

**ANALYSIS OF SPATIAL DISTRIBUTION OF RURAL INFRASTRUCTURAL  
FACILITIES IN MAKARFI LOCAL GOVERNMENT AREA OF KADUNA  
STATE, NIGERIA**

**By**

**Ganre Watly, EMUOPHE  
MSC/SCIE/05098/2010-2011**

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**DEPARTMENT OF GEOGRAPHY  
FACULTY OF SCIENCE  
AHMADU BELLO UNIVERSITY, ZARIA**

**DATE: JULY, 2016**

## DECLARATION

I hereby declare that the work in this dissertation titled “**Analysis of Spatial Distribution of Rural Infrastructural Facilities in Makarfi Local Government Area of Kaduna State, Nigeria**” was carried out by me - EMUOPHE Ganre Watly, under the supervision of Dr. J. O. Adefila and Dr. R. O. Yusuf. All the information obtained from literature has been acknowledged in the text as well as the list of references. No part of this dissertation has been previously presented for any degree or any diploma course at any University.

.....  
EMUOPHE Ganre Watly

.....  
Signature

.....  
Date

## CERTIFICATION

This dissertation titled “**Analysis of Spatial Distribution of Rural Infrastructural Facilities in Makarfi Local Government Area of Kaduna State, Nigeria**”, meets the standard guiding the award of Master of Science degree of Ahmadu Bello University, Zaria. It is also approved for its contribution to knowledge and literary presentation.

.....  
Dr. J. O. Adefila  
Chairman, Supervisory Committee

.....  
Signature                      Date

.....  
Dr. R. O. Yusuf  
Member, Supervisory Committee

.....  
Signature                      Date

.....  
Prof. I. J. Musa  
Head of Department

.....  
Signature                      Date

.....  
Prof. K. Bala  
Dean, School of Postgraduate Studies

.....  
Signature                      Date

## **DEDICATION**

This research work is first and foremost dedicated to my loving parents - Mr John and Mrs Rita Emuophe, my brothers and sister, Michael, Samuel, Wilfred and Victoria.

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## **ABSTRACT**

The provision of infrastructural facilities is inevitable for socio-economic development of any rural area and the deficit of these essential facilities can create socio-economic regional imbalance for rural development. The aim of this study is to analyze the spatial distribution of rural infrastructural facilities in Makarfi local government area of Kaduna State, Nigeria. The study area population was about one hundred and forty six thousand two hundred and fifty nine (146,259). But Makarfi headquarter is not included as an urban area and the population of the nine wards is 86,430 (NPC, 2006). This figure was projected to 108,417 in 2014 using 3.18% growth rate retrieved from the National Population Commission (NPC), Kaduna State Official Website, 2014. Sample size of 399 respondents was derived from this, and a multi-stage sampling technique was adopted for the study. Descriptive statistics was employed to summarize the data into percentages, frequency counts and averages. Also, Standardized score (z-score) technique was used to measure variation in the distribution of rural infrastructural facilities. The findings using z-score technique showed spatial unevenness in the distribution of rural infrastructural facilities in the study area. Gubuchi, Nasara Doya and Gazara are more favoured in the provision of rural infrastructural facilities. Dan Damisa and Gimi have fair amount of the distribution of these rural infrastructure while, Meyare, Makarfi Tudun-wada, Gwanki and Ruma are inadequately provided for. Based on the findings, the study recommends adequate distribution of rural infrastructural facilities in order to bring about equitable development among the regions that make up the country. Also, government should encourage community participation in decision making on the critical infrastructure needed in their domain.

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## **CHAPTER ONE**

### **BACKGROUND TO THE STUDY**

#### **1.1 INTRODUCTION**

Infrastructure are the basic physical and organizational structures and facilities ( e.g. roads, power supply, healthcare facilities, water supply and more) needed for the operation of a society.

Infrastructure are basically the instruments or the components of functional structure for a nation. Therefore, infrastructure is key to rural development for example; rural electrification, rural water supply, rural roads, telephone connections and more (NPCM, 2011). Infrastructure is viewed as those facilities and services that are needful to improve the quality of life of the people. Abumere (2002) opined that infrastructure include the system of physical, human, and institutional forms of capital which enables rural residents to perform their production, processing, and distribution activities, as well as to improve the overall quality of life effectively. In addition, infrastructure can be better understood as those specialized elements in the development process that bring about improvements in the socio-economic welfare of the masses. Moreover, they are catalysts of development and at the same time their presence can be an indicator of the level to development (Oguzor, 2011; Oisasoje and Ojeifo, 2012).

The need for rural infrastructure towards socio-economic development of any nation cannot be easily ignored. As a matter of fact, the rural areas are known for primary economic activities which formed the foundation of economic growth and development (Ezeah, 2005; Abbah, 2010; Arigbede, Kolade and Yusuf 2010; Coker and Obo, 2012). Economic potential is largely determined by infrastructure (UN, 2011) and as a result, the spatial distribution of infrastructure is of great concern to policy makers. But while analysts may agree that developing infrastructure in rural areas is a necessary step to

reduce inequality and poverty, not all rural infrastructure development programmes have been uniformly successful in delivering these benefits. Therefore, a crucial question that comes to the policy makers is how can such programmes be planned so that their impact on the productivity and welfare of the poor is maximized and sustained (UNDP, 1997).

For some years back, development strategies by the government have been urban based resulting to relative neglect of the rural areas as evidenced in the inadequacy or dearth of infrastructural facilities in the rural areas (Yusuf, 2004; Abbah, 2010; Musa, 2010 and Ikechukwu, 2013). Okoli and Onah (2002); Barrios and Olujimi (2007) agreed with the situation that the rural areas are characterized by human deprivation of the highest level particularly of basic social amenities that set back the course of development. Even when available, they are mostly in poor conditions (Reusing, 2000).

Worthy of note, is Owoola (2002) who asserted that the problem of rural areas is mostly policy bias because stimulating growth, services and facilities are found in the urban areas therefore undermining the rural areas. The work further stressed that dire consequences are the outcome as inadequate provision of social amenities is a mark of the rural areas. Abbas (1997) and Egunjobi (2013) posited that apart from the existing poverty problem in the rural areas, there are still more issues that require immediate attention, most especially the rural-urban drift. Rural-urban exodus which occurs in the latter would continue unabated until such facilities are relatively provided and sustained in the former. Hence, the sustainability of rural development is key (Oviasuyi, Idada, and Isiraojie, 2010).

Despite the backbreaking reality that development of rural infrastructure is important to promote growth and poverty alleviation and high economic rates of return to investments in rural infrastructure, neither national governments nor international aid

agencies seem to prioritize investments in the construction of new infrastructure and maintenance of existing infrastructure (Tarique, 2008). All the efforts to formulate rural development policies by various regimes, their implementations have not yet transcended beyond the written forms or proclamations. The central place of infrastructure in development efforts need not be overemphasized, in fact infrastructure are the basic and the basic are the fundamentals. Idachaba (1985) observed that efforts to improve rural welfare must necessarily go beyond the traditional and limited approach of raising per capita income through agricultural development projects, to the provision of rural basic needs: health and medical facilities, rural transportation facilities, electricity, pipe-borne water and schools. Beyond the roles as producers of food and materials for urban dwellers, the rural dweller must be recognized, appreciated and entitled to good things of life like their urban counterparts. To achieve this, infrastructure should be equitably distributed in rural areas. Actually, the provision of infrastructural facilities in the rural areas is important for a better quality of life (FAO 2005)..

The level of infrastructure development has shown without any doubt that there are inadequate infrastructural facilities in Makarfi local government area which are meant to improve the lives of the rural dwellers. As far as rural infrastructure problems is concerned, George (2002) has stated distinctively that about two-third of Nigerians populations have had a raw deal in terms of enjoying basic utilities like potable water supply, access to good roads, electricity, storage and market facilities, educational facilities, health services, and more. George further explained that lack of development of rural areas has alienated the rural people from the good intention of government and these have resulted to tax evasion.

The study area is characterized by non-functioning borehole points, about three quarters (3/4) are broken down due to poor maintenance. The boreholes location poses serious challenges to rural dwellers, in as much as, the near-by ones are in bad shapes and the good ones are distance apart. The rural dwellers spend much time on queue at the few functioning ones. Moreover, some of the boreholes water are not drinkable because of the taste. The infrastructural field inventory survey by the researcher revealed inadequacies of healthcare facilities in the study area, the few available ones are dilapidated structure. Medical personnel are not readily available to attend to patients. The cost of service delivery is high, there is also delay in service delivery with irregular number of days the healthcare center opens per week. The electricity infrastructure makes no difference as insufficient power supply becomes regular, with inadequate distribution of transformers, high cost of electricity bills, break down of electrical equipments and epileptic power supply. With regards to the low quality of available infrastructural facilities in the study area; the rural dwellers have no choice than to go through the pains and expenses to patronize healthcare facilities located in the surrounding urban areas, where the quality of healthcare services are considered higher. It is a consensus among scholars (Ndulu, 2006; Calderon and Serve, 2008; Egbetokun, 2009) that infrastructures are the criteria for the success of public and private efforts aimed at accelerating economic development.

## **1.2 STATEMENT OF THE RESEARCH PROBLEM**

The study area is characterized by deficit of rural infrastructure and the available ones are not in good condition. The number of boreholes water supply are insufficient to meet the demands of the rural dwellers. Some wards like; Gwanki and Gimi have five (5) numbers of boreholes points in each. Ruma has three (3) while the rest are having

between nine (9) to fourteen (14). The healthcare facilities such as; clinic, dispensaries, primary health centre are grossly distributed in the study area.

Efforts have been made by various administrations in Makarfi Local Government Area to provide infrastructural facilities yet, some of the rural areas require even more. For instance, some of the bore-hole projects have failed due to inappropriate techniques used for the siting and non institutional capacity and willingness to support and manage such projects sustainably (Schmoll, Chorus, Howard and Appleyard, 2006).

Adefila and Bulus (2014) examined the level of spatial dimension of inequalities in infrastructural development in Plateau State. The result of the study revealed considerable inter-local government disparities in all levels of infrastructural development in seventeen local government areas using standardized score (z-score). The z-score results conclusively said that there is a lopsided spatial pattern of infrastructural development among seven areas that are most privilege and they constituted 41.2%. while the other ten areas are under-privilege and they constitutes 58.8%. Adefila and Bulus stated that the role of infrastructures depends on the extent to which the infrastructures are adequately provided, distributed over space and maintained particularly in the rural communities. A situation where the people trek a long distance before they can access infrastructural facilities is not globally acceptable. Irrespective of this however, it is believed that the few ones in the study area are having some significant on the lives of the people but how much of this significant is still a pressing issue.

Healthcare facilities such as; drugs and other medical services are inadequately supplied in the study area. The epileptic power supply has caused more hardship to the people in terms of cooking, grinding, source of light, even for small scale enterprises. Despite this

pathetic situation, some of these communities in Makarfi L.G.A. do not even have these infrastructure.

Oguzor (2011) observed inequalities in the distribution of socio-economic facilities in Nigeria. Furthermore, Oguzor's paper presentation on a spatial analysis of infrastructures and social services in rural Nigeria: implications for public policy examined the availability of some social infrastructural facilities in eighteen (18) rural communities of Imo State, and the extent to which those facilities promoted rural development in the state. The result of the findings using z-test of proportion statistics indicated unevenness in the availability of portable water supply and telephone (analogue landline) facilities.

Apart from Ekpo, (2012) who studied the comparative analysis of the influence of socio-economic variables on women attitude on family planning in Jaba and Makarfi, none of these studies have been conducted on analysis of spatial distribution of rural infrastructural facilities in Makarfi local government area. So it is this gap in knowledge the study intends to fill because a spatial analysis of rural infrastructure distribution and the pattern of distribution will bring to light not only the pattern of distribution of the infrastructure but whether they are evenly or partially distributed in the study area.

Considering the statement of the research problem, the study seeks to answer the following research questions and they include:-

- (1) What are the types of rural infrastructural facilities in rural communities of Makarfi L.G.A.?
- (2) Is there any spatial distribution of rural infrastructural facilities in the study area?
- (3) What are the factors responsible for the pattern of distribution of infrastructural facilities in the study area?
- (4) What is the condition of the rural infrastructural facilities in the study area?

(5) What are the challenges of accessing the facilities in the study area?

### **1.3 AIM AND OBJECTIVES**

The aim of the research is to analyze the spatial distribution of rural infrastructural facilities in Makarfi local government area. However, the specific objectives of the study are to:-

- (i) identify and characterize rural infrastructural facilities in the study area.
- (ii) analyze the spatial distribution of infrastructural facilities in the study area
- (iii) examine the factors responsible for the pattern of infrastructural facilities distribution in the study area.
- (iv) assess the condition of the infrastructural facilities in Makarfi local government area
- (v) assess the challenges facing accessibility to the infrastructural facilities in the study area.

### **1.4 SCOPE OF THE STUDY**

The study is concerned with analysis of spatial distribution of rural infrastructural facilities in Makarfi local government area of Kaduna State. The spatial scope of the study covers nine wards namely: Mayare, Gubuchi, Ruma, Gimi, Gazara, Kwanki, Makarfi Tudun-wada, Dan Damisa, and Nasarawa doya with the exception of Makarfi town because it is the headquarters and considered as an urban area. The study is confined to three major infrastructural facilities namely water supply, electricity and health care infrastructure. The content scope include characterization of the facilities, spatial distribution, factors influencing the spatial pattern of distribution, the condition of the infrastructure and challenges facing accessibility of the facilities. The temporal

scope covers the infrastructural facilities provided since the creation of the Makarfi Local Government Area in 1991-2014.

### **1.5 SIGNIFICANCE OF THE STUDY**

Policy makers should prioritize the provision of rural infrastructural facilities which are the basic needs of the rural dwellers in order to justify the essence of rural development. Spatial distribution of rural infrastructure must be a concern for policy makers, stakeholders, community groups, development planners and government at large with the view of transforming the rural area (Makarfi) into a modern town (Filani, 2012). Apart from agriculture as the leading economic development variable, the availability of infrastructure supports farming and other livelihood options. The presence of good roads, pipe borne water, electricity, markets, health centres and education among others have been the major agents of transformation (Oguzor, 2011). But how can development strategies and regional imbalance be improved to reduce rural poverty and to maximize the rural welfare has lingered in the mind of the developers. The researcher must discover the impending issues with the view to profile solutions. Therefore, the needs for development strategies of delivering the provision of equitable rural infrastructure has become paramount. In this view, the researcher analyzes the spatial distribution of rural infrastructural facilities in Makarfi local government area.

The analysis of spatial distribution of rural infrastructural facilities in Makarfi local government area using standard score (Z-Score) revealed unevenness in the distribution of portable water supply, healthcare facilities (dispensaries, clinic and primary healthcare centres) and electricity power supply in the study area. Some communities are more provided for than others while some are grossly provided for resulting to suffering and high rate of poverty in some part of Makarfi local government area.

However, a situation where people that live in rural areas and are provided with little infrastructural facilities, creates a regional imbalance causing migration from rural to urban areas (McCatty, 2004, Egunjobi 2013). Proper infrastructural planning helps in the eradication of mass poverty, creating job opportunities and improving the standard of living. Recommendations and suggestions are given to correct these regional imbalance in the distribution of the rural infrastructures. Therefore, a clear understanding of rural development dynamics is necessary for transformation progress.

## **CHAPTER TWO**

### **CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW**

#### **2.1 CONCEPTUAL FRAMEWORK**

##### **2.1.1 Concept of Rural**

There is no international standard for defining rural areas, and standard may vary even within an individual country. There are two axes for rurality: population-based factors and geography-based factors. The perception of rurality includes small population size, sparse population density, predominance of primary activities (especially agriculture) and distance from an urban centre, settlement pattern and labour market influences. Few people would disagree that a small village in a sparsely populated municipality is ‘rural’, or that a city in a densely populated municipality is ‘urban’ (UN, 2009; Cromartie, and Bucholts, 2012).

According to the United Nation Organization (UNO, 2000) rural settlement is an area with less than 20,000 population. Rural settlements engage in primary activities such as farming, hunting, fishing, weaving, blacksmithing and other informal occupations.

The concept of rurality is a relative term which can be articulated as follow. It refers to a territory that is characterized by a relative low absolute number and density of population together with certain district socio-economic parameter. An official definition of “rural” does not always exist. Those commonly used vary significantly. In most cases, rural is treated as a residual category as not being ‘urban’ (USDA, 2015)

In terms of life expectancy, as an indicator of rurality studies have shown that life expectancy rates are higher in urban areas than in rural areas while for working conditions, rural area often has fewer job opportunities and higher unemployment rates than urban areas. The professions are often physical in nature, such as farming, forestry, hunting, fishing, weaving, blacksmithing among others (Pitblado, 2005).

Frequently, the concept of rural development is used confusedly with “agricultural development” or “regional development”, however these concepts differ. The definition of “rural” differs by country, though it is usually used in contrast to “urban”. For instance, this word is defined based on population density in Japan, indicating “an area with over 5,000 people, which consists of each district with a population density of over 4,000 per square kilometer”. However, this definition cannot be applied to other countries. Moreover, due to the fact that the concept of “rural” varies from Asia to Africa, it is difficult to define it uniformly. Therefore, the use of “rural” (including fishing and mountain villages) as a relative concept to “urban”, based on social, economic, and natural conditions in each country may be most adequate. The term could also be used to describe areas where a majority of the residents are engaged in agriculture in a broad sense (including livestock farming, forestry, and fisheries) USAID (2000) and World Bank (2001).

Nigeria’s internal disparity between rural and urban areas still remains very high even after several national and regional development efforts (Olayiwola and Adeleye, 2005). Measured in terms of quality of living, social opportunities, physical facilities, human development and standard of living, the overall score for rural areas still stands very low in comparison with its urban counterparts.

Rural population in Nigeria have varied over the years in response to rapid urban expansion and accompanying rural-urban migration. Nigerian post-independence effort at estimating the number of people residing in the rural areas started in 1963. The 1963 Census recorded 80.7% of the national population residing in the rural areas. This proportion dropped to 70.13% in 1985 and was estimated to further drop to 69% by 1990s (Muoghalu, 1992). In 2005, it was estimated that 53% of the Nigerian populace resided in the rural areas (World Development Reports, 2005) and in 2011; the World

Bank reports recorded 51.6% of Nigeria's rural population. These statistics are, however, countered by some recent reports projecting the rural population above 70% of the Nigerian population (see Presidential Report, 1999; Yakubu and Aderonmu, 2010). Rural areas in Nigeria have generally been associated with agriculture which still depends on manual and local efforts. The implication is that the rural areas depend on agricultural sector for income, employments and other livelihoods opportunities. Despite its contribution to the national economy and GDP, rural areas in Nigeria remain very poor and deeply neglected (IFAD, 2011). Investments in physical, social and economic infrastructure have been focused largely on the cities. As a result, the rural population has extremely limited access to services such as schools and health centres, while the highest number of the populace lack access to safe drinking water. In the Nigerian context, the rural areas are associated with poverty and, as such, not attractive to live.

### **2.1.2 Infrastructure**

Infrastructure is one of the pillars of economic transformation. Sustainable economic growth often occurs in an environment where there are adequate infrastructure, and there is evidence that it reduces inequality in the society (Canning, Fay and Perotti, 1994 and ETP, 2010). It is also clear that development of rural infrastructure (energy or electricity, transport, water, storage facilities among others) significantly contributes to the level and quality of rural development. Countries that have developed their rural infrastructure have recorded higher and better quality of rural development than those that have failed to do so (ECA, 2013 and IMF, 2014). For all intents and purposes, rural infrastructure are very critical for rural development and national programmes (Ikeji, 2013).

WHO (2000) define infrastructure as necessary services, facilities, equipments and devices desired for the physical, mental, health and social well-being of the family and individual. These include sewages, sanitation, roads, electricity, drainage, waste disposal and other public transportation systems. Better rural infrastructure allows people to participate in and share the benefits of wider economic growth. Indeed, infrastructure contributes to inclusive rural development in many ways and the overall impact of high quality rural infrastructure on the quality of life of the rural population can be substantial. For instance, rural infrastructure provides rural people with access to market and to basic services that they need. In 2002, a summit was held in Jos (Plateau State) to analyze the way forward to achieve infrastructural development in Nigeria bearing in mind that the tempo of development in a nation depends very largely on the extent of its infrastructural development. It also influences rural economic growth and employment opportunities and thereby improving incomes and social development. Omnipaedia (2012) buttressed the above fact that the ministry of rural development (MoRD) government of India implemented the provision of urban amenities in rural areas (PURA) as a central sector scheme that aim at solving the rural area's immediate problems.

