LAGOS JOURNAL OF ENVIRONMENTAL STUDIES

Vol 8, No 2 (2016)

Table of Contents

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LAGOS JOURNAL OF ENVIRONMENTAL STUDIES

FACULTY OF ENVIRONMENTAL SCIENCES, UNIVERSITY OF LAGOS, NIGERIA

February 1, 2017

Dear Dr Popoola, **ACCEPTANCE OF Manuscript:**

Your Paper entitled **ASSESSMENT OF PHYSICAL CHARACTERISTICS OF PERI-URBAN RESIDENTIAL NEIGHBOURHOODS IN MINNA, NIGERIA** been reviewed and accepted for publication in the next issue (Volume 8, No 1&2, 2016) of the Lagos Journal of Environmental Studies.

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ASSESSMENT OF PHYSICAL CHARACTERISTICS OF PERI-URBAN RESIDENTIAL NEIGHBOURHOODS IN MINNA, NIGERIA

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ABSTRACT

Inadequate infrastructure and poor housing conditions are basic characteristics of peri-urban neighbourhoods in the less developed countries. This study assessed the physical characteristics of selected peri-urban neighbourhood in Minna, Nigeria. Cluster sampling method was adopted in the selection of the sampled neighbourhoods. A Total of 600 houses were sampled, while 29 housing and infrastructure attributes were adopted in determining the physical condition indices. Two-step cluster analysis was employed in assessing similarities in physical characteristics of environmental condition of the selected neighbourhoods. Analysis revealed that Environmental quality indices of the sampled neighbourhoods ranges between 0.60 and 0.73; rating the environmental conditions of the sampled neighbourhoods as fair, though, quality of houses and conditions of infrastructure varies within and across the neighbourhoods. Conditions of houses in the selected neighbourhoods rated higher than the infrastructure provided in the neighbourhoods. This is an indication that all selected neighbourhoods are deficient in infrastructure to support increasing development of the built environment. Also, result of the Two-Step Cluster revealed that all sampled peri-urban residential neighbourhoods are distinct, yet similar in term of physical features. However, neighbourhoods in close proximity in term of geographical location are more similar in physical features than distant neighbourhoods. The study recommended participatory planning and infrastructure provision for the achievement of a sustainable and inclusive city.

Keywords: peri-urban, physical characteristics, housing and residential neighbourhoods.

INTRODUCTION

As city grows spatially, demand for housing and commercial space increased, creating competition for land between real estate developers and non-urban users (Venkatesh, 2012). This increase in demand for land has led to the taken-over of most 'undeveloped land' at the urban fringe by migrants to satisfy their urban land needs (Agbola and Agunbiade, 2009). These peri-urban areas, which develop along the periphery of cities, highways and major roads connecting a city are characterized by uncontrolled and unorganized developments and lacks basic amenities like treated water supply, sanitation/sewerage system, and primary health centre, amongst others (Agbola and Agunbiade, 2009; Shivendra and Ramaraju, 2013).

In spite of enormous shortages and lack of basic infrastructure, many of these settlements are able to gradually consolidate with some of them acquiring public services and legal status after decades of foundation (Blanco and Kobayashi, 2009).The haphazard development of peri-urban region can be attributed to lack of foresight by urban planners in the course of city planning, policy and decision-making process. They had not been able to adequately make provision for how urban fringe can be effectively integrated in to the urban fabrics in case of eventual expansion of the city. The ripple effect of

these loopholes in planning is seen in the proliferations of slum and squatters settlements in the urban fringes.

This study assessed the physical characteristics of the peri-urban residential neighbourhoods of Minna in order to establish similarities in physical condition in the neighbourhoods. This knowledge will help policy makers in decisions relating to planning, development and management of urban fringes in Niger State and Nigeria at large.

LITERATURE REVIEW

The impact of urban growth on the peri-urban region is enormous; these neighbourhoods are battling with challenges such as loss of agricultural land, open space, ecologically sensitive and environmental problems which impacted directly and adversely on human health. These areas also lacked basic amenities like treated water supply, sanitation/sewerage system, primary health centre amongst others (Shivendra and Ramaraju, 2013). In Nigeria, two-third of the population servicing the nation's capital (Abuja), live in the fringe of the nation's Federal Capital Territory. These areas are characterized by inadequate infrastructure and development of informal settlements (Jinadu, 2004). Minna and almost all other urban areas of Niger State are experiencing growth that is unplanned and uncontrolled, most especially at the urban fringe. The peri-urban areas of Minna are characterized by spontaneous development without infrastructure such as roads and water supply. The quality of majority of the buildings in the areas fall below acceptable standard that can guarantee the health and safety of their occupants; yet real property values within these areas are on constant increase (Niger State Government, 2009). This development poses a great threat to the achievement of Sustainable Development in the state.

The major challenges facing peri-urban areas, according to Allen, daSilva and Corubolo (1999) are the rapid conversion of agricultural and natural land to residential and other uses, environmental pollution and conflict in land management system. Lawanson, Yadua and Salako (2012) however, identified rapid population increase, lack of infrastructure and insecurity as the major challenges of peri-urban areas across the world.

