CHAPTER ONE
INTRODUCTION

1.1. Background to the study

Rural infrastructure and household welfare in Nigeria

The rural welfare literature accentuates rural livelihoods and the choices made by rural households in their bid to insure the welfare of their members. A livelihood can be explained as a way of earning money that enables people to make a living. A livelihood is achieved by employing different types of capital or assets in income generating activities whose participation is dictated by institutional and social interactions to enable people live well. According to Barrett and Reardon (2000); Winters *et al.* (2001) and Niehof (2004), the livelihoods concept has gone a long way to explain the different activities that households go into and the significance of capital or assets in deciding the ability to take up the activities.

Several studies have revealed that households in the rural areas use various assets in carrying out many income generating activities. (Winters *et al.*, 2007; Winter *et al*., 2009; Davis *et al*., 2007; De Haan and Zoomer, 2005; World Bank, 2005 and Mutenje *et al*, 2010). Similarly, data from Nigeria also corroborates the fact that rural households are engaged in many economic activities to sustain their livelihoods (DFID, 2004; Bello, 2004; Anyanwu, 2005; World Bank, 2008; Babatunde and Quaim, 2008; Oluwatayo, 2009; Awoyemi, 2004; Idowu, 2010; Olugbire, 2010; Oni and Fashogbon, 2013).

Infrastructure is a public asset and adequate access to it contributes immensely to the well-being of households. The type of infrastructure available and which households have access to in a community determine largely the type of livelihood activities which they can carry out and this directly increases their potentials to diversify their income source; which will consequently yield improved household welfare. Despite the tremendous contributions of rural dwellers to the economic development of Nigeria, the rural sector of the economy has experienced retarded growth, low development and a high level of poverty for many years, mainly due to the absence and/or limited access to infrastructure (Dittoh and Okumadewa, 1990; Idachaba *et al*, 1994; Akinola, 2003; 2007).

The eight Millennium Development Goals (MDGs) of the United Nations entrusted the member nations to an extensive vision of putting human capital development at the core of socio-economic growth with the aim of reducing poverty by at least half by the year 2015. Explicitly singled out was the economic infrastructure and most importantly transport, information, water, sanitation, irrigation and power. Economic infrastructure is a vital part of the capital assets of an economy which are used in economic production to attain growth and development. Investments in infrastructure buttress almost all the MDGs. It is generally admitted that infrastructure plays a major part in decreasing the incidence of poverty by half which is the first goal and the most significant goal out of all eight (Willoughby, 2004).

Access to infrastructure also promotes advancements in health, nutrition, education and social unity. For instance, access to telecommunications makes information readily accessible and thereby increases productivity and lowers expenditure (MDG I, II and III), promotes easy access to health (MDG IV, V and VI) and promotes global economic relationship (MDG VII and VIII). The United Nations Millennium Project (2005) has affirmed that infrastructure is highly essential and pleads for a considerable rise in fundamental infrastructure investments to aid African nations to come out of the poverty trap.

Infrastructure are public goods and members of the community have equal rights to access and benefit from their services without necessarily paying for access to them because they are usually supplied by the government and sometimes, non-governmental organizations and private organizations. Thus, the provision of infrastructure closes the gap between the poor and the better-off in a community. As stated in the World Bank 1994 report, access to rural infrastructure aids rural dwellers in their production, processing and marketing activities and enhances the nature of rural life generally. A lot of other studies show that adequate infrastructure access reduces production cost thus increasing their profit levels, other things remaining constant and ultimately household welfare (Obayelu *et al*.; 2014; Adeoye *et al*.; 2011; Ashok and Balasubramanian, 2006; Adefuke, 2005; Escobal, 2005; McNeil, 1993 and Idachaba, 1985).

The effects of access to infrastructure on household welfare can both be immediate and indirect. The immediate effects include enhanced welfare which cannot be captured in monetary terms like higher level of household expenditure or income. For instance, the provision of toilets and

potable water (deep wells and boreholes) will automatically lead to better hygiene which will improve the health condition of the beneficiaries. However, most infrastructure services indirectly enhance household welfare. For instance, government spending on electrification, feeder roads and; processing and storage facilities in rural areas will expand their scope of production and increase their income which will ultimately improve the household welfare.

The current poverty level is estimated to be 67.1% (NBS, 2016) and this means that more than half of the population live in extreme poverty. Reducing extreme poverty is grossly hindered by many factors and notable among them is the pervasive nature of inadequate infrastructure supply and unequal allocation to and access by households.

Although the benefits of infrastructure investment is obviously incontestable, more often than not, the use of those funds have not in general, been efficient as the real outcomes have been less than expected. The implicit benefits of infrastructure investments are at times limited by some factors including institutional bottlenecks, ineffective administration and corruption. Cases of white elephant projects are widespread. The proceeds and benefits that accrue from huge spending on infrastructure development are often times too meager. In addition, many infrastructure projects are not demand-driven but are usually provided without proper assessment of the target beneficiaries (Foster and Pushak, 2011). In Nigeria, most of the infrastructure development projects by the government are done because of the financial profit that will go to the officials and the politicians. Some of the decisions to supply infrastructure are even outcomes of political games and power play which have resulted in what can be termed “project misfit”. Another bane of infrastructure development in Nigeria is that the projects costs are overestimated and more than the overage is deducted from funds allocated for their implementation. This results in poor and incomplete project execution which more often than not have negative aftermath like environmental degradation for the people, thus, making them more vulnerable (Foster and Pushak, 2011).

Infrastructure is a public good that aids production activities and enhances the level of quality of living of the people. Every member of the community, both the destitute and wealthy, is able to use equal amount of the good and services to their satisfaction. Hence, the development of infrastructure is reasoned to be one of the solutions to eradication of poverty.

Classification of infrastructure

Infrastructure is usually classified and discussed in relation to its functions and characteristics. Examples include roads, bridges, educational institutions, health facilities, telecommunication facilities, and so on which are accessible to all. They are required for a nation or organisation to operate efficiently.

Infrastructure is grouped into either hard or soft. Hard infrastructure is the physical constructions and installations which maintain the society and economy and they are found in the basic sectors of the economy. Examples of hard infrastructure are railway, ports and roads in the transport sector; oil pipelines, electrical grids and electricity generation stations in the power sector; internet and telephones and in telecommunications sector; health clinics and hospitals in the health sector; and primary, secondary schools and tertiary institutions in the education sector. The soft infrastructure are regulatory, policy and institutional frameworks; social networks; mechanisms for governance; procedures and systems; openness of system of financing and procurement that enable development and operation of the hard infrastructure (Bhattacharyya, 2009).

The UN-HABITAT (2011) generally defined infrastructure as all essential inputs and equipments that are required for an economy to work. There are some that are economic in nature, that is, they are used for economic purposes while some other ones are social in nature.

- Economic infrastructure is the capital wealth of a nation that is used to facilitate economic production. Examples are power, roads, railways, airports and seaports.
- Social infrastructure includes health, educational and recreational services which affect the quality of life directly or indirectly. It directly improves productivity of economic activities and indirectly shapes things like recreation, education, health and safety. For instance, an indirect advantage of improved education is enhanced productivity which translates to higher employment opportunities, increased real incomes and higher economic growth. Social infrastructure also enhances the standard of living of the citizenry and this leads to more optimal use of a country's resources and ultimately reduction in poverty.

Infrastructure and economic development

Many research work have revealed the importance of access to infrastructure to sustainable development (Aschauer, 1989; World Bank, 1994; Jalan and Ravallion, 1998; Ariyo and Jerome 2004; Ndulu, 2006 and Jerome, 2009). The connection between investments in infrastructure and economic growth is a correlative one as they both affect each other's performance. According to DFID (2000), infrastructure provision contributes to sustainable development in many ways like reduction in transaction costs which promotes both local and international trades that empowers individuals, organisations and the government to take up new challenges. It also creates employment opportunities and reduces input cost for entrepreneurs thereby making businesses more lucrative. Access to infrastructure can also upgrade human capital by increasing accessibility to health centres and schools and improving the state of the environment which results in enhanced standard of living thus making the poor less vulnerable.

1.2 Problem statement

Inadequate access to infrastructure in rural Nigeria is the main cause of the under-development of rural economy and the consequent high level of poverty and poor welfare among its households. Interestingly, the economic activities of these households are vital to the overall growth and development of the country, particularly through their agricultural activities which constitutes the major share of the country's export earnings. Despite the important role it plays, the rural sector continues to experience stunted growth and development over the years primarily due to inadequate and sometimes no access to infrastructure.

The development literature has revealed the significance of infrastructure access in an economy (Sawada, 2015; Mensah, 2011; Estache and Wodon, 2010; Ogun, 2010; Calderon, 2008 and Ariyo and Jerome, 2004). One distinct feature of the first world countries is that there is adequate provision and access to infrastructure, both economic and social. These countries give great attention to infrastructure as evident in the volume of investments they put into its supply and maintenance and they are so called developed because of the quality, type and number of infrastructure available in their countries. Undoubtedly and as reasoned in the development literature, improved access to infrastructure brings about rapid development, better opportunities

for employment and creation of human capital. Thus, the nature of infrastructure found in a country or community determines how developed it is. Consequently, the countries that have inadequate and low quality infrastructure are referred to as developing or under-developed countries.

Nigeria is considered a developing country largely because of its lack of modern infrastructure which has hindered its economic development. Despite being the "Giant of Africa", some other countries in the continent have overtaken her in terms of infrastructure development because over the years, their governments had given greater attention to its provision and supply. Until recently, very little attention was given to infrastructure and even so, priority was given to the urban centres at the detriment of the rural. The problem of inadequate transportation facilities, potable water, power, sanitation and hygiene to mention a few, has limited the country's economic transformation and alleviation of poverty. The rural areas of the nation have suffered too much negligence from various governments and a large share of infrastructure investment is given to the urban areas. The frail nature of infrastructure in rural Nigeria has brought untold hardship to its dwellers. The productivity of the rural households are hampered because of lack of infrastructure such as irrigation facilities, extension services, standard educational and health facilities, incognizance of modern production facilities and friendly government policies. They are deeply plunged into poverty because of low profitability of their enterprises due to poor marketing and storage facilities, bad road network and obsolete storage and preservation techniques.

The provision of infrastructure is very expensive particularly in a developing country like Nigeria. This is owing to the fact that the materials, technologies, technicalities and most times the technicians that are employed to supply them are brought in from the developed world and this will require huge withdrawal from the nation's foreign exchange reserves (Jerome, 2008). The manufacturing and construction sector of the country are not yet equipped as their foreign counterparts even though individuals, private sector, corporate organisations and NGOs are making tremendous effort to grow these sectors by investing hugely in them. The monstrosity of financial investment needed to build infrastructure makes it necessary for households to depend absolutely on the government and non-governmental bodies for its provision and accessing.

In view of the volume of capital that the provision of infrastructure requires, the Economic Commission for Africa (2005) suggested an annual expenditure of five percent of the GDP of a country for new infrastructure provision and four percent of the GDP for maintaining the infrastructure over a ten year period between 2005 and 2015. The total amount for Africa is almost USD 20 billion. However, the AfDB and World Bank study recommended about USD 93 billion annual requirement till year 2020 (AfDB, 2011 and Foster and Pushak, 2011).

There is a mammoth infrastructure requirement in Nigeria for the country to be at par with other developing countries. Specifically, it is paramount to give attention to the quantity, range of coverage and quality of key infrastructure like ICT, irrigation, power and potable water supply. To achieve this, an estimated annual spending of $14.2 billion will be needed from 2005 through 2015 which is a 10year period out, of which about $11 billion is earmarked for federal infrastructure like ports, primary roads, electricity, railway, information technology, airports and large-scale irrigation. The remaining $3.7 billion is to be spent on secondary and tertiary roads, water, small-scale irrigation and sanitation at the other two levels of government (Foster and Pushak, 2011; World Bank, 2011).

Nigeria's total spending requirements is projected to take up to around 12% of GDP out of which spending at the federal level only is 9% of GDP (Foster and Pushak, 2011). This is far from what China expended (15%) on her infrastructure up to the mid-2000s. Currently, the country is spending just $5.9 billion annually to meet federal infrastructure requirements out of which the private sector contributes $2.5 billion being the largest, followed by government capital outlay of $1.7 billion a year share investment. The balance comes from non-OECD and ODA.

Nigeria's infrastructure investment demands can be managed in view of the magnitude of the economy. According to the 2011 AICD country report, about $2.5 billion worth of resources are wasted due to different kinds of inefficiencies (Foster and Pushak, 2011). It has been suggested that Nigeria could realize its infrastructure goals if inefficiencies are tackled without even necessarily sourcing for more funds.

The crude state of rural infrastructure is the major sole factor underlying the low level of development of the rural areas of Nigeria. Information gathered on rural infrastructure in comprehensive national surveys since 1979 clearly shows its flagrant defective state, vast rural – urban disparities, revelatory variation between geo-political regions and significant variations within rural areas (Idachaba, 1985; Adefuke, 2005). For Nigeria, empirically robust evidence on the connection between household welfare and infrastructure is vital for achieving her developmental goals of, especially in the rural areas.

Many research questions arise from the foregoing and they are raised in the context of southwestern Nigeria which is the study area. These are:

1. what are the livelihood choices and welfare profile of rural households in southwestern Nigeria?
2. how developed in terms of accessibility to rural infrastructure is southwestern Nigeria?
3. what determines the livelihood choices of rural households in southwestern Nigeria?
4. how does access to rural infrastructure affect the choice of livelihood type among rural household in southwestern Nigeria?
5. is there any causal relationship between access to rural infrastructure and household welfare in southwestern Nigeria?

1.3. Objectives of the study

The main objective of the study is to examine the effect of rural infrastructure on household livelihood choice and welfare in rural southwestern Nigeria.

The specific objectives are to:

1. profile the livelihood choice and welfare of households in southwestern Nigeria;
2. assess the extent of rural infrastructural development in southwestern Nigeria;
3. examine the determinants of livelihood choices of households in southwestern Nigeria;
4. examine the effects of access to and usage of rural infrastructure on livelihood choices of rural households in southwestern Nigeria;
5. determine the effect of access to and usage of rural infrastructure on welfare of households in southwestern Nigeria.

1.4. Research hypotheses

Stated in the null form, these hypotheses were tested:

1. Cost of accessing rural infrastructure does not affect access to infrastructure.

2. Rural infrastructure has no significant effect on household livelihood choices and diversification in rural southwestern Nigeria.

3. Rural infrastructure has no significant effect on household welfare in rural southwestern Nigeria.

1.5. Justification of the study

The collective connection between rural infrastructure and development has been broadly discussed in several previous studies. For example, Idachaba (1985), Dittoh and Okumadewa (1990), Idachaba (1994), Röller and Waverman (2001) and Prud'homme and Rémy (2004) have studied extensively on rural infrastructure and development; Adefuke (2005), Mendes *et al*. (2008), Adeoye *et al.* (2011) and Obayelu *et al.* (2014) studied the effect of rural infrastructure on farmers' profitability and productivity Lebo and Schelling (2001) and Jacoby (2002) studied the effect of access to market and rural road benefit; van De Walle (1996); Jerome and Ariyo (2004) and Ogun (2010) studied the impact of access to infrastructure in reducing poverty; Tabi and Ndam (2013) and Mensah (2011) have also studied the relationship between infrastructure and household welfare.

These studies acknowledge that spending on infrastructure meaningfully affected rural income and welfare. However, as rightly observed by Ayogu *et al*. (2007) and Mensah (2011), many of these studies have not pointed out the causative relationship between livelihood opportunities and infrastructure investment which result into household welfare. This limits policy recommendation to only proposing a general expansion of infrastructure investment. The study aimed at closing the gap in existing literature by evaluating the effect of rural infrastructure development on livelihood choices and household welfare.

Despite the fact that good accessibility to infrastructure has been acknowledged as a requisite for boosting the social and economic well-being of households, empirical evidence of its contribution to improving the welfare of households is limited. Apart from the works of Ogun (2010), Adefuke (2005), Dittoh and Okumadewa (1990) and Idachaba *et al* (1994), not much work has been done on the effect of access to infrastructure. This study will respond to the gap in knowledge by giving empirical evidence of the effect of rural infrastructure on the welfare of households. Infrastructure provision is very expensive and so much funds have been expended on its supply. There is therefore the need to determine how they have impacted on the well-being of households in the rural area.

A major point of development literature is that many of the past research studies only reckoned with investment in one type of infrastructure that is necessarily not the same with access. Thus, it is impossible to differentiate between the benefit from infrastructure access and spending on infrastructure. Therefore, while the literature on the effect of infrastructure on poverty, economic growth and inequality has been developed, the significance of its access in these relationships is not well researched. In addition, though there exists more than enough proof that huge investment in infrastructure leads to growth of the economy, not much work have been done to show how it affects welfare positively.

The six infrastructure elements in this study are those considered to be vital to the overall welfare of rural households and these are potable water, electricity, health centre, school, market and agro service centre.

Electricity plays a vital role in the welfare of rural households. Households that have access to electricity can engage in a wide range of off-farm and non-farm activities that generally require the use of electricity, thus increasing their productivity and improving the welfare of households (UN-HABITAT, 2011). They are also able to use machines to process and store their farm produces. Other researchers have also shown the importance of electricity to overall welfare of households (Barnejee *et al*., 2009, Foster and Jevgenigs, 2009; Dinkelman, 2011 and Winters *et al*., 2017).

Potable water is very important to welfare as it directly impacts on the health status of households. Clean water is required for living clean and healthy to drink, cook, bathe and achieve general good sanitation. Households that have good access to clean water can maintain good hygiene and this will prevent outbreak of diseases and its aftermath which is usually deadly (WHO, 2010).

Access to schools is also essential to the welfare of households. Education equips members of a household with the skills to be able to engage in livelihood activities that yield higher income and ultimately high welfare (Adepoju and Obayelu, 2013 and Stifel, 2010). School (education) is a principal means of improving the welfare of individuals and households. Education is vital to the attainment of welfare by households because it equips people with skills, knowledge and attitude necessary for them to take up their places in the society. It also provides the tools to make critical appraisal of their society and offer possible solution to the problem which arises from time to time. Education, under certain conditions may also be expected to fulfill equity goals as it is a vehicle by which children of poor households have managed to move to higher levels in the occupational and income structure of the society.

Adequate access to health centres are very important for households to attain and maintain welfare. Health is wealth as only the healthy has the strength, capacity and capability to create wealth.

Access to market is also important to household welfare because it ensures that rural households are able to sell their farm produce and off-farm products in the markets directly to consumers and make more profit because marketing costs are reduced (Escobal, 2005).

Access to agro service centre ensures that households are able to get good agro inputs at moderate prices which increases the productivity of farmers and thereby improves their standard of living and overall welfare.

Development of infrastructure in rural Nigeria has suffered so much neglect while the urban centres continuously enjoy adequate access to potable water, health facilities, education and other infrastructure (Idachaba, 1985; Adefuke, 2005; Akinola, 2003; 2007).

Mensah (2011) studied how access to infrastructure influenced household welfare in rural Ghana. He adopted the Generalized Methods of Moments Model. This study is different from this and other studies on infrastructure in that the Ordered Logit Model was used to establish a linkage between rural infrastructure and household welfare.

1.6. Report of the study

The study is organised into five chapters. The first chapter introduced the study while the second chapter presented the theoretical/conceptual framework and literature review on rural infrastructure, livelihood choices, diversification strategies and welfare. The third chapter discussed the methodology applied in achieving the objectives of the study and the results of data analysis are presented in chapter four under five sections. Section one describes the socio-economic characteristics of the respondents in the study area while the household livelihood choices and diversification are discussed in section two. Household's access to rural infrastructure is presented in section three and section four discussed the welfare status of households by socio-economic characteristics and their access to rural infrastructure. This gives account of household distribution of monthly expenditure, grouping of households according to their welfare status, categorization into welfare status based on socio-economic characteristics and household welfare status in relation to access to rural infrastructure. Section five presents the result of the computed rural infrastructure index. The determinants of livelihood choice and the effect of infrastructure access on livelihood choices are presented in section six. Section seven discusses the effect of rural infrastructure on household welfare. Chapter five summarises the major findings of the study and gives the conclusion. This chapter also includes policy recommendations from the study, suggestions for further studies and contribution to knowledge.

CHAPTER TWO

THEORETICAL / CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

In this chapter, a number of theories and concepts underpinning infrastructure, livelihood and welfare are reviewed. It also includes the conceptual framework for the study and empirical reviews of past studies relevant to the work.

2.1. Theory of Public Goods

The theory of public goods was proposed by Samuelson (1954). The theory stipulates that public goods are provided to better the lot of members of a society rather than to make a profit and it is so called public because it is usually supplied by the government and other non-governmental organisations. They are non-rivalrous and non-excludable in consumption (Samuelson, 1954 and Frischman, 2005).

The non-rivalrous characteristic is met if the use of a specific quantity of a good by one person does not reduce the satisfaction that another person using the same quantity of the good will derive. Thus, there is mutuality or unity in the use of the good because the produced good can yield many units to be consumed. An example is water from a public tap. The quantity of water fetched by one person does not affect or reduce the quantity that other people will fetch from the same tap. Therefore, the benefit of the public tap is enjoyed by everyone in the community.