Infrastructure are those basic physical, social and institutional forms of capital, which enhance production, distribution, consumption activities and ultimately the quality of life (Ekong, 2000). Essentially, it constitutes facilities such as basic services without which primary, secondary and tertiary productive activities cannot function (Madu, 2007) Infrastructure form the necessary ingredients for motivating people to be more productive and achieving relative self-reliance (Ekong, 2005). In other words, infrastructural facilities are elements in the package of basic needs which a community would like to procure for better living (Olayiwola and Adeleye, 2005). Infrastructure are viewed as those facilities and services that are needful to improve on

the quality of life of the people. Infrastructure are commonly subdivided into physical, economic and social.

## **2.2 LITERATURE REVIEW**

### **2.2.1 Types of Infrastructure**

#### *2.2.1.1 Physical Infrastructure*

Physical infrastructure refers to the basic physical structures required for an economy to function and survive, such as transportation networks, a power grid, sewerage and waste disposal systems. Physical infrastructure is a prerequisite for trade and other productive activities. In a functional sense, a society's physical infrastructure facilitates the production of goods and services. Abumere (2002) put infrastructure to include the system of physical, human, and institutional forms of capital which enables rural residents to better perform their production, processing, and distribution activities, as well as to improve the overall quality of life. In addition, infrastructure can be better understood as those specialized elements in the development progress that bring about improvements in the socio-economic welfare of the masses. Moreover, they are catalysts of development and at the same time their presence can be an indicator of the level of development (Oguzor, 2011; Oisasoje and Ojeifo, 2012).

Anthropological research has demonstrated the importance of infrastructure to social development. Infrastructure shapes human society and, in turn, society shapes the infrastructure in ways that will enable its growth through rural physical infrastructure such as; roads, bridges, storage facilities, dams, irrigation, water facilities which this study considers and other form of processing facilities (Idachaba, 1985).

#### *2.2.1.2 Economic Infrastructure*

Idachaba (1985) posited that economic infrastructure means those basic facilities and services which directly benefit the process of production and distribution of an economy. Irrigation, power as (electricity power supply), transport and communication are the examples of economic infrastructure. Barrios (2007) had assisted in categorizing the infrastructural facilities to include - economic such as incentives from government, loan, production support; physical infrastructure such as roads, electricity, irrigation facilities; capacity building in terms of training, information dissemination; and support service namely, market services, and access to basic social services.

#### *2.2.1.3 Social Infrastructure*

Social infrastructure means those basic activities and services which, in addition to achieving certain social objectives, indirectly help various economic activities. For example, education does not directly affect economic activities like production and distribution but indirectly helps in the economic development of the country by producing scientists, technologists and engineers. So education, health services as one of three selected infrastructure, sanitation and water supply are the example of social infrastructure (Mehta, 2002).

### **2.2.2 Infrastructural Distribution and Economic Development**

It has been noted that the spatial variation in availability and access to rural infrastructure results in spatial disparities in living standard both within and between regions and localities (Madu, 2007). The existence of disparities in living standards therefore makes the analysis of the patterns of rural development imperative in order to identify areas of deprivation. The analysis is particularly important in Nigeria, where inadequate and non-functional rural infrastructure is the major characteristic of the rural settlements.

In terms of the roles that rural settlements play in the economy of a nation, infrastructure is meant to enhance the productive capacity and the quality of life of the rural areas and inhabitants. It is in this way that the nation can actually achieve what might be regarded as the essence of rural development in the spatial economy with its characteristic rural-urban dichotomy (Mylott, 2009; Adedayo, 2013). Infrastructure is often regarded as the underlying foundation or basic framework of a system (Abumere, *et al.*, 2002). Therefore, programmes for poverty reduction in rural areas or indeed for overall rural development cannot succeed unless supported by infrastructure. Hence, access to infrastructure is usually used as a sensitive measure of poverty and rural performance. Madu (2007) supporting the above assertion reports that availability of rural infrastructure can be effectively used as proxy indicators of the level of rural development in Nigeria.

Basically, rural development is concerned with raising the quality of life of the low-income population living in rural areas on a self-sustaining basis, through a fundamental transformation of the rural mode of production. It entails the total transformation of the rural component of the nation's mode of production. This involves a transformation of not only production technology and organization but also social relationships and social basis for coordinating the rural population. Thus, when viewed as socio-economic transformation, rural development means the restructuring of the Nigerian rural economy so as to lift it from being a peasant, subsistence agricultural economy to a modern agro-industrial economy capable of raising and sustaining the quality of life in our rural areas (Attah, 2012 and Adedayo, 2013). However, Olujimi and Olanrewaju (2003) are of the opinion that provision of rural infrastructure that will facilitate the production, distribution and consumption activities as well as enhance the quality of rural life is central to rural transformation.

Infrastructural delivery arrangement in the rural settlements in Nigeria both in quality and quantum are far from satisfactory. Consequently, spatial variation in availability and access to rural infrastructure has resulted in spatial disparities in socio-economic development both within and between regions and locations. The extent to which infrastructure provision impacts on socioeconomic development of rural settlements in the country becomes necessary so as to come up with strategies for sustainable infrastructural delivery.

### **2.2.3 The Factors Responsible for the Pattern of Infrastructural Distribution**

Geography plays a significant role in the development process. Three spatial features influence the economic development (page 14 and 15) of a rural area; population, accessibility and availability (spatial integration of economies). Improvement access to people and infrastructure is key for development and plays an important role in poverty reduction. Development among rural populations depends on access to markets for buying and selling goods, to water and electricity power supply, and to various social and economic services such as education, healthcare, banking and loan (Schumann, 2012).

The lack of reliable infrastructural facilities forces rural population to spend a significant amount of time in travelling to meet basic needs and increase cost incurred to access these services. Improving the accessibility of remote populations is an important priority for many of the Millennium Development Goal (MDG) targets, such as those focused on eradicating extreme poverty and developing a global partnership for development (Linard, Gilbert, Snow, Noor, and Tatem, 2010; Schumann, 2012).

#### **2.2.4 Challenges Facing Accessibility of Infrastructural Facilities**

Several other stylized facts about rural infrastructure and its impact on economic growth and the poor have emerged from the literature. For example, how effective an infrastructure asset would be in meeting the needs of the poor, would depend on peculiar characteristics such as quality, reliability and quantity. At the same time, its impact would vary not only by sector, but also by its location and timeliness. Even so, though developing infrastructure promises to hold many benefits for the poor, it is not sufficient on its own to generate sustained increases in economic growth in rural areas.

A lack of access to physical infrastructure like electricity, clean water and proper roads and housing are closely linked with poverty. Important though the physical infrastructure for development is, the recent debates around sustainability raise the critical issue of continuity of service and use of resources. Where incomes are stagnant or declining, an extension of services can run into the difficulties of continuity. Where there are low levels of payment and inadequate inter-governmental transfers disconnections, vandalism, and deterioration of services can result. Service delivery without poverty alleviation and rising incomes is unstable and wasteful. It can also lead to the rapid degradation of natural resources, often exacerbated by unsustainable practices (Meyer and Maphunye 2004).

##### *2.2.4.1 Challenges of Accessibility to Water*

To establish how much an individual needs, standard quantities have been established as guidelines. For example, not all water will be needed in the house. It may be preferable to provide separate water supplies for bathing, washing as well as for hospitals feeding centres and schools. Water for hand washing will be needed near latrines. Water does not all have to come from the same source, thus people may be provided with bottled drinking water, but use a stream to wash their clothes. As demand for water increases,

generally the quality needed for each use can be reduced (House and Reed, 2000). People use water for a wide variety of activities. Some of these are more important than others. For example, having a few litres of water to drink a day is more vital than washing clothes but people will need to wash if skin diseases are to be prevented and physiological needs met. The requirement of needed water per person per day is often measured in litres per person(capita) per day (LPCD). Estimates vary, but each person uses about 80-100 gallons of water per day. The largest use of household water is to flush the toilet, to take showers and baths. A higher quantity of about 20 litres per capita per day should be assured to take care of basic hygiene needs and basic food hygiene.

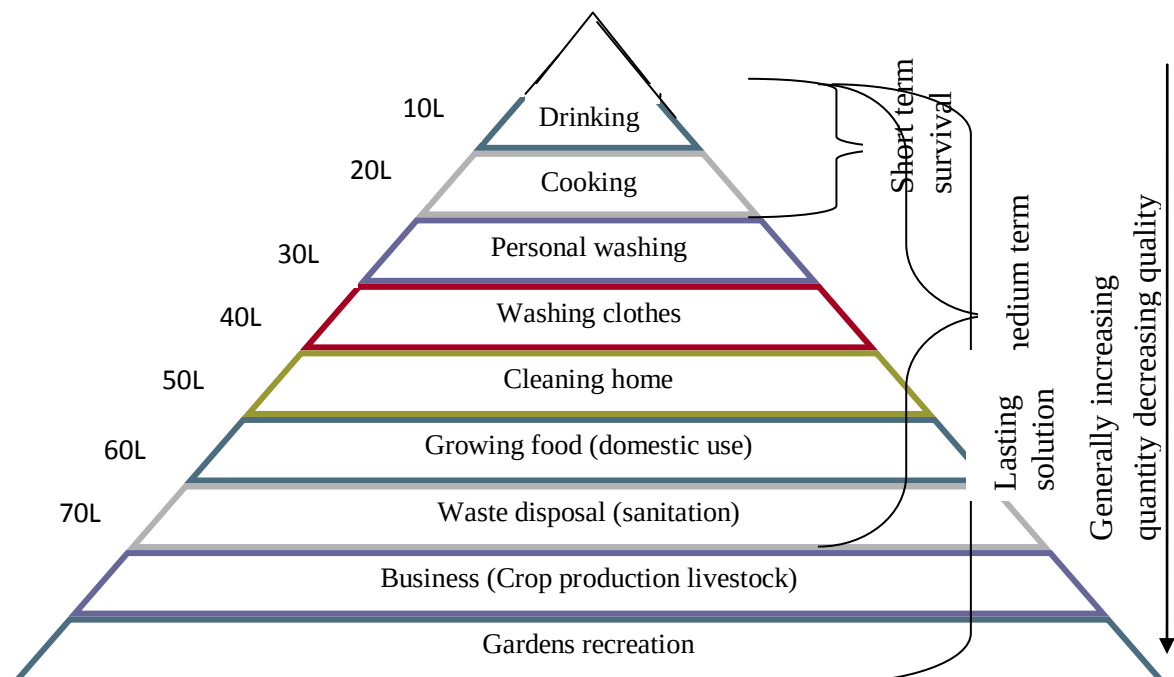


Fig 2.1 : The Requirement of needed water per person per day  
Source: USGS, 2016

The volume of water required to meet consumption is estimated at 20 liters per day. International monitoring organizations therefore define “access” as the availability of at least 20 litre per person per day from an “improved” source within 1 kilometer of the

user's dwelling (WHO and UNICEF, 2000; World Bank, 2005 and Fogden 2009). Thus, increasing access to domestic water supply and sanitation services and improving water resources management are catalytic entry points for efforts to help developing countries fight poverty and hunger, safeguard human health, reduce child mortality, promote gender inequality, and manage and protect natural resources. In addition, sufficient water for washing and safe, private sanitation facilities are central to the basic right of every human being for personal dignity and self-respect (WHO and UNICEF 2000).

Increased population and insufficient investment in infrastructure over the past several decades have left almost one-third of the world's people without access to clean water. Approximately, 60% of rural families and 25% of urban home lack safe water. Water supplies in much of the developing countries are either contaminated with sewage due to the lack of sanitation systems or are inaccessible to large numbers of people. Water borne diseases such as cholera, cryptosporidium, guinea worm and schistosomiasis affect over 300 million people. These diseases, when not resulting in fatalities, are debilitating and leave many of their victims unable to work at their full potential. Water-borne diseases are a wide spread hazard in the rural areas, and people frequently must travel long distances to obtain household water. In worldwide over one billion people lack access to an adequate water supply; more than twice as many lack basic sanitation (WHO and UNICEF, 2006).

George, (2008) had remarked that lack of access to clean water and sanitation has had devastating effects on many aspects of daily life. It is projected that by 2025 water scarcity will affect nearly two-third of all people on the planet. The majority of these people live in rural areas without community infrastructure. The lack of access to clean water is a serious health concern (WHO, 1996). Reports have revealed that about 2.3 billion people suffer from diseases related dirty water and water related diseases are

growing human tragedy, leading to the death of over 5 million people yearly (Godwin, 2008). In 2005, the UN Millennium project report attributed million deaths per year to unsafe water and poor sanitation with close to 90% of these deaths occurring in children under five years of age (Dun and Derrington, 2010).

The Millennium Development Goals (MDGs), with respect to environmental sustainability (Goal no 7), it is targeted that by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation should be halved. Real successful achievement of the MDGs will depend on the method of addressing water scarcity issues. The lack of water hampers development through constraining food production, health and industrial development.

UN-Water, (2006) stressed the important livelihood assets (water) which will eradicate poverty and hunger, when equitable and fair access to water for domestic and productive uses is given immediate attention. Access to safe water and sanitation is a major challenge in Nigeria especially in rural areas. The Nigerian government has a national water supply policy, whose aim is to provide potable water to all citizens by the year 2020. The objective of the policy is for all Nigerians to have access to adequate, affordable and sustainable sanitation through the active participation of the Federal, State and Local Governments, Non-Government Organization (NGOs).

Sadoff and Grey (2005) posited that achieving water security is through the reduction of its destructive potential and increasing its productive potential. There is now gradually re-emerging consensus that water resources development and management are essential to generate wealth, mitigate risk and alleviate poverty; that poverty demands that many developing countries will need to make large investments in water management and infrastructure at all levels; and this development must be undertaken,

building on the lessons of experience, with much greater attention to institutional development, to the environment and to more equitable sharing of benefits and costs.

Water has always played and continues to play, a central role in human societies. Water is source of life, livelihoods and prosperity. It is an input to all production, in agriculture, industry, energy, transport, by health people in healthy ecosystems. Water is also a cause of death, devastation and poverty. It is force destruction, catastrophically through erosion, inundation, desertification, contamination and disease. Managing water resources to achieve water security remain at the heart of struggle for growth, sustainable development and poverty reduction. This has been the case in all industrial countries, most of which invested early and heavily in water infrastructure, institutions and management capacity. But investment in water development and management remain an urgent priority in rural areas (Grey, 2007).

The challenges of managing water in rural areas is almost without precedent yet, if these challenges are not met, sustainable growth and rural socio-economic development cannot be achieved. The term “water security” is often used but lacks and needs. “Food or energy security” generally means reliable access to sufficient supplies of food and energy. Water security is availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production coupled with an acceptable level of water-related risks to people, environments and economics (Grey, 2007).

Past Government efforts have been fragmented focusing on water resources development on a sub-sectorial basis but neglecting to manage it strategically as a national resource. The Government recognizes the need to manage water supply in an integrated and sustainable manner, and has embarked on the preparation of a National Water Resources Management Strategy (WRMS) to ensure proper management and development of its water resources. A participatory approach has been adopted giving

consideration to the needs of all stakeholders. The WRMS will include considerations of water supply development and rehabilitation, water-shed protection, basin management, water quality monitoring and pollution control, international waters, pricing and environmental protection (Henley, 2000).

The women, children, and elderly in the world's poorest countries are often most adversely impacted by disparate distribution and access to potable water. The National Academy of Engineering documents that "more people die from lack of access to clean water than from war," and that in 2009 about one in six people lacked adequate access to clean water. Access to clean water and sanitation infrastructure is essential for the planet's growing population, both from a health and economic perspective. Constructing miles of underground pipe to deliver water and convey wastewater and building hundreds of facilities to treat drinking water and remove pollutants from wastewater requires massive capital investment in countries across the globe. Given that much of this infrastructure will be needed in cash-poor developing countries and that private entities have large sums to invest in infrastructure, water infrastructure privatization has been hailed by governments, financiers, and even communities as a progressive wave of the future. Access to water resource is an uninhibited right of the community. With this in mind, the United Nations Millennium Development Goals (MDG) aims to reduce the proportion of people without sustainable access to safe drinking water and basic sanitation by 50 % by year 2015 (WHO, 2010).

Access to water is a prerequisite for health and livelihood, which is why the MDG target is formulated in terms of sustainable access to affordable drinking water supply. The availability of improved and quality water supply and sanitation infrastructures are widely recognized as an essential component of human rights, social and economic development (ADF, 2005).

Based on available data, Nigeria has adequate surface and ground water resources to meet current demands for potable water though the temporal and spatial distribution of water has led to scarcity in some locations especially in the north. This disparity has led to rapid depletion of groundwater, especially in the northern towns which have resorted to other sources making life difficult. As state capitals and larger towns become more and more dependent on surface sources and experience the difficulties associated with treating such water, water shortages are developing in the far north and potential conflicts in the south west, where water transfer between states is necessary. In other locations, particularly in the Delta region and near major cities, conflicts arise due to insufficient control of water pollution, and serious erosion problems. All these water insecurity tend to shift the focus of economic development to water challenges retarding the objective of rural development (Anand, 2006).

#### *2.2.4.2 Challenges of Accessing Electricity*

Steviethe man (2015) made it known that electricity is used not only for lighting and household purposes, but it also allows for mechanization of many farming operations, such as threshing, milking and hoisting grain for storage. In areas facing labour shortages, this allows for great productivity at reduced cost. According to International Energy Agency IEA (2009) worldwide 1.456 billion people (18% of lives of the world's population) do not have access to electricity, of which 83% live in rural areas. In 1990 around 40% (2.2 billion) of the world's population lacked access to power (electricity). Much of this increase over the past quarter century has been in India, facilitated by mass migration to slums in powered metropolitan areas. India was only 43.0% electrified in 1990 as opposed to about 75.0% in 2012. In 1979 37.0% of China's rural population lacked access to electricity entirely. Some 23.0% of people in East Java, Indonesia, a core region, also lack electricity as surveyed in 2013. In sub Saharan Africa less than

10.0% of the rural population has access to electricity. Worldwide rural electricity progresses only slowly. The IEA estimates that, if current trends do not change, the number of people without electricity will rise to 2.2 billion in 2030. Due to high population growth, the number of people without electricity is expected to rise in Sub-Saharan Africa. In impoverished and rural areas, small amount of electricity can free large amounts of human time and labour. In the rural areas, people carry water and fuel by head, their food storage may be limited, and their activity is limited to daylight hours. This is partly because there is little or no access to electricity that could be used to achieve these activities as necessary and desired.

Adding electric-powered wells for clean water can prevent many water borne diseases e.g. dysentery, by reducing or eliminating direct contact between people (hands) and the water supply. Refrigerators increase the length of time that food can be stored, potentially reducing hunger, while evening lighting can lengthen a community's daylight hours allowing more time for productivity.

Nigeria's energy crises are linked to some inadequacies in supply and distribution, pricing, planning and manpower. Unmet households' energy demands have some adverse effects on the living standards of the population, with grossly degenerated income and energy poverty. The situation is more pathetic when one realizes the magnitude of nonrenewable resources that the nation is naturally endowed with (Orukpe and Igbinovia 2007; Iwayemi, 2008).

The National Bureau of Statistics (2007) noted that not only is electricity generation in Nigeria characterized by excess capacity and inadequate supply, but that peak demand is often about one-third of installed capacity. The inadequate supply is mainly because of the no availability of spare parts and poor maintenance of the system. Another reason is the fluctuation in water level powering the hydro plants. According to the CIA,

(2011) Nigeria produced 18.62 billion kWh of electricity with an installed capacity of 5.9 million Kw but consumed 17.66 billion kWh in 2009. The transmission network is overloaded, with poor voltage resulting in low current in most parts of the network. The technologies used generally deliver very poor voltage stability and profile.

Electricity generation is mainly from the thermal power plants, which make up for 77% with two-thirds from natural gas and the rest from oil. The hydroelectricity constitutes 23%, however, according to IEA the amount generated reduced from 8.2 billion KWh in 2002 to 4.5 billion KWh in 2009. This has been due to the trend in the climate change leading to fluctuation in the water level. There was, however, an improvement of 1.8% in the electric power generation in 2011 compared to 2010 attributed to increased gas supplies to the thermal stations. The increased supply from the generating stations allowed for the increase in electricity in the same year.

