

# Application of GIS in Spatial Analysis of Demographic Determinants of Rentals Housing Quality in Nigerian Settings

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**Abstract:-** Housing is one of the essential human needs of life. House is needed by man to protect him against elements of weather. The provision of good housing therefore, has a profound effect and influence on the wellbeing, health and efficiency of any community. The study assesses the geo-spatial analysis of demographic determinants of rentals housing quality in traditional Nigerian settings with a view to determining the pattern of housing quality and its distribution in the area. Housing quality in the context of type, facilities and amenities available were examined; also the quality of residential environment was examined, especially to determine if the two meet the desire and satisfaction of the respondent's tenants. Majority of the respondents are not satisfied with their present houses and residential environment, perception of neighbourhoods is largely determined by safety, availability of facilities, quality of residential environment, residential preference is solely determined by socio-economic variables. Lastly, the study identified the relevance of income level in determining the quality of a house and mostly earn below minimum wage per month, most of the people living in the study area are low and medium income earners. Those residents were distributed based on their income levels and is closely link with their occupational status, and that the study has both theoretical and practical implications. The theoretical implication rests on the need for the development of sense of place of study while the practical implication exposes the need for preference studies before planning housing and residential areas. Finally, there is the need for involvement of housing and environment consumers in issues relating to housing policy and environmental planning so as to achieve optimality in planning.

**Keywords:-** *Geo-Spatial Analysis, Housing Quality, Demographic, Neighbourhood.*

## I. INTRODUCTION

Housing does not mean an individual's dwelling unit only. It is a composite of the overall physical and social components that makeup the housing system (Mohit & Raja, 2014). Furthermore, housing is a multidimensional phenomenon, including structural type (e.g., single family home), tenure (own or rent), location and political jurisdiction (Scanlone, 1998).

Quality housing has been defined as the general standard, characteristics, attributes or degree of excellence of housing (Microsoft Encarta, 2020; Merriam-Webster Dictionary, 2020). According to Lawrence (1995), quality of housing can be perceived in several dimensions, depending on the perspectives and intentions of researchers or the sponsor(s) and those who formulate policies. Housing quality is viewed as theoretical or an abstract hence may not have real or specific concept/definition; and therefore it is not directly assessable, but has many observable indicators (Gandil, 1995; Goodman, 1978; Babalola, 2016). For instance, a study in USA (HUD, 2011b) identified 13 variables that can be used to describe or measure housing quality standards (HQS). These are "sanitary facilities; food preparation and refuse disposal; space and security; thermal environment; illumination and electricity; structure and materials; interior air quality; lead-based paint; access; site and neighbourhood; sanitary condition; water supply; and smoke detectors".

Corporation for Supportive Housing (CSH, 2009) in U.S. in their study, conceived housing quality using seven dimensions of "administration, management, and coordination; physical environment; access to housing and services; supportive services design and delivery; tenant rights, property management and asset management; input, and leader-ship; data, documentation, and evaluation". From the foregoing, it is evident that housing quality is determined by a number of parameters, namely: (i) management and related issues; (ii) physical aspect of the housing and housing environment; (iii) social-cultural and psychological aspects; (iv) rights, rules and regulations and (v) location and study contexts.

There are several reasons for which housing quality may be assessed and defined. They include aesthetic value and use value; identifying housing targets for upgrade or those requiring replacement; to attempt to match household income with quality scale; and as part of assessment of wellbeing and health of the residents with respect to their housing (Lawrence, 1995). There has also been a lack of agreement on definition and assessment of housing quality.

The Engineers, Economists, Sociologists and the Architects are interested in studying the various aspect of housing. The Architects and the urban planners are interested in studies on housing policy-oriented research that covers many spectrums which include Housing Policy and Finance

(Onibokun, 1975, 1984, 1986; Adedokun and Tambiyi 2018.) Other areas of study are Housing Design, Housing Needs and Demand, Housing Market and Housing Choice (Arimah, 1990, Huang et al.2016, Kwan, 2016; Adedokun and Tambiyi

➤ *Housing Needs Theory*

According to Rossi 1955 as cited in Mohit & Raja (2014), the notion of housing needs is to conceptualize residential satisfaction or their dissatisfaction. In his theory, he posited that changing in housing needs and aspiration is usually followed through stages. The young couple stage is the stage were only the couples without any child; the foundation stage which comprise the couple and their children of less than eight years old; the growing family stage comprises the parents and their children of age brackets eight to eighteen years. Therefore, a good housing is the one which meet all the desire and aspiration of the stages. As the family is expanding /increasing or as a result of migration the available house hold size will be over crowded, having less space to accommodate. The resulting force of the increase in family size may result to the need for the household searching for an alternative. A good housing is the one which fit the desired needs and aspirations of the household at the young couple, the foundation and the growing family stages.