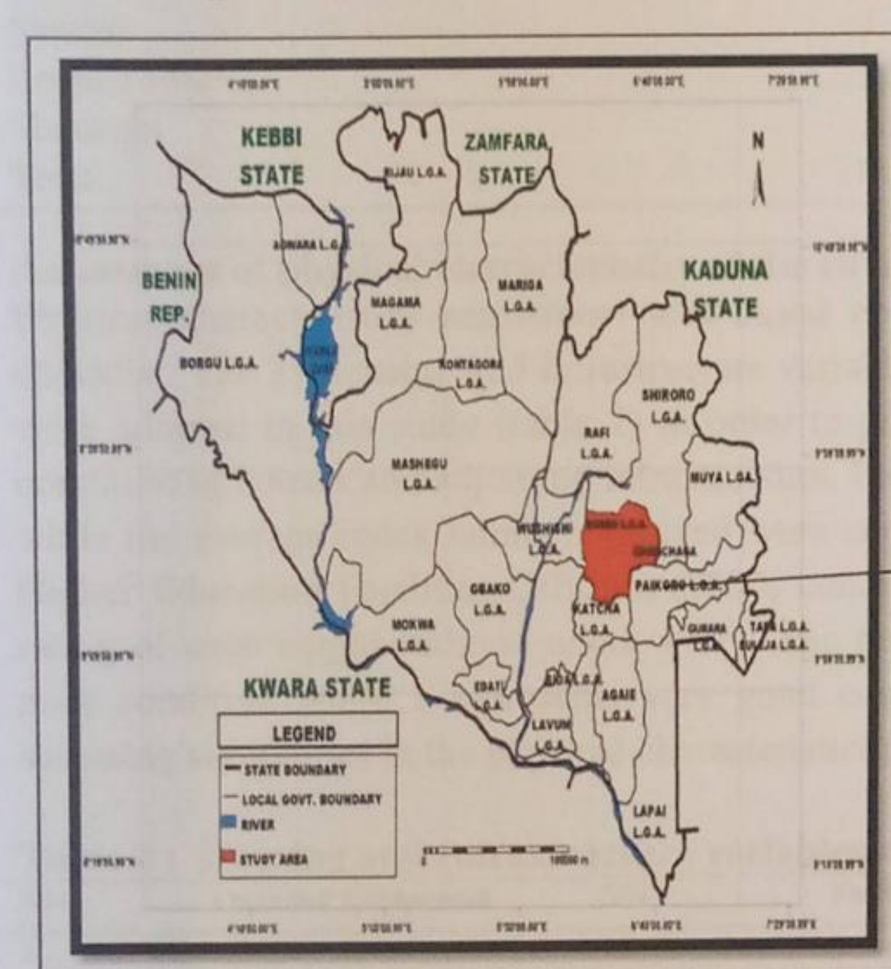
Most cities in developing countries are so financially and resource-strained that they fail to monitor and channel urban development in the desired manner. This development gradually extended into the urban fringe, making residents vulnerable to disaster risks and makes accessibility difficult in times of need due to the unplanned nature of the environment (Chirisa, 2010). Since most peri-urban areas lack development plans, standards are being compromised during development activities resulting to poor housing and environmental conditions.

Minna has grown and developed into a modern city since its creation as the state capital in 1976. The modernization is however, not without the attendant problems associated with most cities in the country. Increase in land and rental value due to increase in population is forcing the poor and low income earners out of the city to the urban fringe or the periphery. The result is the proliferations of sprawling areas, which over times, had consolidated into various slum neighbourhoods at the urban fringe. Most residential areas at the Minna peripheral now exhibit the characteristics of clustered low quality dwellings on an unplanned vast area of land with the attendant problems of poor sanitary environment, lack of adequate open spaces, lack of community facilities and basic services (Niger State Government, 2009). These have negative implications for the quality of peri-urban neighbourhood and the health of the

residents. Challenges of the peri-urban areas therefore, call for strong political will and ongoing commitment (World Bank Institute, 2008) or else it will remain a fertile ground for slums formation.

Minna peri-urban residential areas exhibit similar characteristics in term of pattern of development, infrastructure inadequacy and development of squatter's settlements. It is based on these development that this study sets to examine scientifically, the physical characteristics of the peripheral residential neighbourhoods. The knowledge of distinctiveness and similarities in physical conditions of the peri-urban environment will help planners and relevant stakeholders saddled with the responsibility of urban management and planning in decision making.

Minna, the capital of Niger State is located between Longitude 3°30' E and 7°20' N and Latitudes 8°20' N and 11°30' N (figure 1a). Minna is about 135km away from the Federal Capital Territory and 300km away from Kaduna city. Within Niger State, it is about 90km away from Bida, 100km away from Suleja and about 130km from Kotangora. The town lies on a relatively highland with a slight height of between 240m-270m above sea level. It is surrounded by a range of hills that stretch from north east westward towards Bosso and Tudun Fulani (Sanusi, 2006). The town is dissected at the lower part by River Suka and its tributaries. The Southeast part of the town is occupied by River Chanchaga which has been dammed to provide water for the greater part of the town (figure 1b).