The non-excludable characteristic is met if it is not possible to stop other people from mutually using the same quality of the good produced. Examples of non-excludable goods are water quality, electricity and a social viewing centre within a community.

2.2. The Utility Theory

The main assumption of the utility theory is that an individual will choose out of many alternatives the commodity that maximises his utility. Given this assumption, the utility theory is useful in forecasting what households would choose among existing options. In that sense, all these alternative choices must be given a worth or value and this is done using the utility function which is a function of the household's preferences. These choices are assumed to be mutually exclusive.

For instance, option M could have three mutually exclusive choices, say, *h, i, j* and the household or individual prefers *j to i* and *h to j*, the utilities U_1, U_2, U_3assigned to *h, i, j* are X_1, X_2, $1 - X_1 - X_2$respectively, option M is expected to have utility:

$$E(U/X) = X_1U_2 + X_2U_2 + (1 - X_1 - X_2) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where,

X = probability distribution characteristic for alternative (i) (X_1, X_2, $1 - X_1 - X_2$).

If alternative *B* is preferred to alternative *A* with *Y* being the probability distribution, then the utility is assigned in both cases is $E(U/Y)^{1/2} > E(U/X)$.

2.3. General Concepts

2.3.1. The Welfare Concept

Welfare is usually interchanged with well-being and well-being is determined by possession of money, education, food, good health, clothing, shelter, network and some fundamental human rights like freedom of speech. Welfare can be viewed both at individual's micro level, society's macro level and the economic or sociological angle. Different researchers have varied perspective on welfare, for instance, Williams (1976) interpreted welfare to be the satisfaction derived from adequate food supply while George and Page (1995) view welfare as a form of social justice. Spicker (1995) narrowly interpreted welfare biologically to mean the quantity of calories needed for survival while Summer (1996) understood the term to mean an important hallmark of our decency. Deacon (2002) explained welfare as an unselfish regard for or devotion to the well-being of others. According to Pigou (1950), money is the only unambiguous measure of welfare and this is applicable in the interpretation of welfare at the macro-level using GDP per capita. He also emphasized that welfare can be grouped into greater or less.

In economic theory, welfare is assumed to be another term for utility. According to Van Praag (1993), there is no clear understanding of the welfare and utility concepts among others. Van Praag and Frijerts (1999) further explained that welfare is the value given to income by a person and the enhancement to well-being that is derived from goods and services purchased with money. Tinbergen (1991) is also of the opinion that welfare can be measured and that it is the same as utility. Welfare is therefore linked to a person's view and utility of income. Thus, welfare is not easy to evaluate at the macro level because utility from income will vary with individuals but the choice of consumers as revealed in market transactions is normally used to explain why gross domestic product per capita represents a good indicator.

Panich (2007) raised the objection that money is not the ultimate objective but a means for attaining welfare. This makes it possible to widen the scope of welfare to encompass GDP per capita, number of people that are poor, economic security indices, proportions in total income, obesity, corruption index, social trust, lack of basic literate skills and so on. According to Allardt (1975) and OECD(2007), expanding the meaning of welfare to include all these is in accordance with the social indicator movement and gives a better understanding of welfare but also introduces a lot of controversies in the estimation of welfare. There is also the challenge of defining government's role in welfare and determining the difference between public and private responsibilities.

According to Barr (2003), welfare in classical economics depends on the utility of an individual and limits the role of government to resolving market failure. However, the behavioural economics contests the basis of employing utility and income as outcome of welfare (Wilkinson, 2008; Layard, 2005) instead of happiness and satisfaction.

2.3.2. Concept of Household Welfare

The theory of household behaviour is based on two assumptions; one - that households will choose a bundle of goods that will maximize their utility from a variety of available alternatives and two – that households responds to change in the economic environment by modifying their behaviour. The welfare of the society is assumed to depend on the welfare of its members. The opportunities available to a household and its preferences dictate the behaviour of the household and this helps it to make utility maximizing decisions on commodities to consume, livelihood activities to go into, what to earn to pay for goods, how much to consume, how much to save and

what assets to hold. The decision and capability of a household to engage in a livelihood type to attain welfare depends on its socioeconomic characteristics, the private assets endowment, public assets that it can access and use as well as other environmental factors.

2.3.3. Concept of Infrastructure Access and Welfare

Household welfare is dependent on factors like the number and characteristics of the household members, the assets of the household, the infrastructure that the household has access to and its livelihood vulnerability contexture in terms of seasonality, shocks, natural disaster and so on.

Access to infrastructure as it relates to household welfare is interpreted as the situation/ citing of infrastructure within vicinity that will enable the household members to be able to constantly use it as at when needed. With respect to this, households can be classified as either having access to infrastructure or as having no access. Households with access usually enjoy free immediate use of the infrastructure and favourable economic externalities resulting from proximity to the location of the infrastructure.

Likewise, households with no access to infrastructure cannot derive any advantage from it because they pay certain amount of money to get to the location of the infrastructure, that is, access fee; and also in many instances pay additional user fee to make use of the resources. The influence of access to infrastructure on livelihood consequences is assumed positive and greater for households with access compared to households without access.

The level of access to infrastructure determines the level of household welfare. Households with higher access to markets and road infrastructure will, all things being equal, generate higher income in their livelihood activities than those with low access; while households with better access to health centres, clean water and sewerage enjoy better living standards than those without. (Winters, *et al.*, 2009). The capability of households to derive the most benefit from access to infrastructure is dependent on factors like socioeconomic characteristics, capital assets, government policies and climate changes (Scoone, 2000).

2.3.4. Household Livelihood Concept

A livelihood is achieved by employing different types of capital or assets in income generating activities whose participation is dictated by institutional and social interactions to enable people

live well. The type of livelihood that a household or an individual engages in is extremely important to their existence, therefore, its sustainability should be insured. Adequate and sustainable sources of income and other assets that will assist households in meeting their basic need of food, clothing, shelter and access to infrastructural facilities must be ensured.

Chambers and Conway (1992) explained that a livelihood can be sustained if it overcomes pressure and external shocks, and can preserve the potentialities and resources and at the same time, the original asset base such that the next generation can benefit from it. Livelihood consists of income generating activities that provide different ways to meet household needs.

The sustainable livelihood framework has in six objectives targeted at raising the ability. The framework advances the following:

a) greater access to high quality education and improved nutrition and healthcare;
b) greater corroborative and united social environment;
c) higher guaranteed access to and more skilful handling of natural assets;
d) higher accessibility to essential infrastructure;
e) higher guaranteed access to finances;
f) conducive policy and institutional environments that encourages diverse livelihood strategies and boost impartial, competitive markets for all.

This is a people-centred concept that is aimed at eliminating poverty in poorer countries by adopting the livelihood objectives stated. It is intended to add directly to realising the United Nations' Millennium Development Goal of decreasing the percentage of extremely poor people by half by the year 2015 (Scoones, 2000). According to the views of Chambers and Conway (1992) and Ellis (2000) a sustainable livelihood can be separated to show its various sub-components. In this regard, the following are the five key sub-components of the definition:

a) Establishment of working days
b) Reduction of poverty
c) Proper measurement of livelihoods
d) Welfare and potentialities
e) Livelihood adaptions, susceptibility and flexibility
f) Sustenance of the natural resource base.

A sustainable livelihood framework was developed with the foregoing in order to deal with rural livelihood research questions.

2.3.5. Infrastructure Access and the Development

The significant role of infrastructure access on sustainable development is apparent in the development literature. As stated by Murphy *et al.* (1989); and Sawada and Mahmud (2015), infrastructure is an extremely important prerequisite for industrialization and economic development. The macroeconomic development literature and empirical findings (Barro 1990; Futagami, *et al.*, 1993; Jimenez 1995; Esfahani and Ramirez, 2002; Calderón *et al.*, 2014) noted that infrastructure development enhances an economy's extended production and levels of revenue. Availability of infrastructure like health centres, potable water sources, electricity, schools, road network, information technology, telecommunications and sewerage are crucial for invigorating the development procedures in an economy (Mensah, 2011). Hence, an economy that accesses infrastructure more is presumed to be more disposed to impel and maintain a development path which bolsters future growth possibilities.

Infrastructure access is also considered to be vital for upgrading trade competitiveness because it reduces market disintegration, varying information and geographical challenges. According to Huchet-Bourdon, *et al.* (2010), the development of economic infrastructure fosters greater connection among local economies and consequently promotes growth and reduces poverty.

2.4. Measurement of Household Welfare

This is the quantitative estimation of the standard of living of individuals and households (Deaton, 1997). There are different schools of thought on the measurement of household welfare. One school of thought considers welfare as the control people have on goods and services to attain a desirable standard of living which depends on the household's social and economic background, the livelihood activities engaged in and the level of income of the household. This view identifies total income of a household over a length of time as a substantial estimation of welfare. Income is money that is earned from work done, investment, business, etc. Income enables individuals and groups to purchase or acquire resources to meet essential needs and is sometimes used by economists to measure welfare but data on it is usually inaccurate, highly variable and seasonal, particularly for households in informal labour markets, small and medium

enterprises and farming. Apart from workers with steady salaries and wages, income is a non-reliable measure of welfare.

Another school of thought is of the belief that the use of household income is highly uncertain even when measured over a brief period of time. They are of the view that the household's actual consumption or expenditure is the perfect estimation of its welfare (Filmer and Pritchett, 2001). Information on household expenditure are easier to collect, more accurate and reliable than on income, particularly in the rural areas. Here, welfare is captured as the sum total of consumed goods and services over a period of time by a household.

2.5. Conceptual Framework

The conceptual framework of this study is anchored on an extrapolation of the combination of the livelihood assets in the Sustainable Livelihood Framework and how they evolve in determining welfare outcomes. This was inspired by Robinson (1971) to give a clear-cut separation between the two types of livelihood assets necessary for analysing this study. The first types are the assets that belong to the households and which they have control over and are so called "household assets" and the other type are those that are outcomes of government policies and which households have no control over and are referred to as public goods and services (or infrastructure).

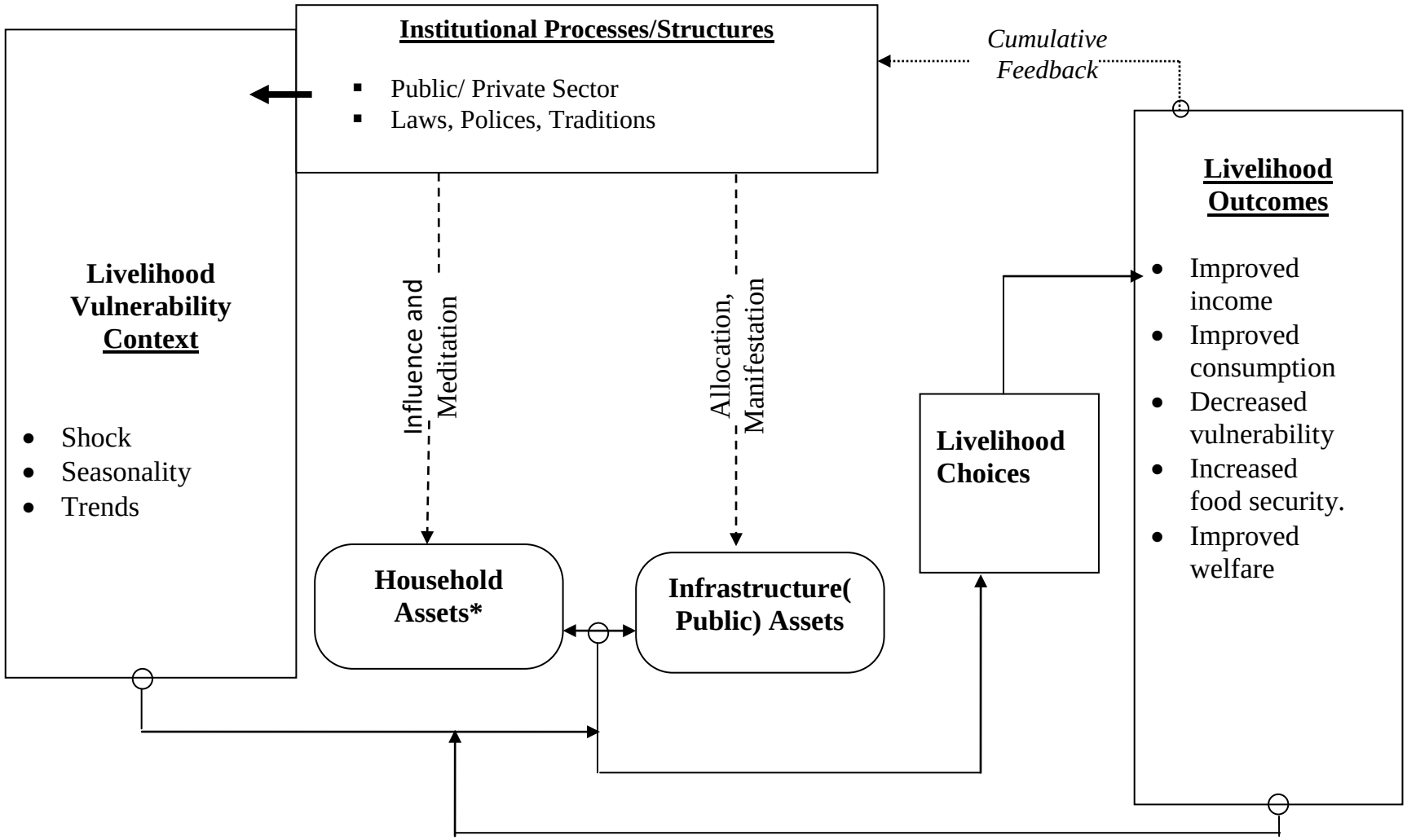
The assets in the original sustainable livelihood framework are presented as solely household assets, whose access and use are mediated by current institutional structures. However, some of these assets are public in essence and are results of institutional organisation, social systems and political processes. Public assets are complimentary in nature because they help households realise the real worth of their asset, the opportunities at their disposal and the real welfare outcomes.

In the sustainable livelihood framework, sustainability is presumed to come from the welfare expectancy of households and thus, exogenous. On the contrary and according to Hardin (1968), this postulation is conflicting with the realities that households are intrinsically welfare-maximizing. This error is corrected by hypothesising that the sustainability of a development course arises within the framework through a balance between households' livelihood

expectations and the direction of institutional evolution and it is introduced as the cumulative feedback from households to institutions. This is presented in Figure 1.

Conceptually, the welfare of a household is determined by its socio-economic characteristics, household's assets, public assets/capital, seasonality, shocks and trends.

Figure 1: Conceptual Framework for Infrastructure and Household Welfare



*Social, Physical, human, financial and natural assets

Source: Adapted from Mensah, 2010.

2.6. Review of Analytical Tools

2.6.1. Multinomial Logit Regression Model

This regression model generalises logistic regression by permitting more than two possible discrete outcomes. MNL models are employed to estimate how independent variables affect dependent variables with unordered response categories (Adugna, 2005; Mpuga, 2008; Stifel, 2010; Adepoju, 2011; Ojo et al. 2013 and Gani, 2015). The multinomial logit is modelled as:

$$Prob(yi = m) = Pim = \frac{e\beta mxi}{\sum_{i=1}^{j} e} \quad \text{…..……..} \quad (2)$$

where i is the household head, j and m are the livelihood types, and x_i represents the independent variables. The probability of a household head choosing livelihood m is P_{im}.

Some assumptions must be met to successfully use this model. Firstly, the value of the error term is independent and equally distributed (Borooah, 2002 and Greene, 2000). Secondly, livelihood choices are not ranked in any particular order. Households are assumed to maximize its utility based on their assets. The third assumption is that the livelihood choices are mutually exclusive. The fourth is that the livelihood choices are collectively exhaustive, that is, the choices identified are the only ones that are available in the community. The last assumption of the model is that the livelihood choices are presumed to be independent of irrelative preferences. This assumption does not hold if they are not mutually exclusive (Liao, T. 1994).

- **Estimation Method of Maximum Likelihood**

In the multinomial logit model, if there are m alternatives only $m-1$separate parameter vectors can be identified. The linear dependence requires that the parameters be, that is

$$\sum \beta_j = 0 \quad \text{……} \quad (3)$$

To be able to compare empirical results, it is better to estimate the partial derivatives of marginal effect. According to Greene (1993), the method of derivation show that the signs or

size of the marginal effects should necessarily not have any connection with the signs of the coefficients used in obtaining them.

The partial derivatives are:

$$\frac{\partial Pj}{\partial X} = P_j(1 - P_j)\frac{\partial Sj}{\partial X} - P_jP_k\frac{\partial Sk}{\partial X} - P_jP_n\frac{\partial Sn}{\partial X}$$

……..(4)

$J, k = p, f, j \neq k$

The model is specified so that $\partial Sj / \partial \ln W_k = 0$ if $j \neq k$.

The formula to estimate the marginal effect is:

$$\frac{\delta\, prob(y = z)}{\delta\, Z_k} = P_z[\beta_{zk} - \sum P_z\, \beta_{zk}] \quad \text{……..} \quad (5)$$

$z = 1$

where,

P_z stands for prob $(y = z)$

The maximum likelihood estimator will be used since it gives parameter estimates that are consistent and corrects large sample statistics (Liao, 1994).

The results will make it possible to evaluate the likelihood of a household adopting a specific livelihood choice with respect to its individual and household characteristics, asset base and access to infrastructure.

2.6.2. Ordered Logit Regression Model

The Ordered Logistic Regression model is employed to evaluate relations between an endogenous ordinal variable and a set of exogenous variables. Ordered logit is applied instead of ordinary logit if the endogenous variable has more than two categories with the values of each category having a significant serial sequence in which a lower value comes before the

greater. The dependent variables are grouped. Group g = 1 is the lowest value of the variable, g = 2 is the next ordered value, and so on, for the empirically determined k categories.

The Ordered Logit Regression Model is expressed as:

$$_{wi}* = \beta' x_i + \varepsilon_i \qquad -\infty < w* < -\infty \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

where,

$_{wi}*$ = welfare

β_i = vector of parameters to be estimated

x_i =vector of dependent variable showing the characteristic of ith person

ε_i = logistically distributed error term.

w_i* is a latent variable and thus, the sample size cannot be estimated with standard regression techniques.

Ordered Logit Regression Model simultaneously evaluates multiple equations. The estimated equations will be the number of groups in the endogenous variable minus one.

2.7. Literature Review: Overview of Literature and Knowledge Gaps

Economists generally are in consensus that government investment on a nation's economic infrastructure has important development advantage. According to World Bank (2009), the availability of infrastructure usually has positive impact on poverty reduction by aiding economic development. The effect of infrastructure on poverty and consequently welfare in the development literature is presented at two levels. One is at the macroeconomic level while the other is at the microeconomic level which includes the household and firm (UN-HABITAT, 2011).

The effect of infrastructure at the macro level is usually on growth and development and a lot of research work had been done on the speculative and empirical evaluation of the effect of infrastructure on these. Many empirical studies such as Demetriades and Mamuneas 2000, Röller and Waverman 2001, Esfahani and Ramirez 2002, Calderón and Servén 2003,

Calderón*et al.*, 2014 and Sawada, 2015) have assessed the contributions of infrastructure to increase in total output.

Researches in various parts of the world have revealed that investing in road has a tremendous positive impact on the economy. Road is linked to reducing cost of inputs and invariably increasing agricultural outputs and profitability. Communities with good access roads enjoy lower costs of agricultural inputs, and higher productivity (IFPRI, 1990; Sida, 1996; Gannon and Liu, 1997). According to Anderson *et al*., 1982; Smith *et al*., 2001; Jacocb, 2000; Estache, 2003; Renkow *et al*., 2004; Ravallion, 2004 and Escobal, 2005, investments in rural roads have also been connected to increment in the commercial value of land, access to credit, increased participation in cooperatives, participation in non-farm enterprises, increase diversification potentials, more employment opportunities and expansion of markets. Research by Estache and Fay (1995) also revealed that better accessibility to roads and improved sanitation has played a meaningful role in raising the savings of households in the poor areas of Argentina and Brazil because this increased the worth of their assets.

Hulten (1996) revealed that variation in the efficient use of public assets is a major factor that causes growth disparities between East Asia and Africa, and almost half of the growth differences between developed and underdeveloped economies. In his study on how to reduce inequality, Ferreira (1995) presented a model explaining how public and private capital complement each other and how increasing government spending can reduce inequality. Lopez (2004) also evaluated the significant role infrastructure plays in reducing income inequality. He revealed that infrastructure has a positive effect that is greater on earnings and well-being of poor than on mean income. Calderón and Chong (2004) also discovered that the level of inequality decreases with bigger stocks of infrastructure and better infrastructure services irrespective of the method of quantifying and measurement used (whether it is Gini coefficients or income shares).

Aǵenor (2010) have observed that shortage of infrastructure is still a fundamental hindrance in the development of many under-developed economies. Specifically in Africa, less than twenty percent of the roads are tarred and less than two in ten African countries are connected to the grid. These countries have the highest cost of transportation globally and this results in a huge

restriction on expanding trade. For example, Yoshino (2008) discovered that the state of infrastructure which was estimated based on mean numbers of days in a year that business enterprises have power outages has an unfavourable impact on exporting in Sub Saharan Africa. Farmers in Rwanda received less than 25% of the cost of their coffee at the point of loading into ships in Monbasa, while the remaining are spent on cost of transportation on poor roads between Kenya and Rwanda.