System (GPS) for the building coordinates, and also physical observations on the buildings, drainage, road Similarly, data were also obtained from the government agencies such as; the Adamawa state ministry of land and survey, ASUPDA, Federal Ministry of Housing and Urban Development Office, National Population Commission and the Federal office of Statistics. Other data collected were satellite image of the houses obtained from the Google earth image 2016 of the study area.

- Other secondary data sourced for this research includes:
- Topographical map sheets covering the study area were used.
- Google earth image 2016 of the study area.
- GPS readings of the selected houses.

Concepts and ideas from written materials, text books, and related research projects, journals, internet and documents. Mixed methods of data were used the research comprises both qualitative and quantitative data. A set of well-structured multiple choice questions mainly based on 5-point Likert type of scale were adopted. The measurements on such 5-point scale range from Strongly Agree or Very Good with five (5) indicating positive statements, four (4) indicating Neutrality, Average or Uncertain statements to Strongly Disagree or Very Poor with a score of (1) to indicate negative statements. The measurements on such 3-point scale range from Agree or Good with three (3) indicating positive statements, two (2) indicating Neutrality, Average or Uncertain statements to Disagree or Poor with a score of (1) to indicate negative statements. All non-responses were coded as appropriate. The closed-ended questions are arranged according to the classifications of the variables in the various sections. Primary data for the research were obtained by administration of questionnaires to household-heads within the calculated sample size, drawn from the sampling frame (within the research population).

Basically, there are eleven (11) political wards in the study area, which were categorised into small, medium and high density residential areas. Where one ward each from low and medium and two from high densities residential areas. Only four (4) political wards in the study area were selected for this research. The second stage was the choice of streets in the wards. The streets in the chosen wards were listed. Then simple random sampling approach was used applied to choose the streets from each ward by picking from the balls of all the numbers representing the streets.

The last stage was the choice of households. On each street, households were selected systematically after the first household had been picked by random sampling. In this way, every third household, beginning from the one picked, randomly, was chosen. In each chosen household, the first to be met adult was chosen. A total of three hundred and seventy seven (377) household heads were chosen and administered the questionnaire from the wards selected.

**II. METHODOLOGY**

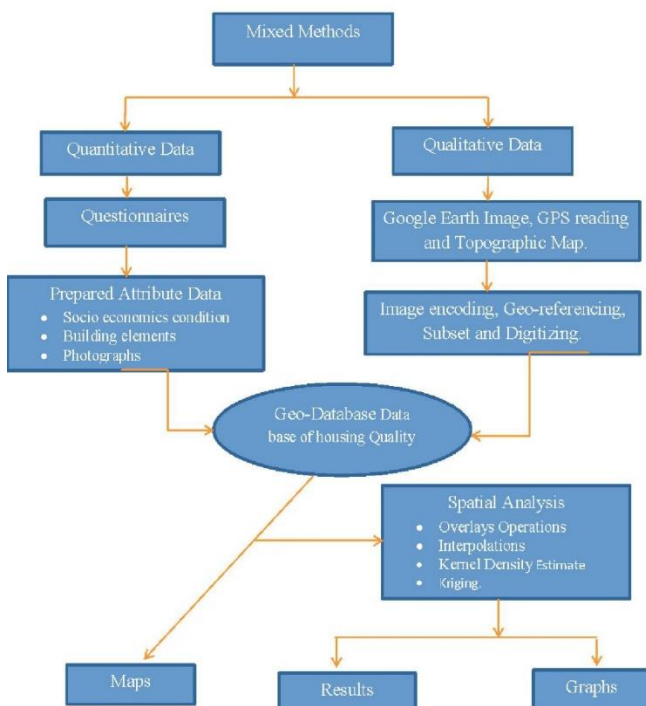


Fig 1 Methodology

Data were collected using structured questionnaire administered to the house heads of the randomly selected house hold in the 4 selected political wards of the study area. The questionnaires consist of the socio-economic characteristics of the respondents, 12 variables of the housing quality and 18 variables of infrastructural facility. Other data collected were the physical observations, Global Positioning

In determining the sample size for the research, table for determining sample size from a given population was used. Percentage was used to determine the sample size for each wards sample. Using the formulae below;

$$X = \frac{N}{T} \times S \dots\dots\dots (1)$$

- X = estimated sample size estimated from
- N = sample house hold size
- T = total sample sizes
- S = samples size, 377 copies of questioners were distributed based on Sample household.