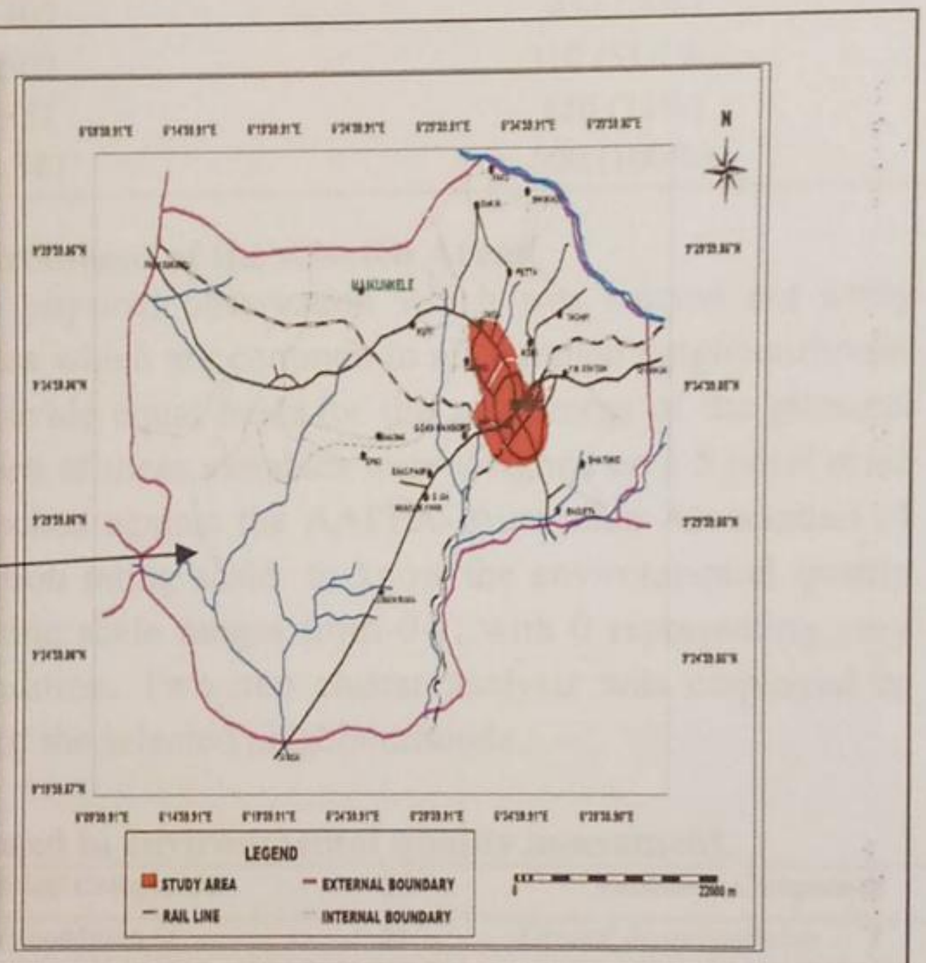


Figure 1a: Location of Minna in Niger State **Figure 1b:** Minna, the Study Area
Source: Department of Urban and Regional Planning, F.U.T. Minna (2016).

METHODOLOGY

Selection of sampled neighbourhoods

Cluster sampling technique was adopted in the section of sample areas for the study. The peripheral residential neighbourhoods were zoned into three namely; South-West peripheral, North-West peripheral and North-East peripheral zones with each zone representing a cluster. Two neighbourhoods were randomly selected within each cluster (zone) to ensure equal representation from each zone. The selected

neighbourhoods formed the sample areas for this study. Barikin-Sale and Shangowere selected from the South-West zone; Fadikpe and Dutsen-kura (Gwari) were selected from the North-West zone while Bosso and Maitumbi were picked from North-East zone.

Sample frame and sample size

Total number of household in all the six neighbourhoods under study is 18,387. Adams *et al.* (2007) simplified formula ($n_0 = Z^2 \alpha/_2 \times P (1 - P) / d^2$). A 95% confidence level, estimate rate of 50% (p=.50) and precision range of 4 % (d=0.04) were adopted to determine the sample size for the study. Sample size of 600 was derived and distributed proportionally amongst selected neighbourhoods (table 1). Systematic random sampling technique was adopted in the administration of questionnaires; questionnaires were administered on every three house chosen on every identified street of which one household was randomly selected from the house chosen.

Table 1: Sample Sizes for Selected Neighbourhoods Using Household Number

Neighbourhoods	No of Household	Sample Size
Dutsen Kura	1,431	47 (7.8%)
Fadikpe	926	30 (5%)
Barkin Sale	1,270	42 (7%)
Shango	1,407	45 (7.5%)
Bosso Town	9,502	310 (51.7%)
Maitumbi	3,851	126 (21%)
Total	18,387	600 (100%)

Assessment of physical characteristics of the environment of the selected Areas

Physical characteristics assessment was based on physical observation which was carried out using checklist. The 29 housing and infrastructure variables which are common to all sampled neighbourhoods were adopted in this study (table 2) in order to provide equal basis for the assessment of the physical condition of houses and adjoining infrastructure. Each of these variables were weighed on a 5 point scale while the average index numbers derived were checked against the AAPPA- Australian Association of Higher Education Facilities Officers, (2000) condition rating scale to know the environmental quality rating of each neighbourhood under study. The rating scale ranges from 0-1; with 0 representing very poor condition while 1 represents very good condition. Two-step cluster analysis was employed in assessing similarities in the physical characteristics of the selected neighbourhoods.