To alleviate these constraints to growth and poverty reduction, many researchers have supported a substantial increment in government spending on infrastructure because they yield impacts that promote growth by their effect on production cost, input-use efficiency and capital profitability. This in agreement with the "Big Push" opinion of Rosenstien Rodan (1943).Some researcher have reiterated that infrastructure also impact on growth indirectly in some ways like affecting health outcomes (Aǵenor and Neanidis, 2006 and Aǵenor, 2009b). The health of members of the households is improved and their productivity increased when there is adequate accessibility to clean water and sanitation. Accessing electricity also positively impacts the health status of members of a household and generally on their welfare because it reduces the money spent in boiling water and at times cooking; and reduces exposure to smoke which could cause respiratory problem from the use of woods and charcoal inside the house.

Although there is substantial evidence that infrastructure supports growth of the economy, little work has been done to substantiate a meaningful effect on welfare. Generally, and as observed in the development literature, wealthy households instead of the poor ones appear to gain more from government spending on infrastructure according to Lokshin and Yemtov (2005), Estache and Fay (2007), Adenegan *et al*. (2002), UNCHS (1996), World Bank (1994) and Howe and Richards (1984). This is however, from the analysis of benefit incidence in which the impact of access to infrastructure on welfare is not evaluated. Besides, the poor households might not really be able to take advantage of infrastructure because accessing it would demand ownership of such household assets like vehicles for road infrastructure, personal computers to access internet facilities and mobile telephones to access Global System for Mobile Communication (GSM) and telephone system among others; which wealthy households possess. The development of infrastructure has been prescribed for poverty alleviation since according to

Donaldson, 2014; Hansen *et al.*, 2012 and Dinkelman, 2011, it boosts production activities, reduces expenditure and enhances the standard of living of people. Numerous studies have also revealed that rural infrastructural development increases agricultural productivity and enhances welfare of rural households. These include Obayelu *et al*. (2014), Adepoju and Salman (2013), Ashagidigbi *et al*. (2011), Gibson and Rozelle (2003), Warr (2005).

A large part of literature in the development discourse has revealed that there exists a direct relationship between poverty and rural infrastructure. Glewwe *et al*., 2000 found in rural Vietnam that poor households residing in communities with tarred roads had over 60 percent greater likelihood of coming out of poverty than households in communities with untarred roads. A similar research by Jalan and Ravallion (2002; 2003) revealed that well-constructed roads reduce the expenses of farming households in rural areas of China. They also revealed that poor households benefitted more from water infrastructure than the wealthy ones in India. Escobal (2001) also revealed that rural roads are vital in reducing cost of transaction and increasing farmers' income in rural Peru.Some of the other researchers that had revealed that infrastructure development is imperative to poverty reduction are Van de Walle (1996); Jacoby (2000); Jalan and Ravallion (2003); Gibson and Rozelle (2003); Lokshin and Yemtsov (2005).

Mahmud and Sawada (2015) and Murphy *et al*. (1989) showed that physical infrastructure is considered as a very basic pre-requisite for industrialization and economic development. Income levels and long-term production are enhanced through developing physical infrastructure (Calderón *et al*., 2014; Canning and Pedroni 2008; Esfahani and Ramirez 2003; Canning and Bennathan 2000; Lipton and Ravallion 1995; Jimenez 1995; Futagami *et al*., 1993 and Barro 1990). Increased government investment in the development of physical infrastructure positively affected rural households as observed by Jimenez (1995); Fan and Zhang (2004); and Zhang and Fan (2004). Some researchers have also shown that development of infrastructure favourably affects productivity, earnings and poverty alleviation. (del Carpio *et al*., 2011; Dillion, 2011; Strobl and Strobl, 2011; Besley and Burgess (2003); Ravallion (2001) and Dollar and Kraay (2000).

Sawada *et al*., (2014) discovered that access to irrigation infrastructure impacted positively on the welfare of households in Southern Sri Lanka and decreased perpetual poverty through improvement in income. They also found that the use of irrigation facilities removed the adverse effect of transitory poverty by decreasing downward expenditure threat.

Dinkelman (2011) in his study in South Africa examined how employment is affected by household access to electricity and discovered that connection to the grid significantly increased, in five years, female employment whereas, female wages were decreased and male earnings were increased. A lot of research works have also show that connection of households to the grid increases employment rate in women because they are encouraged to start small-scale business enterprises (Barnejee *et al*., 2009, Foster and Jevgenigs, 2009 and Winters *et al*., 2017).

Jensen (2007) examined the effect of use of mobile phones on the cost of sardines in the state of Kerala in India. His study revealed that the use of these phones by the traders and those fishing extremely reduced variation in prices, outright elimination of wastage, almost complete adherence to the decree of single price and meaningful boosting of welfare of the producers and the consumers. Aker and Isaac (2010), Ragnhild (2006)

Donaldson (2014) evaluated the effect of network of railroads in India and discovered that the price disparity and cost of trade was dramatically reduced, trans-boundary trade was expanded and made highly profitable and levels of real incomes were raised as a result of this transport infrastructure.

Banerjee *et al*. (2012) evaluated how the economy was affected by access to transportation networks over a period of twenty years of rapid income growth in China. They revealed that closeness to a network of transportation infrastructure positively affected the level of per capita GDP across sectors. Their study showed that mobility is crucial to gaining the economic advantage of infrastructure development.

2.7.1. Empirical Review of Studies on Rural Infrastructure and Livelihood Outcomes

Sawada and Mahmud (2015) discovered that there was a decrease in household unemployment, and the new infrastructure enhanced employment mobility from farm to non-farm in Bangladesh. Specifically, they found that being young (not more than 30 years) encouraged transition from farming to paid labour and trading, unemployment rate of the productive age group (31 to 50 years) decreased by around sixteen percent and female unemployment reduced by twenty percent.

Dillon *et al.* (2011) carried out a study in the rural area of Nepal in which they estimated the effect of accessing rural roads, irrigation, and extension services on household welfare. The study used the hedonic method to estimate the possible boost in future income as a result of raising rural infrastructural investments that would enhance household welfare; and also panel data to evaluate lagged infrastructure access effect on welfare. The Generalized Methods of Moment estimation technique was employed. The results from their study revealed that farmers from rural Nepal can be assisted by connecting them to markets through feeder roads, increasing their productivity through provision of irrigation and extension services.

Mensah (2011) revealed that accessing public transportation, connection to national grid and potable water significantly affected household welfare in rural Ghana. Specifically, accessing public transportation and connection to the grid positively impacted welfare, whereas the private assets of households influenced the impact of accessing potable water on their welfare. For the agricultural households, accessing public transportation positively affected welfare regardless of the assets of the households. The marginal effect of accessing electricity and potable water was negative although household assets positively affected welfare. Government spending on rural transportation was revealed as an effective device to reduce poverty in rural Ghana.

Sawada *et al* (2014) showed that access to irrigation increased per capita income and expenditure in Sri Lanka, whereas, it reduced the likelihood of obligatory credit in dry season. This means that access to irrigation made it easier for households to get credit and this further reduces transitory poverty. They discovered that access to irrigation decreased perpetual poverty by raising stable income. It also eliminated the adverse effect of transitory poverty by

reducing downward expenditure risk. Their findings substantiated the fact that government investment on infrastructure reduces transitory and perpetual poverty.

Michael *et al.* (2009) carried out a research study on how rural transportation affect maternal deaths in Ghana. They found that the mortality rate of babies during their first month of life per 1,000 live births in Ghana rose from 30 in 1998 to 43 in 2003, owing to the poor state of rural roads. They found out that irregularity in prenatal care, non-supervised birthing and insufficient postnatal care were responsible for the increased rate of maternal and neonatal mortality. Questionnaires were administered to pregnant women and mothers (new and old) in one hundred and sixty thousand households. The study revealed that the bad condition of road infrastructure in the Gushegu District made it very hard for expectant mothers to get medical attention in registered health facilities. They are forced to rely on traditional midwives that do not have the required equipment and skills to face complicacies. They therefore suggested that improving rural roads in Ghana could reduce neonatal and maternal deaths tremendously.

Mendes *et al* (2008) examined how investments in infrastructure affect total factor productivity (TFP) growth in Brazilian Agriculture. Their findings revealed that government spending on roads impacted on TFP the most followed by research, telecommunications, irrigation and electricity. They showed that a 1% increase in spending on roads yielded an average increase of 0.72% in TFP. Concerning investments in the other infrastructure type, the results demonstrated that a1% increase in spending on research, telecommunications, irrigation and electricity increased TFP by 0.15%; 0.31%; 0.20%; and 0.43% on the average respectively. The lag time estimated for the model was from zero to two years and this showed that the impact on TFP took place in the short run. They found that rate of growth of TFP between 1995 and 2004 was more than in previous period of between 1985 and 1994, the reduction in the government spending notwithstanding. This showed that the introduction of modern instruments of agricultural policies from 1994 aided TFP growth.

Lokshin and Yemtsov (2005) discovered that improving schools yielded meaningful increase in the rates of school enrolment, raised attendance in school and reduced health hazards of school children in Georgia. Road rehabilitation and bridge constructions induced absolute economic benefits in the community and improved accessibility to health services among

households. The study further revealed that projects of various types had varied impacts among the poor and non-poor. Rehabilitation of schools produced a rise in school attendance and an improvement in the state of health of pupils more in poor households than in the wealthy ones. However, rehabilitation of road and water improved accessibility to emergency health services and obviously reduced cases of water-borne diseases more in the wealthy households than in the poor ones.

Adefuke (2005) evaluated the role of infrastructure in agricultural production in all the ADP zones of Oyo state, Nigeria. He reported that 25 villages, representing about 61% of the all the villages used in the study were developed because they had infrastructure index below the value of the average computed index. However, the remaining 16 villages were underdeveloped with infrastructure index higher than average. The study further revealed that the result of the gross margin for the maize, cassava and maize-cassava enterprises showed these enterprises were more profitable in the developed villages. The result of the normalised restricted profit function revealed that all the variable inputs and the infrastructure index had the expected negative sign for all the enterprises which indicated that these variables facilitated increased profit. He concluded that farmers in the developed areas were more technically efficient than those in the underdeveloped ones.

Warr (2005) in his study to show the connection between construction of road and poverty reduction in Lao PDR found that in the period of 1997 to 1998 and 2002 to 2003, the incidence of rural poverty reduced by 9.5%. The result from the study implied that around 13% of the poverty reduction is connected solely to improvement inaccessibility to road. Specifically, the provision of dry season access roads for the isolated households of Lao PDR reduced the rural poverty rate permanently by 3.3 percent because they were able to engage in more economic activities. These findings provide evidence that better access to road is an effectual in decreasing poverty in the rural areas.

Calderón and Servén (2004) found out that increased supplies of the infrastructure volume and quality raised growth and reduced inequality and they submitted that infrastructure development an extremely important factor for alleviating poverty.

2.7.2. Empirical Review of Studies on Rural Household Livelihoods and Livelihood Diversification Strategies.

Stifel (2010) in his study evaluated how non-farm employment affected household welfare in rural Madagascar. He identified four different household livelihood strategies and estimated how much barriers existed in the choice of the dominant strategies. He found that the high-return non-farm sector is a major path out of poverty and it positively impacted welfare in rural Madagascar. His findings revealed that only 39% of the rural population whose sole income was from Non-Farm (NF) activities were poor compared to 69%, 75% and 85% of those whose sole income source was the Farm Family and Non-Farm (FFNF), Farm Family (FF) and Agricultural Wage (AW) respectively. The results showed that there are restrictions in entering the non-farm activities that yield high returns as more educationally qualified households were likely to choose FFNF and NF while those with lower levels of education found it almost impossible to choose these livelihood strategies. He also found out that households that do not access formal credit were likely to take up the lower strategies and had a lower likelihood of engaging in non-farm activities and family farming; and those that accessed telecoms and knowledge of the price and market situations beyond the community had a higher likelihood to participate in the highest paying livelihood strategies while households residing in communities that do not have such access were had a higher likelihood to choose the lower livelihoods.

Oluwatayo (2009) used primary data to estimate the linkage between income diversification and poverty in rural households of Nigeria. He revealed that most of them are involved in combined livelihoods with the aim of boosting the major source of income. He found out that almost 38% of the households were solely into agriculture and this reaffirmed the fact that agriculture still remained the major occupation in rural Nigeria with around 30% of them as artisans and about 13% of them into trading. The remaining 20% of the households were engaged in private employment (10.7%) and government jobs (9.3%). His study also showed that more than half of the male-headed households were involved in every livelihood activity identified while only 43.6% of the female-headed ones combined at least two livelihood activities compared to the male-headed households due to their high vulnerability status. It was

further revealed that declining income (43.1%), rising poverty levels (24.5%), non-access to credit facilities and insurance schemes (17.1%), pressure from family (6.9%), increasing cost of goods (4.1%) and others (4.3%) were the reasons households engaged in multiple livelihoods.

Lopez (2008) found out that the households in Bolivar, Equador were involved in agricultural marketing, non-farm livelihoods, diversified activities and agricultural paid work. He discovered from the multinomial logit regression analysis that irrigation access, land size, education and location significantly determined the particular livelihood strategies of the household. In his analysis of the welfare significance of choosing a specific livelihood using least squares method corrected for selection bias, he found that credit access and educational attainment positively impacted welfare.

Adugna and Wagayehu (2008) showed that the gender of the head of household, educational qualification and size of land negatively determined whether a household would go into agriculture and off-farm livelihood strategy while extension service had a positive effect on going into agriculture and off-farm livelihood strategy by households. They also discovered that age and level of education negatively affected engaging in agriculture and non-farm activities while dependency ratio had a positive effect. With respect to the choice of diversified livelihood strategy, that is, combining agriculture, off-farm and non-farm, they found that livestock asset, agro-ecology, credit access and land size had a negative effect while household size, use of input, membership in a cooperative and remittance had a positive effect.

Miyuki *et al*. (2007) found that diversification of households into off-farm and farm activities was much more profitable than engaging in solely off-farm or agricultural activities as households that engaged in both earned more than double of what the least diversified households earned. The likelihood of implementing soil conservation measures was also higher among these households. Their results showed that taking income and soil management into consideration, the main factor that determined the type of livelihood strategies that households undertook and their efficiency of pursuit was their human capital endowment. They concluded that policies targeted at increasing household welfare should consider the various assets of the household and the livelihood strategies they get involved in.

Barret *et al*. (2006) found that households that accessed credit and got remittances were able to diversify into more profitable livelihood activities as opposed to those without financial aids who are forced to settle for less profitable livelihood choices. They concluded that livelihood strategies yield varying levels of return on asset investments and that households asset endowment and location determine whether a household can participate in highly profitable livelihood strategies or not.

Adejobi (2004) in a study on rural poverty in northern Nigeria showed that rural farming households are engaged in much diversified livelihood activities. The main livelihood strategy types were agriculture, that is, crop production with small-scale livestock (98%), agriculture with large-scale production (5%), small and micro enterprises (70%), wage labour (35%), pensioners (7.5%), remittances (85%), unpaid domestic labour (40%) and other illegitimate activities like street begging, fuel hawking and petty crimes (45%).

Bongo Adi (2004) revealed that many households diversified their economic activities and the type of diversification was influenced by human capital and agro-climatic factors. He also found out that younger households with formal and informal education were more diversified in rural Nigeria.

2.7.3. Empirical Review of Studies on Rural Infrastructure and Livelihood Diversification.

Stephen *et al*. (2015) in their studies in southwestern Amazon discovered that the impact of infrastructure access in boosting livelihood variety in places where infrastructure is being upgraded was great. They submitted that access to infrastructure promotes flexibility of the households in their income generating activities. They also found that the more diversified households possess greater increase in diversity and this meant that there is growing livelihood inequality among the households in the area. They concluded that it is still necessary to take into consideration inequalities in livelihood variety because households that are not much diversified do not gain much from new infrastructure development and are left still more

vulnerable to hazards to their livelihoods. They also found that households that had more distributive varied livelihoods were more likely to aspire to enlarge their range of activities. The findings revealed that the more diversified households targeted widening their range of activities than less diversified ones. This implies increase in inequalities in livelihood diversity among households.

Tanga *et al*. (2014) showed that prior to the rehabilitation of the road, households in Phamong suffered a dearth of essential social amenities. In their quest to access infrastructure, they had to travel a distance of about 135 kilometers and this led to a high prevalence of poverty in the community. Their findings also revealed that improved road infrastructure enhanced household accessibility to health, education and markets which were absent in Phamong. The improvement of road and transport infrastructure had enhanced the livelihoods of the households by increasing connectivity with residents of other communities.

Sellamuttu *et al*. (2013) studied how access to irrigation infrastructure affected poverty and enhanced the livelihood diversification strategies of the people of Sri Lanka. They found that households that assessed the irrigation facilities had more diversified livelihoods and were able to raise their income levels. They also found that a significant rise in the consumption level of poor households that accessed to irrigation and they reasoned that such households could cultivate their land instead of engaging in paid labour or relying on rain for cultivation.

Olivia and Gibson (2009) found that both poor accessibility to and inferior type of infrastructure restricted households' non-farm businesses in rural Indonesia. The households were unlikely to go into non-farm livelihood activities and thus, had a low non-farm income proportion if they resided in isolated areas, lacked good quality roads, had no access to electricity and suffered incessant electricity blackouts. They also pointed out that improvements in the number of infrastructure in the rural area between 1993 and 2000 resulted in a rise in the proportion of households that went into non-farm enterprises and that poor infrastructure restrict rural non-farm businesses. They concluded that both poor access to and quality of infrastructure negatively affected non-farm activities and that upgrading the quality of existing infrastructure and provision of more infrastructure to increase accessibility are economically profitable.

Ashok and Balasubramanian (2006) in their studies proved that government investment in rural public assets like markets, roads and irrigation raised agricultural productivity in Tamil Nadu. Their findings on the impact of infrastructure on diversification varied. Whereas markets, irrigation and commercial motors positively affected crop diversification, road negatively affected diversification. The results clearly show that rural infrastructure is a major factor that determines efficiency and profitability in agricultural production.

Escobal (2005) in his study found meaningful complementary relationship in investment of infrastructure in rural areas of Peru. He observed that the effect of specific infrastructure like potable water, roads, telecommunications, electricity, sanitation services and so on are subject to diminishing returns when done in isolation unless they are provided alongside other investments; and only when this is done can the growth effect of infrastructure on rural income be sustained. The study revealed that access to infrastructure decreased transaction costs and aided better market efficiency which resulted in enhanced household welfare.

Winters *et al*. (2001) in their study discovered that some social and public asset variables meaningfully affected earnings from both agricultural and non-agricultural activities in the rural areas Mexico. Specifically, they discovered that nearness to an urban centre had positive effect on crop income and households residing close to urban centres earned more income while households that lived very far from urban centres earned remarkably low income. Their findings also pointed out that households that accessed basic infrastructure like water, telephones, bathrooms and sewage got more income in livestock, crop production, non-agriculture wage employment and self-employment. Their findings reveal that communities in which households had adequate infrastructure access are definitely open to more livelihood opportunities.

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter describes the study area, source and method data of collection; and the techniques employed in data analysis.

3.1 Study Area

The study was done in southwestern Nigeria (SWN). SWN is a geo-political zone out of six in Nigeria and it consists of six states - Ondo, Oyo, Ekiti, Ogun, Lagos and Osun States. It lies between latitude 60^0 211' and 80^0 371' North and longitude 20^0 311' and 60^0 001' East (Faleyimu *et al.,* 2010). It shares boundary with Kogi and Kwara states to the north, Delta and Edo states to the east, Republic of Benin to the west and Atlantic Ocean to the south.

Southwestern Nigeria has an expansive land area of about **77,**818km^2 with an estimated population of around 27, 581, 992 people. (NPC, 2006) and it is dominated by various tribes of the Yoruba ethnic group. The climate of the zone is tropical in nature with two seasons. lt has a dry season from November to March characterised by the North-east Trade wind from the Sahara Desert and the wet season from April to October which is characterised by the Southwest Monsoon wind from the Atlantic Ocean. SWN has an average annual rainfall of about 1480mm with the average monthly temperature in the rainy season being 18^0C – 24^0C while in the dry season, the temperature is 30^0C – 35^0C.

Southwestern Nigeria controls the largest proportion of the nation's commerce, industrial capacity, banking, financial and insurance assets. The geopolitical region also has the three seaports in Apapa, Roro and Tin Can Island; the international airport and three major thermal stations at Egbin, Papalanto and Omotosho. In addition, three major industrial estates at Agbara, Ikeja and Ota are all linked to the West African gas pipeline plan. Western education was introduced into Nigeria from Europe and America through the region and this is explains why it has the most educated people in the country (Falau, 2007).

Livelihood activities in southwestern Nigeria are diverse in nature. There are farm activities which include the cultivation of staple food crops, fruits, vegetables and tree crops, livestock production of poultry, goat and sheep keeping, fishing and fish farming. Most farming households engage in mixed cropping and mixed farming. The staple crops in this region are yam, cassava, maize and fruits and vegetables such as mango, orange, pineapple, cherry, okra, tomatoes, pepper and tree crops like cashew, cocoa and kolanut.