➤ *Study Area*

Jimeta is the administrative headquarters of Adamawa State capital is located between the Longitudes 12° 25' E and 12° 28' East of the Greenwich Meridian Line and Latitudes 9° 14' N and 12° 20' North of the Equator, (Figure 1). It is situated along the banks of the River Benue (Hong, Law and Suleiman, 2014), one of the two (2) major rivers in Nigeria. It has total land coverage of 66247 square kilometres and the total population of 395,871 persons. National Bureau of Statistics (2006) 2012 projection gives the population as 410,598 persons. Ministries and Agencies are located. Ilesanmi (2013) described Jimeta-Yola as belonging to the first-order (1st) Core (Urban centre) with its influence spanning the entire State and the neighbouring states of Taraba, Gombe, Bauchi, Borno and Yobe. The city is clearly stratified in terms of population densities. These are low, medium and high density areas. The low density areas are well planned units where government officials reside while medium and high density areas are made up of common people with little or unplanned buildings. Zemba, (2010).

Jimeta falls within the tropics, hence experiences tropical climate. It has monthly mean sunshine temperature hours of about 220 from January to April (Adebayo, 1999), this decrease to a mean value of 207 hours between May and September due to increasing cloudiness. The mean sunshine hours increases again to about 255 from the period between October and December. Approximately, 2750 hours is the average sunshine hours for Jimeta-Yola. Temperature in Jimeta is generally high almost throughout the year. The weather is marked by a gradual increase in temperature from January to April due to increasing receipt of solar radiation. The temperature reaches its maximum by April with over 450-C (Zemba, 2010).

.There is a visible mixed residential density in most parts of the metropolis, Organic solid waste generations' rates increases across the high densities neighbourhoods of the metropolis, considering the favourites consumption of un-processed food among the low income earners, residential structures deteriorated in some high densities subdivisions, connect with stumpy distribution of drainages system and irregular sanitary conditions of these environments (Aminu, Abdulrahman Sahabo & Ibrahim 2015).

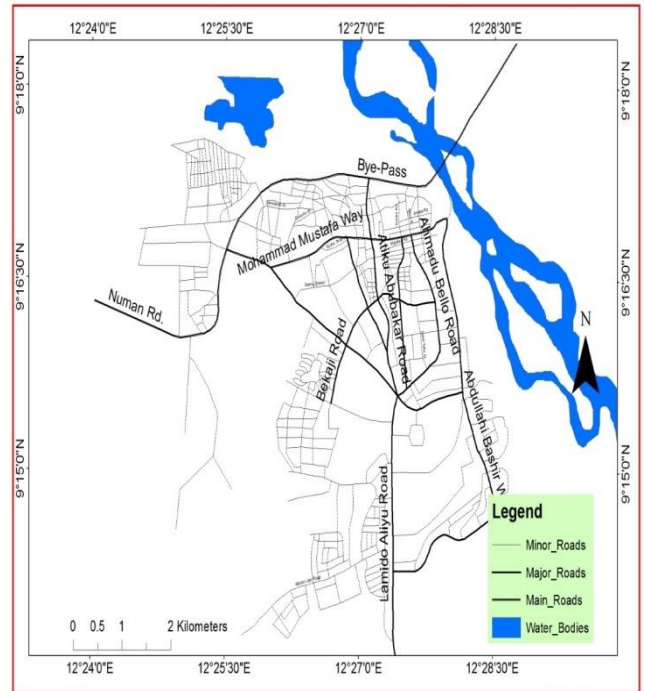


Fig 1: The Study Area

➤ *Data Collected*

**Table 1: Sample Wards According to Populations of Households**

Wards	Projected Household 2017	No of Respondents
Karewa	8,728	155
Nasarawo	7,766	138
Alkalawa	3,343	59
Ajiya	1,378	25
<b>Total</b>	<b>21,215</b>	<b>377</b>

Source: Researchers work, 2019.

**III. DISCUSSION OF RESULTS**

**Table: 2 Regression Table**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.988 <sup>a</sup>	.977	.976	.177

Source: Researchers work, 2019.

