

**INFLUENCE OF CONDITION OF ROAD TRANSPORT INFRASTRUCTURE
ON RURAL AGRICULTURAL DEVELOPMENT IN THE JAMAN SOUTH
DISTRICT**

by

KNUST

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DECLARATION

I, Stephen Yeboah, declare that this submission is my own work towards the attainment of the MSc and that, as far as my knowledge could serve me right, it contains no previously published material(s) by another person nor material(s) which has been accepted for the award of any other degree of the University, except instances where acknowledgement has been duly made in text.

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DEDICATION

This work is dedicated to my lovely son, Nhyiraba Kwame Ankamah YeboahAsuamah and my dear wife Beatrice Amoakooa Mintah. Lots of love to you.

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ABSTRACT

This study was designed to assess the influence of road transportation infrastructure on rural agricultural development in the Jaman South District of the Republic of Ghana. The cross-section survey research design was adopted in this research work. Purposive sampling was used to select 30 rural communities while questionnaires and structured interview schedule were used to collect data from 387 farmer households and 84 drivers by means of simple probability sampling technique. Data collection was based on both primary and secondary sources. Descriptive statistics technique such as percentages, frequencies, means and chi square was used to highlight the socioeconomic characteristics of the farmers in the study area. The SPSS package was used to analyse data.

The study established that less than 45% of the road network in the district was properly engineered and classified to be good. It was found out that, the average farm distance from the community to the main road or nearest market was approximately 2500m out of which approximately 1,375m was in bad shape. Most of the road networks linking the various communities to the main market were unpaved and immotorable during the rainy season. Farming in the district was characterised by farmers who owned small portions of farm size and used rudimentary methods of agriculture. This accounted for the reason why about 76% of the farmers earned less than two thousand (2000) cedis a year from their farm produce. The study revealed that, the type of road connecting the communities to the market had a significant relationship with the estimated travel time to Drobo, cost of transportation, where farmers sold their farm produce, choice of crops, the use of fertilizers, willingness of the farmers to diversify their farms and accessibility of labour. It did not however find a statistically significant influence of road transport infrastructure on farm size of the farmers in Jaman South District. The study recommended the development and expansion of road infrastructure in Jaman South District making use of local resources and technology to boost agricultural development which will further augment farmers' income and general well-being.

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CHAPTER ONE

INTRODUCTION

1.1 Introduction to the Problem

Agricultural development is an especially pro-poor source of economic growth. The World Bank (2011) estimates that, it is about two to four times more effective in raising incomes among the very poor than growth in other sectors. Agriculture is the main source of income and employment for the rural people. The sector has been identified as the primary and biggest source of income in rural communities and provides employment to approximately 70 percent of its population (World Bank, 2012). There are many factors that affect rural agricultural development. Transportation has been identified as one of these factors. Hill (cited in Akangbe et al., 2013) indicates that a great amount of agricultural work involve “moving equipment and materials from one place to another which involve a wide variety of types and sizes of loads to be moved over different distances and types of terrain.” Akangbe et al., (2013) cited Njenga and Priyanthi (2007) and argue that they see transport as being a physical asset and also an essential link in the utilization of other assets and having the ability to improve access to product markets that could stimulate surplus farm production.

Transport is extensively important and crucial to the economic development of any state and more so developing country like Ghana. Transport enhances movement of people and goods and facilitates national integration and development in general. Girvan (2007) posits that transportation is a necessary precursor to the development of agricultural productivity and has a unique role and relationship with agriculture development because of the characteristics of agricultural production, commodities and markets. For the agricultural sector to achieve its potential, investments in both hard and soft infrastructure are necessary (Wanmali and Islam, 1997). They listed roads and bridges as essential components of hard infrastructure and argued that it provides the framework within which soft infrastructure can be made available in developing countries. Soft infrastructure they described as consisting of rural services such as banking, credit, extension, seed provision, transport, communications and marketing of rural produce.