International Energy Agency (IEA, 2006) noted that in order to meet the households' energy needs, about 70% of rural households in sub-Saharan Africa rely on fuel wood, charcoal, kerosene oil or wood wastes. However, dependence on biomass energy sources are laden with several environmental challenges that are associated with deforestation and land degradation (World Energy Council, 1999; Faye, 2002). This raises the concern of sustainability. Adverse health implications of biomass fuel usage have also constituted some concerns to policy makers. Specifically, indoor air pollution that results from burning of biomass is responsible for some worrisome health hazards (Muchiri and Gitonga, 2000). The World Health Organization (WHO) estimated that about 1.5 million annual premature deaths can be linked to indoor air pollution from the use of solid fuels (IEA, 2006). Incidences of respiratory infections and cataracts in some rural areas have been linked to emitted smokes from biomass fuels (UNDP and

ESMAP, 2003). Inducement of energy switch from biomass to cleaner energy through workable energy policies (electricity) is expected to offer safety to rural people.

Nigeria has an abundant supply of energy sources. It is endowed with thermal, hydro, solar, and oil resources, and yet it is described as an energy-poor country because the sector is relatively under-developed. The available statistics show that only about one third of Nigeria or approximately 40 per cent of the population has access to electricity. The distribution of electricity shows great disparities between rural and urban, and between residential and industrial areas in the urban centers (Ali-Akpajiak and Pyke, 2003). The very poor quality of electricity supply in recent years has been a major constraint on the performance of the economy. As power supply through the Power Holding Company of Nigeria (PHCN) formerly, National Electric Power Authority (NEPA) has proved very unreliable. Ali-Akpajiak and Pyke (2003) in Ubi and Effiom, (2011) said that it has become imperative for most industrial or commercial establishments or even individual consumers to acquire diesel standby generating plants at exorbitant costs. Besides, the hazards of diesel fumes to the environment, the situation has contributed significantly to increase in production costs in a highly depressed economy.

In this regard, adequate supply and distribution of electricity constitute a central development issue which cannot be over-emphasized. Apart from serving as the pillar of wealth creation in Nigeria, it is also the nucleus of operations and subsequently the engine of growth for all sectors of the economy (Ayodele, 2001). In recognition of the consolidating linkage between the energy sector and the other sectors of the economy, electricity development and utilization therefore have pervasive impacts on a range of socio-economic activities and consequently on the economic progressiveness and wellbeing of citizens of the country. It is in the light of this facts that Okonkwo (2002)

stated that there is a correlation between electricity supply, industrialization, and human comfort.

Considerable efforts have been made to establish the relationship between energy consumption and economic growth. Very few studies have been carried out to investigate the relationship between the energy sub-sector (electricity supply) and economic development in Nigeria. Even the studies in this energy sub-sector and growth tend to be descriptive (Ayodele, 2001; Adegbulugbe and Akinbami, 2002).

All in all, the state of rural electrification in Nigeria leaves much to be desired, regardless of various half-hearted efforts on the part of the Federal and State governments, and their agencies. The necessary outcome of the overall poor state of rural infrastructure in Nigeria is further rural underdevelopment and decay. There is a vicious circle uniting poor rural infrastructure, to rural underdevelopment. As a way of breaking this vicious circle and thereby freeing the rural areas from, the clutches of underdevelopment, the Federal Government had embarked on a variety of programmes, the focus of which is the provision of rural infrastructures. These government-led programmes include the Agricultural Development Project (ADP). The River Basin and Rural Development Authorities (RBRDAs), and the Directorate for Food Roads, and Rural infrastructure (DFRRI). A more detailed discussion of the activities of these projects in rural infrastructure development will be in order.

Petroleum products and electricity constitute the most widely used domestic energy sources in Nigeria. Because of inefficiency of the centralized energy industry, prices of these products have been unstable, while supply is grossly inadequate for the rapidly growing population. Therefore, the economy had suffered perennial energy crises with some huge economic losses and social consequences (Shittu *et al.*, 2004). The political dimension of the crises can be vividly portrayed from the fact that while federal

government often makes promises of energy sector reforms as ambitious legislative work, corruption in the public sector stands as impediment in the implementation processes.

#### *2.2.4.3 Challenges of Accessing Health Care Infrastructural Facilities*

If Health programmes in the rural areas in Nigeria should ensure a deep rooted, self-sustained and self-retained development based. The need to have health delivery programme designed to mobilize the rural citizenry to actively participate and cooperate in the task of rural health development become imperative. This pre-supposes government that in their pursuit for a health delivery programme in the rural dwellings should have the responsibility of democratizing the rural development process by involving the rural dwellers in planning and implementing rural health development projects and providing rural revenue credit facilities. This means that for an effective health delivery system, it must involve active rural participation, rural finance, rural credit and saving mobilization involvement and cooperation in planning, implementation of health delivery programme. In Nigeria, an approach to health delivery scheme is still far from reality, there are several underlying factors responsible for the failure of effective and competent health management in Nigeria. These include poor funding, non-participation of communities on health care programmes, inadequate personnel, lack of self-sustenance and rural credit facilities (Enabulel, 2013; Nnabuihe, 2015).

Having exposed thus, it is imperative to adopt an approach towards a more effective rural health services in Nigeria as a solution to solving forces acting upon rural health services. Health is a major form of human capital. It is assumed that improvement in health leads to improvement in life expectancy, which is a robust indicator of human development. A simple channel through which health affects human development is by

improving living conditions. As living conditions improve, human longevity is expected to improve and vice-versa. Empirical evidence has shown that among poor countries, increase in life expectancy is strongly correlated with increase in productivity and income (Deaton 2003)

Health care utilization is the use of health care services by people. The health care utilization of a population is related to the availability, quality and cost of services, as well as to social-economic structure, and personal characteristics of the users (Chakraborty, Islam, Chowdhury, Bari and Akhter 2003; Manzoor, Hashmi and Mukhtar 2009; Onah, Ikeako and Iloabachie 2009). It is, therefore, in recognition of this fact that various Nigerian governments have made numerous great efforts towards the provision of health care facilities to its population.

#### **2.2.5 PROBLEMS OF INFRASTRUCTURE DEVELOPMENT IN NIGERIA**

Dearth of Visionary Leaders: Visionary leaders are the builders of a new dawn, working with imagination, insight, and boldness. They present a challenge that calls forth the best in people and brings them together around a shared sense of purpose. Visionary leaders are change agents. Nigeria contains few change agents and therefore lacks the needed infrastructure to develop the nation (Oyedele, 2012). In spite of the growing importance attached to rural infrastructure, the rural areas have long been deprived and neglected even though they constituted the majority of the Nigeria's population. It is obvious that rural population has limited access to modern farming inputs, productive resources, and basic infrastructures such as schools, health centers, potable water, good feeder roads, culverts, storage and irrigation facilities (Fakayode, Omotesho, Tsoho, and Ajayi 2008).

In Nigeria, a major problem is the pattern of distribution of these basic infrastructures which exhibits urban bias hence poverty is at a higher level in the rural areas than urban

areas. A considerable emphasis is placed on the development of urban infrastructure either directly or indirectly to the almost neglect of the rural areas (Oguzor, 2011). Climate change is a major factor for infrastructural development challenges in rural areas of Nigeria (Abah, 2012).

Erratic power supply hamper infrastructural development in Nigeria because most of the infrastructure are power driven in nature (Ohajianya, Abumer, Owate and Osarolube, 2014). Government non sustainable policy action towards rural transformation, is responsible for the poor state of affairs among rural dwellers in Nigeria. There is decaying healthcare facilities in the rural areas (Osain, 2011).

#### **2.2.6 EFFECTS OF INFRASTRUCTURE ON SOCIO-ECONOMIC DEVELOPMENT**

There have been considerable changes in the delivery of national infrastructure services across Africa. While Nigeria has improved its telecommunication infrastructural situation, it has not improved in other areas like health, education, infrastructures, electricity, housing and transportation. However, performance in terms of infrastructure service delivery and quality continue to vary across countries. Infrastructure is the medium of production of goods and services and forms the national asset of any nation. According to Kathmandu Final Workshop Report (2009), infrastructure can help solve our problems: social; health and environment; development; and, economics. A region's infrastructure network, broadly speaking, is the very socio-economic climate created by the institutions that serve as conduits of trade and investment. Some of these institutions are public, others are private. In either case, their roles in the context of integration are transformative, helping to change resources into outputs or to enhance trade by removing barriers. Therefore, an improvement in regional infrastructure is one of the

key factors affecting the long-term economic growth of a region (Sahoo, Dash and Nataraj 2010).

The linkages between infrastructure and economic growth are multiple and complex. Not only does infrastructure affect production and consumption directly, it also creates many direct and indirect externalities. It also involves large flows of expenditure, thereby creating additional employment. Studies have shown that infrastructure can have a significant impact on output, income, employment, international trade, and quality of life. Infrastructure development can reduce stress and promote good health. It will also reduce crime level. Infrastructure has always played a key role in integrating economies within a region. Well developed and efficient infrastructure is essential for a region's economic development and growth. In a dynamic concept, infrastructure is seen as a regional public good that moves factors of production within and across countries, thus helping the region attain higher productivity and growth (Sahoo, Dash and Nataraj 2010).

In Nigeria, however, the lacks of emphasis on rural infrastructure make most rural areas underdeveloped. The rural areas have not been attracting personnel in the few available institutions like primary and secondary schools, dispensaries, maternity centers etc. When these personnel are posted to the rural areas rather than stay and work in these areas, they prefer to live in nearby urban centres and continue to shuttle between the urban centers and the location of their posting in the rural areas. The shuttling in most cases is usually one day per week affairs. This does not allow for meaningful contribution through their work performance to the welfare of the rural people. Hence rural areas are characterized with high illiteracy and mortality rates. The rural population of many developing countries including Nigeria has been suffering different

kinds of deprivation. Quality of services for many rural people is considerably poorer than for urban areas (OECD, 2011).

In many communities in Nigeria, inadequate and low quality infrastructure has been known to have serious implications for welfare and the persistence of poverty. Rural infrastructural development in Nigeria has long been neglected, yet investments in health, education and water supply have largely been focused on the cities. Consequently, the rural population have limited access to services such as schools and health centers, and about half of the population lacks access to safe drinking water (Fakayode, 2008). Limited education opportunities and poor health perpetuate their poverty cycle; the neglect of rural infrastructure has also reduced the profitability of producing for the markets. Nigeria's rural road network is one of the least developed in sub-Saharan Africa as a result the poor tends to live in isolated villages that can become virtually inaccessible during the rainy seasons (The World Bank Group, 1998).

A major problem with the pattern of distribution of public facilities in Nigeria however, is that it exhibits an urban rather than a rural location bias which further helps to increase rural poverty. While some areas are heavily served with public facilities such as health centers, schools, electricity, water and postal services, others are either underserved or not served at all (Aderamo, 2010). Another problem with the distribution of public facilities in Nigeria particularly in the rural areas is the lack of coordination in their distribution so as to make them more relevant to the population they are meant to serve.

Many studies so far have been carried out for studying the relationship between infrastructure and rural development. For example, Filani (1993), Aderamo (2010) and Tunde (2012) found in their different studies that where motorable roads exist in rural areas of Nigeria, they are mostly of unpaved surface, narrow width, circuitous

alignment and with low quality bridges. In most cases, they are either clad with potholes or characterized by depressions and sagging. Such surfaced roads are hardly passable during the rainy season when vehicles get stuck in mud or when the improvised bridges of cut-free trunks get swept away by flood. The study by Adereti and Adeokun (2005) on the rural women's access to infrastructural facilities in rural areas in Osun State, Nigeria revealed that most (89.7 percent) of the respondents did not have access to reliable public transportation.

The implication of this for rural women is that they will find it difficult to get their produce to the market and the perishable produce may get spoilt. Nearly all the basic infrastructural facilities are not available and in areas where they are available, most of the respondents do not have access to them. The consequence of this finding as revealed by Akinwunmi, Akinwumi, and Ogundahunsi, (2011) was that rural residents needed to go to larger towns to secure such services. The study concluded that there is need therefore to improve upon the condition of the rural areas in order to alleviate the suffering of these rural women in terms of their access to infrastructural facilities.

Furthermore, Ayoade (1982) in Dogo (2006) investigated the provision of health facilities in both the rural and urban areas of the then Plateau State and subjected the location of the hospitals in the state to policy analysis using the criteria of distributive equity and optimum location. The study revealed that bed-patient ratio; hospital personnel patient ratio; doctor patient ratio; nurse patient ratio were all high and also observed that there was a high concentration of public and private hospitals in Jos, the state capital. The literature cited above pointed out that health facilities needed substantial rehabilitation so that they could effectively offer the required services. The researcher also noted that a lot is needed to be done so as to meet the required standards like ratio of medical doctors to a given population in order to adequately cater for the

health needs of the rural people. However, it appears that there has been no available study that analyzed spatial distribution of rural infrastructural facilities on the social life of rural dwellers in Makarfi Local Government Area (L.G.A.). Therefore, this research intends to bridge the knowledge gap by analyzing the spatial distribution of rural infrastructure on social development using Makarfi L.G.A as a case study.

## **CHAPTER THREE**

### **THE STUDY AREA AND METHODOLOGY**

#### **3.1 THE STUDY AREA**

##### **3.1.1 Location**

The study area is Makarif Local Government Area, it is located between Latitudes  $11^{\circ} 15' - 11^{\circ} 27'$  North of the Equator and Longitudes  $7^{\circ} 51' - 8^{\circ} 9'$  East of the Green Wich Meridian. It is bordered by Kano State to the north west, Ikara Local Government Area (L.G.A.) in the east, Soba Local Government Area (L.G.A.) to south west of Katsina State and Kudan Local Government Area (L.G.A.) in the west (See Fig. 3.1 and 3.2). The study area was carved from Ikara Local Government Area (L.G.A). of Kaduna State in 1991 and is situated in the Northern Guinea Savanna. It is one of the 23 Local Government Areas in Kaduna State (Adedipe, 2002 and Nchouji, 2007).

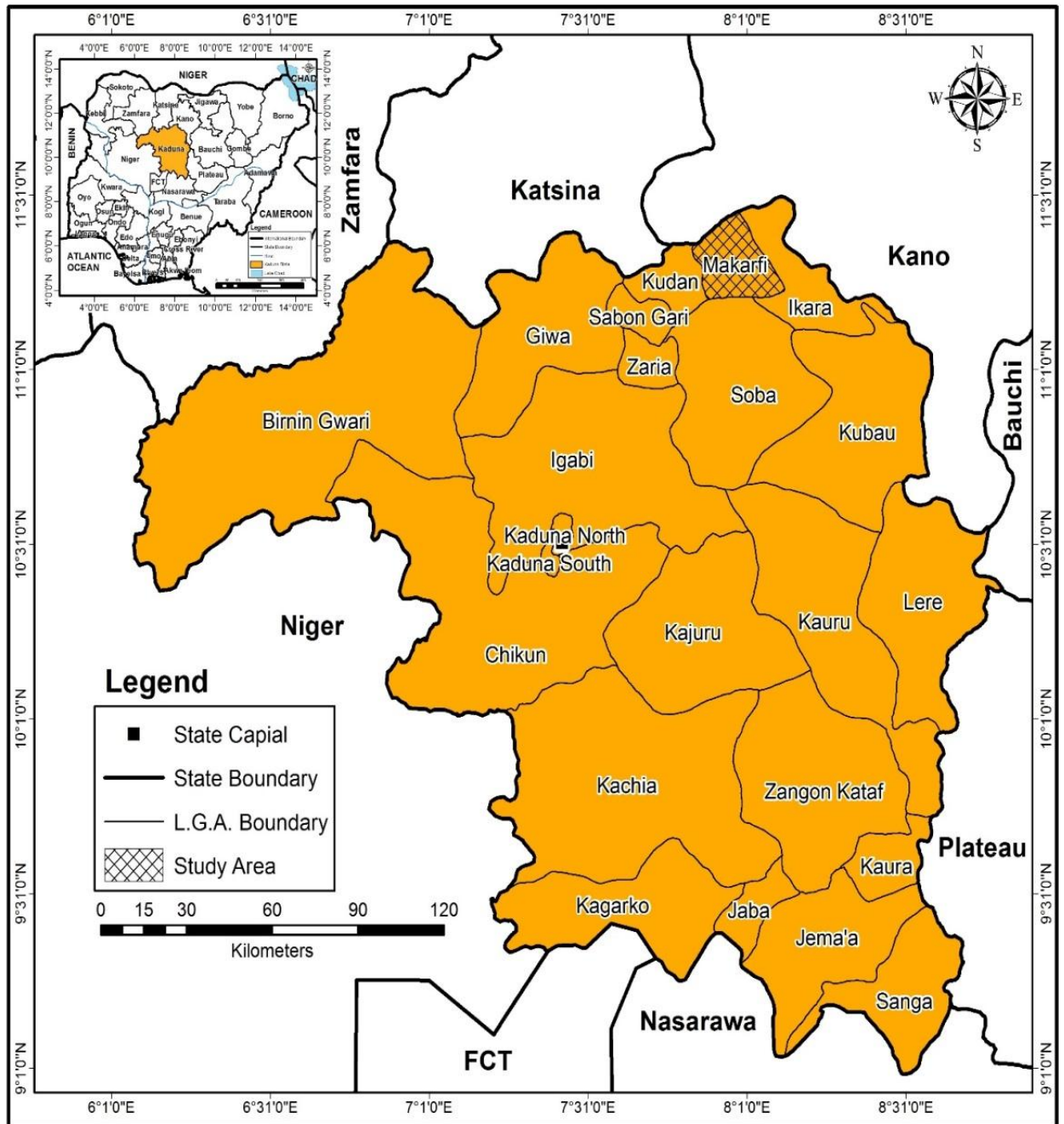


Figure 3.1: Kaduna State showing Makarfi Local Government Area  
 Source: Adapted from the administrative map of Kaduna State

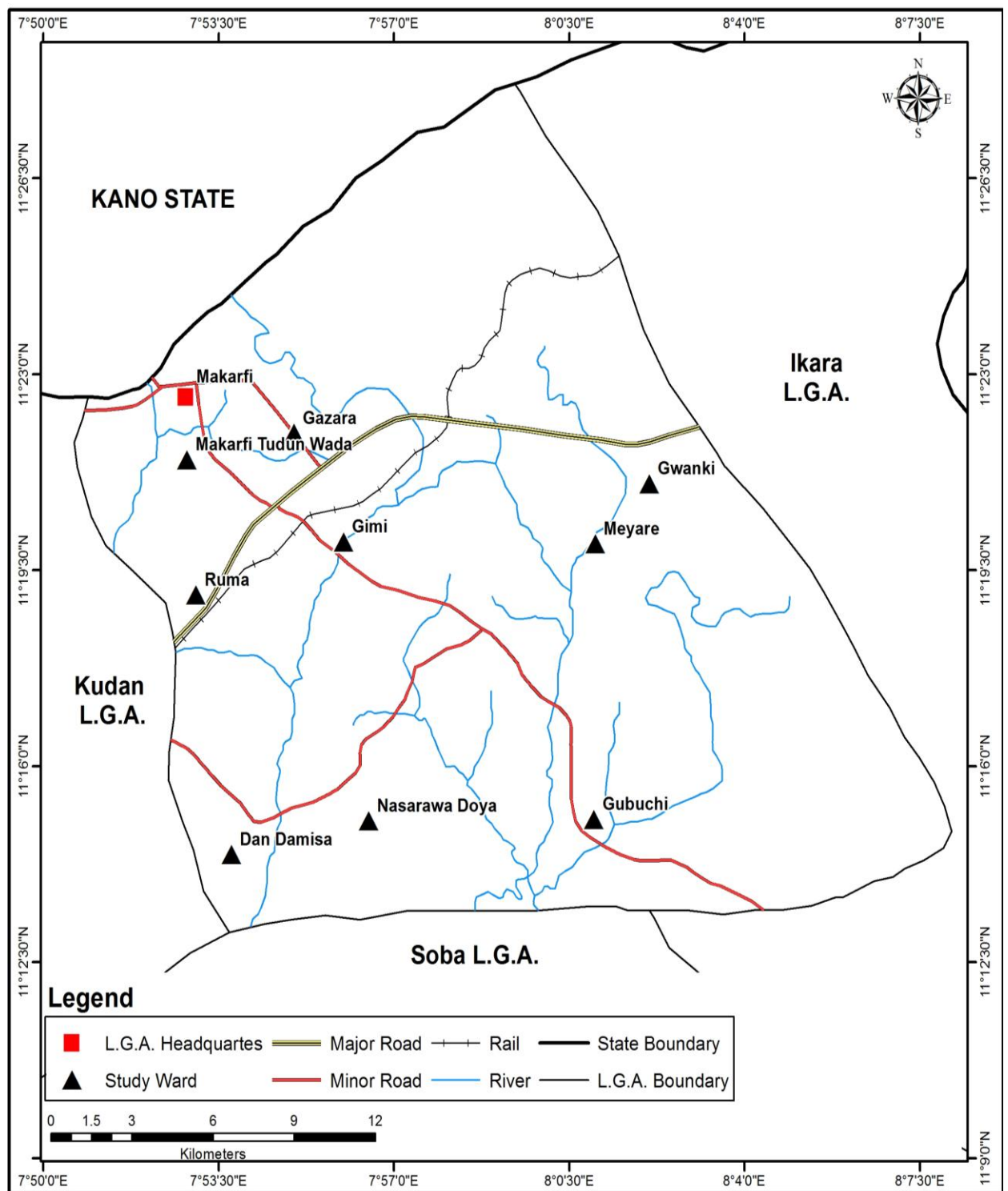


Figure 3.2: Makarfi Local .Government.Area.