The value of R Square is 0.977. It indicates those predictors are the main variables for determining 97.70/0 the housing quality in the study area. This implies that housing quality and their environment tends to increase as the conditions and availability of the predictors such as; lighting, ventilation, painting, windows, roof, door, bathroom, floors, ceiling, wall, kitchen and toilet. Roof is and envelope which covers the building component, in determining a quality housing a structure needs to provide cover to the user against rain and any harsh weather. Window to be provided for free flow of air during hot seasons, nets to be provided to prevent

mosquitoes and harmful insects from affecting the residents. Door for any quality their need for provision of an entrance into it, and to be secured enough to prevent any burglar from entering.

**Table: 3 Relationships between Income and Modes of Residency**

Income	10,000 and Below	11,000 – 20,000	21,000 – 30,000	31,000 – Above	Total
Land Lord % of Total	6.7%	5.6%	6.7%	12.8%	32%
Tenant % of Total	26.4%	15.4%	16.7%	9.7%	68%
<b>Total % of Total</b>	<b>33.1%</b>	<b>21.0%</b>	<b>23.3%</b>	<b>22.6%</b>	<b>100.0%</b>

Source: Researchers work, 2019.

26% of the respondent are tenant and are earning less than 10,000 per month. Available statistics, as documented in the National Housing Policy (1991), indicate that the most predominant form of tenancy housing accommodation in many of the Nigerian cities is rented accommodation, providing over ninety per cent (90%) of the housing sector in the country, this implies that poverty level is considerable. The findings in this study area is in line with the studies of Ogunleye (2011), which revealed that a significant proportion of the low income people in the cities of the developing world live in rented houses.

**Table: 4 Relationships between Modes of Residency and Building Age**

Residency	Sing le Room	One Bedroom Self Cont.	Two Bedroom	Three Bedroom	Total
Land Lord	1.5%	0.5%	21.8%	7.9%	31.8 %
Tenant	22.6 %	35.6%	7.4%	2.6%	68.2 %
<b>Total</b>	<b>36.2 %</b>	<b>24.1%</b>	<b>29.2%</b>	<b>10.5%</b>	<b>100.0 %</b>

Source: Researchers work, 2019.

There is high percentage of occupants of one bedroom in the study area which accounts for higher percentage (36%) and are tenants there by resulting into overcrowding of the available rooms and the deteriorations of their immediate environments. Overcrowding of persons per room is another dimension of the problem. Most of those occupants have their monthly income of less than ₦10,000 monthly and have more than five people living per room. There is strong relationship between the housing layout and mode of residency of the respondents in the study area. Those range of peoples mostly looking for any available and affordable with low rent value which is mostly located in slum areas.

**Table: 5 Relationships between Modes of Residency and Building Age**

Residency	0-10yrs	11-20yrs	21-30yrs	Above 30yrs	Total
Land Lord	3%	6%	13%	10%	32%
Tenant	7%	21%	13%	27%	68%
<b>Total</b>	<b>10%</b>	<b>27%</b>	<b>26%</b>	<b>37%</b>	<b>100.0%</b>

Source: Researchers work, 2019.

Most of the buildings in the study area were built for over 30years (traditional houses) as shown in figure: 4 below. Built up structures degenerate in quality with age and become obsolete Adeleye & Anofojie (2011). This is the case of the study area, which shows that 37% of the houses in the area were built for over 30 years ago and they lack maintenance from the land lords. It indicates that there is strong relationship between the building age and mode of residency of the occupants. Most of the tenants are living in the old building that has been degenerated into slum areas.

**Table: 6 Relationships between Modes of Residency and Occupation**

Residen cy	Civil Serva nt	Farmi ng	Busine sses	Artisa ns	Total
Land Lord	1%	20%	7%	4%	32%
Tenant	12%	3%	24%	29%	68%
<b>Total</b>	<b>13%</b>	<b>23%</b>	<b>31%</b>	<b>33%</b>	<b>100.0 %</b>

Source: Researchers work, 2019.

The development of an area is determined by the people’s occupation. Table 8 reveals that Artisans, accounting for larger proportion (33%) and are tenants. Those are the categories of peoples looking for cheap houses irrespective of their quality, while (31%) of them were Businessmen. Farmers account for (22.31%), while Civil servants accounted for the lowest proportion (12%). It displays the relationship that is between the natures of housing quality in the study in relation to the occupation students of the respondents in the study area, higher percentage of the tenants were artisan.