Since agriculture is essentially the backbone of rural economy, the development of agriculture is as well essential. To maximize agricultural development, transportation infrastructure is central. The question to ask, however is, to what extent does transportation infrastructure influence agricultural development in the areas of food production, and marketing of produce? It has been indicated by several writers writing on the relationship between agriculture and transportation that increase in agricultural activities has increased the surge in demand for mobility in terms of passenger travel and movement of goods. Agricultural development can not be effectively enhanced without an efficient transport network. Crosssley et al. (2009) reports that transport operations are a basic component of agricultural input and produce supply chains and that transport can be the decisive factor for the success of a farm or business activity, or else the one constraint that makes costs prohibitive or renders a project economically non-viable. And that transport has a major component of the operation cost in the food chain and it is becoming a barrier for small-scale producers and for the development of efficient, lucrative agribusinesses.

The Jaman District was established by the LI 1376 of 1988. By the LI 1777 of 2004, the Jaman District was further subdivided into Jaman South and Jaman North districts (GSS, 2010). The Jaman South District is predominantly rural with agriculture the leading economic industry in the area. Major food crops including yam, plantain, cassava, cocoyam, pepper, and cash crops including cocoa and cashew nut are grown for consumption and in commercial quantities. With a population of over 92,600, 54.1 per cent are rural farmers [Jaman South District Assembly (JSDA), 2010]. The Medium Term Development Plan puts it that out of about 478 kilometers of road network in the district, only about 45 % is classified as good and these are mostly in urban areas. It is estimated that about 80% of farm produce is conveyed by headportage from farms to villages mainly by women and children. There is high incidence of drudgery in transporting agricultural produce in the district (ibid).

1.2 Problem Statement

The country's agricultural renaissance, it is said, can be realized only if products actually get to markets. Rural infrastructure, particularly roads and transport services, continues to constrain farm incomes and adoption of technologies (Banjo et al., 2012). Though considerable investment in roads and transport have been seen over the years, high costs of transport services adversely affect the cost of agricultural production and

the marketing of outputs (Akangbe et al., 2013; Banjo et al., 2012). Again, Banjo et al., 2012 argue that people who cannot move themselves and their goods cannot pursue economic and social activities. People who cannot move cannot move out of poverty. World Development Report on Agriculture and Rural Development (WDR) (2008) posited that getting agriculture moving in SSA requires, *inter alia*, better access to markets and more modern market chains. Roads and transport services have been identified as necessary variables to this direction (Fang et al., 2004).

In the Jaman South District, farming is the main occupation of the people with estimated 72 percent engaged in agriculture (GSS 2013; JSDA, 2010). The surface of roads linking most communities is in a very deplorable state. Bridges on some roads are broken down cutting communities from the rest of the district. Out of about 478 kilometers of road network in the district, only about 45 percent is classified as good which are mostly urban areas (JSDA, 2010).

Farmers and buyers use motor-cycles and bicycles to transport their produce to main roads. Many of these farmers carry their produce on their heads walking long distances to the roadside or the nearest small town. The deplorable nature of roads linking the main secondary market at Drobo (the District Capital) to the adjoining small towns or communities means few vehicles ply the roads resulting in overloading and huge haulage cost (JSDA, 2010) and this presents a huge problem to farmers affecting agricultural development in the district.

It is estimated that about 80% of farm produce is conveyed by head-porterage from farms to villages mainly by women and children resulting in high incidence of drudgery in transporting agricultural produce in the district (ibid). Perishable crops like tomatoes, okra, plantain and yams get damaged in the course of transporting as a result of excessive heat and poor winding and bending roads resulting in loss of quality and reduction in farmers' income; eventually discouraging farmers in expanding their farm size the next growing season (Akangbe et al., 2013; JSDA, 2010; MoFA, 2012). Farmers who wish to avoid the hustle sell produce at farm gates at very low cost and which even becomes difficult to sell sometimes (MoFA, 2012).

The study assessed how rural agricultural development is affected with accessibility within the Jaman South District. From this it was hoped to infer how rural agricultural

development would change “if access were improved through road investment, and hence lead to better methods of planning rural roads” in the district and elsewhere.

1.3 Research Questions

1. What is the state of roads in the Jaman South District?
2. What is the nature of rural agriculture development in the district?
3. What is the nature of influence of road transport infrastructure on rural agricultural development in Jaman South District?
4. What policy recommendations can be made?

1.4 Objectives of the Study

The core objective of the study is to assess the influence of road transportation infrastructure on rural agricultural development in the Jaman South District.

Specifically, the study seeks;

- a. To assess the state of transportation infrastructure development in the district;
- b. To assess the nature of rural agriculture development in the district;
- c. To assess the nature of influence of road transport infrastructure on rural agricultural development in the Jaman South District; and
- d. To make policy recommendations to help address the gap (if any) in the district.