Table 2 : Housing and Infrastructure variables used in environmental quality assessment.

S/N	Facilities/ Component	S/N	Facilities/ Component	S/N	Facilities/ Component
1	Water source	11	General sanitary condition of neighbourhood	21	General doors condition
2	Water frequency	12	Roof type	22	Toilet type
3	Power source	13	Roof condition	23	Toilet location
4	Power frequency	14	Ceilings type	24	Condition of toilet
5	Drainage type	15	Ceiling condition	25	Bathroom type
6	Drainage condition	16	Wall materials	26	Bathroom location
7	Access road condition	17	General walls condition	27	Condition of bathroom
8	Waste disposal method	18	Floor type	28	Kitchen location
9	Sewage disposal	19	Floor condition	29	Kitchen facility
10	Security	20	General windows Condition		

RESULTS AND DISCUSSION

Assessment of Physical Characteristics of the Environment of the study Areas

Physical observation during field work revealed deplorable state of infrastructure and lack of essential facilities such as; water, drainages and security in some neighbourhoods. The neighbourhoods were characterized by: poor accessibility, lack of good drainages, sprawling residential development, substantial number of low quality dwellings and emergence of considerable numbers of good residential houses in some neighbourhoods, poor solid waste management, haphazard development and lack/shortage of pipe borne water (Appendix II). Housing characteristics differs across selected neighbourhoods; varying from old dilapidated structures to fairly new and modern structures. All the neighbourhoods lack availability of some basic infrastructure, though at varying degrees. The summary of distinct physical characteristics of each sampled neighbourhood is presented in Appendix II.

Analysis of Similarities in Physical Conditions of Sampled Neighbourhoods.

Results of housing and infrastructure indices obtained were used to analyze similarities in the physical characteristics of the sampled peri-urban neighbourhoods. Result revealed housing condition rated higher than available infrastructure (table 3). Two Step Cluster Analysis produced three (3) clusters for the six (6) neighbourhoods. Cluster one with population sample of 164 represents 27.3% of the total sampled population while clusters 2 and 3 with sample numbers of 126 and 310 represents 21% and 51.7% of the sampled population respectively (table 4 & figure 2).

Table 3: Indices for Housing and Infrastructure Conditions Rating in Minna Peri-Urban Neighbourhoods

S/N	Neighbourhoods	N	Housing Condition Index	Infrastructure Condition Index
1	Dutsen-kura	47	0.74	0.61
2	Fadikpe	30	0.79	0.65
3	Barkin-sale	42	0.71	0.60
4	Shango	45	0.67	0.56
5	Bosso	310	0.65	0.52
6	Maitumbi	126	0.62	0.55
	TOTAL	600	Average 0.70	Average 0.58

Neighbourhoods in cluster one are selected ones from the South-west and North-West zones of Minna peri-urban areas. This grouping together of neighbourhoods in the same western axis expressed spatial contiguity; which implies that the close proximity of these neighbourhoods influenced similarities in their physical features (table 4).

Cluster one (1) house four (4) neighbourhoods: Shango, Fadikpe, Dutsen-kura (Gwari), and Barkin-sale. Shango and Dutsen-kura represents about 8% each of the total percentage representation for cluster one, while Barkin-sale is about 7% of the percentage representation in the cluster and Fadikpe represents about 4.3% of the cluster percentage representation. Clusters two (2) and three (3) have a neighbourhood each (Maitumbi and Bosso) and each represents 21.0% and 51.7% respectively (figures2, 3 & table 4).

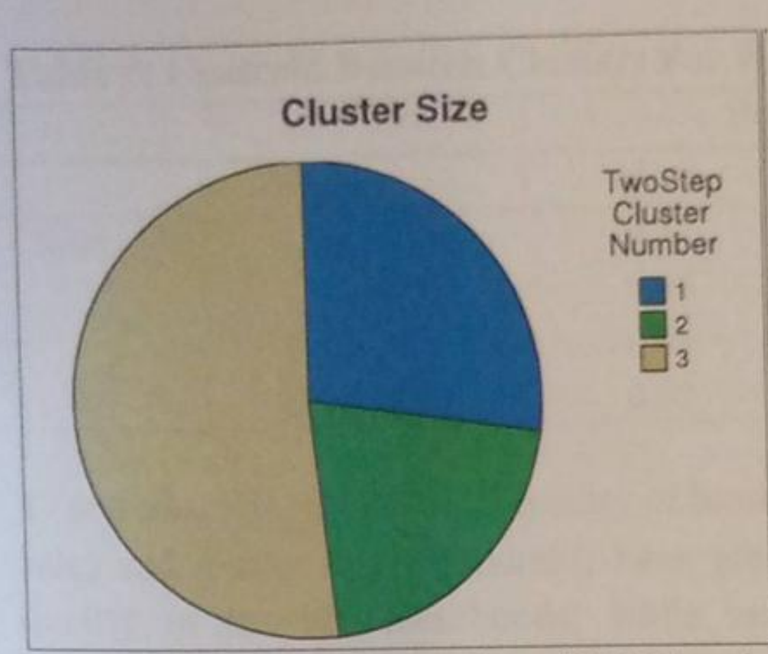


Figure2: Cluster Representation of Neighbourhoods.