Source: Adapted from the administrative map of Kaduna State

### **3.1.2 Relief and Drainage**

Makarfi (L.G.A.) is underlain primarily by sedimentary rocks. There are isolated occurrences of granite in the north-west and south-east and limited occurrence of alluvial deposit within the major arraigns. The rocks identified account for most of the rugged terrain and inselberg within the region most notably in the central and south west sections. The whole local government area is covered by the red-brown to red-yellow ferruginous tropical soils which are heavily weathered and markedly laterized. They are mostly formed on granite and gneiss parent materials, and on aeolian and many sedimentary deposits. The topography of this sub-region includes the alluvial and valley of less than 100 meters above sea level located at the major river course and its tributaries (River Fadama). The undulating plain with low hills and rocks constitute more than half of the total land surface ranges in height between 100-500 meters above sea level and spread throughout the entire region. The relief of the area is relatively flat with some undulating altitude of 549m at the North-East of the town above sea level (Abaje, 2007).

The geology and relief affect the distribution of infrastructure in terms of groundwater and the nature of rocks. The groundwater that is, water beneath the earth's surface in soil pore spaces and in fracture of rock formations. A unit of rock or an unconsolidated deposit as an aquifer when it can yield quantity of water is void in the study area. The depth at which soil pore spaces or fractures in rock become completely saturated with water (water table) is very deep. The study area is characterized by undulating plain with low hills and rocks, which constitute more than half of the total land surface. The depth of water table in the area is deep because of the geology and relief nature resulting to difficulties in equitable distributions of infrastructure. The laying down of the water

pipelines, infrastructure and structural integrity and their ability to resist external forces pose great challenges. Aging pipelines, infrastructure are increasingly susceptible to failure (Simonoff, Restrepo, Zimmerman and Naphtali, 2008 and NSW, 2013).

### **3.1.3 Climate**

The study area lies in a transitional zone between the tropical low lands of southern Nigeria. In this zone, the dry and wet season cover approximately five to seven months respectively. The climate and soil have supported the development of various savannah plants. The climate of the region is determined by the alternating dominance in the region, by either the dry continental air mass (The north-east trade wind) that brings harmattan or marine air mass from the south (south-west trade wind) that brings rainy season. Seasonal variation in rainfall is directly influenced by the interaction of two air masses: the relative warm and moist tropical maritime (mT) air mass, which originates from the Atlantic Ocean associated with southwest Trade winds in Nigeria; and the relatively cool, dry and stable tropical continental (cT) air mass that originates from the Sahara Desert and is associated with the dry, cool and dusty North-East Trades Wind known as the Harmattan (Sawa, 2002; Abaje, Ati and Iguisi 2012). The highest average air temperature normally occurs in April ( $28.9^{\circ}\text{C}$ ) and the lowest in December ( $22.9^{\circ}\text{C}$ ) through January ( $23.1^{\circ}\text{C}$ ). The mean atmospheric relative humidity ranges between 70-90% and 25-30% for the rainy and dry seasons respectively. The highest amount of evaporation occurs during the dry season.

During the dry season between October and May, there is practically no rainfall and potential evapo-transpiration rates are very high. The rainfall is mono model and usually commences in late May as intermittent severe sandstorms as the monsoons move northwards. The mean annual rainfall ranges between 1000mm to 1750mm (Kareem

and Mbason, 2002). Day time temperatures also vary with a mean minimum of 22<sup>0</sup> C and a mean maximum of 24<sup>0</sup> C as the readings are extremely high for most part of the year (ZEMDA, 2015). The climate affects water resources, these effects can reduce the quality of water and can damage the infrastructure. Extreme rain are very likely to destroy infrastructure by increasing flooding and damaging. Benson finds that different types of hazards cause varying levels of physical damage to infrastructure and economically productive sectors. For example, drought may have minor impacts on infrastructure and productive capacity, but can results in heavy crop and livestock losses. Flood can cause extensive damage to both infrastructure and other productive capacity, and can wipe out agricultural yields, depending on the agricultural cycle (Benson and Clay, 2000). Governments and victims tend to pay for the damage to infrastructure. Small changes in climate variability correlate with large increase in infrastructure damage.

#### **3.1.4 Vegetation**

The region falls within the Guinea Savannah belt of the country. This belt is characterized by sparsely distributed forest zones and tall grasses. The zones are mostly located along the river bank with scattered trees. The whole region is covered by the tropical grassland vegetation with the density of trees and other plants decreasing as one move northwards (Abaje, 2007). According to Alfredo, (2002) cited in Yunana, Bonet and Ali (2014) said that, the vegetation comprises of transitional woodland, known as indigenous or economic trees species such as; *Daniela*, *Oliverii*, *Vitex*, *Domana*, *Diospyros*, *Mespitofomus*, *Khaye*, *Grandi*, *Fohala* and *Albizia Africana* (OnlineNigeria, 2003). The types and characteristics of the vegetation in the study area depicts that the study area water table depth is high and the source of water becomes a challenge. This

problem poses a serious threat to the implementation of rural water supply infrastructure (Ashok and Balasubramaman, 2003). The grassland can facilitate construction of roads when compared to rainforest belt in the southern part of the country.

### **3.1.5 Soil**

Majority of the soil within the region have been developed from the crystalline rocks of the basement complex. To a lesser extent, sedimentary rocks, and stone, have served as the parent materials. The soil is in their general form to the physical and chemical constituents of the weathered sedimentary rocks called Zaria soil, local factors such as topographic position, vegetation type and climate condition determine the site specific morphology of the soil (OnlineNigeria, 2003). The soil is constantly exposed to different environmental hazard and different human activities which can negatively affect or contaminate the soil water especially, the physical and chemical constituents of the weathered sedimentary rocks. The chemical constituents sedimentary rocks corrodes the pipes of these borehole infrastructure resulting to pipe burst and also contaminate the quality of portable water supply. Worrisome still, when the area is flooded this can lead to destruction of these infrastructure reducing their quality, quantity and values compounding and defeating the purpose of rural development (FAO, 2013)

### **3.1.6 People and Occupation**

The study area is sparsely populated with majority of the people being Hausas and Fulanis. Other ethnic groups include the Yorubas, Igbos, Igala, Nupes, and Ebiras. Two major religions are noted in the areas which are Islam and Christianity. Generally, socio-cultural patriarchy is well established in this rural settlement. The area is famous for its leading position in sugarcane farming, rice, maize, perishable goods such as;

pepper, onions, vegetable and tomatoes (Adebayo, 2010 and ZEMDA, 2015). Makarfi is renown in terms of culture and traditional heritage. Other primary production activities in this area include livestock rearing; carving, black smiting, pottery etc. there also secondary activities which include bakery and other local food processing activities. The tertiary activities in this area are basically transportation and marketing of agricultural products. It constitute a proportion of the historic and famous Zazzau Emirate Council with seven (7) district (Gidan Zarto, Dan Guzuru, Soko, Runbuna, Unguwan, Gangara and Tudun Wada) headed by traditional rulers that are appointed by the Emir of Zazzau (ZEMDA, 2015). Politically the local government has ten (10) wards also headed by political elites. They are Makarfi as Headquarters, Makarfi Tudun Wada, Meyare, Gimi, Gwanki, Gazara, Gubuchi, Ruma, Nasarawan Doya and Dan Damisa (Babangida, 2009).

### **3.2 Sources of Data**

- i. Types of the infrastructural facilities in rural areas of Makarfi local government area
- ii. data on spatial distribution of the infrastructural facilities
- iii. data on factors that affect spatial distribution of the infrastructural facilities
- iv. data on the condition of the infrastructural facilities
- v. data on the distance covered to access the infrastructural facilities
- vi. data on the challenges facing accessibility and use of the infrastructural facilities
- vii. data on the location and distribution of the rural infrastructure
- viii. Data on the socio-economic characteristics of the respondents
- ix. Data on the population of the people in the study area
- x. Coordinates of the rural infrastructure.

The study used both primary and secondary data

### **3.2.1 Types of Data**

#### *3.2.1.1 Primary Source*

The questionnaire survey constituted the major research instrument to this study. It was administered to elicit information from the respondents. Some of the issues the questionnaire addressed include: types of infrastructural facilities, accessibility and usage of the available infrastructure, the maintenance, sponsorship, challenges facing the infrastructural facilities as well as effects on the well-being of the respondents. The questions include closed-ended responses to permit consistency in scoring (Ekeh, 2003; Abiola, 2007).

#### *3.2.1.2 Secondary Source*

Topographical map of Makarfi is obtained to show the nature of the distribution of the available rural infrastructure in the study area. Data were obtained from documented materials on rural development projects, published and unpublished projects, research findings, journals on rural infrastructure indices such as, health centers (clinics, dispensaries, primary health centres), portable water supply and electricity were used for literature review, text books, newspapers, websites, which were useful and helpful in generating ideas, facts and issues relating to the study were also included and considered.

### **3.2.2 Sample Size and Sampling Techniques**

A reconnaissance survey was carried out in order to ascertain the available infrastructural facilities in the study area and the appraisal of rural communities' development. This assisted the researcher to know the location, name, size, distance, and the number of the available infrastructure. In addition, it enabled the researcher to

make a spot assessment of some phenomena relating to rural infrastructural development.

The population of the study area was about one hundred and forty six thousand two hundred and fifty nine (146,259) NPC, (2006). But Makarfi headquarter which is considered as an urban area is not included and the population for the nine wards is 86,430 (NPC, 2006). This figure was projected to 2014 using 3.18% growth rate retrieved from the National Population Commission (NPC), Kaduna State Official Website, 2014 which gave 108,417 population (see table 3.1). The sample size for the study was obtained through the application of Yamane (1976) sample size selection formula as stated below.

$$SS = \frac{N}{1+N(e)^2}$$

Where: SS = sample size

N = finite population of the study area

e = level of significance (0.05)

$$\begin{aligned} SS &= \frac{108,417}{1+108,417*0.0025} \\ &= \frac{108,417}{271.045} \\ &= 399.99 = 399 \end{aligned}$$

The study made use of 399 questionnaire for the samples size and administered the questionnaire to respondents in the study area. The sample size of each ward was taken in proportion to the population size of the wards using a method called proportional allocation (Neville and Sidney, 2001). The projected population for each ward is

divided by the entire population and multiplied by the total sample size as shown below:-

$$n/N * 399$$

n = population of the ward

N = total population of the study area

399 = sample size

This formula is applied to obtain proportionate share of sample size for each ward according to their population sizes.

As regards the sampling procedure, a multi-stage sampling technique was adopted. The first stage involved the purposive selection of Makarfi L.G.A. out of twenty-three L.G.A. in Kaduna State. Purposive selection is also known as non-probability sampling, and non-probability sampling does not involve random selection but use when you want to access a particular subset of people. Most sampling methods are purposive in nature because we usually approach the sampling problem with a specific plan in mind. In purposive sampling, we sample with a purpose in mind. We usually would have one or more specific predefined groups we are seeking and reject people who did not fit a particular profile (William, 2006). Secondly nine wards were purposively selected out of ten wards in the study area. The selected wards have more of the rural infrastructural facilities. Moreover, Makarfi headquarters was exempted because it was considered as an urban area. Thirdly random sampling was used to select households in each ward. The sample size for each ward in the study area is presented in Table 3.1

Table 3.1: Sample Size by Wards in Makarfi Local Government Area (LGA)

| wards                 | Sample population |         |             |      |
|-----------------------|-------------------|---------|-------------|------|
|                       | Population(2006)  | (2014)  | Sample size | %    |
| 1. Meyare             | 7,521             | 9,434   | 35          | 8.7  |
| 2. Gubuchi            | 19,092            | 23,949  | 88          | 22.1 |
| 3. Ruma               | 7,322             | 9,185   | 34          | 8.5  |
| 4. Gimi               | 8,212             | 10,301  | 38          | 9.5  |
| 5. Gazara             | 9,130             | 11,453  | 42          | 10.5 |
| 6. Gwanki             | 6,302             | 7,905   | 29          | 7.3  |
| 7. Makarfi Tudun-wada | 8,211             | 10,300  | 38          | 9.5  |
| 8. Dan damisa         | 8,720             | 10,938  | 40          | 10.0 |
| 9. Nasarawa doya      | 11,920            | 14,952  | 55          | 13.8 |
| Total                 | 86,430            | 108,417 | 399         | 100  |

Source: Adapted from (NPC, 2006).

### 3.3 Data Analysis

**Objective i:** Identify and characterize the rural infrastructural facilities in the study area

Descriptive statistics has been employed to summarize the data into tabular form.

**Objective ii:** Examine the variation in spatial distribution of the infrastructural facilities

Standardized score (Z-score) technique was used to show variation and depict pattern of infrastructural distribution in the study area. The Z – Score formula is stated below:-

$$Z_i = \frac{X - \bar{X}}{SD}$$

Where  $Z_i$  = Z-score for observation i

$X$  = the original value in the cell,

$\bar{X}$  = the mean for the variable, and

$SD$  = the standard deviation of the  $X$  values, and

$$SD = \sqrt{\frac{\sum (x - \bar{x})^2}{N}}$$

Where  $N$  = Total number of observation.

The standardized score model was adopted because it is suitable for measuring variation in the distribution of a facility over space. The use of Z-score had also made it possible to clearly identify the values of each unit after the composite scores were standardized so that the mean became Zero and the standard deviation became unit of measurement (Aderamo and Aina, 2011). This zero mean forms the base line for comparing departure scores of observations on a given variable, thus, the wards form the units of the observation in this study. The technique is popular for its simplicity, elegance and gives opportunity to rank the unit areas according to their performance in infrastructural distribution.

**Objective iii:** examine the factors responsible for the pattern of infrastructural facilities distribution in the study area. This objective is achieved using the descriptive statistics which involve calculating the percentages, frequencies, and charts.

**Objective iv:** Assess the condition of the rural infrastructural facilities. Descriptive statistics was employed to measure the status of the infrastructural facilities in Makarfi local government area

**Objective v:** Assessment of the challenges of accessing the infrastructural facilities in the study area. Likert scaling technique was employed to assess the variety of opinions of the respondents on the accessibility to rural infrastructural facilities.

## **CHAPTER FOUR**

### **RESULTS AND DISCUSSION**

#### **4.1 SOCIO-ECONOMIC CHARACTERISTICS OF THE RESPONDENTS**

The socio-economic characteristics of the respondents are shown in Table 4.1. The result show all of the respondents were males. This is an indication that most household heads are males and they tend to be concerned about rural infrastructures. The result also show that about 54.0% of the respondents were between 36 and 40 years while a little above 20% were of ages 31-35 years. This implies that a typical rural household head is in his economic active years and are saddle with a lot of responsibilities. As regards marital status, 97% were married with just about 3% still single. This indicates the importance attached to marriage institution in the study area which necessitate the need for more infrastructure such as the maternity centres and educational facilities to cater for the expected increasing number of every child. Occupation of the respondents shows that approximately 57.0% engage in farming and about 40% were civil servants while 3% of the respondents were traders. About 57.1% of the respondents have primary school certificate while those with secondary school accounted for 43.1%. It can be inferred that literacy level is relatively high compare to other rural areas.

The income level of the respondents shows that 58.1% earned between ₦20, 000 – ₦40, 000 while 20.8% earned above ₦41,000 monthly. The result show that 83.2% and 5.3% had family size of 4-6 persons and 1-3 persons respectively, although the average household size in the study area was found to be within 5 persons national average household size (National Bureau of Statistics, 2007). The necessity to make rural life better through adequate provision of infrastructure such as water, health, electricity and other forms of social infrastructure which are capable of transforming lives cannot be overstated. Inadequate and low quality of infrastructure could have serious implication for welfare, persistence of poverty and even rural-urban drift crises.

Table 4.1: Socio-Economic Characteristics of Respondents

| Sex                      | Frequency | Percent (%) |
|--------------------------|-----------|-------------|
| Male:-                   | 399       | 100         |
| Female                   | -         | 0           |
| Total                    | 399       | 100         |
| Age:-                    |           |             |
| 20-25 years              | 5         | 1.3         |
| 26-30 years              | 20        | 5.0         |
| 31-35 years              | 83        | 20.8        |
| 36-40 years              | 215       | 53.9        |
| 41-45 years              | 76        | 19.0        |
| Total                    | 399       | 100         |
| Marital Status:-         |           |             |
| Married                  | 387       | 97.0        |
| Single                   | 12        | 3.0         |
| Total                    | 399       | 100         |
| Occupation:-             |           |             |
| Farming                  | 228       | 57.1        |
| Trading                  | 11        | 2.8         |
| Civil Servant            | 159       | 39.8        |
| Unemployed               | 1         | 0.3         |
| Total                    | 399       | 100         |
| Educational Status:-     |           |             |
| No Formal Education      | 5         | 1.3         |
| Primary School           | 194       | 48.6        |
| Secondary School         | 172       | 43.1        |
| Tertiary                 | 28        | 7.0         |
| Total                    | 399       | 100         |
| Income Level per month:- |           |             |

|                 |     |      |
|-----------------|-----|------|
| No Fixed Income | 6   | 1.5  |
| Below N20, 000  | 78  | 19.5 |
| N21,000-N40,000 | 232 | 58.1 |
| Above N41,000   | 83  | 20.8 |
| Total           | 399 | 100  |
| Family Size:-   |     |      |
| 1-3 Persons     | 46  | 11.5 |
| 4-6             | 332 | 83.2 |
| 7-10            | 21  | 5.3  |
| Total           | 399 | 100  |

Source: Author Field Survey, (2016)

## 4.2 CHARACTERIZATION OF INFRASTRUCTURAL FACILITIES IN THE STUDY AREA

As of the time of this study, the researcher went to the field to take the inventory of all the available rural infrastructure in the study area. Also to access the condition, the types, the numbers, the locations and the number of the working and non-working ones in each of the nine wards. Makarfi town was excluded because it is regarded as an urban area. After the inventory of rural infrastructure in the study area, the researcher selected healthcare facilities as social infrastructure instead of school. Portable water supply was equally considered to represent the physical infrastructure and finally electricity power supply was included to stand for economic infrastructure purposively. This in accordance with (Williams, 2006) which states that most sampling methods are purposive in nature because we usually approach the sampling problem with a specific plan in mind.

The inventory of the existing rural infrastructure in the study area are; educational infrastructure, commercial infrastructure, administration, public utility (water and

electricity) transport, local industries as well as health and recreational infrastructure is presented in the table below.

**Table 4.2 The Inventory of infrastructural facilities in Makarfi Local Government Area**

| <b>Wards</b>           | <b>Population<br/>by wards</b> | <b>Schools</b> | <b>Health</b> | <b>Market</b> | <b>No. of<br/>paved roads</b> | <b>Bore-<br/>hole water</b> | <b>Electricity</b> | <b>Local<br/>industry</b> | <b>Total</b> |
|------------------------|--------------------------------|----------------|---------------|---------------|-------------------------------|-----------------------------|--------------------|---------------------------|--------------|
| <b>Meyare</b>          | 7,521                          | 1              | 2             | 1             | 1                             | 10                          | 1                  | 1                         | <b>17</b>    |
| <b>Gubuchi</b>         | 19,092                         | 4              | 3             | 1             | 1                             | 19                          | 2                  | 5                         | <b>35</b>    |
| <b>Ruma</b>            | 7,322                          | 2              | 1             | -             | -                             | 3                           | 1                  | -                         | <b>7</b>     |
| <b>Gimi</b>            | 8,212                          | 2              | 1             | -             | -                             | 5                           | 2                  | -                         | <b>10</b>    |
| <b>Gazara</b>          | 9,130                          | 3              | 2             | -             | 1                             | 10                          | 2                  | 1                         | <b>19</b>    |
| <b>Gwanki</b>          | 6,302                          | 3              | 2             | -             | 1                             | 5                           | -                  | 3                         | <b>14</b>    |
| <b>Makarfi T/ Wada</b> | 8,211                          | 8              | 1             | 1             | -                             | 9                           | 1                  | 1                         | <b>21</b>    |
| <b>Dan damisa</b>      | 8,720                          | 3              | 2             | -             | -                             | 7                           | 2                  | 1                         | <b>15</b>    |
| <b>Nasarawa doya</b>   | 11,930                         | 4              | 3             | 1             | 1                             | 14                          | 2                  | 2                         | <b>27</b>    |
| <b>Total</b>           | <b>86430</b>                   | <b>30</b>      | <b>17</b>     | <b>4</b>      | <b>5</b>                      | <b>82</b>                   | <b>13</b>          | <b>14</b>                 | <b>165</b>   |

The above table clearly show the obtainable rural infrastructural facilities in the study area. Apart from Makarfi Tudun-wada with eight (8) the remaining have five (5) and below. Descriptively, the educational facilities is inadequately provided for in the study area.