**Table: 7 Respondents' Perceptions of Condition of Infrastructure**

<b>Infrastructure</b>	<b>1 VB</b>	<b>2 B</b>	<b>3 F</b>	<b>4 G</b>	<b>5 VG</b>	<b>SWV</b>	<b>MWV</b>
Security	89	98	105	62	45	1073	2.69
Drainage System	143	189	35	17	15	769	1.91
Power Supply (YEDC)	39	67	135	142	16	1226	3.07
Private Health Facility	78	67	162	67	25	1091	2.73
Private Primary School	49	79	137	97	37	1191	2.98
Private Secondary School	31	78	177	96	17	1187	2.97
Public Health Facility	79	176	111	19	14	910	2.28
Public Primary School	143	189	35	17	15	769	1.91
Public Secondary School	47	147	179	21	4	982	2.47
Public Toilets	73	179	121	21	4	897	2.25
Public Transportation	87	168	79	37	27	943	2.37
Recreational Facility	123	178	52	34	12	827	2.07
Refuse Management	149	198	23	17	12	742	1.86
Roads	73	69	103	78	75	1207	3.03
Sewage Management	161	169	37	19	13	751	1.88
Shopping Centres/Shops	99	132	117	37	14	932	2.34
Traditional Market	127	135	92	32	13	866	2.17
Water Supply	127	143	79	30	16	850	2.14
<b>Total</b>						<b>43.12</b>	
Mean of $\Sigma MWV = 43.12/18 = 2.40$							

Source: Researchers work, 2019.

Respondents' perception of the condition of infrastructure in the selected areas as shown on Figure: 5. It was established that power supply is ranked high with 3.07 (fair), private secondary schools ranked 2.97 (fair), while refuse management, drainage system, sewage management and public primary school ranked least with 1.89, 1.91, 1.88 and 1.91 ( bad) respectively. The overall condition of infrastructure (HQI) is 2.40 (bad). It reveals that the distribution of infrastructural facilities in the study area is not adequately being distributed and the available ones are being dilapidated and there is need for upgrading of available ones and expansion in some new areas.

**Table: 8 Respondents' Perceptions of Condition of Houses**

<b>Building elements</b>	<b>1 VB</b>	<b>2 B</b>	<b>3 F</b>	<b>4 G</b>	<b>5 VG</b>	<b>SWV</b>	<b>MWV</b>
Bathrooms	148	102	86	32	30	888	2.23
ceiling	131	141	78	31	17	856	2.15
Doors	70	178	97	33	20	949	2.38
Floors	92	143	78	47	38	990	2.49
Kitchen	143	133	72	30	20	845	2.12
Roofs	156	116	75	30	21	838	2.11
Paintings	139	198	32	17	12	759	1.91
Lighting	87	88	115	47	61	1107	2.76
Toilets	126	105	89	43	35	948	2.38
Ventilation	156	179	31	17	15	750	1.88
Walls	79	115	178	21	5	952	2.39
Windows	140	133	80	29	16	842	2.12
<b>TOTAL</b>							<b>26.92</b>
Mean of $\Sigma MWV = 26.92/12 = 2.24$							

Source: Researchers work, 2019.

Respondent's perception on rating of building elements in the study area as shown in Figure: 4 below. Lighting and floors were ranked highest with 2.76 and 2.49 (fair) respectively. Walls, toilets, doors, and bathrooms followed, with rankings of 2.39, 2.38, 2.38, and 2.23 (bad) respectively. Ceilings, kitchens, windows, roofs, painting and ventilation were ranked 2.15, 2.12, 2.12, 2.11, 1.91, and 1.88 (bad)

respectively. The overall condition of the building elements HQI in the study area was rated bad (2.24). As shown in Figure:2 below most of the houses in areas such as Kareaw and Alkalawa have very good quality of houses unlike Ajiya and Jambutu their housing quality within most area are very bad.