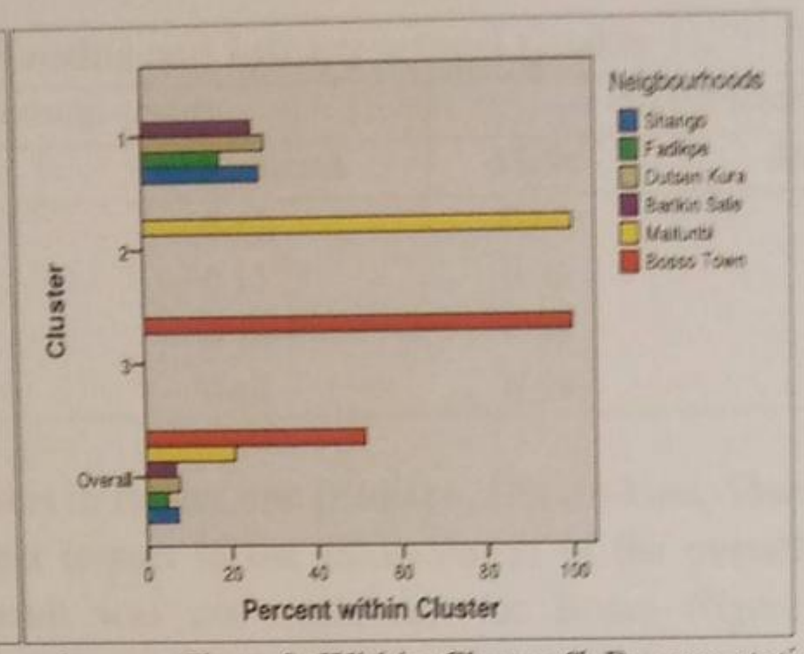


Figure3: Within-Cluster % Representation

This occurrence is explainable by Tobler's First Law of Geography which states that, "Everything is related to everything else, but near things are more related than distant things" (Tobler, 1970). The implication is that, negative associations exist between distance things because similarities between spatial entities decrease over distance (Toby, Shilad and Brent, 2014). Even though each neighbourhood has distinct and intrinsic characteristics which differentiate it from other neighbourhoods, yet, neighbourhood can share in one another's physical characteristics due to locational proximity.

Table 4: Cluster Distribution of Physical Characteristics of Minna Peri-urban Neighbourhood

		N	% of Combined	% of Total
Cluster	1	164	27.3%	27.3%
	2	126	21.0%	21.0%
	3	310	51.7%	51.7%
	Combined	600	100.0%	100.0%
Total		600		100.0%

Houses in cluster one (1) have the highest mean score (0.72) in term of house quality; an indication that houses in cluster one are better in quality compared with houses in the other two (2) neighbourhoods which have mean housing scores of 0.63 and 0.65 respectively. That is, houses in Barkin-sale, Dutsen-kura (Gwari), Shango and Fadikpe are better than houses in Bosso and Maitumbi. Though, Maitumbi neighbourhood has the least quality houses, yet variation in mean score is lowest (0.11) compared to Bosso and neighbourhoods in cluster one. This implies that gaps in mean housing score in Maitumbi are not as wide as those of the other two clusters (table 5 & appendix I B & C).

Houses in cluster one (1) are better also in term of neighbourhoods infrastructure (mean =0.66) compared to Bosso and Maitumbi. Bosso neighbourhood is the most deprived in term of neighbourhood's infrastructure (0.52). However, mean quality of residential houses in all sampled neighbourhoods are better than quality of infrastructure available (table 5 & appendix I B& C).

Table 5: Centroid Between Clusters For Housing and Infrastructural Quality

		Housing quality		Infrastructure quality	
		Mean	Std. Deviation	Mean	Std. Deviation
Cluster	1	0.72	0.12	0.60	0.10
	2	0.63	0.11	0.55	0.10
	3	0.65	0.14	0.52	0.11
	Combined	0.67	0.13	0.55	0.11

T- test analysis revealed that quality of houses in cluster one (Fadikpe, Dutsen-kura, Shango and Barkin-sale) and cluster two (Maitumbi) have great impact in the enhancement of the overall environmental quality in the neighbourhoods; while result was not significant for Bosso (figure 4). However, infrastructure plays significant role in the enhancement of overall environmental quality in Cluster three (Bosso) and Cluster one (Fadikpe, Dutsen-kura, Shango and Barkin-sale); but not significant in cluster 2, that is, Maitumbi (figure 5).