1.5 Scope of Study

Geographically, the study area was Jaman South District of the Brong Ahafo Region with estimated 123 communities and hamlets which population is predominantly employed in agriculture. Of the 123 communities only six (6) have assumed urban status using population of 5000 as the rural-urban dichotomy using the 2010 population and housing census. The district has a total land area of about 798 square kilometers (km²) and shares borders with Jaman North District in the North-East, Berekum Municipality in the South-East, Dormaa Municipality in the South and La Cote d’Ivoire in the West (JSDA, 2010; GSS, 2013). The 2010 Population and Housing Census put the population of the district at 92,649 of which 25,118 (27.1%) and 67,531 (72.9%) live in urban and rural areas respectively. The total number of households in the district is 20,178 with 14,180 being rural. About 12,588 (88.8%) of

the rural households are farmers and are predominantly (99.2%) into crop farming (GSS, 2010).

Contextually, the study focused on the nature of road transport infrastructure in the Jaman South District, the state of agricultural development in rural communities in the district and the form of influence exerted by the former on the latter in the district. How road transportation infrastructure affect rural agriculture development was critically explored.

1.6 Justification of the Study

Rural transport is an important factor in advancing the MDG on poverty and hunger (UN, 2012:p11-15). It has a role in improving food security and agricultural productivity over the medium and long term (Banjo et al., 2012; World Bank, 2011). According to the World Bank (2011), improving agriculture performance is “the most powerful tool” to reduce global poverty and hunger and that the potential of rural agricultural production can be released through rural infrastructure investment. Transportation infrastructure has been identified as an important variable or rural infrastructure needed to enhance rural development of which agriculture is a key component.

It is acknowledged that a lot of work have been carried out to assess the impact of transportation infrastructure on agriculture, varied conclusions have been drawn which sometimes contradict. Some researchers including (Banjo et al. 2012) conclude that transportation infrastructure has significant influence on agricultural production and development. Jedwab and Moradi (2012) identifies that rural roads reduce poverty in connected villages, by integrating labour and goods markets, thus providing new economic opportunities to their inhabitants. They observe for instance that farmers obtain higher profits because there are cheaper agricultural inputs and higher farm gate prices for their crops. Others on the other hand conclude that the relationship or impact is very minimal. It is suggested for instance that little evidence is found to suggest that agriculture is adversely affected by inaccessibility (Hine et al. 1983). These variations may be attributed to prevailing differences with the study areas and the period of the various studies which tend to influence the outcomes of such studies. This study provides useful information in planning in transportation infrastructure which will help in bridging the knowledge gap in enhancing rural agriculture development in the Jaman South District.

Policy makers and implementers especially in the study area can well be informed on issues of agriculture and provision of transport infrastructure. The planning of rural road investment in developing countries can be improved by an understanding of how that investment may influence agricultural development and subsequently rural development in general (Akangbe et al, 2013). Narrowing this down, planning of rural road investment in the Jaman South District with focus on agriculture development can be enhanced by this work. Though there exists the general knowledge in the study area of problems that confront farmers that are attributable to transportation, there has been very little or no concrete study of the problem to ascertain the extent of its effect on agricultural development in the district. The study provides significant information that can be generalized in the study area to provide useful input for planning in the district and as well provide the basis for further research in the area.

1.7 Research Methodology

1.7.1 Data Collection

The Cross-Section survey research design was adopted in this research work. Purposive sampling was used to carefully select rural communities and then out of these communities, simple probability sampling used to sample farmers as respondents. The main instrument used to collect primary data for this study was structured interview schedule. The study made use of structured interview schedules to collect data from 387 farmer households selected from 30 communities by means of random sampling technique. Data collection was based on both primary and secondary sources. Primary data (both qualitative and quantitative) was collected from vehicle operators (drivers), agricultural extension officers, the district feeder roads officer, and farmers through structured questionnaires, interview guides and observation. Secondary data was gathered from the District Agricultural Development Unit, the District Medium Term Development Plan (2010-2013), books, related research works and other relevant publications.

1.7.2 Data Analyses

Descriptive statistics technique such as percentages, frequencies and means was used to highlight the socio-economic characteristics of the farmers in the study area. The SPSS package was used to analyse data.