The non-agriculture activities undertaken include trading, handcraft, public service and private employment, private business, processing of agricultural produces, carpentry, tailoring, bricklaying, driving and mechanical repairs.

3.2. Types and Sources of Data.

This study used primary data gathered with the use of well-structured questionnaires in the study area. Information gathered from households include:

1. Socio-economic and demographic characteristic like age, gender, household size, educational qualification, income and occupation;
2. Assets owned by households;
3. Access to rural infrastructure access;
4. Household monthly expenditure.

3.3. Sampling Procedure and Sample Size

Data were collected from selected households in the study area between June and September 2014 through a multistage sampling procedure. The first stage involved the selection of two out of the six states randomly in the study area (that is, Ogun and Oyo). In the second stage, a total of 12 Local Government Areas were randomly selected from the six senatorial districts of the two states, proportionate to size. Senatorial districts were used because the provision of rural infrastructure is mostly done by governments at all levels based on senatorial zoning. Each state of the country is divided into senatorial districts to ensure that no part of the country is marginalized. Five (5) LGAs were selected from Ogun State and seven (7) from Oyo State. In the third stage, simple random sampling technique was employed to select villages from the

selected rural Local Government Areas, proportionate to size. A total of thirty-six (36) villages were selected. Using a proportionate to size sampling, the sum of 450 households were selected randomly from the sampling frame, proportionate to the size of the villages at the fourth stage with 180 and 270 households from Ogun and Oyo states, respectively. The proportionate factor used is given below:

$$N_i = \frac{ni}{N} \times 450 \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

Where Ni = the number of LGAs selected from state I (i = 1 to 2)

ni = the population of the state i

N = population of the two states

450 = total number of instruments used in the selected states.

Whereas four hundred and fifty (450) copies of the questionnaire were administered, only four hundred and forty two (442) were used in the analysis. The remaining eight (8) were rejected due to inadequate information and inconsistency. The sampled zones, villages and the corresponding households sampled are as presented in Table 1.

Table 1: List of States, LGAs and Villages Sampled in South-Western Nigeria

	Senatorial District	LGA	Village	Administered Questionnaire	Retrieved Questionnaire	Unretrieved Questionnaire
1.Ogun	1.Ogun Central	1.Odeda	1.Ojebiyi	9	9	0
			2.Orile Ilugun	6	6	0
			3.Alabata	13	13	0
			4. Olodo	10	10	0
		2.Abeokuta North	5.Oyan Imala	10	10	0
			6.Tibo	8	8	0
			7.Idi Emi	20	20	0
			8. Ilewo	7	7	0
	2.Ogun West	3.Ipokia	9.Mogbara	14	14	0
			10.Ifohintedo	10	10	0
			11.Idosemo	6	6	0
		4.Yewa South	12.Ajilete	14	14	0
			13.Oke Odan	7	7	0
	3.Ogun East		14. Seguse	13	13	0
		5.Ijebu Igbo	15. Idagolu	17	17	0
			16.Imosu Daniel	16	16	0
2.Oyo	4.Oyo Central	6.Itesiwaju	17.Aba-Aladie	19	19	0
			18.Eleku	16	16	0
		7.Surulere	19.Aresaapa	16	16	0
			20.Pooro	16	16	0
			21.Asangbo	8	8	0

			22. Aressadu	16	16	0
	5.Oyo North	8. Afijio	23.Imini	19	19	0
			24.Ilu Aje	15	15	0
		9.Olorunsogo	25. Igbeti	16	16	0
			26. Dogo	13	10	0
		10. Iseyin	27.Otiiri	15	10	3
			28.Akinwunmi	9	9	5
	6.Oyo South		29.Ayerinna	12	12	0
		11.Ido	30. Igbonna	12	12	0
			31. Odebode	11	11	0
			32. Abiose	13	13	0
		12.Ibarapa East	33.Temidire	11	11	0
			34.Okolo	9	9	0
			35.Maya	11	11	0
			36. Eruwa	13	13	0
Total	6	12	36	450	442	8

Source: Field Survey, 2014

Table 2: Distribution of Questionnaires by States

The distribution of the questionnaires in the states is as presented in table 3 below.

No.	State	Number Administered	Number Retrieved	Number Unretrieved
1.	Ogun	180	180	0
2.	Oyo	270	262	8
	Total	450	442	8

Source: Field Survey, 2014

3.4 Analytical Techniques

The study used analytical tools and models to achieve its objectives. The descriptive statistics used included frequencies, means, standard deviation, percentages and infrastructure index. The inferential statistics included multinomial logit and the ordered logit regression models.

3.4.1 Descriptive statistics

This was used to analyze objective 1. The descriptive tools used include measures of central tendency and dispersion, frequencies and percentages.

3.4.2 Construction of Infrastructural Index (Component Measure of Access to Infrastructure)

This was used to analyze objective 2. A common infrastructural index was constructed for all the types of infrastructure (Ahmed and Hossain, 1990; Adefuke, 2005; Bhatia and Rai, 2008; Fakayode *et al*. 2008; Ashagidigbi *et al*., 2011 and Bulus and Adefila, 2014) to determine how developed the rural communities are with respect to the level of infrastructure access. Transportation cost to the location of the nearest assessed infrastructure was used because most of the respondents could not give precise distance to their various infrastructure. (Ahmed and Hossain; 1990; Obayelu et al, 2014).

The index of development was obtained as presented in the equations below:

$$AC_i = \frac{\sum_{i=1}^{n} IDci}{n} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

$$TC_i = \sum_{i=1}^{n} ACi \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (9)$$

$$ATC_i = \frac{TCi}{N} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (10)$$

$$W_i = \frac{ACi}{ATCi} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (11)$$

$$INF = \sum_{i=1}^{n} Wi \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (12)$$

Where:

IDC_i= transportation cost of a respondent to an infrastructure in each community (N);

AC_i = average cost of transportation in each community to an infrastructure (N);

TC = total cost of transportation to an infrastructure across communities (N);

ATC= average cost of transportation to an infrastructure across communities (N);

W_i = weight of average transportation cost to an infrastructure in each community;

INF= infrastructural index;

N = number of communities;

n = number of respondents in each community.

The addition of the individual access cost (TC_i) to the infrastructure gave the cost of transportation of individual respondents (IDC_i) in each of the communities. The TC_i was obtained by summing the AC_i. The selection of these infrastructure elements was based on their relative homogeneity across the selected communities. The average total cost (ATC) of accessing each infrastructure across these communities was calculated and divided by the average costs (AC_i) of getting to a particular infrastructure facility in each of the communities to give W_i which was added together to get the INF. INF indicates the level of access to infrastructure and how developed a community is. The lower the value of INF, the more the access to infrastructure and hence, the more developed the community (Ahmed and Hossain, 1990; Bulus and Adefila, 2014).

The communities were grouped into developed and underdeveloped by finding the average infrastructural index. Communities with values more than the average are underdeveloped and those whose values are less than average are developed. A step was taken further to group the communities into four categories namely highly developed, moderately developed, moderately underdeveloped and highly underdeveloped (Adeoye et al., 2011).

3.4.3. Multinomial Logit Model

Objective 3 was analysed using a multinomial logit model since livelihood choice is a polytomous choice variable (Greene, 2000; Liao, 1994; Nkoya *et al,* 2004; Jansen *et al*, 2006a).

The model was used to identify how each variable, particularly the rural infrastructure variables affects the probability of choosing each livelihood. The identified livelihood choices are:

1. Cropping and Non-farm activities (CN);
2. Cropping, Non-Poultry Livestock and Non-farm activities (CNPLN);
3. Cropping, Poultry Livestock and Non-farm activities (CPLN);
4. Cropping, Fishing and Non-farm activities (CFN).

This study assumed that all the livelihood choices were mutually exclusive (Green, 2003; Mpuga, 2004; Awoyinka, 2008; Adepoju, 2011; Olowa, 2015 and Gani, 2015). Therefore, a household has made an optimal allocation of its resources by making a livelihood choice that maximises its utility (Brown et al, 2006; Gani, 2015,). In this way, the *ith* household could be modelled as maximizing utility by selecting the y^{th} livelihood choice out of Y discrete choices. This is expressed as:

$$Max_y = E(U_{iy}) = f_y(x_i) + e_{iy}; \quad y = 0, \ldots\ldots, Y \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(13)$$

Generally, for an outcome variable with Y categories, let the y^{th} livelihood choice that the i^{th} household picks in order to maximize its utility assume 1and if contrary 0. The likelihood that the household with x characteristics chooses y strategy is as follows:

$$P_{iy} = \frac{exp(X_i \beta_y)}{exp(X_i \beta_y)} \qquad for\ y = 0, , , , , , Y \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(14)$$

The rule is that $\sum_{J=0} P_{iy}$ must equal 1 for all households i.

P_{iy} = probability of the i^{th} household being in y category

X = predictors of response probabilities

β_j = covariates effects particular to the y^{th} response category with the second category as the reference.

Based on the foregoing general model,

Assume that the probability of observing outcome *M*, given *X* is:

$P_r(D_{it} = M/X)$

D_{it} will be:

$$Pr\,(D_{it} = M/X) = \frac{exp(\beta_0 + \beta_t X2_t + \ldots\ldots\beta k_t X_{wt})}{exp(\beta_0 + \beta_t X2_t + \ldots\ldots\beta k_t X_{wt})} \quad for\ j = 0,1,\ldots\ldots J \qquad \ldots\ldots\ldots\ldots\ldots\ldots (15)$$

Since not all the model parameters were identified, the model had to be normalised by setting any of its sets of parameters to zero, thereby eliminating elements of indeterminacy. To this end, a constraint was imposed on the model by setting the parameters of the second choice of livelihood strategy (i.e. CNPLN) to be all zero. Thus, $\beta_{12} = \beta_{22} = \beta_{nk} = 0$ which was used as the base category against which the other categories were compared.

Choosing a particular livelihood strategy (a polytomous variable with categories O,……,J) is modelled as a function of some socioeconomic and demographic factors:

$D_{it} = f\,(X_i)$ ……………………………………………... (16)

Where, D_{it} assumes a value from 1, 2, ….., *J* if a household chooses a specific livelihood.

The explanatory variables are:

X_1 = Age of household head (years)

X_2 = Age Square of the household head

X_3 = Gender of household head (1 = male; 0 =female)

X_4 =Marital status (married = 1; single, divorced or widowed = 0)

X_5 = Household size

X_6 = Dependency Ratio

X_7 = Primary education (yes = 1, No = 0);

X_8 = Secondary education (yes = 1, No = 0);

X_9 = Tertiary education (yes = 1, 0 No = 0);

X_{10}= Household Income (₦)

X_{11} = Land Ownership (yes = 1, 0 if otherwise)

X_{12} = Farming Experience (Years)

X_{13} =Access to credit facility; 1if Yes; 0 otherwise

X_{14}= Household participation in cooperatives (yes = 1, 0 if otherwise)

X_{15}=Household Disposable Assets

X_{16} = Access to rural infrastructure

3.4.3a. Interpretation of Coefficients Signs.

According to Basant (1997), the estimated coefficients of the model can be explained thus: the coefficient of a variable that is positively significant reveals that the variable has a higher likelihood of being in that category relative to the reference group. This means that the likelihood of the household being placed in that category is greater than the likelihood of it being in the reference group. A coefficient of a variable that is negatively significant means that the likelihood of the household choosing that livelihood type is lower than the probability of it being in the reference group. Coefficients that are not significant, either positive or negative shows that the particular variable has no influence on the choice of the category which it belongs, relative to the reference group.

3.4.4. Ordered Logit Regression Model

Objective 5 was analysed using the Ordered Logit Regression Model to determine the likelihood of a household being in high, moderate and low welfare categories.

The welfare (w), of a household i (i =1, …, N)is modelled as:

$w_i = f(x^h, x^e, x^r)$ …… (17)

where,

x^h represents the household characteristics variables;

x^e represents the household's asset endowment;

x^r represents access to rural infrastructure.

The model estimates relationships between a categorical and ordered dependent variable and a set of independent variables (Mohammadi *et al*., 2015; Oksuzler, 2008; Ozcan *et al*., 2003; Sawkins *et al*., 1997). In this model, a variable *W* that is measurable or termed ordinal is

determined by another variable *W** that is infinite, latent and cannot be measured. The values of *W** determine what *W* will be. *W** has various threshold points and the value on *W* is dependent on if a specific threshold is exceeded or not.For instance, when *N* = 3,

$Wi = 1 \quad if \quad W^*i \leq \kappa_1$

$Wi = 2 \quad if \quad \kappa 1 \leq W^*i \leq \kappa_2$ ……... (18)

$Wi = 3 \quad if \quad W^*i \geq \kappa_3$

W is a collapsed version of W*.

It is possible for W* to take an endless range of values that can be disintegrated into smaller groups of W. In the population, W* equals:

$$W^*_i = \sum_{k=1}^{K} \beta_k X_{ki} + \varepsilon_i = Z_i + \varepsilon_i \quad \text{……... (19)}$$

The random disturbance term has a standard logistic distribution. Only a fraction of equation (19) can be evaluated by ordered logit. That fraction is:

$$Z_i = \sum_{k=1}^{K} \beta_k X_{ki} = E(W^*_i)$$

…….(20)

Since W* can be lower or higher than Z. The K βs and the N-1 κs are parameters to be estimated. After they have been estimated, equation (21) below can be computed.

$$Z_i = \sum_{k=1}^{K} \beta_k X_k \quad \text{……. (21)}$$

The N-1 cut-off terms are used to estimate the likelihood of W taking on a specific value. The formulas are:

$$P(W_i > j) = \frac{(X_i\beta - k_j)}{1 + [\exp (X_i\beta - k_j)]} \quad j = 1, 2, \ldots\ldots, M\text{-}1, \quad \text{…… (22)}$$

which implies that,

$$\exp (X_i\beta - k_1)$$

$$P(W_i = 1) = 1 - \frac{}{1 + [\exp (X_i\beta - k_1)]} \quad \text{……...(23)}$$

$$P(W_i = j) = \frac{\exp (X_i\beta - k_{j-1})}{1+ [\exp (X_i\beta - k_{j-1})]} - \frac{\exp (X_i\beta - k_j)}{1 + [\exp (X_i\beta - k_j)]} \quad (j = 2, \ldots, M - 1) \ \text{……} \ (24)$$

$$P(W_i = N) = 1 - \frac{\exp (X_i\beta - k_{N-1})}{1 + [\exp (X_i\beta - k_{N-1})]} \quad \text{……} \ (25)$$

In the case of N = 3, these equations are simplified to

$$P(W = 1) = \frac{1}{1 + \exp (Z_i - k_1)} \quad \text{……...} \ (26)$$

$$P(W = 2) = \frac{1}{1 + \exp (Z_i - k_2)} - \frac{1}{1 + \exp (Z_i - k_1)} \quad \text{..……} \ (27)$$

$$P(W = 3) = 1 - \frac{1}{1 + \exp (Z_i - k_2)} \quad \text{….……} \ (28)$$

Therefore, the probability that W* falls within different threshold limits can be estimated by the value of W and the presumed logistic distribution of the residual error term.

Coefficients are usually not interpreted directly in ordered logit model since changes in probability are not constant. The marginal effect is calculated as given below:

$$\left(\frac{\delta P(y_i = j \mid x_i)}{\delta x_k}\right) = \frac{\delta_\gamma(\mu_j - \beta' x_i)}{\delta x_k} - \frac{\delta_\gamma(\mu_{j-1} - \beta' x_i)}{\delta x_k} = \left\{(\mu_{j-1} - \beta' x_i)\beta_k\right\} \quad \text{……..} \ (29)$$

$$\delta_\gamma(x_i)$$

In which $\mu_j = +\infty$, $\mu_0 = -\infty$, $\lambda_j(x_i) = \frac{}{\delta_\gamma(x_k)}$ …….. (30)

The value of the exogenous variables determines the marginal effect. The total probability is always 1, therefore, the total marginal effect for each variable must be zero.

Y= Welfare status of households (1 = low welfare, 2 = medium welfare, 3 = high welfare).

The explanatory variables are:

X_1= Age of the household head (years)

X_2= Square of the age variable in years

X_3 = Gender of the head of household, (1 = male, 0 = female).

X_4 = Marital status of household head (married = 1; single, divorced or widowed = 0)

X_5 = Labour size

X_6 = Household size;

X_7 = Dependency Ratio (household members that are below 15years old)

X_8 = Years of education (in years)

X_9 = residence status of the household head (1 = migrant, 0 =indigene)

X_{10} = Sector (major employment of the household head)

X_{11} = Household Income (₦)

X_{12} = Non-farm Income (Yes = 1, No = 0)

X_{13}= Own Land (Yes = 1, No = 0)

X_{14} = Cooperative Membership (Yes = 1, No = 0)

X_{15} = Access to Credit (Yes = 1, No = 0)

X_{16} = Value of disposable asset (₦)

X_{17}= Access to rural infrastructure in (₦)

ε = the error term.

The explanatory variables were selected following Mensah (2011), Asmah (2011), Tabi (2013), Shuujat (2014) and Rubaba (2014).

3.4.4.1. Welfare Measurement

The total monthly expenditure was used to measure the welfare status of households. This is because it gives a more accurate picture of how much of the households' earnings that are

expended and which translates to welfare outcomes. This has been used by many researchers and institutions (Gani, 2015; Adepoju, 2013, Adepoju and Obayelu, 2013; Mensah, 2011; Oni and Yusuf, 2008; Lopez, 2008; NBS, 2005; Meyer and Sullivan, 2003; Ravallion, 2003; World Bank, 2001; Barrett *et al*. 2001 among others). Households with per capita expenditure that is less than one-third of the mean per capita household expenditure were grouped as low welfare while those whose per capita household expenditure was less than two-third but greater than one-third of the MMPCHHE were grouped as medium welfare. The high welfare households had their per capita expenditure equal to and more than two-thirds of the MMPCHHE.

3.4.4.2. Explanation of the independent variables

a. Age

This is the age of the head of household in years. A quadratic term of the variable, age^2 was included in the model to account for likely non-linear age effect on household welfare. This is because below a particular threshold, it is expected that age will negatively affect household welfare as younger households usually have relatively low levels of assets and potentials to earn income. Above this threshold, it is assumed that age will positively affect household welfare because older households are likely to have an increased capability to earn higher income, handle risks better and more assets.

b. Male

This is the gender of the household head. Households headed by males are reasoned to have higher welfare levels than those headed by females because most income generating activities in rural Nigeria are labour intensive. The traditions, social and cultural background and beliefs constrain women from participating in challenging but higher paid jobs particularly in the rural areas.

c. Labour Size

This is the number of adults that engage in economic activities in the household and who are between the ages of 15 and 65. Some empirical studies use the real household size to capture labour size but this will not give the true picture of the variable. Labour size is expected to positively affect household welfare.

d. Asset

The total sum of disposable assets in a household was used. Asset is postulated to positively affect welfare because they are a form of capital of the household. Household's capital enable the households to access and use complementary resources like infrastructure (public assets) to make livelihood choices;

e. Rural infrastructure variables: electricity, water, school, market, health centre and agro-centre.

The infrastructure variables show the degree of household access to infrastructure. They are dummy variables with a value of 1 if households can access these infrastructure within the communities they live in or within a distance of 1 km or less from their communities), and 0 if they have to travel farther than this. The use of a distance of 1 km is in agreement with the UN-MDG which considers as logical a 1km distance to access an infrastructure. It is hypothesized that this will positively affect welfare, because households closer to infrastructure save more time, energy and cost in access and also enjoy positive externalities.

f. Education

This is the number of years of education of the household head. This variable is used to show the effect of education on welfare. The effect of education on household welfare is hypothesized to be non-linear and it is assumed that education will negatively affect welfare in households with lower educational levels. Above a particular level of qualification, education will positively affect welfare, *ceteris paribus*. To account for this, $\boldsymbol{educ^2}$which is a quadratic term was included in the model. The relationship between education and household welfare is direct because the higher the number of years of education, the better quality of livelihood choice and other household decision making will be which will translate into higher level of welfare.

g. Sector

This variable represents the primary livelihood type of the household head. The identified sectors are – Cropping and Non-farm activities (CN), Cropping, Non-Poultry Livestock and Non-farm (CNPLN), Cropping, Poultry Livestock and Non-farm (CPLN) and Cropping, Fishing and Non-farm (CFN). The relevant sector has the value 1, otherwise 0.

h. Migrant

This defines the position of the household head as a migrant or indigene of the community he resides in. This variable has the value of 1 if the head is a migrant and 0 otherwise. According to Ellis, 2000 and Mensah 2011, migration is recognized as a significant livelihood strategy. In this study, we reason that migration has a direct impact on welfare because households move for economic reasons to obtain better welfare status.

i. Ɛ is the error term.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

This chapter presents and discusses the results of the analysis of the data collected for this study.

4.1 Socio-economic characteristics of respondents

The socio-economic characteristics of the respondents are presented in table 3. As shown in the table, about 72.6 percent of the respondents were between 25 and 54 years of age. Most of the respondents were still economically active since the average age was 48.11±11.46 years. A large number of the households were male headed (69.2 percent) and many of the households

(57.7 percent) had between five and eight members while only 1.5 percent of the households had over 12 members. The average household size is 7±2.79. This means that the households have a ready family labour for their farming activities. This corroborates findings from other researches like Bulus and Adefila (2014) and Obayelu *et al*. (2014). According to Obayelu et al. (2014), the average farming household is made up of 7 members.