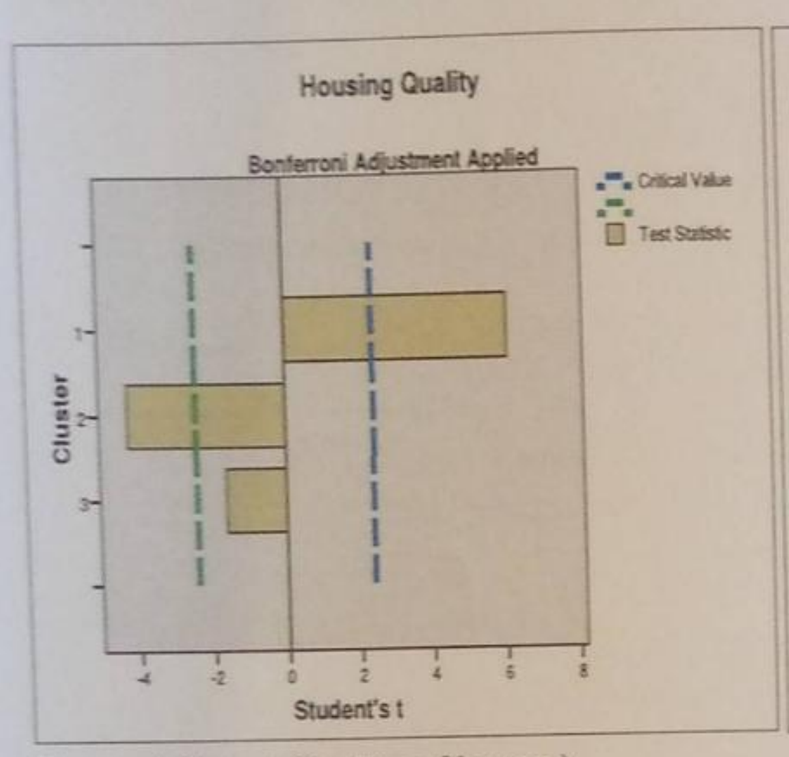


Figure 4: T-test (Quality of houses).

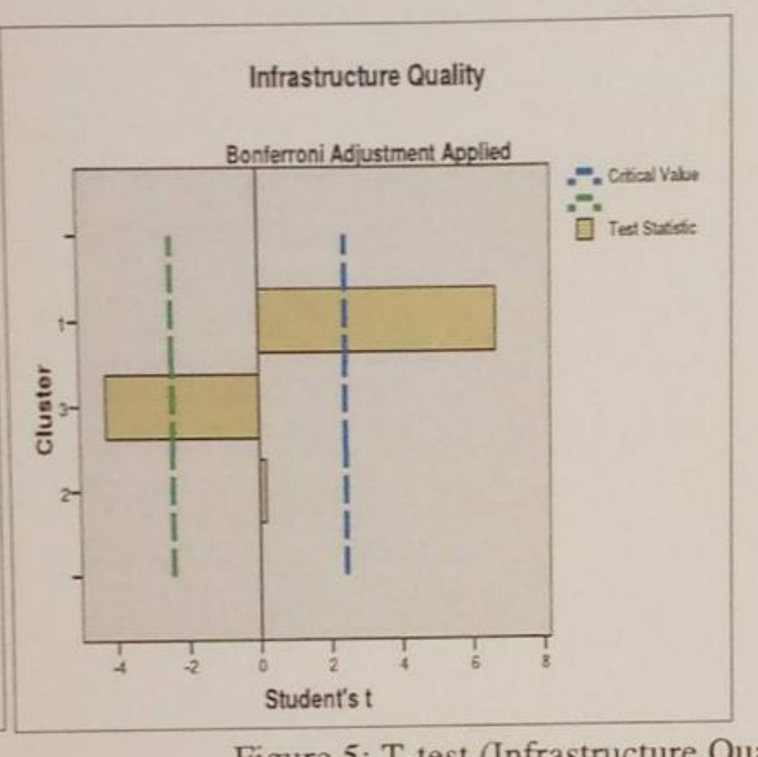


Figure 5: T-test (Infrastructure Quality).

Physical observation and analysis revealed that all sampled peri-urban residential neighbourhoods are distinct, yet similar in term of physical features. However, neighbourhoods in close proximity are more similar in physical features than distant neighbourhoods; which suggest an exhibition of spatial contiguity amongst neighbourhoods.

Mean quality of houses in cluster one is 0.72 which is above the overall mean of 0.67; while those of clusters two and three are 0.63 and 0.65 which are below the overall mean. Mean infrastructure scores for clusters one and two (0.60 and 0.56 respectively) are above the overall infrastructure mean (0.55) for the three clusters (Appendix I B & C).