1.8 Limitations

In conducting this research a real constraint had to do with limited time. Poverty and poor education level of the respondents posed difficulties in getting documented information. Study relied heavily on respondent's memory to gather information pertaining to certain variables under study. Though utmost care was taken while collecting data, possibility of some errors creeping in cannot be ruled out completely. The results of this study can only be strictly generalisable to the geographical area studied.

1.9 Organisation of the Study

Chapter one explains the aims and objectives; research questions; scope of the study; statement of research problem; justification of the study; limitations of the study and methodology used for the research. Chapter two reviews the state of rural agricultural development; road transport infrastructure; and the relationship that the two have with the research problem in mind. It aims at ascertaining the extent of the problem identified in chapter one including identifying and narrowing research questions. Underpinning theoretical and conceptual frameworks are analysed. The chapter assesses the strengths and weaknesses of methods which have been employed in addressing similar problems.

Chapter three presents the research design and data analysis devised to address the research problem. The chapter recounts the processes of data collection and their administration are also presented. Finally the chapter presents the techniques for analyzing the data collected from the fieldwork activities and the data analytically presented and interpreted.

Chapter four summarises and discusses the research findings. Significant findings emanating from the data analysis are identified and discussed. Chapter five, the final chapter, presents recommendations for policy and planning and for future studies. The chapter further presents the final conclusion of the thesis.

CHAPTER TWO

REVIEW OF LITERATURE ON ROAD TRANSPORT INFRASTRUCTURE AND RURAL AGRICULTURAL DEVELOPMENT

2.1 Introduction

Chapter I adduced the research problem, set out the objectives for this research and provided the justification for the research. This chapter addresses such questions as; how has road transport infrastructure in rural agricultural development been assessed and what does the extent literature contribute to the agricultural development and transportation debate? This is by analyzing the existing state of knowledge on the linkages of road transportation infrastructure and rural agricultural development with the view of identifying the gap in previous research in the field for which this study will make a contribution. The review of relevant literature on the research topic is expected to inform the methods of collecting data and analysis.

This chapter disaggregates and analyses the following terms; „road transport infrastructure“ (RTI) and „rural agricultural development“ (RAD), and postulates working definition for each for this thesis. Next, the chapter presents and discusses various literatures on road transport infrastructure, rural agricultural development, and the relationship between the two phenomena.

2.2 Defining and Disaggregating Concepts

2.2.1 Roads, Road Transport, Road Condition

A road is a strip of land, smoothed, paved, or otherwise prepared to allow easy travel, connecting two or more nodes (Keskinen, 2007). Road has been defined in broad terms as “a formed path or track suitable for use by all forms of non guided vehicular transport” (Salas, 2006). It is identified that road can be built in different stages, starting from the soil itself (a simple path) and then passing on to gravel, concrete or pavement. Roads are arranged in a *hierarchy* of different categories with different attributes based on the importance and the function of a road (World Development Report, 2008; Hamlett and Baumel, 1990). The different functions and characteristics such as road width, construction and paving material, bring out the various categories (U.S. Department of Transportation, 1987). Roads are categorized generally into three levels (NDPC, 2010). Category one has been identified as comprising high ways, national, main or primary roads that connect strategic nodes like cities and regional capitals. Category two roads are departmental, provincial, regional or secondary roads

that connect regions with the country and are feeder routes that provide the main links between highways, national, main or primary roads. The third category comprises municipal, local and tertiary roads including urban and rural roads that connect towns within one province or provide basic access of rural areas (NDPC, 2010; Hamlett and Baumel, 1990).

Road transport, the most widely used mode of transportation, can loosely be divided into infrastructure, vehicles, and operations. The vehicles generally ride on the networks while the operations deal with the control of the system (Keskinen, 2007). Siddiqui and Pant (2008, p.779) write that an efficient transport system is not only required for economic development but is also important to achieve the objective of economic integration among countries. The U. S. Chamber of Commerce (2010) defines “transportation infrastructure” as the underlying structures that support the delivery of inputs to places of production, goods and services to customers, and customers to marketplaces.

For Xie and Levinson (2008), road infrastructure represents the supply side of transportation system. Pavement and road surface condition they identified as a critical indicator to the quality of road infrastructure in terms of providing a smooth and reliable driving environment on roads. To Keskinen, road infrastructure is „a set of roads (*linkages*) which are organised as a network connecting all areas inhabited and exploited by human beings“. Salas (2006) further indicates that adequate provision and maintenance of road infrastructure in terms of the physical condition of the road surface is critical for a good service quality.