The study further revealed that most of the respondents had formal education with only 19.8 percent of household heads having informal education. Thus, the literacy level is very high in rural southwestern Nigeria. Majority of them (40.5 percent) had primary education as the highest level attained; 34.7 percent had secondary education and only 5% had access to tertiary education. About 80.1 percent were married and only 29.4 percent were non-indigenes.

Table 3: Distribution of socio-economic characteristics of the respondents

Variables	**Frequency**	**Percentage**
Age(in yrs)		
25 – 34	40	9.0
35 – 44	152	34.4
45 – 54	129	29.2
55 – 64	72	16.3
>=65	49	11.1
Mean / Standard deviation	48.11±11.46	
Gender		
Male	306	69.2
Female	136	30.8
Marital Status		
Married	354	80.1
Widow/Widower	36	8.1
Divorced/Separated	52	11.8

Household Size		
1-4	137	31
5-8	255	57.7
9-12	43	9.7
>12	7	1.6
Mean / Standard deviation	7.17±2.79	
Years of Schooling		
0	88	19.9
1-6	179	40.5
7-12	153	34.6
>12	22	5.0
Mean / Standard deviation	7.29±4.7	
Migrant Status		
Indigene	312	70.6
Non-indigene	130	29.4
Primary Occupation		
Farming	361	81.7
Non-farm	81	18.3
Farming Experience (Years)		
<=10	125	28.3
11 – 20	288	65.1
>20	29	6.6
Mean/ Standard deviation	13.7±10.4	
Credit Access		
Yes	123	27.8
No	319	72.2
Income (₦)		
≤20,000	88	19.9
20001 – 40000	256	57.9
>40000	98	22.2
Mean/ Standard deviation	36,500±24,800	

Source: Computed from field survey data, 2014

The main occupation of the respondents was farming (81.7 percent) with an average of fourteen 14±10 years of farming experience while the remaining 18.3 percent were engaged in non-farm activities. This indicates that a higher number of the respondents had agriculture as either a primary or secondary source of income. Furthermore, over half of the respondents (57.9 percent) earned between N20,000 and N40,000 monthly while one-fifth of them earned over N40,000, with the average income in the study area being N36, 5000±24,800 per month.

4.2. Household Livelihood Strategies and Choices

4.2.1. Profile of Livelihood Strategies of Households

The livelihood strategies of the households in southwestern Nigeria are presented in Table 4. As can be observed, there are four major livelihood strategies that the households engaged in. The majority of respondents were involved in crop farming only (about 62.7 percent) while only 38.3 percent were involved wholly in non-farm activities. The remaining were into livestock and poultry farming (29.6 percent) and mixed farming (49.4 percent).

This shows that all the households were engaged in one agricultural activity or the other and this corroborates the findings of Adejobi (2004), Oluwatayo (2009) and Gani (2015).

Table 4: Livelihood Strategies of Households

Livelihood Strategies	Activities	Percentage
Crop farming	Cultivation of food and cash crops	62.7
Livestock / Poultry Farming	Rearing of small ruminants like goat, rabbit and grasscutters; raising of cockerels, broilers and layers.	29.6
Mixed farming	Both crop farming and animal rearing	49.4
Non-farm activities	Govt. job, Private job, Trading, tailoring, driving/okada riding, carpentry, bricklaying, dry cleaner, barbing, food	38.3

	selling, photography, electrician, hair dressing,	
Total		**180**

Source: Computed from field survey data, 2014

4.2.2. Profile of Household Livelihood Choice.

In order to increase the income of households and improve welfare, members diversified into other economic activities. The various livelihood choices adopted by the households are presented in Table 5.

Four livelihood choices were identified during the survey and these were:

Y1 = those into cropping and non-farm activities (CN);

Y2 = those into cropping, non-poultry livestock and non-farm (CNPLN);

Y3 = those into cropping, poultry livestock and non-farm (CPLN);
Y4 = those into cropping, fishing and non-farm (CFN).

As shown in Table 5, most (about 41.6 percent) of the respondents derived their livelihood from a combination of cropping, non-poultry livestock and non-farm activities (CNPLN) while only 10.4 percent of the respondents engaged in fishing (fishing on the sea) and fish farming (raising fish in earthen and artificial ponds, (CFN). About 12.2 percent of the respondents derived their livelihood from cropping, poultry livestock and non-farm activities (CPLN) and the remaining 34.8 percent were involved in a combination of cropping and non-farm activities only (CN).

From the table, it can be observed that all the households were involved in agriculture. This is expected since nearly every rural household depends mainly on agriculture as their primary livelihood.

Table 5: Livelihood Choices of Respondents

Livelihood Portfolio	Crops Grown	Non-farm Activities	Diversification	Percentage
Cropping and Non-farm (CN)	Yams, maize, cassava, cocoyam, cocoa, vegetables, okra, melons, fruits, citrus,	Govt. job, Private job, Trading, tailoring, driving/okada riding, carpentry, bricklaying, dry cleaner, barbing, photography,	None	35.82

	garden egg	electrician, hair dressing and food selling		
Cropping, Non-Poultry Livestock and Non-farm (CNPLN)	Yams, maize, cassava, cocoyam, cocoa, vegetables, okra, melons, fruits, citrus, garden egg	Govt. job, Private job, Trading, tailoring, driving/okada riding, carpentry, bricklaying, dry cleaner, barbing, photography, electrician, hair dressing and food selling	Sheep, goat, cattle, pigs, grasscutter	41.57
Cropping, Poultry Livestock and Non-farm (CPLN)	Yams, maize, cassava, cocoyam, cocoa, vegetables, okra, melons, fruits, citrus, garden egg	Govt. job, Private job, Trading, tailoring, driving/okada riding, carpentry, bricklaying, dry cleaner, barbing, photography, electrician, hair dressing and food selling	chicken, quail, duck	12.20
Cropping, Fishing and Non-farm (CFN)	Yams, maize, cassava, cocoyam, cocoa, vegetables, okra, melons, fruits, citrus, garden egg	Govt. job, Private job, Trading, tailoring, driving/okada riding, carpentry, bricklaying, dry cleaner, barbing, photography, electrician, hair dressing and food selling	Fishing in the sea, Fish farming	10.41

Source: Computed from field survey data, 2014

4.3. Household Access to Rural Infrastructure

The households' access to rural infrastructure is presented in table 6. The table revealed that 89.1 percent of the respondents had access to potable water either from borehole or deep wells. While some were provided by the government, a large percentage of the boreholes and deep wells were provided by organizations like the Justice for Development and Peace Commission (JDPC), Lions Club, Rotary Club and by the World Bank through its various development

projects. A good example is the Second National Fadama Development Project (Fadama II) which had the rural infrastructure investment (termed RII) as one of its major components.

As revealed in the table, most of the households (88.5 percent) had access to at least primary schools in their communities. These schools were provided by the government in line with the Universal Basic Education policy that every child must go through at least the basic primary education.

It was also revealed that the majority of the households (56.1 percent) did not access primary health care service. Many of them had to travel great distances to enjoy good health care facilities while households opted for the crude traditional health care services and unauthorized medicine sellers.

About 64.5 percent of the households accessed markets while only 40.7 percent accessed electricity despite the rural electrification projects of many state governments in southwestern Nigeria. This low access affected mostly the non-farm activities of households, many of which depend on the use of electricity. The majority of them relied on the use of power generators which increased their overhead cost and increased their total production cost.

The study further revealed that only 33.7 percent of the respondents had ready access to agro-service centres and this often caused a major setback for their agricultural activities. Access to high quality farm inputs such as improved seeds and seedlings, fertilizers and other agro-chemicals are essential in agricultural production and as such, many farmers go through a lot of hardship in the form of high transportation cost in getting them.

Table 6: Households' Access to Infrastructure

Variable	**Frequency**	**Percentage**
Portable water		
Yes	394	89.1
No	48	10.9
Primary School		

Yes	391	88.5
No	51	11.5
Health Centre		
Yes	194	43.9
No	348	56.1
Market		
Yes	285	64.5
No	157	35.5
Agro Service Centres		
Yes	149	33.7
No	293	66.3
Electricity		
Yes	180	40.7
No	262	59.3

Source: Computed from field survey data, 2014

4.4. Household Expenditure and Welfare Profile

4.4.1. Household Monthly Expenditure

The distribution of the monthly average expenditure of households is presented in Table 7. The highest share of the monthly expenditure was on food which was 44 percent of the total household expenditure, followed by fuel (11.1 percent) and transportation (9.7 percent). The

lowest share of the monthly expenditure was on clothing (1.6 percent), followed by water and electricity at 2.1 percent each.

An average of ₦55,214.55 was spent monthly by a household.

Table 7: Distribution of Household Monthly Average Expenditure

Item	**Average (₦ per month)**	**Percentage**
Food	24,275.48	44
Health	2,508.63	4.5
Rent	4,030.16	7.3

Education	3,156.68	5.7
Telecommunication	2,649.32	4.8
Clothing	860.7	1.6
Electricity	1,150.8	2.1
Fuel	6, 151.82	11.1
Water	1,177.85	2.1
Remittance	1,927.13	3.5
Transport	5,367.87	9.7
Others	1,958.16	3.6
Total	55,214.55	100

Source: Computed from field survey data, 2014

4.4.2. Categorization of households by their welfare status

The study used monthly mean per capita household expenditure (MPCHHE) as a proxy for welfare status. The MPCHHE for the study area was ₦7, 152.14. Households with per capita expenditure less than one-third of the MPCHHE were classified as low welfare while those with per capita expenditure that was less than two-third but more than one-third of the

MPCHHE were grouped as medium welfare. The high welfare households are those whose per capita expenditure was more than or equal to two-thirds of the MPCHHE. Table 8 below shows that 31.7 percent of the households had low welfare, 24.4 percent had medium welfare while 43.9 percent had high welfare.

The households were grouped into quintiles based on a measure of their MPCHHE. Table 9 shows the distribution by quintiles. The households in the first quintile had a MPCHHE of N2,908.16 which represents just 8.1 percent of the total MPCHHE. The MPCHHE increased from the first quintile to the fifth with a MPCHHE of N14,297.12 which accounted for 40 percent of the total mean.

Table 8: Welfare Status of Households

Welfare Status	**Frequency**	**Percentage**
High Welfare	194	43.9
Medium Welfare	108	24.4
Low Welfare	140	31.7

Total	**442**	**100**

Source: Computed from field survey data, 2014

Table 9: Monthly Mean Per Capita Household Expenditure in Quintiles

Quintile	MPCHHE(₦)	Percentage
1	2,908.16	8.13
2	3,742.8	10.5
3	6,663.71	18.6
4	8,148.91	22.8

5	14,297.12	39.98
Total	**35,760.7**	**100**
Mean	**7,152.14**	

Source: Computed from field survey data, 2014

4.4.3. Classification of Households Based on Welfare Status in Relation to Socio-economic Characteristics

The classification of households into low, medium and high welfare groups with respect to socio-economic characteristics is presented in Table 10. As shown in the table, majority of the respondents from low welfare households (41.4 percent) were in the age range of 25 – 34 years while just 3.1 percent of respondents from the high welfare households were in this age range. The majority of the respondents in the high welfare households (48.5 percent) were within the age range of 55 – 64. Younger households usually have relatively low levels of assets and potentials to earn income which increases as the family grows older. The medium welfare group however did not show much variation within the various age groups.

The table further revealed that fewer households (about 27.9 percent and 7.9 percent of the low welfare households) were in the age range of 35 – 54 and 55-64 years respectively compared to about 46.3 percent and 48.5 percent respectively of the high welfare households in these age ranges. This is as expected because older households are likely to have an increased capability to earn higher income, handle risks better, possess greater asset endowment and acquire improved portfolio of livelihood strategies (Mensah, 2011; Adepoju, 2013). Also the low

welfare households had a higher percentage of respondents (about 22.8 percent) above the age of 64 years than the high welfare households which had only 2.1 percent in this age range.

As expected, household heads with more than 12 years of education had the least representation in the low welfare category (2.1percent) compared to those with no formal education and with primary education that were 38.6 percent and 46.4 percent respectively. On the other hand about 80.6 percent and 85 percent of respondents in the medium and high welfare categories had at least secondary education as their highest level of qualification with only 8.3 percent and 2.6 percent having no formal education respectively. This corroborates of the findings of Stifel (2010), Adepoju (2013); and Adepoju and Obayelu (2013) that the educational qualification of the household head determines the status of welfare of a household to a great extent (Adepoju, 2013 and Stifel, 2010).

Table 10: Distribution of Respondents Based on Welfare Status in Relation to Socio-Economic Characteristics

Variables	**Pooled**		**Low Welfare**		**Medium Welfare**		**High Welfare**	
Age(years)	**Freq.**	**Percent**	**Freq.**	**Percent**	**Freq.**	**Percent**	**Freq.**	**Percent**
25 – 34	92	23.5	58	41.4	28	25.9	6	3.1
35 – 44	63	15.2	20	14.3	22	20.4	21	10.8
45 – 54	94	21.1	19	13.6	27	25.0	69	35.5
55 – 64	126	25.2	11	7.9	21	19.4	94	48.5
>=65	67	15.0	32	22.8	10	9.3	4	2.1
Gender								
Male	292	65.4	53	37.8	86	79.6	153	78.9
Female	150	34.6	87	62.2	22	20.4	41	21.1
Marital Status								
Married	297	64.9	57	40.7	74	68.5	166	85.6
Widow/Widower	145	35.1	83	59.3	34	31.5	28	14.4
Household Size								
1-4	130	29.3	9	6.4	47	43.5	74	38.1
5-8	143	30.4	8	5.7	39	36.1	96	49.5
9-12	82	19.2	47	33.6	14	13.0	21	10.8
>12	87	21.1	76	54.3	8	7.4	3	1.6
Years of Schooling								
0	68	16.5	54	38.6	9	8.3	5	2.6
1-6	101	23.3	65	46.4	12	11.1	24	12.4

7-12	121	28.8	18	12.9	50	46.3	53	27.3
>12	152	31.4	3	2.1	37	34.3	112	57.7
Migrant Status								
Indigene	283	65.8	63	45.0	95	88.0	125	64.4
Non-indigene	159	34.2	77	55.0	13	12.0	69	35.6
Primary Occupation								
Farming	339	77.8	107	76.4	91	84.3	141	72.7
Non-farming	103	22.2	33	23.6	17	15.7	53	27.3
Livelihood Choice								
CN	236	55.1	114	81.4	51	47.2	71	36.6
CNPLN	89	21.1	21	15.0	32	29.6	36	18.6
CPLN	71	14.4	0	0.0	16	14.9	55	28.3
CFN	46	9.4	5	3.6	9	8.3	32	16.5
Coop Membership								
Yes	209	43.0	12	8.6	41	40.0	156	80.4
No	233	57.0	128	91.4	67	60.0	38	19.6
Access to Credit								
Yes	255	54.2	28	20.0	62	57.4	165	85.1
No	187	45.8	112	80.0	46	42.6	29	14.9

Source: Computed from field survey data, 2014.

As shown in table 10, about 1.6 percent and 7.3 percent of the respondents in the high and medium welfare categories respectively had a household size of more than 12 members. However, majority of households in these categories had between 5 and 8 members (49.5 percent and 36.1 percent respectively). On the contrary, households with more than 12 members had the highest representation among the low welfare households (54.3 percent). This could be ascribed to large household size which consequently affects welfare status negatively.

With regards to livelihood choice, households that were more diversified, that is, those households that were involved in animal husbandry in addition to their cropping and non-farm activities were more in the high and medium welfare categories (63.4 percent and 52.8 percent respectively) compared to only 18.6 percent of such households in the low welfare category. It is remarkable to note that none of the households in the low welfare category was involved in poultry livestock farming. More households in the high and medium welfare groups were members of a cooperative society (80.4 percent and 40 percent respectively) and had access to credit (85.1 percent and 57.4 percent) than the households in the low welfare category with 8.6

percent and 20 percent respectively. This signifies the importance of cooperative societies and credit facilities in improving the welfare of rural households.

4.4.4. Access to Rural Infrastructure in Relation to Household Welfare Profile Distribution

The profile of access to infrastructure in relation to the welfare status of households is presented in Table 11. The result revealed that more households in the medium welfare category (61.1 percent) had access to potable water than the low welfare households (23.6 percent) while all the households (100 percent) in the high welfare group had access to potable water and schools. About three - quarter of the households in the medium welfare group (75.9 percent) had access to schools while more than half in the low welfare group (55.7 percent) did not have access to schools.

With regards to access to primary health services, almost all of the households in the low welfare category (80 percent) in the study area did not have access compared to only 32.4 percent and 10.8 percent in the medium and high welfare categories respectively. The same pattern was observed with respect to all the other infrastructural facilities – fewer households in the low welfare category had access to agro service centres and electricity, (30.7 percent and

19.3 percent respectively) compared to the 52.8 percent and 56.5 percent respectively among the medium welfare households. Almost all the households in the high welfare groups (94.3 percent and 96.4 percent respectively) had access to these infrastructural facilities, that is, agro centres and electricity.

It is interesting to note that all the welfare groups had good access to the market infrastructure at 85 percent, 88.9 percent and 97.4 percent respectively for the low, medium and high welfare groups.

The result shown in Table 11 reveals the vital roles that access to infrastructure play in determining household welfare.

Table 11: Distribution of Respondents Based on Welfare Status in Relation to rural infrastructure access

Variable	Pooled		Low Welfare		Medium Welfare		High Welfare	
Potable Water	**Freq.**	**Percent**	**Freq.**	**Percent**	**Freq.**	**Percent**	**Freq.**	**Percent**
Yes	285	54.1	33	23.6	66	61.1	194	100
No	157	45.9	107	76.4	42	38.9	0	0
Total	**442**	**100**	**140**	**100**	**108**	**100**	**194**	**100**
School								
Yes	365	82.6	62	44.3	86	75.9	194	100
No	77	17.4	78	55.7	26	24.1	0	0
Total	**442**	**100**	**140**	**100**	**108**	**100**	**194**	**100**
Health Centre								
Yes	303	61.5	28	20.0	73	67.6	173	89.2
No	139	38.5	112	80.0	35	32.4	21	10.8

Total	**442**	**100**	**140**	**100**	**108**	**100**	**194**	**100**
Market								
Yes	290	65.6	119	85.0	96	88.9	189	97.4
No	152	34.4	21	15.0	12	11.1	5	2.6
Total	**442**	**100**	**140**	**100**	**108**	**100**	**194**	**100**
Agro Centre								
Yes	229	46.7	43	30.7	57	52.8	183	94.3
No	213	53.3	97	69.3	51	47.2	11	5.7
Total	**442**	**100**	**140**	**100**	**108**	**100**	**194**	**100**
Electricity								
Yes	206	39.8	27	19.3	61	56.5	187	96.4
No	236	60.2	113	80.7	47	43.5	7	3.6
Total	**442**	**100**	**140**	**100**	**108**	**100**	**194**	**100**

Source: Computed from field survey data, 2014

4.5. Status of Rural Infrastructure Development

4.5.1. Cost of transportation to infrastructure

The average cost of transportation to all the infrastructure facilities is presented in Table 12. The cost of transportation to school (N32) was the lowest, closely followed by transportation cost to clean water sources (N34). The cost of transportation to the health centre was N69, to the market was N83, while the cost to the agro-service centre was the highest at N87. This shows that many communities had adequate access to schools and potable water while health centres, markets and agro service centres were still fairly out of the reach of most rural communities. The cost of transportation to health centres, markets and agro-service centres is higher than the findings of Obayelu et al (2014) where respondents spent N60 to access each of the three infrastructure facilities.

The residents of Oyan Imala spent the highest transportation cost to access health centres (N400), market (N500) and agro centres (N500). On the contrary, households in Igbeti were paying the lowest cost of accessing all infrastructure services (N22).

Table 12: Transportation Cost to Infrastructure in Naira (₦)

No.	Village	Water	School	Health Centre	Market	Agro Centre	Average
1	Ojebiyi	20	30	70	70	70	52

2	Orile-Ilugun	10	20	30	50	50	32
3	Alabata	15	20	30	90	90	49
4	Olodo	20	25	20	40	150	51
5	Oyan Imala	10	20	400	500	500	286
6	Idi Emi	15	20	30	20	30	23
7	Tibo	25	30	50	100	100	61
8	Ilewo	25	50	50	50	50	45
9	Ifoyintedo	20	20	30	30	30	26
10	Idosemo	50	30	100	100	100	76
11	Mogbara	50	50	50	50	50	50
12	Oke Odan	50	30	60	100	30	54
13	Ajilete	50	30	100	100	100	76
14	Seguse	70	30	200	200	299	160
15	Idagolu	70	30	80	100	100	76
16	Imosu Daniel	70	100	100	150	150	114
17	Aba-Aladie	30	30	100	200	200	112
18	Eleku	25	30	60	100	100	63
19	Arepaapa	30	20	30	30	30	28
20	Pooro	40	40	65	80	50	55
21	Asangbo	35	30	50	50	50	43
22	Aresaadu	30	20	200	30	30	62
23	Imini	30	20	30	30	30	28
24	Ilu-Aje	30	30	150	150	150	102
25	Igbonna	20	35	40	70	70	47
26	Odebode	35	40	50	50	50	45
27	Abiose	30	50	20	50	50	40
28	Temidire	50	40	40	70	70	54
29	Okolo	30	50	20	50	50	40
30	Maya	20	25	30	40	40	31
31	Eruwa	35	20	30	30	30	29
32	Dogo	25	20	40	50	50	37
33	Igbeti	20	30	20	20	20	22
34	Otiiri	50	30	20	70	70	48
35	Akinwunmi	25	20	20	20	50	27
36	Ayerinna	50	20	50	50	50	44
	Average	**34**	**32**	**69**	**83**	**87**	**61**

Source: Computed from field survey data, 2014

4.5.2 Level of Access to Rural Infrastructure (Infrastructure Index)

To show the level of access to rural infrastructure which measures the degree of development of the communities that households reside in, an index of infrastructure was computed. The result of the infrastructural index is shown in Table 13. The average index is 1.00. The higher the index above the average, the lower the level of infrastructure access and the less infrastructurally developed the community is; and the lower the value below the average, the higher the infrastructure access and the more developed it is. This is in consonance with the findings of Obayelu *et al*., (2014); Ashagidigbi, *et al*. (2011) and Ahmed and Hossain, (1990).