Healthcare facilities is not equally distributed in the study area, for example, Meyare, Gazara, Gwanki and Dan damisa has two healthcare facilities each, while the remaining wards are left with one hospital or clinic each. But Gubuchi and Nasarawa doya have two added private hospitals making three healthcare centres in each ward respectively. The study area has one commercial centre which is operative for every Thursday of the week, while the rest operate local markets except Ruma, Gimi, Gazara, Gwanki and Dan damisa which go for their neighbouring markets. Notable paved roads (tar roads) is constructed in almost all the wards. So communication network connectivity is not a problem in the study area. The number of boreholes seems encouraging in all the wards. The total sum column for boreholes infrastructure is one hundred and twenty (120), schools is forty-five (45), healthcare facility is twenty-three (23) and electricity transformers is eighteen (18). So far from this figure one will say boreholes infrastructure is adequate in the study area. The number of electric transformers is also encouraging because all the wards have two electric transformers except three communities with one each. Finally, the inventory records stated that some numbers of local industries existed which boast the power of their economic activities in the study area.

### 4.3 THE BORE HOLE INFRASTRUCTURAL FACILITIES

#### 4.3.1 Condition of the Bore Holes

The study examined the status of the infrastructural facilities as to whether they are functioning or not. The focus was on the targeted infrastructure boreholes. The result was presented in Table 4.3

Table 4. 3: Assessment of the Bore holes by the Respondents

| Ward               | Working |      | Not Working |      | Total |       |
|--------------------|---------|------|-------------|------|-------|-------|
|                    | Freq    | %    | Freq        | %    | Freq  | %     |
| Makarfi Tudnu-wada | 3       | 12   | 6           | 10.5 | 9     | 10.98 |
| Gimi               | -       | 0    | 5           | 8.8  | 5     | 6.09  |
| Gazara             | 1       | 4    | 9           | 15.8 | 10    | 12.19 |
| Nasarawa Doya      | 7       | 28   | 7           | 12.3 | 14    | 17.07 |
| Dan Damisa         | 1       | 4    | 6           | 10.5 | 7     | 8.54  |
| Ruma               | -       | 0    | 3           | 5.3  | 3     | 3.66  |
| Gwanki             | 1       | 4    | 4           | 7.0  | 5     | 6.09  |
| Meyare             | 5       | 20   | 5           | 8.8  | 10    | 12.19 |
| Gubuchi            | 7       | 28   | 12          | 21.1 | 19    | 23.17 |
| Total              | 25      | 30.5 | 57          | 69.5 | 82    | 100   |

Source: Author Fieldwork, (2016)

Table 4.3 revealed that 69.5% of the constructed boreholes in the study area were not functioning as at the time of data collection. However, Gubuchi have the highest

number of boreholes with 23.17% although more than half of them were not in working condition, some are in dilapidated structure, broken stunk due to poor and mismanagement policy of those responsible for their maintenance. Nasarawa Doya was next with 17.07% of boreholes where half were said to be functioning perhaps due to careful handling of the boreholes facilities by the rural dwellers.

#### **4.3.2 Spatial Distribution of the Bore Holes in Makarfi Local Government Area**

The wards with the least number of boreholes are Ruma with 3.66% while Gimi and Gwanki accounted for 6.09% each. This has its own implications on the rural dwellers psychology and readiness for profitable output, which could lead to rural-urban drift.

The reason which is attributed for the high concentration of borehole facilities in Gubuchi could be as a result of its political influence with the local government headquarters. This is evident in (Fig.4.1) displaying Gubuchi community with the highest number of borehole facility and overhead water projects respectively. However, majority of the borehole facility in the study area were not in working condition as of the time of this fieldwork creating pressure on the available ones. The few working ones are overcrowded with rural dwellers who scuffle for water at the working borehole points. The pattern of distribution of boreholes water supply is given on the map in the next page. The distribution of boreholes water supply favoured Gubichi, Nasarawa doya and Gazara clusterly partly due to political and traditional ruler influence(fig. 4.6) and Ruma, Meyare, Makarfi T/Wada and Gwanki are dispersely distributed while Gimi and Dan-Damisa are evenly distributed. It is believed that with the population growth rate of 3.18% from the National Population Commission (Kaduna State Official Website 2014) the demand for portable water supply would necessitate the equitable provision of borehole water supply in the study area (see table 4.8).

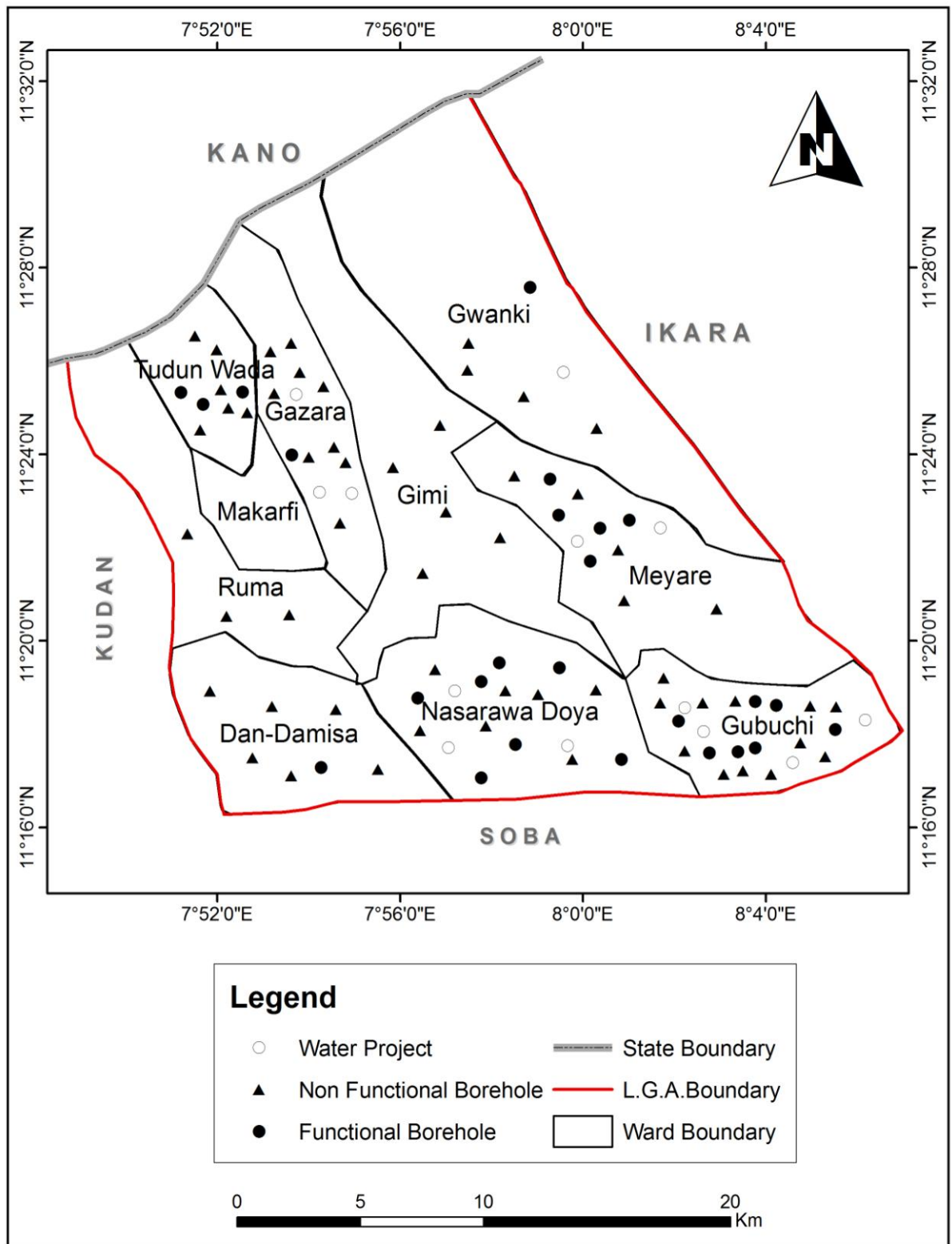


Figure 4.1: Distribution of Boreholes in the Study Area

Source: Author Fieldwork, (2016)

#### 4.4 WATER SUPPLY INFRASTRUCTURAL FACILITIES

The result in Table 4.4. revealed that majority 65.2% of the respondents sourced their water through public well whereas 24.3% of the respondents said through private wells in their compounds.

Table 4.4: Nature of Water Infrastructural Facilities in the Study Area

| Source of Water          | Frequency | Percentage (%) |
|--------------------------|-----------|----------------|
| Private well             | 97        | 24.3           |
| Public well              | 260       | 65.2           |
| Community borehole       | 42        | 10.5           |
| Total                    | 399       | 100            |
| Quantity of Water        |           |                |
| 1-50 litres              | 26        | 6.5            |
| 50-100 litres            | 75        | 18.8           |
| 100-150 litres           | 127       | 31.8           |
| 150-200 litres           | 171       | 42.9           |
| Total                    | 399       | 100            |
| Distance to Water Source |           |                |
| Less than 500m           | 92        | 23.1           |
| 500-1km                  | 297       | 74.4           |
| Above 1km                | 10        | 2.5            |
| Total                    | 399       | 100            |

Source: Author Fieldwork, (2016)

This might be attributed to the fact that most of the borehole were not in working condition as earlier established. About 75% of the household in the study area consume over 100 litres daily for their domestic purposes per household. Distance from water source as revealed in Table 4.4 indicated that 23.1% and 74.4% of respondents walk less than 500m and between 500m-1km respectively to get water. This implies that the

respondents walk a longer distance to source for water in the study area because the ones in good condition are few and far away from their houses. This also mean that the closer boreholes in their surrounding were under pressure due to high water demands from the surrounding residents which leads to their breakdown. At the level of households, domestic consumption of rural populations is determined by access to water sources. The World Development Goal Indicators for 2005 defines access as the availability of a minimum of 20 liters per person per day or 7.3 m<sup>3</sup> per person per year from water source within 1km of the dwelling (World Bank, 2005). Accessibility is a measure of how well a person can reach a place or a place can be reached (Olujimi, 2007).

Providing African households with reasonable access to water would bring significant improvement in productivity, health and welfare. On average, urban households that lack private water connections live about 500 meters from their water source, while in rural areas the average distance is closer to one kilometer (Blackden and Woden, 2006). The finding reveals that 20% percent of urban households and 30% percent of rural households live more than one kilometer from their water source which supports the distance to water source in Table 4.4.

Findings of IJSER, (2015) showed that, the average distance covered to access each of the following facilities (potable water, hospital/healthcentre/clinic, nursery/primary school, secondary school and market) is 1 to 4km. The source of potable water falls within less than 1km none was found between 1-2 km and 3-4 km respectively. The findings were established in selected rural communities in Etche local government area of River State, where the rural communities main source of potable water was rain water which represented 36.3% while submersible borehole represented 30.1% to support the rural daily water requirement.

## 4. 5 POWER SUPPLY INFRASTRUCTURAL FACILITY

### 4.5.1 Condition of Electric Transformer

Result in Table 4.5.1. shows that all the wards do not enjoy electricity supply from the provided national grid by Power Holding Company of Nigeria (PHCN) because the transformers were not in working conditions.

Table 4.5.1: Distribution of Electricity Transformer

| Ward               | Transformer |             | Total | Percentage (%) |
|--------------------|-------------|-------------|-------|----------------|
|                    | Working     | Not Working |       |                |
| Makarfi Tudun-wada | -           | 1           | 1     | 8.33           |
| Gimi               | -           | 2           | 2     | 16.67          |
| Gazara             | -           | 2           | 2     | 16.67          |
| Nasarawa Doya      | -           | 2           | 2     | 16.67          |
| Dan Damisa         | -           | 1           | 1     | 8.33           |
| Ruma               | -           | 1           | 1     | 8.33           |
| Gwanki             | -           | -           | -     | -              |
| Meyare             | -           | 1           | 1     | 8.33           |
| Gubuchi            | -           | 2           | 2     | 16.67          |
| Total              | -           | 12          | 12    | 100            |

Source: Author Fieldwork, (2016)

This has resulted in most respondents depending on others means of power supply like generators for their domestic lighting energy. Fig. 4.2 shows the locations of the transformers in the study area. This suggests a poor and dull night life in the study area and definitely will impact negatively on other aspect of socio-economic development,

since the agile youths were not usually attracted to these villages because of the dull night life.

#### **4.5.2 Distribution of the Electricity Transformer in Makarfi Local Government Area**

The study examined the distribution of the electricity transformer in the study area. The result is presented in Fig. 4.2 It is generally seen in the figure below that the wards require more of electricity transformers than the presented ones. But bad as the situation is, each ward has at least one transformer except Gubuchi, Gazara and Nasarawa Doya which have two each and all these electricity transformers are not functioning. This indicated the state at which these rural communities are estranged from the pace of rural development. It is true that energy in form of electric power is a driven force for any economy development of a country or nation. Where there is no power supply the rural dwellers tend to resort for other alternative, which could be hazardous to individuals or the nation as a whole in terms of the ozone layer depletion. This is so, because of the various means by which the rural dwellers will sort for power supply consumption.

Community like Gwanki has no electricity transformer probably as a result of vandalization or no institutional capacity to sustain any in this locality. This community will have a setback in local and handy industries development which is one imperative indices for rural development.

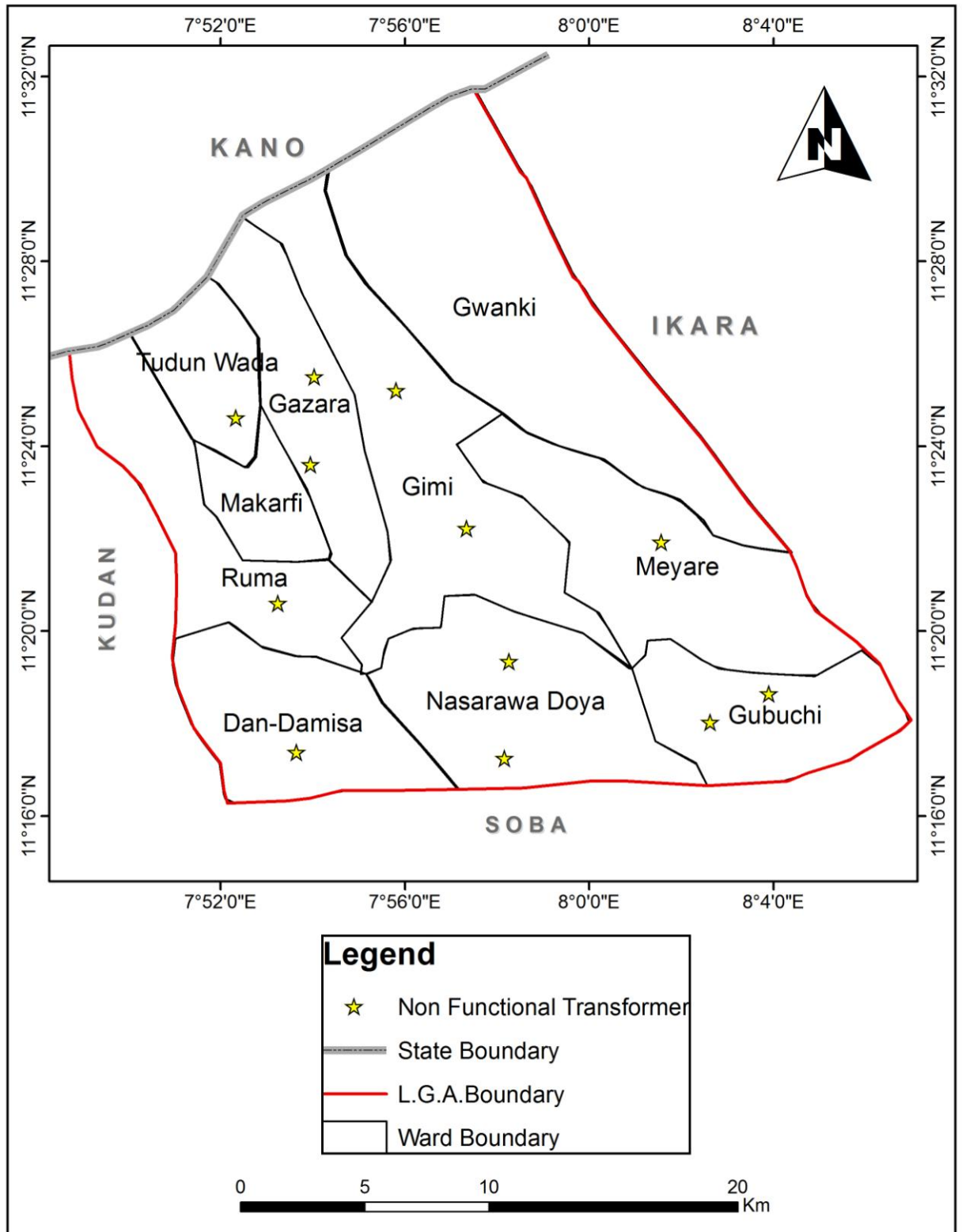


Figure 4.2: Distribution of Transformers in the Study Area  
Source: Author Fieldwork, (2016)

### 4.5.3 Nature of Electricity Infrastructural Facilities in Makarfi Local Government Area

The study investigated the nature of the electricity infrastructural facilities in the study area. The responses of the respondents are presented in (Table 4.5.3). The distribution of electricity transformers by wards is discussed in (table 4.5.1) while the distribution of the electricity transformers in the study area is depicted in (figure 4.2). The below table explains the nature of electricity supply and the viable economic benefits the rural dwellers stand to gain when this needed rural infrastructural facility is provided and sustained.

Table 4.5.3: Nature of Electricity Infrastructural Facilities in the Study Area

| Source of Electricity        | Frequency | Percentage (%) |
|------------------------------|-----------|----------------|
| Connection to National Grid  | 399       | 100            |
| Frequency of Power Supply:-  |           |                |
| Daily                        | 11        | 2.8            |
| Once in a Month              | 388       | 97.2           |
| Total                        | 399       | 100            |
| Duration of Power Per Week:- |           |                |
| 1-2 hours                    | 399       | 100            |
| Amount Paid Per Month:-      |           |                |
| Less than N1,000             | 42        | 10.5           |
| N1,000-N2,000                | 357       | 89.5           |
| Total                        | 399       | 100            |

Source: Author Fieldwork, (2016)

Table 4.5.1 revealed that all the respondents agreed to their houses been connected to the national grid for electricity supply, this complied with the standard rural system of electrification, although 97.2% said that electricity is only supplied to them once monthly. National Grid owns and manages the grids that connect people to the energy they need. In Britain the systems deliver electricity to millions of people, businesses and communities. They play a vital role in delivering electricity efficiently, reliably and safely. There are four main elements in rural electricity supply; **Generators** produce electricity from coal, gas, oil and nuclear power plants. Electricity cannot be stored efficiently, so it is generated as needed.

**Suppliers** supply and sell electricity to the consumers. They use transmission and distribution networks to pass the electricity to home and businesses.

**The National Transmission Network** owned by National Grid, maintains the flow of generated electricity through to the regional distribution networks.

**Distributors** own and operate the distribution network of towers and cables that bring electricity from our national transmission network to homes and businesses. So based on the rural electrification processes the central message is that the energy power is delivered to homes and businesses. Though the area is connected to the National Grid but the table above indicated that about 89.5% pay high electrical bills (#1000 to #2000) which is not deliverable.

The lack of regular power supply is expected to limit the growth of agro allied industrial activities especially processing of agricultural products given that most respondents were farmers.