Analyzing the definitions above it can be summarized that road transport infrastructure constitute systems and facilities that are necessary for delivery of people, goods and services from one place to another. This include road surface (pavement or graveled), road length (coverage or connectivity), road width (narrow or wide), bridges, and road furniture (drains and signage).

2.2.2 Agriculture Development: Meaning of Agriculture

The term „agriculture“ has been defined by different writers in diverse ways. It comes from the Latin word „*agricultura*‘. *Agri* means "of the land" or "field" and *cultura* means "cultivation"; literally, agriculture means field cultivation (Microsoft Encarta, 2009). Today, however, the term is broadly defined as the production of crops and

animals for human consumption and industrial uses. In trying to find a working definition for the term, HELCOM (2001) outlines a number of definitions. 1) The use of land for production of food, fodder, fibre, energy, medicine, etc and for grazing (landscape preservation). 2) Agriculture: The science or art of cultivating the soil, growing and harvesting crops, and raising livestock. 3) Agriculture: The science or business of raising plants and animals useful to man. It implies the cultivation of the soil, the production and harvesting of crops, the care and breeding of livestock.

According to Nchuchuwe & Adejuwon (2012), the definition of agriculture changes over time. They give a broad definition to agriculture as;

“... the cultivation of plants and husbandry of animals, that is, the management of living things and ecosystems to produce goods and services for the people. Agriculture includes farming; ranching; aquaculture; apiculture; horticulture; viticulture; animal husbandry, including, but not limited to, the care and raising of livestock, equine, and fur-bearing animals; poultry husbandry and the production of poultry and poultry products; dairy production; the production of field crops, tobacco, fruits, vegetables, nursery stock, ornamental shrubs, ornamental trees, flowers, sod, or mushrooms; timber; pasturage; any combination of the foregoing; the processing, drying, storage, and marketing of agricultural products when those activities are conducted in conjunction with, but are secondary to, such husbandry or production.”

2.2.3 Meaning of Rural Agricultural Development

What is rural essentially has geographic connotation. Guttenberg (1988) defines a rural place as one that is not urban, and opines that rural can have no meaning without reference to urban. He indicates thus that what is rural is the residual space that is not urban.

Rural areas can be defined by settlement size, population density, distance to metropolitan areas, administrative division, and importance of the agricultural sector.

For The Organisation for Economic Co-operation and Development (OECD), population density of 150 people per square kilometer is used to define rural (World Development Report 2008, p. 58) whereas the GSS, 2012 categorised communities with population below 5000 as rural. This definition of a rural community by GSS was used for the purpose of this study.

Agricultural development, a subset of economic development, implies a sustained increase in the level of production and productivity over a reasonable length of time and the subsequent improved wellbeing of farmers as reflected in their higher per capita income and standard of living (Nchuchuwe & Adejuwon, 2012). Agricultural Development may be defined as the process of gradually replacing or improving on the traditional ways of farming with modern technologies and better methods of farming. These modern methods include the use of technologies such as new and improved crop varieties and animal breeds, improved cultural practices, improved use of agro-chemicals and other technologies. The end-results that agricultural development seeks to achieve include; to achieve self-sufficiency in food production, enhance the production of industrial raw material, improve on the efficiency of farmers, ensure diversified cash crop production and to practice sustainable agriculture (World Bank, 2007a, 2008; Salami et al., 2010; Hazell, 2001). Agricultural development is characterized by agricultural expansion which is characterized by positive changes that occur in the nature and/or quantity of farm inputs namely land, labour and capital, agricultural growth (which refers to growth in physical quantities), market value of agricultural products and the contribution of agriculture to the national economy (NDPC, 2013). Agricultural growth is characterized by market value of agricultural products which provides enough incentives for farmers to continue to produce. Increased food production is one major characteristic of agricultural development and concerns changes in the overall production capacity of the land in terms of higher crop yields, better animal products or a combination of these (Asmah, 2011).

Rural agricultural development and rural development have been distinguished. While rural agricultural development aims at improving the welfare of rural populations through sustained improvements in the productivity of the agricultural sector, rural development aims at the improvement of welfare of rural populations through the sustained growth of the rural economy, which includes agriculture, but may not be its only component (Anríquez and Stamoulis, 2007).