As revealed in table 13, nineteen villages with infrastructure index not more than the average index of 1 were developed and the remaining seventeen with infrastructure index more than the 1 were underdeveloped. This shows that most villages in southwestern Nigeria are developed.

Table 13: Construction of the Composite Infrastructure Index (INF)

		Weight of Average Transportation Cost to a Particular Infrastructure in each village						
No.	**Village**	**Water**	**School**	**Health Centre**	**Market**	**Agro Centre**	**INF**	**Development Status**
1	Ojebiyi	0.60	1.00	1.02	0.84	0.80	0.84	Developed
2	Orile-Ilugun	0.30	0.63	0.44	0.60	0.57	0.51	Developed
3	Alabata	0.45	0.63	0.44	1.08	1.03	0.75	Developed
4	Olodo	0.60	0.79	0.29	0.48	1.72	0.78	Developed
5	Oyan Imala	0.30	0.63	4.38	4.82	2.87	2.70	Underdeveloped
6	Idi Emi	0.45	0.63	0.44	0.24	0.34	0.36	Developed
7	Tibo	1.04	1.00	1.02	1.32	1.15	1.11	Underdeveloped
8	Ilewo	0.74	1.59	0.73	0.60	0.57	0.75	Developed
9	Ifoyintedo	0.45	0.63	0.29	0.24	0.34	0.39	Developed

10	Idosemo	1.50	1.00	1.46	1.20	1.15	1.27	Underdeveloped
11	Mogbara	1.50	1.60	0.73	0.84	0.80	1.09	Underdeveloped
12	Oke Odan	1.50	1.00	0.88	1.20	1.15	1.15	Underdeveloped
13	Ajilete	1.50	1.00	1.46	1.20	1.15	1.26	Underdeveloped
14	Seguse	2.08	0.95	2.92	2.41	2.29	2.31	Underdeveloped
15	Idagolu	2.08	0.95	1.17	1.20	1.15	1.31	Underdeveloped
16	Imosu Daniel	2.08	3.17	1.46	1.81	1.72	2.05	Underdeveloped
17	Aba-Aladie	0.89	0.95	1.46	2.41	2.29	1.60	Underdeveloped
18	Eleku	0.74	0.95	0.88	1.20	2.07	1.17	Underdeveloped
19	Arepaapa	0.89	0.63	0.44	0.36	0.34	0.53	Developed
20	Pooro	1.19	1.27	1.17	1.20	0.57	1.08	Underdeveloped
21	Asangbo	1.04	0.95	0.73	0.60	0.57	0.60	Developed
22	Aresaadu	0.89	0.63	2.92	0.84	0.34	1.12	Underdeveloped
23	Imini	0.89	0.63	0.44	0.36	0.34	0.53	Developed
24	Ilu-Aje	0.89	0.95	2.19	1.81	1.72	1.51	Underdeveloped
25	Igbonna	0.60	1.11	0.58	0.84	0.80	0.79	Developed
26	Odebode	1.04	1.27	0.73	0.60	0.57	0.84	Developed
27	Abiose	0.89	1.59	0.29	0.6	0.57	0.79	Developed
28	Temidire	1.49	1.27	0.58	0.84	0.80	1.07	Underdeveloped
29	Okolo	0.89	1.59	0.29	0.60	0.57	0.79	Developed
30	Maya	0.60	0.79	0.44	0.48	0.46	0.55	Developed
31	Eruwa	0.74	0.63	0.44	0.36	0.34	0.50	Developed
32	Dogo	0.74	0.63	0.58	0.60	0.57	0.60	Developed
33	Igbeti	0.60	0.95	0.29	0.24	0.23	0.46	Developed
34	Otiiri	1.50	1.00	1.46	0.84	0.80	1.12	Underdeveloped
35	Akinwunmi	0.74	0.63	0.29	0.24	0.57	0.49	Developed
36	Ayerinna	1.49	0.63	0.73	1.08	0.57	1.13	Underdeveloped

	Mean INF						1.00	

- INF means index of infrastructure
- Calculated INF that is greater than 1.00 indicates underdeveloped communities INF that is less than 1.00 indicates developed communities.

Source: Computed from field survey data, 2014.

4.5.3. Classification of Villages by Degree of Access to Infrastructure

The villages were further divided into four categories to actually show the magnitude of infrastructure development (Adeoye *et al*., 2011) as shown in table 14. The distribution of the villages by their degree of infrastructural development in table 15 shows that of 9 villages, representing only 25 percent of the total number of villages were highly developed while 10, representing 27.8 percent of the villages were moderately developed with infrastructure index of between 0.55 and 1.0. As further revealed in the table, 12 villages, representing 33.3 percent of the total number of villages were moderately underdeveloped with infrastructure index of not more than 1.5 and the remaining 5 villages representing 13.9 percent and having infrastructure index that is more than 1.5 were highly underdeveloped.

In all, 52.8 percent of the villages were infrastructurally developed and this shows that over a half of the total number of villages were developed. The remaining 47.2 percent of villages with infrastructure index more than 1.0 were underdeveloped.

Table 14: Degree of Infrastructural Development

No.	Village	INF	Development Status
1	Ojebiyi	0.84	Moderately Developed
2	Orile-Ilugun	0.51	Highly Developed
3	Alabata	0.75	Moderately Developed
4	Olodo	0.78	Moderately Developed
5	Oyan Imala	2.70	Highly Underdeveloped
6	Idi Emi	0.36	Highly Developed
7	Tibo	1.11	Moderately Underdeveloped
8	Ilewo	0.75	Moderately Developed
9	Ifoyintedo	0.39	Highly Developed
10	Idosemo	1.27	Moderately Underdeveloped
11	Mogbara	1.09	Moderately Underdeveloped

12	Oke Odan	1.15	Moderately Underdeveloped
13	Ajilete	1.26	Moderately Underdeveloped
14	Seguse	2.31	Highly Underdeveloped
15	Idagolu	1.31	Moderately Underdeveloped
16	Imosu Daniel	2.05	Highly Underdeveloped
17	Aba-Aladie	1.60	Highly Underdeveloped
18	Eleku	1.17	Moderately Underdeveloped
19	Arepaapa	0.53	Highly Developed
20	Pooro	1.08	Moderately Underdeveloped
21	Asangbo	0.60	Moderately Developed
22	Aresaadu	1.12	Moderately Underdeveloped
23	Imini	0.53	Highly Developed
24	Ilu-Aje	1.51	Highly Underdeveloped
25	Igbonna	0.79	Moderately Developed
26	Odebode	0.84	Moderately Developed
27	Abiose	0.79	Moderately Developed
28	Temidire	1.07	Moderately Underdeveloped
29	Okolo	0.79	Moderately Developed
30	Maya	0.55	Highly Developed
31	Eruwa	0.50	Highly Developed
32	Dogo	0.60	Moderately Developed
33	Igbeti	0.46	Highly Developed
34	Otiiri	1.12	Moderately Underdeveloped
35	Akinwunmi	0.49	Highly Developed
36	Ayerinna	1.13	Moderately Underdeveloped

- INF means index of infrastructure

Source: Computed from field survey data, 2014.

Table 15: Distribution of Villages by Degree of Infrastructure Development Index

Range of Index No.	**No. of Villages**	**Percentages**	**Development Status**
≤ 0.55	9	25.0	Highly Developed
>0.55 – 1.0	10	27.8	Moderately Developed
Subtotal	***19***	***52.78***	
>1 – 1.5	12	33.3	Moderately Underdeveloped
>1.5	5	13.9	Highly Underdeveloped
Subtotal	***17***	***47.22***	
Total	**36**	**100**	

Source: Computed from field survey data, 2014

4.5.4. Access of the Villages to Infrastructure

The level of access of the villagers to five of the infrastructure considered in this study is presented in Table 16. It shows that access to infrastructure was measured by the average transportation cost of the household heads to the locations of these infrastructural facilities.

From the survey conducted, the cost of transportation to the infrastructural facilities varied widely. The communities were grouped into four categories; which are those that paid less than N20, those that paid between N21 and N40, those that paid between N41 and N60 and those that paid more than N60 (Adeoye *et al*. 2011; Adefuke, 2005).

As shown in table 16, households from about eight (21 percent) villages spent N20 or less to access the five infrastructural facilities while households from about seven (20 percent) and twenty (58 percent) villages spent more than N60 and between N21 and N60 respectively to access the infrastructural facilities. The table further reveals that households from 26 villages (72.2 percent) spent not more than N40 to access potable water while households from 10 villages (27.8 percent) spent more than N40. This shows that most villages have ready access

to safe drinking water sources like boreholes constructed by both government and non-governmental organizations.

The table also shows a high level of access to schools as households from 30 villages (83.3 percent spent not more than N40 to access schools compared to households from only 6 (16.7 percent) villages that spent more than N40. This is due to the Universal Basic Education policy of the Nigerian government that all children must attend and complete at least the basic primary school education. Households from 19 villages (52.8 percent) spent not more than N40 to access health centre while households from 17 (47.2 percent) villages spent more than N40.

Furthermore, households from 27 villages (75 percent) spent not more than N40 to access market in the study area compared to 9 villages (25 percent) which spent more than N40. Market infrastructure was found to be adequate in southwestern Nigeria. They also incur losses through the activities of middlemen and delay in taking their produce to the markets. Households from 7 villages (19.5 percent) spent not more than N40 to access agro-service centres in the study area,

Table 16: Access to Infrastructure in the Villages

	Number of Villages						
Infrastructure	**≤ N20**	**N21-40**	**N41-60**	**>N60**	**Total**	**Chi Square**	**Pr**
Water	10.0 (27.8)	16.0 (44.4)	6.0 (16.7)	4.0 (11.1)	36.0 (100)	83.84	0.000
School	11.0 (30.5)	19.0 (52.8)	5.0 (13.9)	1.0 (2.8)	36.0 (100)	87.19	0.000
Health	9.0 (25.0)	10.0 (27.8)	6.0 (16.7)	11.0 (30.5)	36.0 (100)	296.31	0.000
Market	7.0 (19.4)	20.0 (55.6)	4.0 (11.1)	5.0 (13.9)	36.0 (100)	120.71	0.000
Agro Centre	1.0 (2.8)	6.0 (16.7)	13.0 (36.1)	16.0 (44.4)	36.0 (100)	122.25	0.000
Average	7.6 (21.1)	14.2 (39.5)	6.8 (18.9)	7.4 (20.5)	36.0 (100)		

Source: Computed from field survey data, 2014
(Figures in parenthesis are the percentages)

compared to households from 29 villages (80.5 percent) that spent more than N40. Low level of access to agro-service centres means that farmers had difficulty in getting farm inputs.

School is the most accessible infrastructure facility in the study area and agro-service centre is the least accessible as presented in table 16.

4.5.5. Access to Infrastructure in Developed Villages

The level of access in terms of cost of transportation to infrastructural facilities in the developed villages is as presented in table 17. As shown in the table, households from about 13 developed villages (70.5 percent) spent N40 or less to access the infrastructure and only 6 villages (29.5 percent spent more than N40.

The Chi-Square (X^2) test of independence was used to determine if there is a significant relationship between access to infrastructure and the cost of access. From the result of the chi-square analysis, the p-value of 0.000 was significant at 5 percent (is less than alpha of 0.05), so the first stated null hypothesis that access to infrastructure and cost of accessing the infrastructure are independent is rejected, that is, the relationship between the two is significant.

As shown in table 17, all the developed villages had access to potable water sources as all the households in the 19 villages spent not more than N40 to access safe drinking water. Also, most households in the developed villages, precisely 16 villages (84.2 percent) and 15 villages

(78.9 percent) had good access to schools and health centres respectively compared to households from only 3 and 4 villages that spent more than N40 to access schools and health centres respectively.

The table further revealed that households from 10 villages (52.6 percent) spent not more than N40 to access market infrastructure in the developed villages. This shows that households in developed villages had fairly good access to market in the study area. With regards to agro-service centres, the level of access is low in the developed villages despite the high level of infrastructure development as only 7 villages (36.9 percent) spent not more than N40 to get to an agro centre while the remaining 12 villages (63.1 percent) spent more to access the infrastructure.

Table 17: Access to Infrastructure in the Developed Villages

	Number of Villages						
Infrastructure	**≤ N20**	**N21-40**	**N41-60**	**>N60**	**Total**	**Chi Square**	**Pr**
Water	9.0 (47.4)	10.0 (52.6)	0.0 (0.0)	0.0 (0.0)	19.0 (100)	71.48	0.000
School	9.0 (47.4)	7.0 (36.8)	3.0 (15.8)	0.0 (0.0)	19.0 (100)	93.25	0.000
Health	7.0 (36.8)	8.0 (42.1)	3.0 (15.8)	1.0 (5.3)	19.0 (100)	154.83	0.000
Market	5.0 (26.3)	5.0 (26.3)	6.0 (31.6)	3.0 (15.8)	19.0 (100)	160.18	0.000
Agro Centre	1.0 (5.3)	6.0 (31.6)	11.0 (57.8)	1.0 (5.3)	19.0 (100)	172.22	0.000
Average	6.2 (32.6)	7.2 (37.9)	4.6 (24.2)	1.0 (5.3)	19.0 (100)		

Source: Computed from field survey data, 2014

(Figures in parenthesis are the percentages)

4.5.6. Access to Infrastructure in Under-developed Villages

The level of access in terms of cost of transportation to infrastructural facilities in the under-developed villages is revealed in tables 18. As shown in the table, households in all the underdeveloped villages had low level of access to market and agro service centres as more than N40 was spent to access the two infrastructure facilities. However, access to school infrastructure was high as households from 12 villages (70.6 percent) spent not more than N40 to access schools in the under-developed villages. Access to potable water was fair – 7 villages (41.2 percent) spent N40 or less compared with households from 10 villages (58.8 percent) that spent more than N40 to access safe drinking water. Access to health centres in the under-developed villages was low with households from only 4 villages (23.6 percent) spent not more than N40 to access health infrastructure.

Comparing tables 17 and 18, households from developed villages spent less to access all five infrastructural facilities compared to those from the under-developed villages. It can be clearly seen that infrastructural facilities with lower transportation costs of access were more readily accessible, hence, the higher the cost of transportation, the lower the level of access and the higher the level of under-development.

Table 18: Access to Infrastructure in the Underdeveloped villages

	Number of Villages						
Infrastructure	**≤ N20**	**N21-40**	**N41-60**	**>N60**	**Total**	**Chi Square**	**Pr**
Water	1.0 (5.9)	6.0 (35.3)	6.0 (35.3)	4.0 (23.5)	17.0 (100)	58.23	0.000
School	2.0 (11.8)	10.0 (58.8)	3.0 (17.6)	2.0 (11.8)	17.0 (100)	71.57	0.000
Health	2.0 (11.8)	2.0 (11.8)	3.0 (17.6)	10.0 (58.8)	17.0 (100)	84.30	0.000
Market	0.0 (0.0)	0.0 (0.0)	1.0 (5.9)	16.0 (94.1)	17.0 (100)	128.67	0.000
Agro Centre	0.0 (0.0)	0.0 (0.0)	1.0 (5.9)	16.0 (94.1)	17.0 (100)	147.43	0.000
Average	1.0 (5.9)	3.6 (21.2)	2.8 (16.4)	9.6 (56.5)	17.0 (100)		

Source: Computed from field survey data, 2014
(Figures in parenthesis are the percentages)

4.5.7. Household Livelihood Choice in Relation to Development Status

The distribution of the livelihood choices of households in relation to the level of development of the villages in which they reside in is presented in table 19. The results show that the choice of CN was not influenced by how developed the village of residence is. As further revealed in the table, 71 households (44.9 percent) and 89 households (55.1 percent) that chose the CN livelihood type were in the developed and underdeveloped areas respectively. There was not much difference in the number of households engaged in the livelihood type in the developed and underdeveloped villages.

With respect to the choice of CNPLN livelihood type, a similar trend was observed as 95 (51.6 percent) households in the developed villages were engaged in this livelihood type and 89

(48.4 percent) households in the underdeveloped villages. The development status of the villages did not really influence the decision of the households to choose CNPLN.

However, the level of infrastructural development influenced greatly the choices of CPLN and CFN. For the CPLN, 49 (90.7 percent) households in the developed villages were engaged in the livelihood type compared to only 5 (9.3 percent) in the underdeveloped villages while in the case of the CFN livelihood type, 35 (76.1 percent) households out of the 46 that chose CFN were in the developed villages while just 11 (23.9 percent) were in the underdeveloped ones.

Table 19: Distribution of Households' Livelihood Choice in Relation to the Level of Development of their Villages

	Livelihood Choice				
Development Status	**CN**	**CNPLN**	**CPLN**	**CFN**	**Total**
Developed	71	95	49	35	250
Underdeveloped	87	89	5	11	192
Total	158	184	54	46	442

Source: Computed from field survey data, 2014.

4.5.8. Household Welfare in Relation to the Level of Development of their Villages

The distribution of households in relation to their welfare status and level of development of their villages of residence is presented in table 20. As shown in the table, more households in the developed villages were in the high welfare group while the underdeveloped villages had more low welfare households. Out of 194 households in the high welfare group, only 19 (9.7 percent) were in the underdeveloped villages while the remaining 175 (90.2 percent) were in the developed ones.

The medium welfare group did not have much variation in the number of households in the two levels of development as 62 (57.4 percent) of them were in the developed villages compared to 46 (42.6 percent) in the underdeveloped ones.

As expected, the low welfare group had very few households in the developed villages. Only 13 (9.3 percent) households were in the developed villages as opposed to 127 (90.7 percent) households in the developed ones.

Table 20: Distribution of Households in Relation to their Welfare Status and Level of Development of their Villages

	Welfare Status			
Development Status	**High**	**Medium**	**Low**	**Total**
Developed	175	62	13	250
Underdeveloped	19	46	127	192
Total	194	108	140	442

Source: Computed from field survey data, 2014.

4.5.9. Households' Livelihood Choice in relation to Welfare

The distribution of households' livelihood choice in relation to their welfare status is presented in table 21. As revealed in the table, almost a half of the households, 78 (49.4 percent) that are engaged in the CN livelihood type have low welfare while 46 (29.1 percent) and 34 (21.5 percent) were in the high and medium welfare groups, respectively. This means that the majority of households that chose the CN livelihood were poor and this could be because their source of income is not as diversified as the other livelihood types.

With respect to the CNPLN livelihood type, there are not much differences in the number of households in the three welfare categories. As is shown in table 21, the distribution of households across the welfare levels are almost equal with 61 households (33.2 percent), 63

households (34.2 percent) and 60 households (32.6 percent) were in the high, medium and low welfare groups, respectively.

It is interesting to note that not a single household in the CPLN livelihood type had low welfare as revealed in the table. Almost all of the households 48 (88.9 percent) that chose this livelihood had high welfare while only 6 (11.1 percent) had medium welfare.

The CFN livelihood type shows a trend that is almost similar with that of the CPLN as only 2 (4.3 percent) of the households that are engaged in CFN had low welfare. However, households in the medium welfare group were just 5 (10.9 percent) while the remaining 39 (84.8 percent) had high welfare.

Table 21 reveals that the CPLN and CFN livelihood types are very profitable.

Table 21: Distribution of Households' Livelihood Choice in relation to their Welfare Status

	Welfare Status			
Livelihood Choice	**High**	**Medium**	**Low**	**Total**
Cropping + Non-farm	46 (29.1)	34 (21.5)	78 (49.4)	158 (100)
Cropping + Non Poultry Livestock + Non-farm	61 (33.2)	63 (34.2)	60 (32.6)	184 (100)
Cropping + Poultry Livestock + Non-farm	48 (88.9)	6 (11.1)	0 (0.0)	54 (100)
Cropping + Fishing + Non-farm	39 (84.8)	5 (10.9)	2 (4.3)	46 (100)

Source: Computed from field survey data, 2014.

4.6. Determinants of Household Livelihood Choices among Households

The multinomial logit (MNL) model was estimated to determine the factors influencing livelihood choice in southwestern Nigeria. The livelihood choice that combined cropping, non-poultry livestock and non-farm activities (CNPLN) was the base category.