➤ Housing quality maps

IV. CONCLUSION

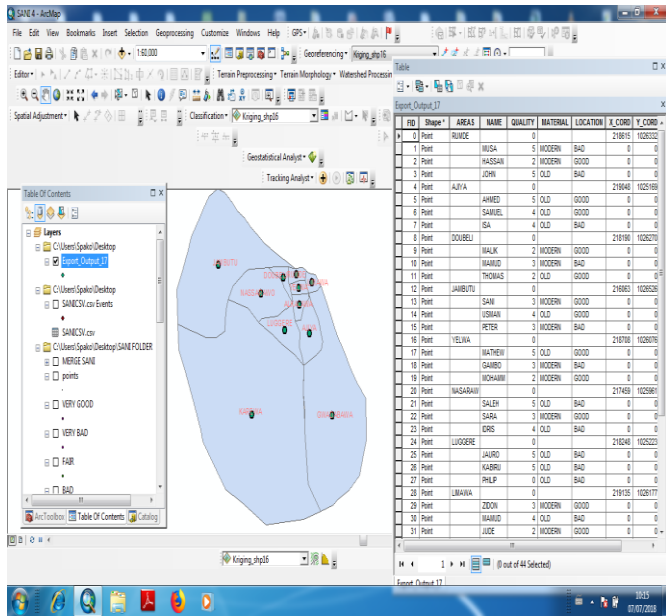


Fig 3: data base for the selected households

From the results obtained on housing quality, many things are revealed about housing quality, neighbourhood perception and demographic determinant resident’s preference in Jimeta. In context of housing quality and facility, it was revealed that most of the houses are rooming apartments (about 36.2% of the houses). This is a clear indication of traditional Hausa housing pattern of “face me, I face you” style. Furthermore, it is revealed that the average age of the houses is more than thirty years. In context of building materials, it reveals that the conditions of most of the housing quality and related infrastructure located within the study area were sub-standard. HQI for Building materials is 2.24(bad), most of the people living in the study area are low and medium earners. Therefore, the higher the lower and middle income earners within the residential setup, the lower the quality of houses within the area. Most of the houses lacked basic functional Infrastructural amenities which accounts for HQI of 2.40(bad).

The study has revealed a significant gap in housing quality between the medium and the low-income earners. The revelation is that there is poor housing quality in the study area. Maps were generated to show the distribution of housing quality, infrastructural, income and occupation of the respondents in the study area among which depict the existing nature of quality of housing in the study area. Most of the residents disposed their waste indiscriminately without having any designated dumping ground, and some low income houses used to dump along the water ways. Most of the buildings have been constructed more than 30years ago, and as such, this reduces the value and the quality of the building. It’s observed that the old age of the building is related to distribution of income level of the study area and was closely linked with the occupational status of residents. This class of individuals is very poor and cannot afford to pay rent or build decent houses..

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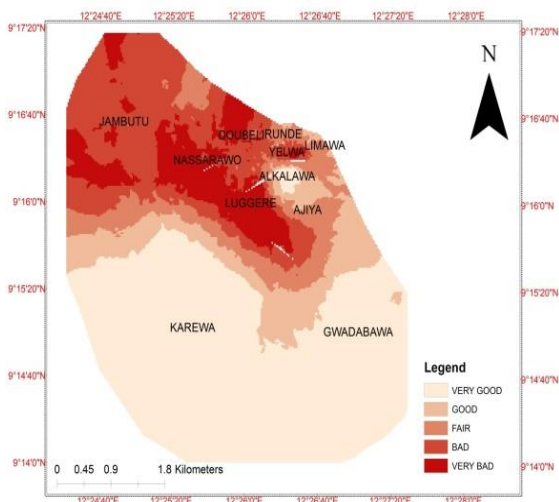


Fig 4: quality of house base on building elements rating

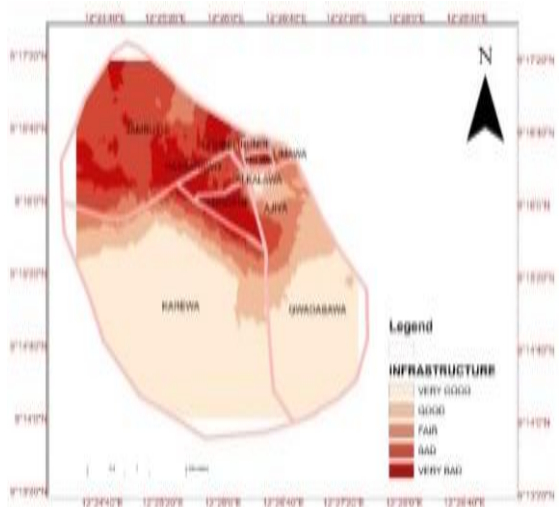


Fig 5: quality of house base on basic infrastructural rating

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