The implication is that neighbourhoods in cluster one (Fadikpe, Dutsen-kura, Shango and Barkin-sale) are better than the other two neighbourhoods in clusters two and three (Maitumbi & Bosso) with regards to quality of houses and infrastructures. Bosso neighbourhood is more deficient in infrastructure while substantial numbers of houses in Maitumbi neighbourhood are substandard. This implies that Minna peri-urban residential neighbourhoods are lacking in neighbourhoods' infrastructure that are required to boost the overall quality of the environment. Uncontrolled and unplanned development which lacked basic infrastructure will degenerate into slum (Agbola and Agunbiade, 2009; Blanco and Kobayashi, 2009).

Shortage of basic infrastructure and emergence of significant numbers of substandard dwellings in Minna peri-urban neighbourhoods can degenerate into slum if not well addressed.

CONCLUSION AND RECOMMENDATIONS

Findings from this study revealed that Minna peri-urban residential neighbourhood is lacking in basic infrastructure such as, water, drainages and security. The qualities of houses in the neighbourhoods rated higher than the neighbourhood's infrastructure. Participatory planning approach, infrastructure refurbishments and provisions will promote good living environment and also enhance real property value in the peri-urban.

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APPENDICES

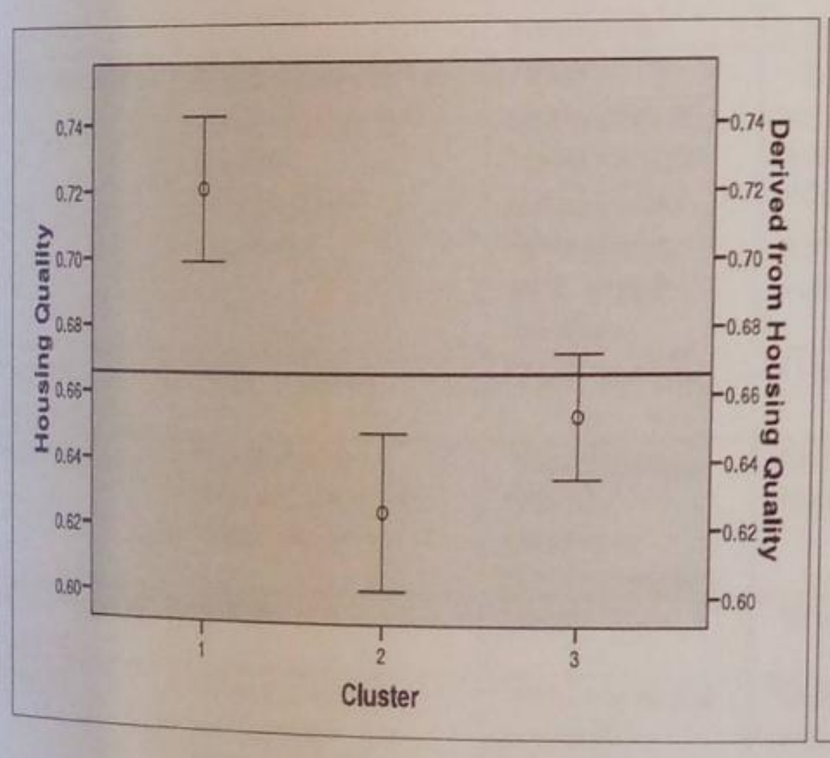
Appendix I: RESULTS OF TWO STEPS CLUSTER ANAYSIS FOR HOUSES AND INFRASTRICTURE

(A). Auto-Clustering

Number of Clusters	Schwarz's Bayesian Criterion (BIC)	BIC Change(a)	Ratio of BIC Changes(b)	Ratio of Distance Measures(c)
	2566.697			
1	1768.402	-798.294	1.000	2.007
2	1399.556	-368.846	.462	1.787
3	1218.466	-181.090	.227	1.657
4	1131.974	-86.492	.108	1.137
5	1062.799	-69.175	.087	1.181
6	1013.085	-49.714	.062	1.546
7	1001.283	-11.803	.015	1.156
8	998.829	-2.454	.003	1.176
9	1005.368	6.540	-.008	1.761
10	1033.962	28.594	-.036	1.112
11	1065.482	31.520	-.039	1.072
12	1098.753	33.271	-.042	1.108
13	1134.393	35.639	-.045	1.460
14	1176.938	42.546	-.053	1.069
15				

a. The changes are from the previous number of clusters in the table.
b. The ratios of changes are relative to the change for the two cluster solution.
c. The ratios of distance measures are based on the current number of clusters against the previous number of clusters.