The determinants of livelihood choice adopted by each household are presented in Table 22. The log likelihood estimate is -498.74 and its chi-square value is statistically significant at $p < 0.01$, meaning that the model fits the data.

The result presented in table 22 revealed that twelve variables out of the sixteen have coefficients that are statistically significant at 1 percent ($p<0.01$), 5 percent ($p<0.05$) or 10 percent ($p<0.1$). The variables are age of the household head, age squared, sex, household size, dependency ratio, primary education, secondary education, tertiary education, household income, land ownership, access to credit and aggregate rural infrastructure variable (access to rural infrastructure (ARI)).

The marginal effects are presented in table 23.

(1) Cropping and Non-farm (CN): The factors influencing the adoption of cropping and non-farm choice in the study area were age, age^2, gender of the household head, household size, dependency ratio, primary education, secondary education and land ownership. The ARI was not significant in the adoption of this livelihood type as revealed in Table 22.

As shown in Table 23, household heads with primary education as their highest level of qualification were 37.1 percent more likely to adopt the CN livelihood choice relative to the base category, that is, the CNPLN. Household heads with low level of education are, most of the time, restricted to only crop farming as they find it very challenging to diversify into other areas of agriculture like poultry and non-poultry livestock and fishing which require a lot of technicalities that are beyond the comprehension of, say, primary school certificate holders. This is in consensus with the findings of Shujaat (2014).

Table 22: Determinants of Households' Livelihood Choices

Variable	CN		CPLN		CFN	
	Coefficient	**Z-Value**	**Coefficient**	**Z-Value**	**Coefficient**	**Z-Value**
AGE	0.4519*	1.74	-0.1053	-0.97	-0.0560**	-2.45
AGESQ	-0.3877**	- 2.55	0.0007	0.68	0.0003	-1.29
SEX	0.9173**	1.82	-0.4586	-0.96	0.2405	0.48
MARITAL STAT	-0.1841	- 1.05	0.2418	1.14	0.0027	0.25

Household size	0.1176***	2.95	0.2363*	1.67	-0.3862***	-2.59
DPR	0.2021**	1.94	0.6170**	1.29	0.1633**	2.21
PRYEDU	0.5795*	1.84	0.1529	0.40	1.2114*	1.78
SECEDU	-1.1258***	-2.01	-1.3414***	-2.74	0.7325	0.99
TERTEDU	0.0759	0.77	-0.0337	-0.04	2.7251***	2.92
HhINCOME	0.0481	0.59	-0.0007*	-4.03	-9.3300	-0.64
OWNLAND	0.8051**	2.99	-0.5973	-1.24	-1.3778*	-2.18
FARMEXP	0.0276	0.86	0.0241	0.08	0.0117	0.02
CREDITACCESS	0.1308	0.46	0.7988***	2.35	0.0271**	1.88
COOPMEMBER	0.0248	0.50	0.1228	0.28	0.5687	1.16
DISPOASSET	0.0214	1.09	0.0001	1.73	-0.3016	-0.60
ARI	-0.3343	-1.27	-0.8637***	-2.04	0.0432**	2.32
Constant	1.7048***	2.29	2.2471***	2.64	3.9541*	2.66
Observations	442		442		442	
Pseudo R^2	0.6325					
Log likelihood	-498.74					

Source: Computed from field survey data, 2014
***, **, * indicate 1%, 5% and 10% levels of significance respectively

The secondary education variable negatively influenced the odds of choosing the CN livelihood type by cropping households; that is, there is a positive relationship between decisions to diversify into non-farm activities and low levels of education and vice versa. Household heads with secondary education were 44 percent less likely to choose the CN livelihood activities.

The coefficient of household size was positive and significant. This means that an increase in household size would increase the likelihood of the households to choose the CN strategy by

23.5 percent relative to the base category. Large households usually go into non-farm activities in order to meet the needs of their members. The dependency ratio variable (DPR) was also positive and significant. As the number of the dependants increase, there is a 46.7 percent likelihood that the household will go into non-farm activities in addition to cropping. This result is in consensus with the findings of Gani (2015); Adepoju and Obayelu (2013); Babatunde and Quaim (2009); Harjes (2007); Bezemer and Lerma (2003) and Ellis (2000).

The likelihood of female headed households choosing the CN livelihood type was increased by 28.1percent. This is in agreement with the findings of Gani (2015) and Shujaat (2014) but contrary to the findings of Farrington *et al*. (2002), Adugna (2005) and Berhanu (2007).

Age of household heads was found to be initially positively related with their decision to choose the CN livelihood type but later as they advanced in age, the relationship became negative relative to the base category. The likelihood of a household head choosing CN livelihood type

Table 23: Marginal Effects for the Multinomial Estimates

Variable	CN	CPLN	CFN
AGE	0.119	-0.004	-0.105

AGESQ	-0.095	0.062	0.033
SEX	0.281	-0.315	0.034
HhSZ	0.235	0.152	-0.387
DPR	0.467	-0.45	-0.017
PRYEDU	0.371	-0.487	0.116
SECEDU	-0.44	0.603	-0.163
TERTEDU	0.51	-0.722	0.212
HhINCOME	0.128	0.183	-0.311
OWNLAND	0.098	-0.021	-0.077
CREDITACCESS	-0.874	0.504	0.37
ARI	0.105	-0.429	0.324

Source: Computed from field survey data, 2014

increased by 11.9 percent and later decreased by 9.5 percent as the household head got older. Younger household heads had a growing family and were obliged to go into non-farm activities to cope with the ever-increasing need of their households. This finding is in

consonance with that of Gani (2015); Shujaat (2014); Berhanu (2007); Adugna (2005); Agboola (2004), Destaw (2003) and Barret *et al*., (2001).

(2) Cropping, Poultry Livestock and Non-farm (CPLN): The determinants of the choice of cropping, poultry and non-farm livelihood choice were secondary education, household income, access to credit and ARI.

The likelihood of diversifying into poultry farming was increased by 18.3 percent and 50.4 percent with increases in household income and access to credit respectively. This is in consensus with the findings of Gani (2015) and Adepoju and Obayelu (2013).

Secondary education increased the likelihood of a household adopting the CPLN by 60.3 percent. This is contrary to *a priori* expectation that household heads with more years of education tend to go into non-farm employment (Adepoju and Obayelu, 2013; Norsida and Sadiya (2009; Destaw, 2003 and Barret *et al*., 2005). But it is in agreement with the findings of Gani (2015), Oluwatayo (2009), Berhanu (2007), and Galab *et al*., (2002) who found that improvement in the educational status of respondents led to occupational specialization and maybe to increased income and general household welfare.

The aggregate rural infrastructure variable, access to rural infrastructure (ARI) was negatively significant in relation to the livelihood choice of CPLN. Specifically, the likelihood of households with low access to infrastructure taking up this livelihood type was reduced by 42.9 percent relative to the base category. This implies that households with low access to infrastructure were less likely to go into poultry livestock farming compared to their counterparts with high access.

(3) Cropping, Fishery and Non-farm (CFN) Strategy: The factors that determined the choice of cropping, fishery and non-farm livelihood were age, household size, tertiary education, land ownership, access to credit and ARI.

Tertiary education was positively significant to the choice of CFN. This means that the likelihood of a household head in the study area choosing this livelihood type was increased by 21.2 percent with respect to tertiary education. This might be due to the fact that respondents with higher education were able to understand the technicalities of raising fish.

Access to credit also increased the likelihood of choosing the CFN livelihood by 37 percent relative to the base category. This is in consensus with the findings of Gani (2015), Berhanu, (2007), Brown *et al*., (2006) and Holden *et al*., (2004).

Age of household head was negative but significant to the decision to diversify into fishing. The likelihood of going into fishing was reduced by 10.5 percent with a unit increase in age of household head.

The likelihood of choosing into fishing was reduced by 38.7 percent with increase in household size. Similarly, the probability of going into fishing was reduced by 7.7 percent among the landless respondents. This might be because the cost of renting land is high in the study area. Hence, such households would rather cultivate crops on their rented land because they believe that crops would yield more income for the households.

The aggregate rural infrastructure variable, access to rural infrastructure (ARI) was positively significant to the livelihood choice of CFN. Specifically, the likelihood of households with high access to infrastructure going into fish farming was increased by 32.4percent relative to the base category.

From the foregoing, the CPLN and CFN livelihood choices require adequate access to some basic infrastructure such as potable water, electricity supply, agro centres.The second stated null hypothesis that rural infrastructure has no significant effect on household livelihood choices in rural southwestern Nigeria is therefore rejected.

4.7. Effect of Rural Infrastructure on Household Welfare

The Ordered logit regression model was used to determine the effect of rural infrastructure access and usage on households' welfare in southwestern Nigeria and the impact of each variable on the likelihood of the respondent to be placed in one of the three welfare groups of

high, medium and low. The result of the ordered logit regression model presented in two models in table 24 reveals that seventeen variables out of twenty-four have coefficients that are statistically significant at 1 percent ($p<0.01$), 5 percent ($p<0.05$) or 10 percent ($p<0.1$). The significant variables are age of the household head, age squared, sex, household size, labour size, DPR, education, edu^2, migrant status, non-farm income, credit access, access to electricity, potable water, school, market, agro service centre and access to rural infrastructure (ARI). The log likelihood estimate is-195.94979 with a p-value of 0.0000 reveals that the model as a whole is statistically significant. The pseudo R^2 is 0.6736. The chi-square value is 47.54 which is significant at 1 percent indicates that the model has a good fit.

The parallel regression test presented in Table 25 revealed that the significance level of Chi Square statistics was 0.863. The insignificant chi-square indicates that the assumption (that the coefficients are the same for each logistic regression) of the ordered logit model is met.

The results show that all the infrastructure variables except access to health facility have positive and significant effect on household welfare. The marginal effects estimates after the ordered logit regression are presented in Table 26.

Access to electricity decreased the likelihood of households in the community having low and medium welfare by 14 percent and 19.6 percent respectively while it increased the likelihood of having high welfare by 34 percent. This highlights the importance of electricity in the welfare of rural households. When there is adequate supply of electricity, households can engage in more non-farm activities that sometimes require the use of electricity, thus increasing their productivity and improving the welfare of households. This is in consensus with findings of UN-HABITAT (2011), Mensah (2011) and Olivia & Gibson (2009). Electricity also facilitates access to information and entertainment through radio, television, telecommunications gadgets, etc. and promotes higher quality of health and education.

Table 24: Effect of Rural Infrastructure on Household Welfare

Variable	**Model 1**			**Model 2**		
	Coefficient	**Z-value**	**P>lzl**	**Coefficient**	**Z-value**	**P>lzl**
AGE	-0.3348**	-2.10	0.036	-0.3502**	-2.72	0.029
AGESQ	0.0032 **	2.03	0.043	0.0051**	1.98	0.085

SEX	0.3778*	1.71	0.087	0.3382*	1.75	0.834
MARRIED	-0.0745	-0.87	0.387	-0.0789	-0.48	0.172
SECTOR	-0.0966	-0.67	0.505	-0.0969	-0.71	0.035
HhSZ	-0.1379***	-4.27	0.000	-0.1395***	-3.08	0.000
DPR	-0.1208***	-3.62	0.000	-0.1318***	-3.35	0.000
LabourSz	0.1930***	4.88	0.000	0.1981***	4.83	0.000
Edu	0.9327**	1.99	0.047	0.9736**	1.94	0.048
Edu^2	-0.1835*	-1.74	0.082	-0.1872*	-1.83	0.625
Migrant	0.2638**	2.03	0.043	0.2904**	2.87	0.008
Dispoasset	-0.3323	-0.90	0.367	-0.3368	-0.72	0.309
HhINCOME	1.4206	0.45	0.652	1.4735	0.42	0.046
NFINCOME	0.4194**	2.50	0.013	0.4428**	2.79	0.042
CREDITACCESS	1.1229**	2.61	0.009	1.1274**	2.54	0.122
CoopMem	0.0944	0.60	0.549	0.0962	0.51	0.624
OWNLAND	-0.1621	-0.93	0.350	-0.1706	-1.29	0.308
ELECT	0.3926**	2.44	0.258			
WATER	0.4046**	2.88	0.416			
SCHOOL	1.7332***	3.15	0.001			
HEALTH	0.1255	1.50	0.032			
MARKET	0.3730**	1.82	0.029			
AGRO	0.5210**	2.38	0.021			
ARI				-0.2162*	-1.76	0.096
cut1 -18.73921 cut2 -17.06933				cut1 -19.17461 cut2 -17.45157		
Observation = 442 Pseudo R^2 = 0.6736				Observation = 442 Pseudo R^2 = 0.6905		
Log likelihood = -195.94979 Prob > chi2 = 0.0000 LR chi2(19) = 43.19				Log likelihood = -143.31706 Prob > chi2 = 0.0000 LR chi2(16) = 47.54		

***, **, * indicate 1%, 5% and 10% levels of significance respectively

Source: Field Survey. 2014

Table 25: The Results of Parallel Regression Test

Model	**-2 Log Likelihood**	**Chi – Square**	**Significance Level**

Current Model	593.641	71.572	0.863
General Model	547.073		

Table 26: Marginal Effect Estimates of the Ordered Logit Regression for Different Welfare Levels

Variable	Marginal Effect for Y = low welfare	Marginal Effect for Y = medium welfare	Marginal Effect for Y = high welfare
AGE	0.1525	0.1762	-0.3287
AGESQ	-0.2406	-0.2711	0.5117
SEX	-0.1235	-0.3384	0.4619
MARRIED	0.0168	0.0157	-0.0325
SECTOR	0.0207	0.0162	-0.0369
HhSZ	0.0309	0.1735	-0.2044
DPR	0.0872	0.0920	-0.1792
LabourSz	-0.1847	-0.1567	0.3414
Edu	-0.1061	-0.1388	0.2449
Edu^2	0.0269	0.0308	-0.0577
Migrant	-0.0520	-0.0961	0.1481
Dispoasset	1.3604	0.2503	-1.6107
HhINCOME	-2.0907	-3.1407	5.2314
NFINCOME	-0.0916	-0.1165	0.2081
CREDITACCESS	-0.1717	-0.2143	0.3860
CoopMem	-0.0204	-0.0213	0.0417
OWNLAND	0.0356	0.0129	-0.0485
ELECT	-0.1444	-0.1962	0.3406
WATER	-0.2573	-0.1027	0.3600
SCHOOL	-0.1132	-0.3739	0.4011
HEALTH	-0.0003	-0.0005	0.0008
MARKET	-0.0766	-0.0928	0.1694
AGRO	-0.0535	-0.0827	0.1362
ARI	0.1788	0.3072	-0.4860

Electricity access can also increases the productivity of poor households' small enterprises resulting into higher income and employment opportunities (Dinkelman, 2011). Connectivity

to electricity also directly improves household welfare by reducing the time spent by the poor in gathering natural fuel (Barnes, 1988; Foley, 1990; World Bank, 1994; Escobal, 2001; Brennerman and Kerf, 2002; Foster and Jevgenijs, 2009; Rosnes and Haakon, 2009 and Barnejee *et al*., 2009).

Access to potable water also increased the likelihood of households having high welfare by 25.7 percent while it decreased the likelihood of households having low and medium welfare by 10.3 percent and 36 percent respectively. This is in agreement with *a priori* expectation and in consonance with the findings of World Bank (2000), Brennerman and Kerf (2002), Morella *et al*. (2008), Barnejee *et al*. (2008a, 2008b, 2009), Keener *et al*. (2009) and WHO (2010) but it is in dissonance with the findings of Mensah (2011). Access to clean water saves households the time and money that would normally be spent in searching for it. Poor households that lack access to potable water sources waste valuable time and energy in fetching water and children of such households, particularly the girls, have inadequate time to attend school. Access to clean water also reduces the incidences of waterborne diseases, lowers child mortality and generally raises the standard of health of the household.

Access to schools also increased the likelihood of households having high welfare by 40.1 percent but decreased the likelihood of a household having low and medium welfare by 11.3 percent and 37.4 percent respectively. This is in agreement with *a priori* expectation and with the findings of Adepoju and Obayelu (2013); Stifel (2010); Babatunde and Qaim (2009); Norsida and Sadiya (2009); Escobal (2005); Brennerman and Kerf (2002) and Behrman (1999). Educated households are able to participate in nonfarm employments and higher income generating activities which improves their welfare.

Access to market decreased the likelihood of households having low and medium welfare by 7.7 percent and 19.3 percent respectively while it increased the probability of households having high welfare by 26.9 percent. This is in consensus with the findings of Adeoye *et al*. (2011), Escobal (2005) and Jacoby (2002). When rural households are able to sell their farm produce and non-farm products in the markets directly to consumers because they have markets in their communities, their physical and financial stress are drastically reduced. Thus, their profit levels and consequently, the standard of living are raised.

Access to agro service centre increased the likelihood of households having high welfare by 13.6 percent while it decreased the likelihood of households having low and medium welfare by 5 percent and 8 percent respectively. Adequate access to agro centre means that households are able to get good quality agro inputs at affordable prices. This increases the productivity of farmers and thereby improves their standard of living and overall welfare.

Age of the household head which endeavors to explain the life-cycle theory negatively affected household welfare while that of the age-squared ($\boldsymbol{age^2}$) was positive. This is in consensus with the findings of Mohammadi *et al*. (2015), Shuujat (2014), Rubaba *et al*. (2014), Mensah (2011) and Asmah (2011). This is because, all things being equal, as the age of the household head advances, the welfare of the household is expected to become higher. Age negatively affected household welfare at five percent level of significance. An increase in the age of the household head increased the probability of the household having low welfare by 15.2 percent and having medium welfare by 17.6 percent but decreased the likelihood of it having high welfare by 32.9 percent. The opposite was observed with age^2variable. An increase in the variable decreased the probability of the household head having low welfare by 24.1 percent and medium welfare by 27.1 percent while it increased the likelihood of having high welfare by 51.2 percent.

The sex variable was positive at one percent level of significance and this implies that male-headed households had higher level of welfare than thefemale headed ones and this is in consensus with *a priori* expectation. Households headed by men tend to attain and sustain higher welfare levels compared to those headed by women, especially with regard to the type of income generation activities in rural Nigeria. Being a male-headed household decreased the probability of the household having low welfare by 12.4 percent and medium welfare by 33.8 percent while it increased the likelihood of the household having high welfare by 46.2 percent. Due to the traditional beliefs in rural southwestern Nigeria, female household heads are constrained from participating in seemingly hazardous but rather high yielding income generating activities unlike the male heads. They are also more vulnerable. This finding is in consensus with the findings of Rubaba *et al*. (2014), Mensah (2011), Asmah (2011) and Oluwatayo (2009) but contrary to those of Mohammadi *et al*. (2015), Shuujat (2014) and Adepoju and Obayelu (2013).

Household size was negative at one percent level of significance. The probability of the household having low welfare increased by 3.1 percent and of having medium welfare by 17.4 percent with an increase in the size of the household while it decreased the likelihood of the household having high welfare by 20.4 percent. This is in agreement with the findings of Gani (2015).

Labour size positively affected household welfare. An increase in the number of household members who are above fifteen and below sixty-five years and are actively engaged in economic activities increased the probability of the household having high welfare by 34.2 percent and reduced the likelihood of it having low and medium welfare by 18.5 percent and 15.7 percent respectively. This is in consonance with *a priori* expectation and with the results of Mensah (2011), Asmah (2011) and Rubaba *et al*. (2014).

The variable DPR had a negative relationship with household welfare at one percent and this is as expected. An increase in the number of dependent household members below fifteen and above sixty-five years of age will increase the probability of the household having low welfare by 8.7 percent and medium welfare by 9.2 percent while it will decrease the likelihood of it having high welfare by 17.9 percent. This could be because the economically active members of the household are encumbered with the responsibility of sustaining the household. This is in consensus with the findings of Asmah (2011), Adepoju and Obayelu (2013), Rubaba *et al*. (2014), Shuujat (2014) and Gani (2015).

Education positively affected the level of welfare at five percent level of significance. An increase in the numbers of years of education of the household head reduced the chances of the household having low welfare and medium welfare by 10.6 percent and 13.9 percent respectively while it increases the likelihood of it having high welfare by 24.5 percent. Households with higher levels of educational attainment usually enjoy higher level of welfare because they are able to participate in high income generating activities and employment. This is in consensus with the findings of Mohammadi *et al*., 2015, Stifel, 2010, Haggblade *et al*., 2007; Amendola & Vecchi, 2007; Bhaumik *et al*., 2006; Brown *et al.*, 2006 and Dercon & Krishnan, 1996.

The migrant status of the head of the household was found to positively affect welfare at five percent level of significance. It follows therefore that migration in rural Nigeria was found to afford households the opportunity to improve their level of welfare. The probability of a migrant household having high welfare is increased by 14.8 percent while its likelihood of having low and medium welfare is reduced by 5.2 percent and 9.6 percent respectively. This is as expected and in consensus with the results of Mensah (2011), Stifel (2010) and Ellis (2000), People migrate to other areas with the aim of attaining higher welfare through better livelihood opportunities.

Non-farm income impacted welfare positively as expected. An increase in non-farm income increases the likelihood of a household having high welfare by 20.8 percent while it reduces the chances of the household having low and medium welfare by 9.2 percent and 11.7 percent respectively. This is in line with the findings of Ruben & van den Berg (2001); Haggblade *et al.* (2007); Stifel (2010) and Adepoju and Obayelu (2013). Households go into non-farm activities to increase income and welfare of the members.