## 4.6 HEALTH CARE INFRASTRUCTURE

### 4.6.1 Distribution of Health Care Centres

The study examined the distribution of health care infrastructure in the study area. The responses are presented in Table 4.6. It showed that on the distribution of healthcare infrastructural facilities in Makarfi LGA, 85.7% were provided by the government except in Nasarawa Doya and Gubuchi with a private clinic each. This result is in contrast with the findings of Fakayode, Omotesho, Tsoho and Ajayi (2008) which states that

Table 4.6: Distribution of Healthcare facilities

| Ward               | Public Healthcare |      | Private Clinic/Maternity |      | Total | Percentage |
|--------------------|-------------------|------|--------------------------|------|-------|------------|
|                    | Freq              | %    | Freq                     | %    | Freq  | %          |
| Makarfi Tudun-wada | 1                 | 8.3  | -                        | -    | 1     | 7.14       |
| Gimi               | 1                 | 8.3  | -                        | -    | 1     | 7.14       |
| Gazara             | 2                 | 16.7 | -                        | -    | 2     | 14.29      |
| Nasarawa Doya      | 1                 | 8.3  | 1                        | 50   | 2     | 14.29      |
| Dan Damisa         | 2                 | 16.7 | -                        | -    | 2     | 14.29      |
| Ruma               | 1                 | 8.3  | -                        | -    | 1     | 7.14       |
| Gwanki             | 2                 | 16.7 | -                        | -    | 2     | 14.29      |
| Meyare             | 1                 | 8.3  | -                        | -    | 1     | 7.14       |
| Gubuchi            | 1                 | 8.3  | 1                        | 50   | 2     | 14.29      |
| Total              | 12                | 85.7 | 2                        | 14.3 | 14    | 100        |

Source: Author Fieldwork, (2016)

56.2% of the health centres in rural communities of Ekiti State were provided by the government and only 43.8% were owned by the private. This suggests low involvement of the private sector in healthcare delivery in the study area because the provision of healthcare facilities is solely by the government across the wards. The locations of the healthcare facilities in the study area is presented in Fig. 4.3 Again the distribution of these healthcare facilities across the nine wards is questionable in the sense that, Gubuchi, Ruma and Makarfi Tudun-wada were the only ones with general hospital while the rest communities are provided with at most two clinics or primary healthcare centres. The information from questionnaire are justifiable that the nine wards required more of these healthcare centres. Insensitivity of the private investors to providing basic infrastructure may have impounded the stress on the available ones of which maintenance is quite irregular, leading to eventual breakdown in many instances. This accounted for substantial loss of productive time, low productivity and poverty in rural areas (Fakayode, Omotesho, Tsoho and Ajayi 2008).

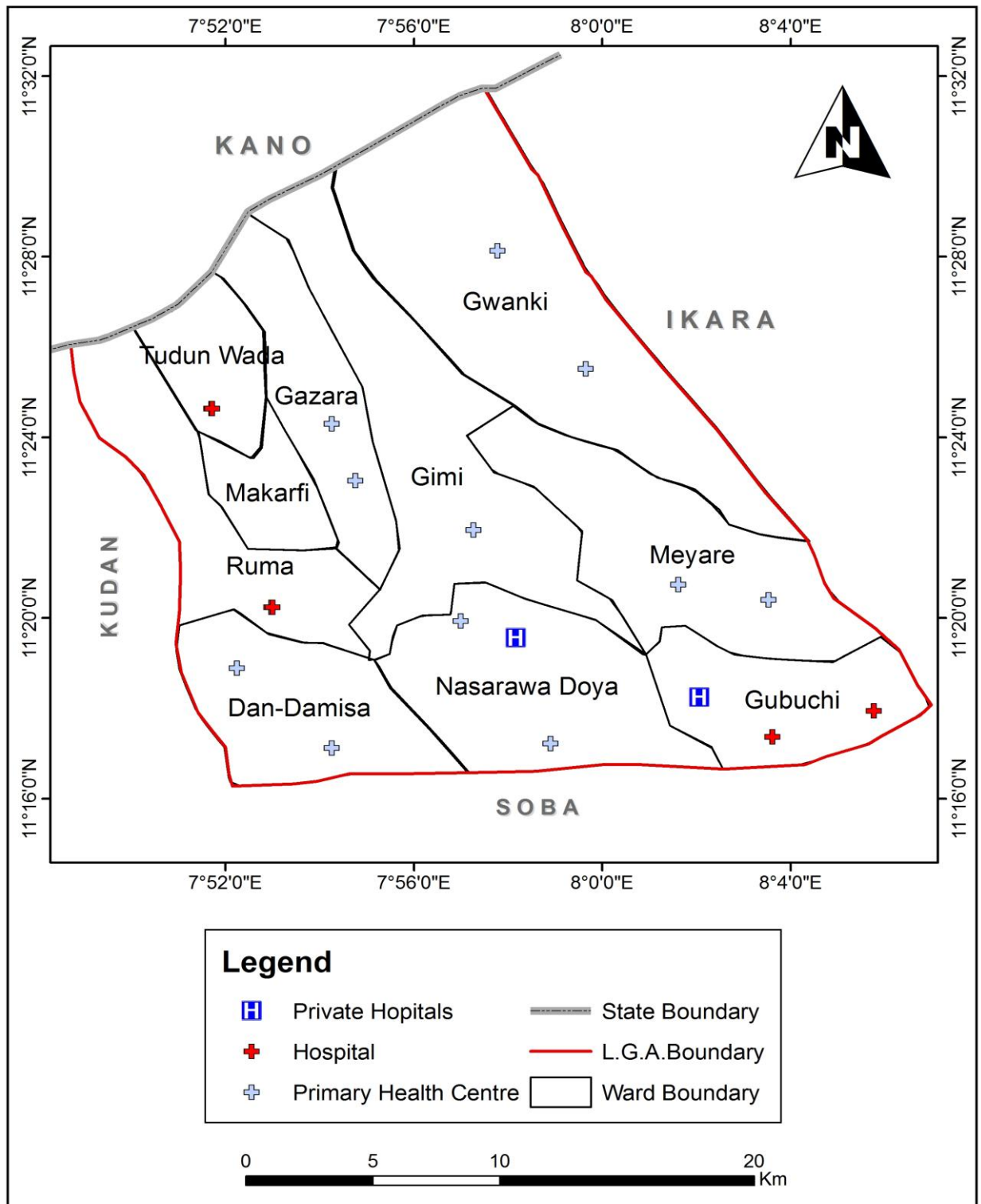


Figure 4.3: Distribution of Healthcare Centres in the Study Area  
Source: Author Fieldwork, (2016)

It also revealed that Gazara, Nasarawa Doya, Dan Damisa, Gwanki and Gubuchi account for 14.29%. It can be deduced that there is little access to healthcare services in the study area given that all the wards were served with at least a healthcare facility.

#### 4.6.2 Nature of Health Care Infrastructure

The study examined the nature of health care infrastructural facilities in the study area.

The result is presented in Table 4.6.2.

Table 4.6.2: Nature of Health Infrastructural Facilities in the Study Area

| Type of Health Facility      | Frequency | %    |
|------------------------------|-----------|------|
| Primary Health Centre        | 75        | 18.8 |
| Clinic                       | 83        | 20.8 |
| Hospital                     | 219       | 54.9 |
| Patent Medical Store         | 22        | 5.6  |
| Total                        | 399       | 100  |
| Distance to Health Centre    |           |      |
| Less than 500m               | 72        | 18   |
| 500m-1km                     | 322       | 80.7 |
| Above 1km                    | 5         | 1.3  |
| Total                        | 399       | 100  |
| Time Spent to See the Doctor |           |      |
| 30mins-1hour                 | 320       | 80.2 |
| 1-2hours                     | 48        | 12   |
| 2-3hours                     | 1         | 0.3  |
| 4-5hours                     | 30        | 7.5  |
| Total                        | 399       | 100  |

Source: Author Fieldwork, (2016)

It revealed that majority 54.9% of the respondents agreed to have hospital in their area while 20.8% and 18.8% accounted for clinic and primary healthcare centre. And about

80.7% of the respondents cover a distance of between 500 metres – 1Km to access a healthcare infrastructural facility as represented in Fig. 4.4 below.

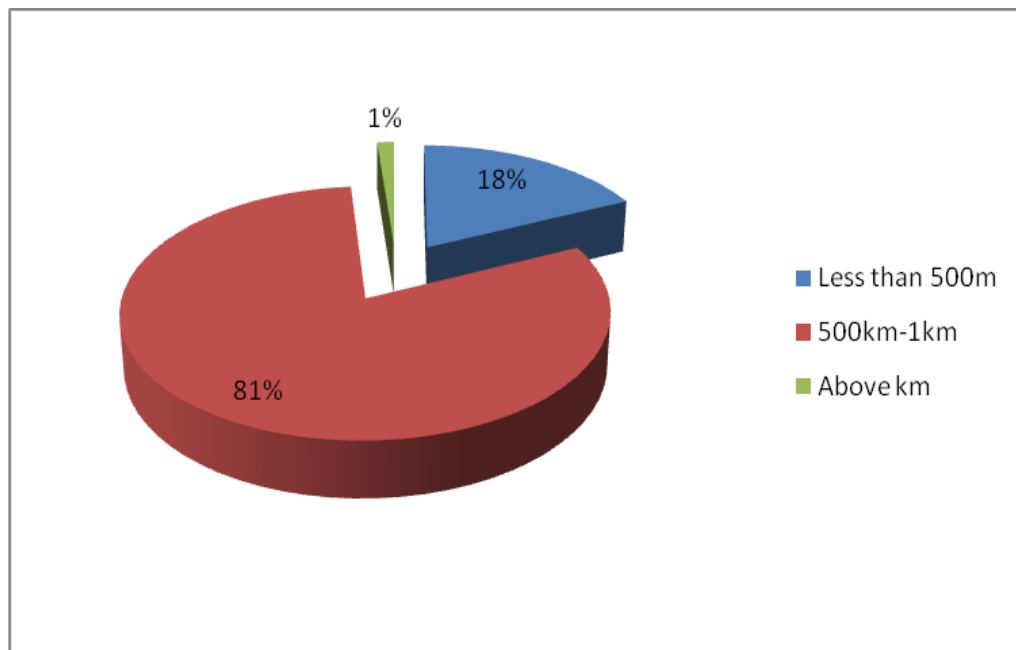


Fig 4.4: Accessibility of healthcare facility in the study area

Source: Author's Fieldwork, (2016)

Distance to health care facilities could significantly impact health care utilization. The distances to regional health care centres can often be long, especially in the rural areas. The distance decay effect states that the interaction between two locales decreases as the distance between them increases. This effect is often found to occur in consumer travel behaviour, as increasingly smaller proportions of the population will travel to certain locations as the distance to those locations increases. A number of studies have measured the impact of distance on health care utilization and was found to have the same effect.

Adesiji, Dada and Komolafe, (2012) investigated the rural people challenges in accessing healthcare facilities in Akure local government area of Ondo State and concluded that some demographic factors showed negative influence in accessing healthcare facilities. They are, distance 57% indicated, road status (bad) 70.1%

indicated, cost of transportation (high) 43% indicated, source of information (low) 42% indicated and gender ( male dominated) 72% indicated as consulting hours. Altitudes of health officials and community supports were statistically significant factors affecting rural people in accessing healthcare facilities.

Rosero-Bixby (2004) conducted a study on 2000 census population with inventory of healthcare facilities using geographic information system (GIS) to access the equity in healthcare in Costa Ricans by the outgoing reform of health sectors. The work used traditional measurements of access based on the distance to closest facility and proposes a more comprehensive index of accessibility that results from the aggregation of all facilities weighted by their size, proximity and characteristics of both the population and the facility. The outcome result revealed that half of Costa Ricans resides less than 1km away from the an outpatient care outlet and 5km away from a hospital. The data show substantial improvement in access to outpatient care between 1994 and 2000. These improvements are linked to the health sector reform implementation. The emphases is on the distance to the outpatient healthcare. Similarly, results from a simpler index based distance to the nearest facility recorded steady improvement in access to the healthcare facility. The reform achieved this result by targeting the less privileged population.

Research shows that the health needs of individuals living in rural areas are different from those in urban areas, and rural areas often suffer from a lack of access to healthcare centres. These differences are the result of geographic, socioeconomic, workplaces and personal health factors. For example, many rural communities have a large proportion of elderly people and children with relatively few people of working age (20-50 years age). Such communities have a high dependency ratio. People living in rural areas also tend to have poorer socioeconomic conditions, less education, high rate

of tobacco and alcohol use, and higher mortality rates when compare to their urban counterparts. There are also high rates of poverty amongst rural dwellers in many parts of the world, and poverty is one of the biggest social determinants of health.

#### 4.7 DISTRIBUTION PATTERN OF INFRASTRUCTURAL FACILITIES

The result of the analysis of the distribution of rural infrastructural facilities shows that disparity exists among the wards in the study area. The standardized scores (Z-score) analytical technique was adopted to depict spatial variation in the distribution of the rural infrastructural facilities among the wards in the study area. The result is presented in Table 4.7

Table 4.7: Standardized Scores on Infrastructural Facilities By Wards in Makarfi LGA

| Wards              | Zi     | Zii    | Ziii   | Sum Z  | Rank | Category |
|--------------------|--------|--------|--------|--------|------|----------|
| Gubuchi            | 1.983  | 0.943  | 0.843  | 3.769  | 1    | Upper    |
| Nasarawa Doya      | 0.981  | 0.943  | 0.843  | 2.767  | 2    | "        |
| Gazara             | 0.178  | 0.943  | 0.843  | 1.964  | 3    | "        |
| Dan Damisa         | -0.423 | -0.471 | 0.843  | -0.051 | 4    | Middle   |
| Gimi               | -0.825 | 0.943  | -1.054 | -0.936 | 5    | "        |
| Meyare             | 0.178  | -0.471 | -1.054 | -1.347 | 6    | Bottom   |
| Makarfi Tudun-wada | -0.022 | -0.471 | -1.054 | -1.547 | 7    | "        |
| Gwanki             | -0.825 | -1.886 | 0.843  | -1.868 | 8    | "        |
| Ruma               | -1.226 | -0.471 | -1.054 | -2.751 | 9    | "        |

Source: Fieldwork, (2016)

Zi= Borehole Infrastructure , Zii= Electricity Transformers, Ziii=Healthcare Infrastructure.

Table 4.7 shows that some wards had better distribution of infrastructural facilities than others. The composite scores revealed that three wards were advantaged while the other

six were disadvantaged. The advantaged wards constituted 33.33% while the disadvantaged accounted for 66.67%. The most advantaged wards were Gubuchi, Nasarawa Doya and Gazara with scores of 3.769, 2.767 and 1.964 respectively. It was observed that three wards had none of negative scores in the selected three infrastructures. On the other hand, there were wards which were not well-off or poor off in fact, they are the middle category of the provided infrastructures which includes Dan Damisa, Gimi, Meyare and Gwanki accounting for 44.44% while Gwanki -1.868 and Ruma (-2.751) were found to be most disadvantaged as far as the distribution of infrastructural facilities is concerned. Some of the other wards that were disadvantaged include Dan Damisa -0.051, Gimi -0.936, Meyare -1.347, and Makarfi Tudun-wada -1.547.

Considering each of the infrastructure across the wards in the study area, in terms of borehole, only 4 wards were advantaged namely Gubuchi 1.983, Nasarawa Doya 0.981, Gazara 0.178 and Meyare 0.178 while the remaining wards were disadvantaged with Ruma being the least deprived. This indicates that Gubuchi was the most advantaged in the distribution of boreholes.

Regarding the distribution of transformers in the study area, a total of four wards were advantaged while the five others were disadvantaged. The advantaged wards include, Gubuchi, Nasarawa Doya, Gazara and Gimi with composite score of 0.943 each. The wards under disadvantaged category include Dan Damisa, Meyare, Makarfi Tudun-wada and Ruma accounting for -0.471 each while Gwanki the most disadvantaged had -1.886.

Table 4.7 further revealed that as regarding healthcare, five out of the nine wards were advantaged. The wards were Gubuchi, Nasarawa Doya, Gazara, Dan Damisa and Gwanki with 0.843 score each. It was observed also that four wards suffered equal level

of deprivation, namely Gimi, Meyare, Makarfi Tudun-wada and Ruma with the same scores of -1.054.

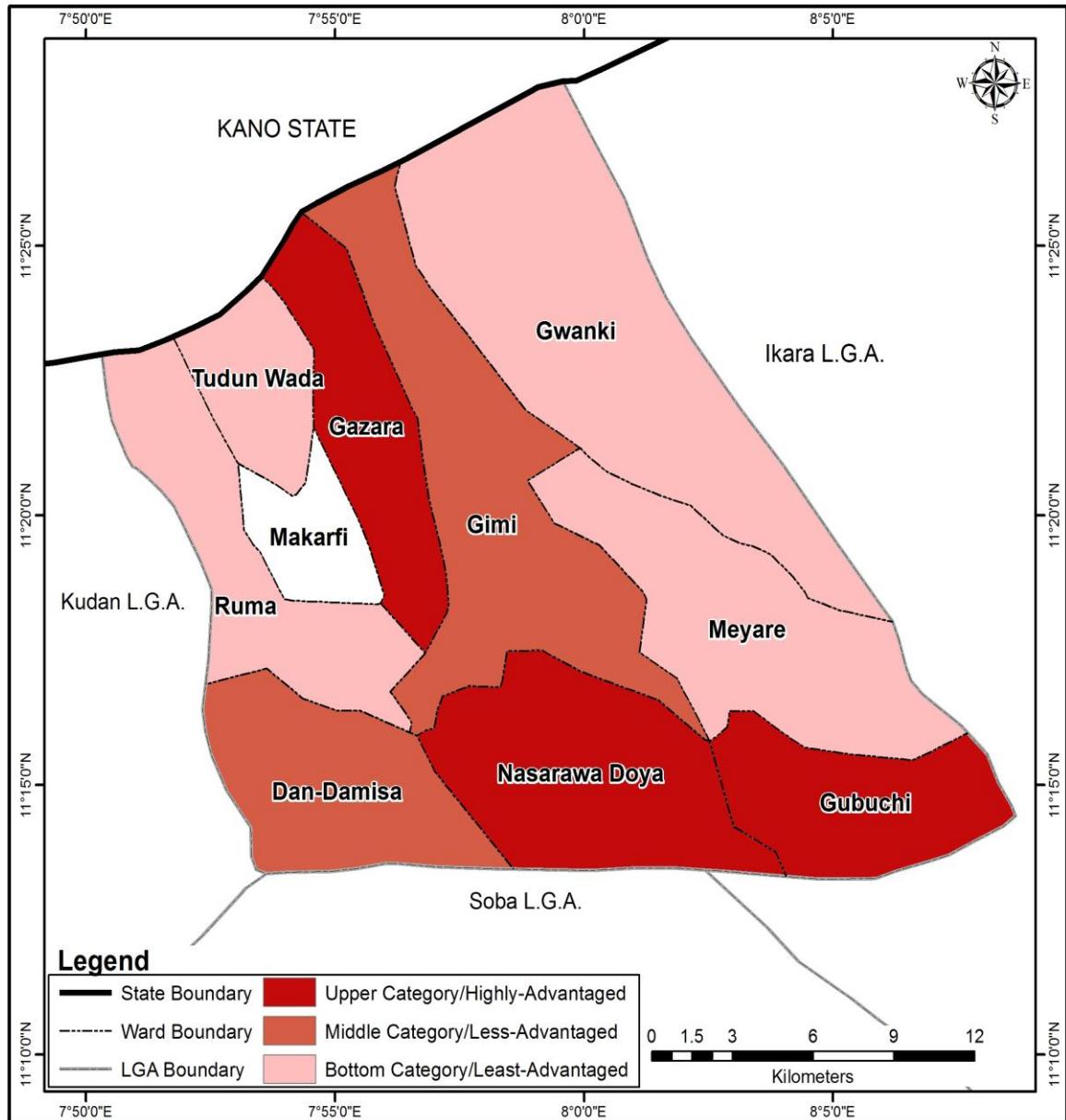


Figure 4.5: Spatial Variation in the Distribution of Rural Infrastructure Among the Wards.

Source: Author Fieldwork, (2016)

Generally, one of the objective of the millennium development goal (MDGs) is to ensure equitable development to the grassroots and government efforts to bring development to rural areas is seen not to be effective. Makarfi local government area

could be considered deprived of number of infrastructural facilities. The provision of infrastructural facilities in the study area, apart from water supply (boreholes) which working condition is considered poor, the lack of electricity and deficit healthcare facilities is a situation that calls for infrastructural distribution review.

#### **4.8 FACTORS AFFECTING SPATIAL DISTRIBUTION OF INFRASTRUCTURAL FACILITIES IN MAKARFI LOCAL GOVERNMENT AREA**

The basic infrastructural facilities which can promote rural economy were available in most of the wards in the study area. However different factors have been identified to be the determinant in the spatial variation of the infrastructural facilities. The responses from the respondents are presented in Table 4.8.