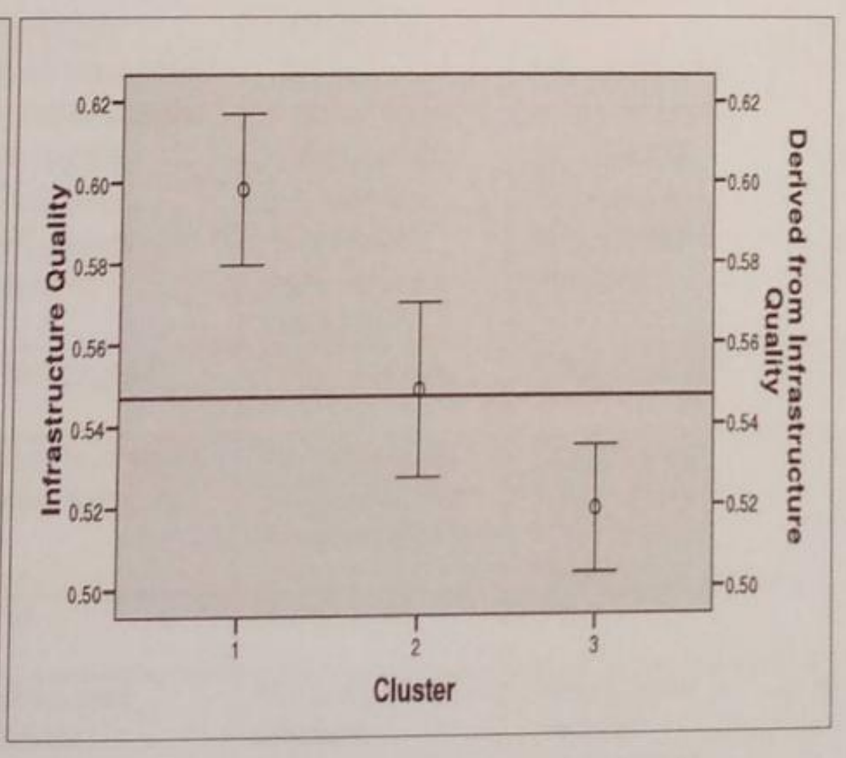
(B)



*Simultaneous 95% confidence Intervals for Means

*Reference Line is the overall mean=0.67

(C)



*Simultaneous 95% confidence Intervals for Means

*Reference Line is the overall mean=0.55

Appendix II: Physical Characteristics of the Selected Peri-urban Neighbourhoods.

nmenta utes	Dutsen-Kura (Gwari)	Fadikpe	Barkin-Sale	Shango	Bosso	Maitumbi
l urhood	*Unplanned; *Predominantly Residential. *Other complementary land uses.	*Unplanned; *Predominantly Residential. *Other complementary land uses.	*Unplanned; *Predominantly Residential. *Other complementary land uses.	*Unplanned; *Predominantly Residential. *Other complementary land uses.	*Unplanned; *Predominantly Residential. *Other complementary land uses.	*Unplanned; *Predominantly Residential. *Other complementary land uses..
g Types	* Ranges from old traditional houses to modern structures. * Mixture of tenement buildings and owner occupier houses. *Basically residential & few commercial property	* Ranges from old traditional houses to modern structures. * Mixture of tenement buildings and owner occupier houses. *Basically residential & few commercial property	* Ranges from old traditional houses to modern structures. * Mixture of tenement buildings and owner occupier houses. *Basically residential & few commercial property	* Ranges from old traditional houses to modern structures. * Mixture of tenement buildings and owner occupier houses. *Basically residential & few commercial property	* Ranges from old traditional houses to modern structures. * Mixture of tenement buildings and owner occupier houses. *Basically residential & few commercial property	* Ranges from old traditional houses to modern structures. * Mixture of tenement buildings and owner occupier houses. *Basically residential & few commercial property
ng ion	*Ranges from poor to very good.	* Ranges from fair to very good. *considerable numbers of good houses.	*Ranges from fair to very good.	*Ranges from poor to good.	*Ranges from very poor to good.	*Ranges from very poor to good.
ion of Road	*Poor accessibility within neighbourhood.	* Fair accessibility within neighbourhood.	* Poor accessibility within neighbourhood.	*Poor accessibility within neighbourhood.	*Fair accessibility within neighbourhood.	* Poor accessibility within neighbourhood.
ge ion	* Open drainage available. *Poor condition.	* Open drainage available. *Poor condition.	* Open drainage available. *Poor condition.	* Open drainage available. *Poor condition.	*Good drainages available in some part. *Condition ranges from poor to good condition.	*Good drainages available in some part. *Condition ranges from poor to good condition.
source	*Part connected to water mains- not regular. *Well, water vendors.	*Part connected to water mains- not regular. *Borehole, well, water vendors.	*Part connected to water mains- not regular. *Borehole, well, water vendors.	*Part connected to water mains- not regular. *Borehole, well, water vendors.	*Part connected to water mains- not regular. *Borehole, well, water vendors.	*Part connected to water mains- not regular. *Borehole, well, water vendors.
ency of supply	*Not regular	*Not regular	*Not regular	*Not regular	*Not regular	*Not regular
Disposal	*Government. *Private operatives. *Open dumping.	*Government. *Private operatives. *Open dumping.	*Road side kerb. *Open dumping.	*Government. *Road side kerb. *Open dumping.	*Government. *Road side kerb. *Open land dumping.	*Road side kerb. *Open land dumping.
l Sanitary ion	*Good	*Good	*Fair	*Fair	*Poor	*Poor
ty	*Close to Police headquarters. *House guards, dogs.	*Police post not available. *Vigilantes. *House guards, dogs.	*Police post available. *Vigilantes. *House guards, dogs.	*Police post not available. *House guards, dogs.	*Police post available. *House guards, dogs.	*Police post available. *Vigilantes. *House guards, dogs.

*Compiled from the checklist used in physical observations