Access to Credit increased the likelihood of a household having high welfare by 38.6 percent but reduced the chances of the household having low and medium welfare by 17.2 percent and 21.4 percent respectively. This is in consensus with the findings of Stifel (2010), Brown *et al*., (2006), Ellis (1998) and Dercon and Krishnan (1996). Households with access to credit are able to expand the scope of their business operations and enjoy higher incomes and thus, higher welfare.

The aggregate access to rural infrastructure variable (ARI) was used to replace the infrastructure variables in model 2 as shown in Table 24. The results showed that ARI was negatively significant at 10 percent and this implies that low access to infrastructure has a negative impact on the welfare of rural households. The likelihood of households in the under-developed villages with low access to infrastructure having low welfare increased by 17.9 percent and having medium welfare by 30.7 percent while the likelihood of these households having high welfare decreased by 48.6 percent as presented in table 24. Therefore, households with high access to infrastructure have a higher welfare than those with low access.

The result presented in Table 24 shows that access to rural infrastructure (ARI) negatively affected household welfare and thus, the third stated null hypothesis that rural infrastructure has no significant effect on household welfare in rural southwestern Nigeria is rejected.

CHAPTER FIVE

5.0. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter discusses the summary, the conclusion and recommends policies targeted at increasing the infrastructure base of rural southwestern Nigeria and increasing the welfare level of rural households. This chapter concludes by giving suggestions for further research.

5.1. Summary of Major Findings

The study looked at the effect of rural infrastructure on livelihood choices and household welfare in southwestern Nigeria. Primary data on the socio-economic characteristics, access to infrastructure, livelihood activities and household expenditure were obtained from Ogun and Oyo states. A total of 442 households from these states were used for the final analysis. The data were analyzed by employing descriptive statistics infrastructural index, multinomial logit regression model and ordered logit regression model. The major findings are highlighted below:

- The average age of the household heads was 48years. Most of the household heads fell between the age range of 35 – 44 years (34.4 percent) and were married (80.1 percent).
- A greater percentage of the respondents had only primary school education (40.5 percent) and were male (69.2 percent).
- The average household size is 7.
- The four livelihood choices adopted by the households were cropping and non-farm activities (CN), cropping, non-poultry livestock and non-farm (CNPLN), cropping, poultry livestock and non-farm (CPLN) and cropping, fishing and non-farm (CFN).
- Majority (41.6 percent) of the respondents derived their livelihood from cropping, non-poultry livestock and non-farm activities (CNPLN) choice while 10.4 percent of the respondents engaged in fishing (fishing on the sea) and fish farming (raising fish in earthen and artificial ponds, CFN). Only 12.2 percent of the respondents derived their livelihood from cropping, poultry livestock and non-farm activities (CPLN) and the remaining 35.8 percent were engaged in a combination of cropping and non-farm activities only (CN).

- The study revealed that 89.1 percent of the respondents accessed potable water, either from borehole or deep well.
- Majority of the households (88.5 percent) had access to at least primary schools in their communities.
- Majority of the households (56.1 percent) could not access primary health care service.
- Majority of the households (64.5 percent) had access to markets.
- 40.7 percent had access to electricity despite the rural electrification projects of many state governments in southwestern Nigeria. This low access affected mostly the non-farm activities of households many of which depend on the use of electricity. The majority of them relied on the use of generators which increased their cost and increased their expenditure.
- The study further revealed that only 33.7 percent of the respondents had ready access to agro service centre and this often caused a major setback for their agricultural activities. Ready access to good quality farm inputs is essential in agricultural production and as such, many farmers went through a lot of hardship in the form of high transportation and transaction cost in getting them.
- The study used the mean monthly per capita household expenditure (MMPCHHE) to group households into welfare categories. The MMPCHHE was ₦7,152.14.

- The households in the first quintile had a MMPCHHE of N2,908.16, representing only 8.1 percent of the total MMPCHHE. The MMPCHHE increased from the first quintile to the fifth with a MMPCHHE of N14,297.12 which accounted for 40 percent of the total mean.

- Households with less than one-third of the MMPCHHE were grouped as low welfare while those whose per capita expenditure was more than one-third and less than two-third of the MMPCHHE were grouped as medium welfare. The high welfare households had their per capita expenditure equal to or more than two-thirds of the MMPCHHE.

- 140 households (31.7 percent) had low welfare while 194 households (43.9 percent) had high welfare. The remaining 108 households (24.4 percent) had medium welfare.

- The result confirmed that cost of transportation to school (N32), was the lowest, closely followed by transportation cost to the drinking water sources (N34). The cost of transportation to health centre was N69 and to market was N83, while cost to the agro-service centre was the highest at N87. This shows that many communities in rural southwestern Nigeria have adequate access to schools and potable water while health centres, markets and agro service centres were still fairly out of reach of rural communities.
- The highest cost of transportation incurred by households to access an infrastructure facility was N500 and the lowest was N10.
- Households in developed communities spent far less transportation cost to access these infrastructure services than those in the under-developed ones.
- The average infrastructure index was 1.00. Based on this criterion, 19 villages were classified as being infrastructurally developed with infrastructure index ranging from 0.36 to 0.84 while the remaining 17 villages were under developed with infrastructure index of above 1.0.

- Households from 7 (19 percent) villages spent N20 or less to access the five infrastructural facilities while households from 10 (29 percent) and 19 (52 percent) villages spent more than N60 and between N21 and N60 respectively to access the infrastructural facilities in the study area.

- Households from 26 villages (72.2 percent) spent not more than N40 to access potable water while households from 10 villages (27.8 percent) spent more than N40.

- Households from 30 villages (83.3 percent) spent not more than N40 to access schools compared to households from only 6 (16.7 percent) villages that spent more than N40.

- Households from 19 villages (52.8 percent) spent not more than N40 to access health centre while households from 17 (47.2 percent) villages spent more than N40.

- Households from 9 villages (25 percent) spent not more than N40 to access market compared to 27 villages (75 percent) that spent more than N40.

- Households from 7 villages (19.5 percent) spent not more than N40 to access agro-service centres compared to households from 29 villages (80.5 percent) which spent more than N40.

- The study revealed that schools were the most accessible infrastructure facility in the study area and agro-service centre was the least.

- Infrastructure with lower transportation cost were readily accessible, therefore, the higher the cost, the lower the access to infrastructure.
- Age and gender of the household head, labour size, dependency ratio, primary education, secondary education and land ownership influenced the choice of CN livelihood choice.
- The determinants of CPLN livelihood choice were secondary education, household income, access to credit and ARI.
- The factors that determined the choice of CFN livelihood choice were age, household size, tertiary education, access to credit land ownership and ARI.

- Age, age squared, sex, household size, labour size, DPR, education, migrant status, non-farm income, credit access, access to electricity, access to potable water, schools, market, agro service centre and ARI had significant effect on household welfare .

- ARI was significant at ($p < 0.5$) and negatively affected household welfare.

- The probabilities of households with low access to infrastructure having low welfare increased by 17.9 percent and having medium welfare by 30.2 percent while the likelihood of these households having high welfare decreased by 48.6 percent.

- The households with high access to infrastructure had high welfare and a better living standard compared to those with low access.

- The socio-economic factors that negatively affected household welfare are age, household size and dependency ratio while the ones that positively affected household welfare are labour size, migrant status, non-farm income, sex, credit access and education.

- Age negatively affected household welfare at five percent level of significance. An increase in the age of the household head increased the likelihood of the household having low welfare by 15.3 percent and having medium welfare by 0.17.6 but decreased the likelihood of it having high welfare by 32.9 percent. The converse was observed with age^2 variable. An increase in the variable decreased the likelihood of the household head having low welfare by 24.1 percent and medium welfare by 27.1 percent while it increased the likelihood of having high welfare by 51.2 percent.
- Household size was negative at one percent level of significance. A unit increase in the number of household members increased the likelihood of the household having low welfare by 3.1 percent and medium welfare by 17.4 percent while it decreased the likelihood of the household having high welfare by 20.4 percent.
- Labour size was positive and significant at one percent. An increase in the number of household members who are above fifteen and below sixty-five years and are actively engaged in economic activities increased the probability of the household having high welfare by 34.1 and reduced the likelihood of it having low and medium welfare by 18.5 and 15.7 respectively.
- An increase in the number of household members below fifteen and above sixty-five years of age (DPR) increased the probability of the household having low welfare by 8.7 percent and medium welfare by 9.2 percent while it will decrease the likelihood of it having high welfare by 17.9 percent.
- Increase in the numbers of years of education of the household head reduced the chances of the household having low welfare and medium welfare by 10.6 percent and 0.13.9 percent respectively while it increased the likelihood of it having high welfare by 24.5 percent.
- The probability of a migrant household having high welfare was increased by 14.8 percent while its likelihood of having low and medium welfare is reduced by 5.2 percent and 9.6 percent respectively.

- A unit increase in non-farm income increased the likelihood of a household having high welfare by 20.8 percent while it reduced the chances of the household having low and medium welfare by 9.2 percent and 11.7 percent respectively.
- Access to Credit increased the likelihood of a household having high welfare by38.6 percent but reduced the chance of the household having low and medium welfare by 17.2 percent and 21.4 percent respectively. This is in consonance with *a priori* expectation that households that are able to obtain external funding in their livelihood activities will generate higher income and thus, higher welfare.
- Being a male-headed household decreased the probability of the household having low welfare by 12.4 percent and medium welfare by 33.8 percent while it increased the likelihood of the household having high welfare by 46.2 percent.

5.2. Conclusion of the Study

The study examined the effect of rural infrastructure on livelihood choice and household welfare in southwestern Nigeria. Data were collected from Oyo and Ogun states. The study provides empirical evidence that access to rural infrastructure influenced households' livelihood choice for cropping, poultry livestock and non-farm livelihood type; and cropping, fisheries and non-farm activities. The empirical findings also reveal that access to rural infrastructure, specifically water, health, electricity, market, agro services and education infrastructure have meaningful impact on household welfare.

The households in the communities were grouped into high access to infrastructure (developed) and low access to infrastructure (underdeveloped) by means of rural infrastructure index. The index of infrastructural development was negative and lower than unity, and this shows that the low access to infrastructural facilities in the underdeveloped communities negatively affected the welfare of those households residing in them. Households with high access to infrastructure enjoy better and increased level of welfare than the ones with low access. The study concludes that low access to infrastructure can limit the general welfare of rural households. It is thus suggested that policies should be targeted at increasing the number, type and quality of infrastructure of rural communities. Households in rural communities with higher (improved) infrastructure are more likely and are able to diversify their livelihoods into

more profitable ventures which could lead to improve welfare. Hence, governments and other organisations should intensify their efforts to have more infrastructures in the rural areas.

5.3. Policy Implication and Recommendation

1. The study used transportation cost to measure access to infrastructure and the results have shown that the higher the transportation cost in accessing infrastructural facilities, the lower the accessibility to that infrastructure. Government at all levels should therefore invest more in rural roads which will result in reduction of cost of accessing infrastructure. This will invariably reduce the share of transportation cost in the household expenditure and thereby improve their welfare.

2. The study showed that many households in rural southwestern Nigeria have low access to infrastructure. The government at all levels should focus more on the provision of necessary infrastructure in these rural communities to make life more meaningful to the people residing in them.

3. The study showed that access to infrastructure has a significant effect on the choice of fishery and poultry livestock enterprises. Investment in infrastructure will therefore encourage more farmers to go into these enterprises and thereby increase their agricultural output (GDP and GNP), farmers' income, food security and ultimately their welfare.

4. The study revealed that access to rural infrastructure increases the welfare of the rural households. Hence, policies that would increase public investment in functional rural infrastructure, especially portable water, electricity, schools, health centres, market, agro service centre and electricity which have been pointed out as an effective tool for poverty reduction in rural southwestern of Nigeria must be given high priority by the government.

5. The study showed that health facilities and agro service centres are not within the reach of a large percentage of rural households as revealed in the high cost of transportation to access these infrastructure. Thus, priority should be given to the provision of more of these two infrastructure elements in the rural areas.

6. The study showed that all the respondents have diversified their sources of income. The government should provide more economic opportunities, for example, establishing more production industries in the rural areas for the people to take advantage of.

5.4. Limitations of the Thesis and Suggestions for Further Studies

The study examined the effect rural infrastructure on household livelihood diversification and welfare in south west Nigeria.

However, further research work should be carried out on the following areas with the view to increasing the welfare of rural households.

1. A limitation of this study is the use of expenditure to measure the welfare of households. Expenditure cannot quantify other vital areas of well-being like health, joy, peace of mind and security. Studies in the future should adopt a more inclusive measurement of welfare to examine the relationship. Nevertheless, the measure of welfare adopted in this study has been widely used and it is universally accepted.
2. The study focused on effect of only six infrastructure elements. Further studies could extend the findings to more infrastructure types.

5.5. Contribution to Knowledge

This study has added the following to knowledge on the effect of rural infrastructure on household welfare with particular reference to southwestern Nigeria in the following areas:

1. It has empirically established the effect of rural infrastructure on livelihood choices and household welfare.
2. It has revealed that households with high access to infrastructure have the advantage of diversifying into poultry livestock and fish farming while those with low access do not.
3. It has shown that households that have high access to infrastructure enjoy higher welfare than those with low access.

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Appendix 1

Analysis of Objectives of the study

S/N	Objectives	Data Requirements	Data Source	Analytical tools
1.	Present a welfare profile on the basis of household socio-economic characteristics and access to infrastructure in southwestern Nigeria;	Data schools, health centres, markets, agro-service centres, boreholes, deep wells, connection to national grid.	Primary Data	Descriptive statistics
2.	Assess the extent of rural infrastructural development in southwestern Nigeria;	Household's access cost to potable water system, health centre, market, agro centre and school.	Primary Data	Infrastructure Index
3.	Examine the determinants of livelihood choices by households in southwestern Nigeria;	Age, sex, marital status and educational level of household head, household size, land size, access to credit, household participation in cooperatives.	Primary Data	Multinomial Logit Regression Model
4.	Determine the effects of rural infrastructure on livelihood choices by rural households in southwestern Nigeria;	Household access to electricity, potable water system, health centre, market, agro centre and school.	Primary Data	Multinomial Logit Regression Model
5.	Examine the effect of rural infrastructure on household welfare.	Age, gender and education of the household head, household size, disposable assets, access to electricity, potable water system, health centre, market, agro centre and school.	Primary Data	Ordered Logit Regression Model

Appendix 2

Apriori Expectation: Effect of Rural Infrastructure on Livelihood Choice and Household Welfare

Variables	Source	A Priori Expectation
Age	Shuujat (2014), Rubaba (2014), Mensah (2011), Asmah (2011),.	- (+)*
Sex	Rubaba (2014), Asmah (2011), Mensah (2011); Oluwatayo (2009), Lopez (2008)	+
Migrant	Mensah (2011),Stifel (2010), Mensah (2011), Ellis (2000)	+
Dependecy Ratio	Gani(2015), Asmah (2011), Adepoju and Obayelu (2013), Rubaba et al. (2014), Shuujat (2014).	-
Household size	Gani (2015), Adepoju and Obayelu (2013)	-
Credit	Stifel (2010), Lopez, (2008), Brown et al., 2006), Ellis (1998) and Dercon & Krishnan (1996)	+
Household Labour Size	Rubaba (2014), Mensah (2011); Asmah (2011) and Adi 2004	+
Education	Mensah (2011), Stifel (2010), Haggblade, 2007; Amendola & Vecchi, 2007, Adi (2004), Dercon & Krishnan, 1996	+

Note: (+) refers to the expected sign of the quadratic term.*

Appendix 3

Questionnaire

University of Ibadan, Ibadan, Nigeria.

Department of Agricultural Economics

I'm presently undertaking a research work on "**RURAL INFRASTRUCTURE, LIVELIHOOD CHOICES AND HOUSEHOLD WELFARE IN SOUTH-WEST NIGERIA"**

This interview schedule is intended to collect data to achieve the objectives of this research study. Please, kindly give all necessary information and they shall be treated with complete confidentiality. Thank you.

QUESTIONNAIRE FOR THE STUDY

(A) Socio-economic characteristics:

Questionnaire number _____ Date of interview _____

Village _____ L.G.A. _____

Household status: Head ( )

Spouse ( )

S/N	Socio-economic characteristics	Response	Options
1.	Age(Years)		
2.	Sex		1. Male 2. Female

3.	Marital status		1= Married 2 = Single 3 = Widowed/widower 4 = Divorced/separated
4.	Household size		
	Adult males (>15yrs)		
	Adults females (>15yrs)		
	Boys: 0-6 years 7-14 years		
	Girls: 0-6 years 7-14 years		
5.	Types of school attended		1= No formal education 2 = Primary education 3 = Secondary education 4 = Tertiary education
6.	Educational level (years of schooling)		
7.	Monthly income of household head		
8.	Main occupation		1= Agricultural 0 = Non-agricultural

9.	If non-agricultural is your option to question '11' what then is your main occupation?		1= Govt. job 2 =Private job 3= Trading 4= Manual labor 5= Tailoring 6= Artisan 7 = Driving/okada riding 8= Carpentry 9= Bricklaying 10 = Dry cleaner. 11 = Others
10.	If non-agric, do you engage indirectly in agric. Activities?		1= Yes 0= No
11.	If Yes to Q13, what types of activities do you engage in?		1= Cash crop processing 2= Food crop processing 3= Livestock processing 4= Both crop and livestock processing 5= Agricultural marketing 6 = others specify

(B) Non-Farm Income Generating Activities

1. Does your household have any source of non-farm income? Yes (1) No (0)

2. Please go through the table and respond in the appropriate place

S/N	Activities	Responses (code 1 = Yes, 0 = No)	Income from each activity on monthly basis (₦)
1	Trading or other business		
2	Government establishment		
3	Private establishment		
4	Manual labour		
5	Pension		
6	Artisan		
7	Hunting		
8	Fishing		
9	Tailoring		
10	Bricklaying		
11	Driving/Okada Ridding		
12	Dry cleaning		
13	Remittance from relatives / friend		

14	Others (specify)		

3. If you are a farmer, do you own plots of land of your own? Yes (1)

   No (0)

4. What is the size of farmland you cultivated in the last planting season? ---------
   (acres/ha)

(C) Household's Private Assets

1. Please indicate if you have the following in your household?

S/N	Facilities	Response (Yes= 1, No=0)	Total (No.)	Selling Value (₦)
1	Furniture			
2	Deep freezer			
3	Refrigerator			
4	Sewing machine			
5	Blender			
6	Gas cooker			
7	Electric cooker			
8	Kerosene stove			
9	Use of charcoal			
10	Generator			
11	Fan			

12	Radio			
13	Television			
14	Record player			
15	Video player			
16	Plough			
17	Others (specify)			

2. Are you a member of any cooperative society? Yes (1) No (0)

3. Do you have access to credit facilities? Yes (1) No (0)

(D) Household's Access to Rural Infrastructure

1. Which of these rural infrastructure elements are available in your community?

S/N	**Type of infrastructure**	**Response (Yes= 1, No=0)**
1.	Potable water	
2.	Agro Service Centre	
3.	School	
4.	Health Centre	

5.	Markets	
6.	Electricity	

2. i. What is the source of drinking water available?

(a) deep well

(b) borehole

(c) tap (d) river

(e) others

ii. What is the distance to the source of water? _____km,

iii. What is the cost of transportation? _____naira

3. i. What are the number of schools available? _____

ii. Types and number of schools

SCHOOLS	**PRIVATE OWNED**	**GOVERNMENT OWNED**
Primary		
Secondary		
Total		

iii. What is the distance to the school? _____km

iv. How long (time) does it take u to get there? _____ mins/hrs

v. Cost of transportation? _____ naira

4. i. What is the number of health centre in your community? _____

ii. What is the distance to the nearest health centre? _____km

iii. How long (time) does it take u to get there? _____ mins/hrs

iv. What is the cost of transportation? _____ naira

5. i. What is the number of markets in your community? _____

ii. What is the distance to the nearest market? _____ km

iii. How long (time) does it take u to get there? _____ mins/hrs

iv. What is the cost of transportation? _____ naira

6. Is there electricity in your community/ are you connected to the national grid? _____

7. What is the extent of use of these infrastructure elements?

S/N	**Infrastructure**	**Always**	**Often**	**Seldom**	**Never**
1.	Potable water				
2.	Agro Service Centre				
3.	School				
4.	Health Centre				
5.	Markets				
6.	Electricity				

(E) Household Expenditure

1. How much do you spend on food items (₦/week):
   (i) Carbohydrate _____

   (ii) Protein _____

   (iii) Fruits _____

   (iv) Water _____

   (v) Others _____

2. How much do you spend on non-food items (₦/week):
   (i) Health _____

   (ii) Rent _____

   (iii) Education _____

   (iv) Telecoms _____

   (v) Clothing _____

   (vi) Electricity _____

   (vii) Fuel (petrol, diesel) _____

   (viii) Kerosene _____

   (ix) Water _____

   (x) Remittance _____

(xi) Transportation _____

(xii) Others _____

Figure 2: Distribution of Villages by Degree of Infrastructure Development Index