Table 4.8: Factors Influencing Pattern of Infrastructural Distribution in the Study Area

| Factor                             | Frequency | Percentage % |
|------------------------------------|-----------|--------------|
| Population size                    | 351       | 88.0         |
| Influence of the traditional ruler | 38        | 9.5          |
| Partisan politics                  | 10        | 2.6          |
| Total                              | 399       | 100          |

Source: Fieldwork, (2016)

The result in Table 4.8 revealed that most (88%) of the respondents agreed that population size was the factor that influenced the location of infrastructure facilities in their communities while very few believed that is 9.5% accounted for the influence of the traditional ruler.

Some scholars (such as Banerjee, Iyer, and Somanathan 2006) and (Almutairi, 2011) were of the opinion that infrastructural facilities location is based on the following

factors: benefit to the people, security, traditional ruler decision and demographic variable. It is believed that demographic variables affect the need of different infrastructural facilities through investment priorities. Moreover, the competing and urgent needs for private and public infrastructure and demographic characteristics bring developmental strategies to the rural areas (Heller, 2014) Population size is an important factor in rural development, when government provides social amenities; communities with larger populations are usually favoured because it is more economical and viable to establish them in populous communities with large demands for goods and services. More importantly, the emergence or establishment of a service in a locality depends on whether the locality can produce the population threshold for the service. This threshold is the minimum population size required to support the existence of a service.

There are other reasons for the location of the infrastructural facilities as expressed by the respondents. The result is presented in Fig. 4.6

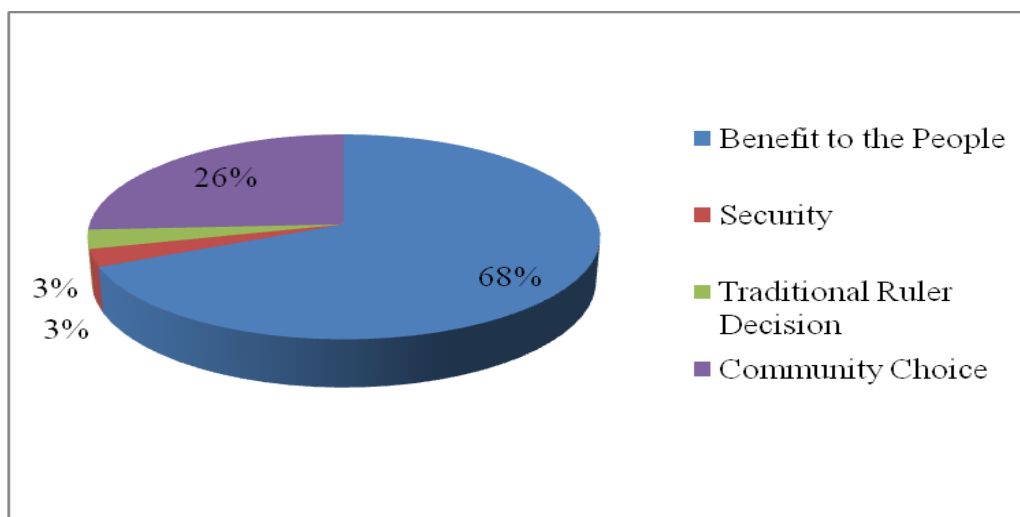


Figure 4.6: Reason for Location of Infrastructural Facility

Source: Author's Fieldwork, (2016)

The Fig. 4.6 shows that majority 68.0% of the respondents in the study area were of the view that benefit to the people was the main reason that determined the location of infrastructural facilities in the study area while community choice accounted for 26.0%.

#### **4.9 ACCESSIBILITY CHALLENGES TO INFRASTRUCTURE IN THE STUDY AREA**

In spite of the provision of these infrastructural facilities in the study area certain constraints such as; inadequate healthcare facilities, lack of adequate drugs, dilapidated structures, few medical personnel, delay in services, frustrating nature of time spent to see medical personnel were identified by the respondents to have limited access to the infrastructural facilities. The field survey revealed that most of the borehole points are non-functioning, some have broken down due to inappropriate techniques for the siting and lack of or poor management are responsible for this set back. The respondents' opinions on health challenges were clearly shown in Table 4.9.1. It also revealed that all the respondents agreed that inadequate healthcare centres and personnel were the challenges of healthcare infrastructural facilities in the study area. Also 68.7% of them did not see long distance trekking as a major challenge and 57.6% believed that the delay in service delivery as a challenge of healthcare infrastructural facilities in the study area.

Table 4.9.1: Challenges of Health Infrastructural Facilities

| Challenge                       | Agree |      | Undecided |      | Disagree |      | Total |     |
|---------------------------------|-------|------|-----------|------|----------|------|-------|-----|
|                                 | Freq  | %    | Freq      | %    | Freq     | %    | Freq  | %   |
| Inadequate Healthcare Centre    | 100   | 100  | -         | -    | -        | -    | 100   | 100 |
| High Cost of Services           | 371   | 93   | -         | -    | 28       | 7    | 399   | 100 |
| Trekking of Long Distance       | 125   | 31.3 | -         | -    | 274      | 68.7 | 399   | 100 |
| Delay in Services Delivery      | 169   | 42.4 | -         | -    | 230      | 57.6 | 399   | 100 |
| Unqualified Medical Personnel   | 125   | 31.3 | 81        | 20.3 | 193      | 48.4 | 399   | 100 |
| Inadequate Personnel            | 399   | 100  | -         | -    | -        | -    | 399   | 100 |
| Functioning Only Once in a Week | 32    | 8    | -         | -    | 367      | 92   | 399   | 100 |

Source: Author's Fieldwork, (2016)

These challenges are; inadequate healthcare centers, high cost of services, long distance trekking, delay in service delivery, inadequate health personnel and irregularity in number of days the healthcare center opens.

Electricity infrastructural facilities challenges include; insufficient power supply per hour, high cost of services, breakdown of electricity equipments, delay in service delivery (epileptic power supply) and inadequate electricity transformers (see Table 4.9.2.

Table 4.9.2: Challenges of Electricity Infrastructural Facilities

| Challenge                          | Agree |      | Undecided |   | Disagree |     | Total |     |
|------------------------------------|-------|------|-----------|---|----------|-----|-------|-----|
|                                    | Freq  | %    | Freq      | % | Freq     | %   | Freq  | %   |
| Insufficient power Supply Per Hour | 397   | 99.5 | 1         | 3 | 1        | 3   | 399   | 100 |
| High Cost of Services              | 393   | 98.5 | 1         | 3 | 5        | 1.3 | 399   | 100 |
| Breakdown of Equipment             | 394   | 98.7 | -         | - | 5        | 1.3 | 399   | 100 |
| Delay in Service Delivery          | 396   | 99.2 | 1         | 3 | 2        | 5   | 399   | 100 |
| Inadequate Transformers            | 399   | 100  | -         | - | -        | -   | 399   | 100 |

Source: Author Fieldwork, (2016)

Result in Table 4.9.2 shows that majority (99.5%) of the respondents attributed the challenges of electricity infrastructural facilities in the study area to be insufficient power supply per hour, 99.2% saw delay in service delivery as the challenge, and 98.7% believed that the challenge is breakdown of equipment among others. All the respondents agreed that inadequate transformers were the major challenge of electricity infrastructural facilities in the area. This implies that availability of transformers in the study area has not necessarily translated to accessibility or utility for the betterment of the rural dwellers

Also, water infrastructural facilities challenges as seen in (Table 4.9.3) include wrong siting of boreholes, lack of maintenance, long distance trekking, spending much time on queue at water point, some boreholes water are not drinkable. The above challenges supported (Brown, 2015) view where electricity, school, water supply and roads infrastructural facilities were inadequately provided for in Etche local government area of River State.

Table 4.9.3: Challenges of Water Infrastructural Facilities

| Challenge                  |  | Agree |      | Undecided |    | Disagree |      | Total |     |
|----------------------------|--|-------|------|-----------|----|----------|------|-------|-----|
|                            |  | Freq  | %    | Freq      | %  | Freq     | %    | Freq  | %   |
| Location of Borehole       |  | 125   | 31.3 | 2         | .5 | 272      | 68.2 | 399   | 100 |
| Lack of Maintenance        |  | 391   | 98   | 3         | .8 | 5        | 1.3  | 399   | 100 |
| Trekking of Long Distance  |  | 248   | 62.2 | 56        | 14 | 95       | 23.8 | 399   | 100 |
| Long Queue at Water Source |  | 332   | 83.2 | -         | -  | 67       | 16.8 | 399   | 100 |
| Not Tasty for Consumption  |  | 303   | 75.9 | -         | -  | 96       | 24.1 | 399   | 100 |

Source: Author's Fieldwork (2016)

Result in Table 4.9.3 revealed that majority (98.0%) of the respondents agreed that lack of maintenance was a challenge of water infrastructural facilities also 83.2% perceived the long queue at water sources is one of the challenge while for 75.9% the challenge was not good for consumption. But for 68.2%, the location of the borehole was not seen as a challenge of water infrastructural facilities in the study area as a result they trekked long distance to source for water. This corroborates Fakayode, *et al* (2008) that rural respondents sometimes were seen to trek long distances before getting to these water sources and often queue for water.

## **CHAPTER FIVE**

### **SUMMARY, CONCLUSION AND RECOMMENDATIONS**

#### **5.1 SUMMARY OF FINDINGS**

The socio-economic characteristics of the respondents indicated that 54.0% of the respondents are between the range of 30-40 years household heads and are economical viable. They are farmers and married with many children which is one of the characteristics of rurality. The number of children and primary activities which they are engaged in necessitated the provision of healthcare services to meet up with immediate healthcare needs of the rural dwellers. The study detailed the selected rural infrastructural facilities (boreholes, electricity and healthcare centers). The analysis and findings show spatial disparities in the distribution of these selected rural infrastructural facilities in the study area. The boreholes, are more concentrated in Gubuchi and Nasarawa doya than any other communities. But a notable characteristic of these boreholes distribution is that, half of the total number of the boreholes points in Gubuchi and Nasarawa doya are in working condition while the remaining are not working. The result of the standardize score show unevenness in the distribution of rural infrastructural facilities in all the nine wards in Makarfi local government area.

The standardized scores of the wards in Makarfi local government area on infrastructural variables is stipulated into three categories. The upper, middle and bottom category. The upper category has Gubuchi with a sum Z-Score of 3.767 followed by Nasara Doya as 2.767 and Gazara as 1.964. This upper category is also called the most advantaged wards which benefitted more in the distribution of rural infrastructure in the study area. Dan Damisa which has a score of -0.051 and Gimi with a score of -0.936 are categorized as the middle category or less privilege wards. The

bottom category involved the remaining wards in the study area which are; Meyare, Makarfi Tudun-wada, Gwanki and Ruma with the scores as -1.347, -1.547, -1.868 and -2.751 respectively (see table 4.7). These wards can also be referred to as the least advantaged wards in terms of rural infrastructure distributions in the study area. The Z-Score technique showed spatial disparities in the distribution of rural infrastructural facilities in the study area.

The factors that are responsible for the pattern of infrastructural facilities distribution in the study area are mostly population size. Where 351 which is 88% of the respondents concur to the fact that the population size of a particular place attracted the distribution of the number of rural infrastructural facilities in their wards. Again 38 which is 9.5% of the respondents agreed to the fact that the influence of their traditional ruler was the main reason for the distribution of rural infrastructural facilities in their wards.

The rural area is faced with inadequacies of infrastructural facilities, poor maintenance, no constant or monitory services, inappropriate techniques used in siting these infrastructural facilities and no institutional capacity to support these infrastructural facilities, breakdown of the few provided infrastructural facilities especially, the electric poles. The working few ones are noted with long queue, no power supply, high electricity bills even when there is no power supply, the rural dwellers trekked a long distance to access other healthcare facilities. The socio-economic characteristics of the respondents showed their occupation as active farmers. They solely depend on rural infrastructural facilities such as; good roads, storage facilities, potable clean water. Majority of these rural people have primary school certificates who are saddled with responsibilities because each of these men has no less than five (5) children in their houses. The condition and nature of boreholes distribution in the study area is very poor.

Gubuchi and Nasarawa Doya are favoured with 23.17% and 17.07% respectively. But about half of the total number of these boreholes in the study area are not working. Some wards are not having access to boreholes water because of the deteriorating nature of the boreholes facilities.

The electricity transformers distribution in the study area is fairly good because most communities have two electric transformers except, Gwanki which has none, stolen and yet to be replaced. Makarfi Tudun-wada, Dan Damisa, Ruma and Meyare have one each. One of the problems facing the study area is the erratic power supply which is so frustrating, it forced them to resort to other means rather than non-functional electric transformers in their wards. The distribution of healthcare facilities is poor in all the communities with one transformer each except Gwanki, Gazara and Dan Damisa which are having two primary health centres each. Gubuchi and Nasarawa Doya augmented the healthcare centre in their wards with additional private healthcare centre each to make up three. And this placed them at advantaged over the others communities.

## **5.2 CONCLUSION**

The study noted that the rural area is characterized by insufficient of infrastructural facilities and general under-development. In spite of the immense contributions of sustainable rural infrastructure to the national development, the availability of these rural infrastructure in the study area is not adequate. And looking at their quantities of selected rural infrastructural facilities in the study area, it is expected that more is needed to be done in the study area.

The level of infrastructure development has shown without doubt that there is lack of so many infrastructure in Makarfi local government area which are meant to improve the lives of these rural dwellers. As far as rural infrastructure problems are concerned there

should be a shift in transfer of rural infrastructure resources to rural communities, that are greatly disadvantaged.

### **5.3 RECOMMENDATIONS**

1. The study area is noted for deficit of portable water supply, electricity power supply and healthcare facility. Therefore, adequate planning strategies should be used in providing infrastructure in the area. One notable point to emphasize is that rural infrastructure should be planned in a comprehensive context for which settlement development provides a suitable framework, such as rural electrification networks. Measures should be taken for equitable distribution of rural infrastructural facilities to ensure even development by government agents, policy stakeholders and relevant agencies.
2. There should be measures to reduce spatial inequality and poverty to incorporate policies that will develop both production-oriented and welfare-oriented infrastructure, in order to improve poor people's productive capacity and quality of life. For example, provision of services such as power, potable water supply and healthcare facilities in rural areas would open up new opportunities for diversifying incomes and employment in backward areas. Constructing and providing drinking water supply schemes and sanitary facilities would reduce regional imbalance, mortality and morbidity, and enable people to live healthier, more productive lives.
3. The need for equitable provision of healthcare facilities in all the wards in Makarfi L.G.A. is imperative.
4. Communities participatory team should be included to ensure sustainability of these rural infrastructural facilities in the rural areas. Government should encourage

public participation in decision making on the exact infrastructure they need rather than impose decisions on them.

5. Evaluation and monitoring team should also not be left out for sustainability processes. Finally, this study concludes by suggesting that future researches should examine themes such as the role of rural infrastructure on social development of rural areas by laying emphasis on the quality of the infrastructure rather than quantity, so as to be able to figure out the true dimension of the rural development.
6. Enhancement of services will form a solid base for development of the entire rural setting in Nigeria. Enhanced and effective information service needs a rural information policy. The Nigerian government must implement its rural development policies. Finally, the government must fully introduce the effective use of solar power for rural development. Solar cells could be used to provide well water, which would reduce the sufferings of rural communities, especially farmers. Recently, an attempt was made by the Energy Research Centre to use solar power to generate electricity for a sampled population of rural inhabitants, which included parts of the Usmanu Danfodiyo University community. The attempt was successful, and some villages like Kwalkwalawa and others in Sokoto are enjoying solar-powered electricity. A similar attempt was made in Kebbi state by Professor Gulma, where a village is using solar power. In addition, renewable energy sources are another important and relevant tool for enhancement of rural communities in Nigeria and other developing countries. Government should expedite action to fix destroyed infrastructural facilities in the rural areas.

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**QUESTIONNAIRE FOR RESIDENTS**  
**DEPARTMENT OF GEOGRAPHY, AHMADU BELLO UNIVERSITY, ZARIA,**  
**NIGERIA**

Dear Respondent,

The researcher is a Masters student from the above named university carrying out a study on ‘Spatial Analysis of Rural Infrastructural Facilities in Makarfi Local Government Area Kaduna State, Nigeria. The study is an academic research leading to the award of Master of Science in Rural Development. Any information given will be kept confidential and used for academic purpose only. Your kind gesture is appreciated.

Yours faithfully

Emuophe Watly

**SECTION A**

1. Sex Male ☐ Female ☐
2. Age 20-25 years ☐ 26-30 ☐ 31-35 ☐ 36-40 ☐ 41-45 ☐ Above 45 ☐
3. Marital status Married ☐ Single ☐ Separated ☐ Widowed/Widower ☐
4. Occupation Farming ☐ Trading ☐ Civil Service ☐ Unemployed ☐ others specify.....
5. Educational Status: No Formal Education ☐ Primary School ☐ Secondary School ☐ Tertiary ☐ others specify .....
6. How long have you stayed here 0-5 years ☐ 6-10 years ☐ 11-15 years ☐ 16-20 years ☐ 21-25 years ☐ Above 25 years ☐
7. Income level (monthly): No fixed income ☐ Below (₦18, 000) minimum wage ☐ ₦18, 000- ₦30, 000 ☐ Above ₦30, 000 ☐
8. Family size: 1-3 ☐ 4-6 ☐ 7-10 ☐ Above 10 ☐

**SECTION B**

**Identify and characterize infrastructural facility in the study area**

| <b>Infrastructural type</b> | <b>Total number available</b> | <b>Number functioning</b> | <b>Number not functioning</b> |
|-----------------------------|-------------------------------|---------------------------|-------------------------------|
| Well                        |                               |                           |                               |
| Borehole                    |                               |                           |                               |
| Electricity                 |                               |                           |                               |
| Patent medical stores       |                               |                           |                               |
| Maternity home              |                               |                           |                               |
| Clinic                      |                               |                           |                               |
| Health center               |                               |                           |                               |
| Total                       |                               |                           |                               |

**Water infrastructure**

1. Source of water: Private well [ ] Public well [ ] Private Borehole [ ] Community Borehole [ ] Stream/River [ ] Water vendors [ ]
2. If pipe borne water, how often do you get water: Daily [ ] Once in a week [ ] Twice in a week [ ] Once in a month [ ] others specify .....
3. Quantity of water consumed by the household daily 1-50 litres [ ] 50-100 litres [ ] 100-150 litres [ ] 150-200 litres [ ]
4. How far do you walk to get water Less than 500m [ ] 500-1km [ ] Above 1km [ ]
5. What do you use water for? domestic reasons [ ] irrigation purposes [ ] business value [ ]

**Electricity infrastructure**

1. Sources of electricity: national grid supply [ ] generator supply [ ] solar supply [ ] traditional means [ ]
2. If PHCN, how frequent is the supply: daily [ ] once in a week [ ] twice in a week [ ] once in a month [ ]
3. Average hour power supply per week 1-24 hours [ ] 1-12 hours [ ] 1-6 hours [ ] 1-2 hours [ ]
4. How much do you pay monthly .....
5. If Generator, how much do you spend on fuel per day? .....
6. What do you use electricity for: heating/lighting [ ] barbering [ ] bakery [ ] audio/visual appliances [ ]

**Healthcare infrastructure**

1. Which type of health facility do you have in this area: primary health center [ ] Clinic [ ] hospital [ ] Patent medical store [ ] others specify.....
2. How far do you trek to the health center: less than 500m [ ] 500-1km [ ] Above 1km [ ]
3. How long do you wait before you see a doctor? 30mins.- 1 hour [ ] 1-2 hours [ ] 2-3 hours [ ] 4-5 hours [ ]
4. How many health centers do you want for your village? 2 [ ] 3 [ ] 4 [ ] 5 [ ]
5. Do you get the best treatment in the health center? Sometimes [ ] no [ ] always [ ] no comment [ ]

### Ownership of the Infrastructural facilities

| Infrastructural type  | State Government | Local Government | Community | Individual | Others |
|-----------------------|------------------|------------------|-----------|------------|--------|
| Well                  |                  |                  |           |            |        |
| Borehole              |                  |                  |           |            |        |
| Electricity           |                  |                  |           |            |        |
| Generator             |                  |                  |           |            |        |
| Patent medical stores |                  |                  |           |            |        |
| Maternity home        |                  |                  |           |            |        |
| Clinic                |                  |                  |           |            |        |
| Health center         |                  |                  |           |            |        |

### Conditions of the infrastructural facilities

| Infrastructural type  | Good | Fair | Bad |
|-----------------------|------|------|-----|
| Well                  |      |      |     |
| Borehole              |      |      |     |
| Transformer           |      |      |     |
| Generator             |      |      |     |
| Patent medical stores |      |      |     |
| Maternity home        |      |      |     |
| Clinic                |      |      |     |
| Health center         |      |      |     |

### SECTION C: Factors responsible for pattern of the distributions of infrastructures

- How does the infrastructure get to this community? Due to population size [ ]  
Influence of the traditional ruler [ ] through partisan politics [ ] community effort [ ]
- Why do you choose this location? To benefit the people [ ] for security reason [ ]  
traditional ruler's decision [ ] community's choice [ ]

#### 3. What processes does the community do in maintaining the infrastructure?

| Infrastructural type | Government | Community efforts | Non-governmental organization |
|----------------------|------------|-------------------|-------------------------------|
| Electricity          |            |                   |                               |
| Water                |            |                   |                               |
| Healthcare centers   |            |                   |                               |

## SECTION D

### 1. What are the challenges you face in using the health facility

| Challenge                       | Agree | Undecided | Disagree |
|---------------------------------|-------|-----------|----------|
| Inadequate healthcare centers   |       |           |          |
| High cost of service            |       |           |          |
| Trekking of long distance       |       |           |          |
| Delay in service delivery       |       |           |          |
| Unqualified medical personnel   |       |           |          |
| Inadequate personnel            |       |           |          |
| functioning only once in a week |       |           |          |

### 2. What are the challenges you face in using the electricity facility

| Challenge                                                                       | Agree | Undecided | Disagree |
|---------------------------------------------------------------------------------|-------|-----------|----------|
| Insufficient power supply per hour                                              |       |           |          |
| High cost of service                                                            |       |           |          |
| Breaking down of electricity equipment                                          |       |           |          |
| Delay in service delivery                                                       |       |           |          |
| Unreliable for gridding, viewing centers, refrigerators, laundries among others |       |           |          |
| Inadequate transformers                                                         |       |           |          |

### 3. What are the challenges you face in using the Water facility

| Challenge                                                          | Agree | Undecided | Disagree |
|--------------------------------------------------------------------|-------|-----------|----------|
| The location of the bore-hole is a problem                         |       |           |          |
| Some bore-hole projects have failed due to lack of maintenance.    |       |           |          |
| Trekking a long distance to gain access to water source            |       |           |          |
| Spending unnecessary time at the source of water due to long queue |       |           |          |
| We need more bore-hole water in our community                      |       |           |          |
| Water is tasty for consumption                                     |       |           |          |

## SECTION E

1. In your opinion which infrastructural facility do you need most in this area and why

Water:

.....