For the purpose of this study rural agricultural development was defined as the cultivation and production of crops, breeding of livestock, harvesting and marketing of produce, using intermediary and modern technology and equipment in other to enhance efficiency and productivity of farmers, safety of produce and a reflection in the socio-

economic well-being of the farmer in the rural area. The focus of the study was on food crops production.

2.3 Road Transport Infrastructure in Africa and Sub-Saharan Africa

Development of roads and road infrastructure in Africa had been mainly attributed to the colonial governments and roads were mainly built as feeders to railways which were the main mode of transporting goods for export (Hine and Riverson, n.d). Akinyemi (2003), and other researchers indicate that road transport in Africa became a dominant sector in terms of demand and investment from the 1960s and that the most widely used means of transport nowadays. Road network in most sub-Saharan

African countries (SSA) were “substantially expanded in the 1960s and 1970s when new roads were built to open up land for development, and the transition from colonial, primary road networks to more sophisticated infrastructure has been remarkable during the last few decades in the SSA.” (Akinwale, 2010). The sector accounts for close to 90 % of all transport services, and in most cases provides generally the only access for communities of rural areas (World Bank, 2011; World Bank, 2006a). It appears rural communities more than ever are highly connected by roads and this is healthy for rural development of which agriculture is paramount. The physical road condition is one area that needs to be looked at. Accessing the road network and rural road management in Africa, World Bank (2006b) indicate that many SSA countries have experienced relative increases of paved road networks considering the low base from which they started and the poor quality of existing roads, accounting for a high proportion of the growth for the upgrading of existing gravel roads. In describing the road network situation in Africa, Wasike (2001: 1-2) writes that road construction has been given a higher priority than road maintenance. Lack of maintenance has left over 50 % of the paved roads in Africa in poor condition and more than 80 % of the unpaved main roads are considered just fair. The revelation by Wasike means roads are constructed only to be left to deteriorate making them impassable. This defeats the purpose for constructing roads especially in rural areas to open up those places to enhance their economic potentials.

The World Development Report (2008) reports that in Africa, less than 50 percent of the rural population lives close to an all-season road. “Improving road connections”, the report enthused, “is thus critical to strengthening the links of farmers and the rural

economy to local, regional, and international markets”. Poor access to markets can exacerbate a rather high post harvest losses and make the rural farmer uncompetitive.

The overwhelming role of the road transport sector in the development of any society can not be overemphasized. Road infrastructure is a key component and maybe the most important one as far as transportation in the sector is concern. Several research works conclude that the road network is “a prime index of development” (Rawat & Sharma, 1997) and where there is the insufficiency and the inefficiency of the road infrastructure it has a great influence on the economies of the SSA countries (World Bank, 1999; World Bank, 2007b). Lampe remarked: “Road transportation can be a marker of economic development of an area as it provides the basic infrastructure for any kind of investment and the harnessing of its economic potential” (Lampe, 1983). It has been recognized that a good quality road infrastructure attract socio-economic development than the bad road condition (Umoren et.al, 2011).

A study conducted by World Bank's Independent Evaluation Group (IEG) [World Bank (2007b)] reviews the Bank's assistance to the transport sector in developing countries over the last ten years. The review suggests that developing countries have made substantial improvement in the sector. Demand for freight and passenger transport, particularly by road, according to The World Bank has typically grown 1.5 to 2 times faster than GDP in most developing and transition countries. The statement continues that public investment in transport typically accounts for 2.0 to 2.5 per cent of GDP and may rise as high as 4 per cent or more in countries modernizing or building new transport infrastructure. Ghana can not be an exception. Consequently, many Governments have assigned transport an important role as a key to economic development and integration into the world economy (Wanmali and Islam, 1997; WDR, 2007). If investment in transport has a key component that target rural transport infrastructure, that will even be more beneficial to agrarian economies.

ESCAP (2005) observe that some Asian countries, particularly in East and South-East Asia, “have been very successful in instrumentalizing transport for their overall national economic development”. ESCAP asserts that many East and South-East Asian countries have substantially expanded their transport infrastructure. Some countries have doubled road network length over the past two decades. Transport infrastructure development has played a key part in the phenomenal growth of world trade (Diao et al., 2007). All

over the world rural road infrastructure development is seen as key component to releasing rural development of which agriculture is integral. The development of transport infrastructure lowers the price of transport and the cost of production as well (MRT, 2003; Omamo, 1998). This can be said to be a catalyst for development.

