in many urban settlements or estates was the variable with the highest level of disagreement with the respondents considering that the plots could never be equal regardless of the situation on ground. The argument that replacing the existing ground cover would reduce the frequency of cleaning was in disagreement with the respondents as they felt that cleaning of the compound was a personal decision with little impact of the ground finish.

Table 3: Mean score of respondents' opinion on basis for removal of existing vegetation

S/N	Item	Sum of Total	Mean	Decision	Rank
1	Allows for introduction of new foreign plants	673	1.610048	Agree	1st
2	Removal of trees allows for effective building space	744	1.797101	Agree	2nd
3	Clear allows for social gathering	789	1.860849	Agree	3rd
4	Clearing the vegetation allows for maximum plot space.	835	2.012048	Agree	4th
5	Removal of trees allows for free designs	867	2.044811	Agree	5th
6	Allows proper planning for shading of building	885	2.097156	Agree	6th
7	Removal of trees allow for planning of landscaping	939	2.225118	Agree	7th
8	Allows for proper location of outdoor activities	979	2.359036	Agree	8th
9	Allow for gardening activities	1036	2.443396	Agree	9th
10	Removal of old trees will reduce risk of cracks	1027	2.492718	Agree	10th
11	Reduction in frequency of cleaning the premises	1098	2.658596	**Disagree**	11th
12	Bare ground allows for expression of beauty	1160	2.768496	**Disagree**	12th
13	Allows for aligning of buildings with other buildings	1190	2.806604	**Disagree**	13th
14	Allows for provision of infrastructure	1198	2.872902	**Disagree**	14th
15	Clearing reduces cost of adapting building to site	1279	3.052506	**Disagree**	15th
16	Removal of vegetation allows for erosion control	1359	3.205189	**Disagree**	16th
17	Allow for equal plot space distribution within settlement	1452	3.432624	**Disagree**	17th

3.3. Nature of Ground Cover within House Premises

In clearing the site of all it vegetation the house owner is left with several options for the ground cover of his premises. The usual choice of ground cover is often a function of desire for aesthetics and that of cost, while in some case it is a function of maintenance which could end up affecting the environmental condition of the settlement or estate. In Figure 4 it was observed that 44% of the houses left with sand a ground finish while 51% of the houses bare areas were filled with materials that are concrete based in terms of mass concrete and concrete tiles. The volume of concrete used is a function of the spaces that are left undeveloped which in many cases includes the parking areas. The sand option is usually not something that the house owners plan for rather some stated that they simply chose to use sand because it was cheaper and they spread the left over sand from construction. A major problem with the use of concrete material is that of heat gain, which is usually increased due to ground finish, in many cases a small port of the premises usually along the fence is dedicate for flowers. The implication of the heat gain means that the house owners would require some form of mechanical means of cooling the building for it to be habitable, given the nature of climate change that is being experienced, getting the building comfortable and by extension the settlement becomes a problem. In Figure 5 it was observed that only 35% of the houses had planted

some form of flowers or shrubs after occupying the house. It could be assumed that house owners did not considered the flowers and shrubs as important as other housing matters. A key factor in the provision of flowers and shrubs is the issue of maintenance in terms of watering of the tendering to the plants as many of them are usually not native to the environment. It is usually better to adapt the building to the environment as much as possible because the plants and vegetation are already used to the climatic conditions of the region hence they would be easier to maintain and serve the required purposes. The trees are usually established hence the long years required for the trees to mature and serve their purpose of shading the building would be reduced in the native plants and trees are preserved this agrees with the view expressed by Olotuoh & Ajemifujah, (2009).

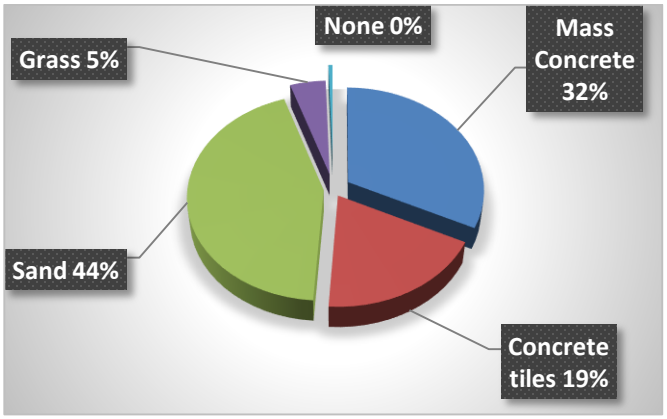

Figure 4: Distribution of various ground covers

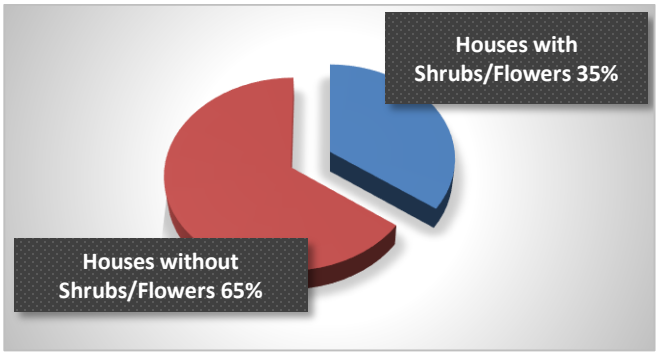

Figure 5: Percentage area of plot covered by building

4. Conclusion

In the design of houses the house owner is usually the person who has to give approval based on the advice of the architect in charge of the project. It is also known that the house owner would be responsible for the operation and maintenance of the house, however, majority of the house owners leave decisions to the architect to take on their behalf. This type of design process is even more pronounced in the development of housing estates where only the recreation part is often left with vegetative cover. It was established in the study that the housing site is usually cleared of all trees and shrubs and many times the design of the buildings does not take into account the site features towards integrating it into the design. The overall site is usually left bare with the clearance so as to allow for free access during construction and for beautification after construction. In ranking some of the supposed benefits and reasons for clearing of the site, the respondents disagreed with some of the points raised. It implies that these points raised to should be examined in such a way that the natural site features in terms of trees, shrubs and vegetation could be left undisturbed and integrated into the house design. In cases where the bare lands have been created there is need to ensure that significant effort is placed towards providing vegetative cover in terms of trees, flowers, shrubs and grasses rather than the emphasis on concrete materials. The shading of the building according to the respondents was beneficial through the planting new trees. In order to improve this benefit of proper shading of buildings a combination of existing trees and new ones could be practiced. Attention should be paid towards ensuring that sites are not cleared of its total vegetation rather they should be planned in such a way that they are fused into the house design.

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