Healthcare center:

.....

Electricity:

.....

2. Has the presence of these infrastructures any effect on the socio-economic development

Yes [ ]

No [ ]

3. What are the effects of infrastructural facilities on socio-economic development?

| <b>Effect</b>                                                              | <b>Agree</b> | <b>Undecided</b> | <b>Disagree</b> |
|----------------------------------------------------------------------------|--------------|------------------|-----------------|
| Water for cooking, irrigation, water vendors                               |              |                  |                 |
| Water for healthy life, washing                                            |              |                  |                 |
| Electricity for grinding, heating during cold, laundry                     |              |                  |                 |
| Electricity for lightening, audio/visual appliances                        |              |                  |                 |
| The presence of the infrastructure brings social gathering                 |              |                  |                 |
| Electricity empowered most youths through the sales of handset accessories |              |                  |                 |
| Improved health status                                                     |              |                  |                 |

4. What are the other effects of infrastructural facilities in this area?

.....  
 .....  
 .....  
 .....  
 .....

Thank You.

## APPENDIXES

The tables below are the co-ordinates (figures) of all the selected rural infrastructural in the nine wards which are used to map out the patterns of the distribution of boreholes water supply, healthcare facilities and electricity power supply in the study area.

**The location of the three selected infrastructure in all the wards using global position system (GPS) for the co-ordinates.**

| WARDS                                  | LATITUDE                  | LONGITUDE                  |
|----------------------------------------|---------------------------|----------------------------|
| Number of <b>working</b> boreholes     |                           |                            |
| <b>Makarfi T/ Wada</b>                 | 11 <sup>0</sup> 22' 51.3" | 007 <sup>0</sup> 53' 08.1" |
|                                        | 11 <sup>0</sup> 22' 56.8" | 007 <sup>0</sup> 53' 07.4" |
|                                        | 11 <sup>0</sup> 22' 50.1' | 007 <sup>0</sup> 53' 10.6" |
| Number of <b>non-working</b> boreholes |                           |                            |
|                                        | 11 <sup>0</sup> 22' 50.6" | 007 <sup>0</sup> 53' 05.8" |
|                                        | 11 <sup>0</sup> 22' 55.7" | 007 <sup>0</sup> 53' 08.1" |
|                                        | 11 <sup>0</sup> 22' 55.8" | 007 <sup>0</sup> 53' 12.4" |
|                                        | 11 <sup>0</sup> 22' 57.2" | 007 <sup>0</sup> 53' 13.5" |
|                                        | 11 <sup>0</sup> 23' 01.8" | 007 <sup>0</sup> 53' 15.5" |
|                                        | 11 <sup>0</sup> 22' 51.9" | 007 <sup>0</sup> 53' 58.6" |
| <b>HOSPITAL</b>                        |                           |                            |
|                                        | 11 <sup>0</sup> 22' 49.3" | 007 <sup>0</sup> 53' 00.3" |
| <b>NON-WORKING TRANSFORMER</b>         |                           |                            |
|                                        | 11 <sup>0</sup> 22' 55.9" | 007 <sup>0</sup> 52' 58.3" |

|                                        |                           |                            |
|----------------------------------------|---------------------------|----------------------------|
| Number of <b>non-working</b> boreholes |                           |                            |
| <b>Ruma</b>                            | 11 <sup>0</sup> 19' 19.7" | 007 <sup>0</sup> 53' 18.4" |
|                                        | 11 <sup>0</sup> 19' 20.9" | 007 <sup>0</sup> 53' 17.7" |
|                                        | 11 <sup>0</sup> 19' 17.4" | 007 <sup>0</sup> 53' 20.5" |
| <b>HOSPITAL</b>                        |                           |                            |
|                                        | 11 <sup>0</sup> 19' 19.4" | 007 <sup>0</sup> 53' 18.5" |
| <b>NON-WORKING TRANSFORMER</b>         |                           |                            |
|                                        | 11 <sup>0</sup> 19' 20.0" | 007 <sup>0</sup> 53' 13.7" |
| Number of <b>non-working</b> boreholes |                           |                            |
| <b>Gimi</b>                            | 11 <sup>0</sup> 19' 43.9" | 007 <sup>0</sup> 51' 04.0" |
|                                        | 11 <sup>0</sup> 19' 43.8" | 007 <sup>0</sup> 56' 07.4" |
|                                        | 11 <sup>0</sup> 19' 47.2" | 007 <sup>0</sup> 56' 17.4" |
|                                        | 11 <sup>0</sup> 19' 54.3" | 007 <sup>0</sup> 56' 18.3" |
|                                        | 11 <sup>0</sup> 19' 46.5" | 007 <sup>0</sup> 56' 08.8" |
| <b>PRIMARY HEALTH CENTRE</b>           |                           |                            |
|                                        | 11 <sup>0</sup> 19' 44.3" | 007 <sup>0</sup> 56' 05.8" |
| <b>NON-WORKING TRANSFORMER</b>         |                           |                            |
|                                        | 11 <sup>0</sup> 19' 46.2" | 007 <sup>0</sup> 56' 16.7" |
|                                        | 11 <sup>0</sup> 19' 46.7" | 007 <sup>0</sup> 56' 07.8" |
| Number of <b>non-working</b> boreholes |                           |                            |
| <b>Gazara</b>                          | 11 <sup>0</sup> 21' 58.1" | 007 <sup>0</sup> 54' 30.0" |
|                                        | 11 <sup>0</sup> 21' 57.7" | 007 <sup>0</sup> 54' 30.7" |
|                                        | 11 <sup>0</sup> 21' 56.6" | 007 <sup>0</sup> 54' 39.7" |
|                                        | 11 <sup>0</sup> 21' 56.0" | 007 <sup>0</sup> 54' 40.4" |
|                                        | 11 <sup>0</sup> 21' 59.0" | 007 <sup>0</sup> 54' 51.4" |
|                                        | 11 <sup>0</sup> 21' 46.7" | 007 <sup>0</sup> 54' 39.6" |
| Number of <b>working</b> boreholes     |                           |                            |
|                                        | 11 <sup>0</sup> 21' 59.0" | 007 <sup>0</sup> 54' 49.0" |
|                                        |                           |                            |

|                                             |                                                                  |                                                                      |
|---------------------------------------------|------------------------------------------------------------------|----------------------------------------------------------------------|
| Number of <b>non working Water Projects</b> |                                                                  |                                                                      |
|                                             | 11° 21' 57.9"<br>11° 21' 55.9"<br>11° 21' 53.4"                  | 007° 54' 45.4"<br>007° 54' 40.2"<br>007° 54' 40.0"                   |
| <b>PRIMARY HEALTH CENTRE</b>                |                                                                  |                                                                      |
|                                             | 11° 21' 57.5"<br>11° 21' 58.2"                                   | 007° 54' 44.9"<br>007° 54' 49.9"                                     |
| <b>NON-WORKING TRANSFORMER</b>              |                                                                  |                                                                      |
|                                             | 11° 21' 54.0"<br>11° 21' 57.6"                                   | 007° 54' 26.0"<br>007° 54' 40.9"                                     |
| Number of <b>non-working</b> boreholes      |                                                                  |                                                                      |
| <b>Gwanki</b>                               | 11° 20' 43.1"<br>11° 20' 43.2"<br>11° 20' 41.4"<br>11° 20' 42.4" | 008° 01' 49.7"<br>008° 01' 53.0"<br>008° 01' 44.9"<br>008° 01' 45.3" |
| Number of <b>working</b> boreholes          |                                                                  |                                                                      |
|                                             | 11° 20' 35.7"                                                    | 008° 01' 44.9"                                                       |
| Number of <b>non working Water Projects</b> |                                                                  |                                                                      |
|                                             | 11° 20' 39.3"                                                    | 008° 01' 44.5"                                                       |
| <b>PRIMARY HEALTH CENTRE</b>                |                                                                  |                                                                      |
|                                             | 11° 20' 43.3"<br>11° 20' 43.4"                                   | 008° 01' 49.6"<br>008° 01' 49.5"                                     |
| <b>NON-WORKING TRANSFORMER</b>              |                                                                  |                                                                      |
|                                             | Null                                                             | Null                                                                 |
| Number of <b>non-working</b> boreholes      |                                                                  |                                                                      |

|                                             |                           |                            |
|---------------------------------------------|---------------------------|----------------------------|
| <b>Meyare</b>                               | 11 <sup>0</sup> 19' 41.0" | 008 <sup>0</sup> 00' 23.6" |
|                                             | 11 <sup>0</sup> 19' 51.7" | 008 <sup>0</sup> 00' 18.3" |
|                                             | 11 <sup>0</sup> 19' 20.0" | 008 <sup>0</sup> 00' 29.6" |
| Number of <b>non working Water Projects</b> |                           |                            |
|                                             | 11 <sup>0</sup> 19' 38.6" | 008 <sup>0</sup> 00' 20.3" |
|                                             | 11 <sup>0</sup> 19' 32.2" | 008 <sup>0</sup> 00' 28.3" |
| Number of <b>working</b> boreholes          |                           |                            |
|                                             | 11 <sup>0</sup> 19' 52.6" | 008 <sup>0</sup> 00' 19.0" |
|                                             | 11 <sup>0</sup> 19' 53.6" | 008 <sup>0</sup> 00' 21.4" |
|                                             | 11 <sup>0</sup> 19' 31.0" | 008 <sup>0</sup> 00' 18.2" |
|                                             | 11 <sup>0</sup> 19' 21.1" | 008 <sup>0</sup> 00' 25.7" |
|                                             | 11 <sup>0</sup> 19' 19.7" | 008 <sup>0</sup> 00' 27.8" |
| <b>PRIMARY HEALTH CENTRE</b>                |                           |                            |
|                                             | 11 <sup>0</sup> 19' 41.6" | 008 <sup>0</sup> 00' 21.9" |
|                                             | 11 <sup>0</sup> 19' 43.2" | 008 <sup>0</sup> 00' 24.6" |
| <b>NON-WORKING TRANSFORMER</b>              |                           |                            |
|                                             | 11 <sup>0</sup> 19' 25.3" | 008 <sup>0</sup> 00' 25.4" |
| Number of <b>non-working</b> boreholes      |                           |                            |
| <b>Gubuchi</b>                              | 11 <sup>0</sup> 14' 30.2" | 008 <sup>0</sup> 01' 18.2" |
|                                             | 11 <sup>0</sup> 14' 29.3" | 008 <sup>0</sup> 01' 16.8" |
|                                             | 11 <sup>0</sup> 14' 28.9" | 008 <sup>0</sup> 01' 17.4" |
|                                             | 11 <sup>0</sup> 14' 20.9" | 008 <sup>0</sup> 01' 28.9" |
|                                             | 11 <sup>0</sup> 14' 19.6" | 008 <sup>0</sup> 01' 34.0" |
|                                             | 11 <sup>0</sup> 14' 14.3" | 008 <sup>0</sup> 01' 22.4" |
|                                             | 11 <sup>0</sup> 14' 18.4" | 008 <sup>0</sup> 01' 20.8" |
|                                             | 11 <sup>0</sup> 14' 20.1" | 008 <sup>0</sup> 01' 04.0" |
|                                             | 11 <sup>0</sup> 14' 40.0" | 008 <sup>0</sup> 01' 41.3" |
|                                             | 11 <sup>0</sup> 14' 25.2" | 008 <sup>0</sup> 01' 23.0" |
| Number of <b>non working Water Projects</b> |                           |                            |
|                                             | 11 <sup>0</sup> 14' 23.0" | 008 <sup>0</sup> 01' 22.4" |
|                                             | 11 <sup>0</sup> 14' 20.1" | 008 <sup>0</sup> 01' 30.2" |
| Number of <b>working</b> boreholes          |                           |                            |

|                                             |                                                                                                                                                                                                         |                                                                                                                                                                                                                |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                             | 11 <sup>0</sup> 14' 27.5"<br>11 <sup>0</sup> 14' 10.6"<br>11 <sup>0</sup> 14' 16.5"<br>11 <sup>0</sup> 14' 21.5"<br>11 <sup>0</sup> 14' 29.7"<br>11 <sup>0</sup> 14' 33.1"<br>11 <sup>0</sup> 14' 39.4" | 008 <sup>0</sup> 01' 39.8"<br>008 <sup>0</sup> 01' 24.5"<br>008 <sup>0</sup> 01' 13.6"<br>008 <sup>0</sup> 01' 14.5"<br>008 <sup>0</sup> 01' 11.9"<br>008 <sup>0</sup> 01' 21.4"<br>008 <sup>0</sup> 01' 34.5" |
| <b>HOSPITAL</b>                             |                                                                                                                                                                                                         |                                                                                                                                                                                                                |
|                                             | 11 <sup>0</sup> 14' 29.8"<br>11 <sup>0</sup> 14' 17.5"                                                                                                                                                  | 008 <sup>0</sup> 01' 17.5"<br>008 <sup>0</sup> 01' 28.4"                                                                                                                                                       |
| <b>PRIVATE CLINIC</b>                       |                                                                                                                                                                                                         |                                                                                                                                                                                                                |
|                                             | 11 <sup>0</sup> 14' 11.7"                                                                                                                                                                               | 008 <sup>0</sup> 01' 22.3"                                                                                                                                                                                     |
| <b>NON-WORKING TRANSFORMER</b>              |                                                                                                                                                                                                         |                                                                                                                                                                                                                |
|                                             | 11 <sup>0</sup> 14' 26.2"<br>11 <sup>0</sup> 14' 28.6"                                                                                                                                                  | 008 <sup>0</sup> 01' 18.5"<br>008 <sup>0</sup> 01' 24.8"                                                                                                                                                       |
| Number of <b>non-working</b> boreholes      |                                                                                                                                                                                                         |                                                                                                                                                                                                                |
| <b>Nasarawa Doya</b>                        | 11 <sup>0</sup> 14' 39.0"<br>11 <sup>0</sup> 14' 37.9"<br>11 <sup>0</sup> 15' 07.1"<br>11 <sup>0</sup> 14' 33.7"                                                                                        | 007 <sup>0</sup> 54' 27.7"<br>007 <sup>0</sup> 54' 21.2"<br>007 <sup>0</sup> 54' 14.0"<br>007 <sup>0</sup> 54' 26.8"                                                                                           |
| Number of <b>non working Water Projects</b> |                                                                                                                                                                                                         |                                                                                                                                                                                                                |
|                                             | 11 <sup>0</sup> 14' 45.3"<br>11 <sup>0</sup> 14' 53.0"<br>11 <sup>0</sup> 14' 57.9"                                                                                                                     | 007 <sup>0</sup> 54' 17.0"<br>007 <sup>0</sup> 54' 21.4"<br>007 <sup>0</sup> 54' 18.4"                                                                                                                         |
| Number of <b>working</b> boreholes          |                                                                                                                                                                                                         |                                                                                                                                                                                                                |
|                                             | 11 <sup>0</sup> 14' 54.7"<br>11 <sup>0</sup> 14' 52.8"<br>11 <sup>0</sup> 14' 53.2"<br>11 <sup>0</sup> 14' 45.9"<br>11 <sup>0</sup> 14' 38.1"<br>11 <sup>0</sup> 14' 45.8"<br>11 <sup>0</sup> 14' 58.8" | 007 <sup>0</sup> 54' 12.3"<br>007 <sup>0</sup> 54' 14.8"<br>007 <sup>0</sup> 54' 22.3"<br>007 <sup>0</sup> 54' 28.4"<br>007 <sup>0</sup> 54' 23.5"<br>007 <sup>0</sup> 54' 17.9"<br>007 <sup>0</sup> 54' 19.6" |

|                                        |                                                                                                                                                                            |                                                                                                                                                                                  |
|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>PRIMARY HEALTH CENTRE</b>           |                                                                                                                                                                            |                                                                                                                                                                                  |
|                                        | 11 <sup>0</sup> 15' 00.8"<br>11 <sup>0</sup> 14' 54.3"                                                                                                                     | 007 <sup>0</sup> 54' 24.6"<br>007 <sup>0</sup> 54' 20.7"                                                                                                                         |
| <b>PRIVATE CLINIC</b>                  |                                                                                                                                                                            |                                                                                                                                                                                  |
|                                        | 11 <sup>0</sup> 14' 22.1"                                                                                                                                                  | 007 <sup>0</sup> 54' 15.9"                                                                                                                                                       |
| <b>NON-WORKING TRANSFORMER</b>         |                                                                                                                                                                            |                                                                                                                                                                                  |
|                                        | 11 <sup>0</sup> 14' 52.1"<br>11 <sup>0</sup> 14' 45.9"                                                                                                                     | 007 <sup>0</sup> 54' 14.6"<br>007 <sup>0</sup> 54' 20.6"                                                                                                                         |
| Number of <b>non-working</b> boreholes |                                                                                                                                                                            |                                                                                                                                                                                  |
| <b>Dan Damisa</b>                      | 11 <sup>0</sup> 14' 14.2"<br>11 <sup>0</sup> 14' 16.6"<br>11 <sup>0</sup> 14' 01.7"<br>11 <sup>0</sup> 14' 07.2"<br>11 <sup>0</sup> 14' 10.6"<br>11 <sup>0</sup> 14' 10.1" | 007 <sup>0</sup> 50' 22.7"<br>007 <sup>0</sup> 50' 23.5"<br>007 <sup>0</sup> 50' 30.7"<br>007 <sup>0</sup> 50' 31.8"<br>007 <sup>0</sup> 50' 30.6"<br>007 <sup>0</sup> 50' 29.0" |
| Number of <b>working</b> boreholes     |                                                                                                                                                                            |                                                                                                                                                                                  |
|                                        | 11 <sup>0</sup> 14' 14.5"                                                                                                                                                  | 007 <sup>0</sup> 50' 20.7"                                                                                                                                                       |
| <b>PRIMARY HEALTH CENTRE</b>           |                                                                                                                                                                            |                                                                                                                                                                                  |
|                                        | 11 <sup>0</sup> 14' 13.8"<br>11 <sup>0</sup> 14' 23.1"                                                                                                                     | 007 <sup>0</sup> 50' 21.5"<br>007 <sup>0</sup> 50' 17.7"                                                                                                                         |
| <b>NON-WORKING TRANSFORMER</b>         |                                                                                                                                                                            |                                                                                                                                                                                  |
|                                        | 11 <sup>0</sup> 14' 11.4"                                                                                                                                                  | 007 <sup>0</sup> 50' 20.7"                                                                                                                                                       |