A road can be optimally useful when its infrastructure is in good shape. The U.S. Department of Agriculture (1988) indicates that 54% of the local rural roads in the United States were rated "intolerable". According to the report common complaints about local rural roads include heavy and over-weight vehicles breaking up road surfaces, lack of paved surfaces creating dust and ride-ability problems, widths and other design characteristics which are inadequate for today's large farm equipment and heavy trucks, and narrow lanes which create safety problems. Citing U.S. Department of Transportation Hamlett and Baumel (1990) stipulate that in U.S. major problems also exist with bridges on the local rural road system. Bridges that are unable to adequately serve their purposes, the writers term "deficient bridges" and report that deficient bridges on local rural roads create serious safety and traffic constraints. "A structurally deficient bridge will not carry a legal load, while a functionally obsolete bridge will carry a legal limit but is too narrow or has other characteristics that do not meet minimum design standards" (ibid).

The problem of unpaved road surfaces creating dust and ride-ability difficulties, narrow widths and narrow lanes with limited or no road signage is even more pronounced in sub-Saharan Africa and Ghana for that matter. Gollin (2012) makes the point that „there is a consensus that rural transportation in Africa is slow, expensive and erratic“. He continues that roads are poor and rural connectivity is very low and intimates that evidence suggests that in many countries of sub-Saharan Africa Rural Access Index (RAI) is around 20-40% and that of the existing rural roads, 60% are in poor condition and only 3% paved. This glaring picture of insufficiency of basic access and infrastructure painted by Gollin can cause huge problems in rural areas particularly. Rural roads connect market centers with villages and farming areas. The purpose of rural transport is primarily to service agricultural demands and local markets, the everyday needs of people for basic levels of mobility and access to services within their own localities (MRT, 2003; Gollin and Rogerson, 2010). Often, governments however place emphasis on the construction and maintenance of national, primary and secondary roads and hence, there exists a major gap in the rural transport of many African

countries (Foster and Pushak, 2011). This gap provides the rationale for critical attention to be given to rural road network by governments. Linking rural communities where most of food and agricultural activities are concentrated, with good road network can boost the spatial agricultural production and distribution and create more opportunities for the rural farmer.

Are roads that critical for the development of every society? Some researchers have argued that roads create poverty to people living at the state's fringes and that roads do not develop marginal people (Colombijn, 2002). Admittedly, this assertion sounds a bit bizarre. Rigg (1997) however reaches the conclusion that, for marginal people, the road literally becomes an escape route from a non-viable subsistence economy to the market. Road play a key role in national development of almost every country. „Rural road system“, observed by Samuelson, „is a public good“ (Samuelson 1954, 1955 cited in Hamlett and Baumel 1990). Likely, this has informed the policy decisions of many countries. Five-year development plans in Indonesia, Malaysia, the Philippines, and Thailand all had road infrastructure as a major component (Leinbach 1989; Seah 1978). It has been reported that in the 1970s and 1980s, in Indonesia, Malaysia, the Philippines, and Thailand, between ten and eighteen per cent of development budgets was spent on transport, mainly on roads (ibid). It is a known fact that when vehicle operators want to save on spare parts and fuel, transport services are restricted to roads with the best-maintained road infrastructure and even some roadside villages become isolated.

A comparative study in Uganda, Zambia, and Nepal could find no solid links between improved road conditions and poverty alleviation, despite government intentions in that direction (Robinson and Stiedl 2001:60). Seah Chee Meow's (1978) overview of road infrastructure in ASEAN countries makes the rare but insightful observation that roads, apart from bringing rural areas into the market, also aggravate problems in the cities, by channelling people from rural areas to cities. In any case road infrastructure becomes very crucial in Africa and more so in the economies of scale of rural communities. It is important to improve the management of the road infrastructure in SSA (World Bank, 2006b). The Sub-Saharan Africa Transport Policy Program (SSATP), which is a broad partnership between the member countries of SSA and the regional international organisations such as the Economic Community of West African States (ECOWAS), the World Bank and the United Nations Economic Commission for Africa (UNECA) exists to help address some of the challenges bedevilling the transport sector (World

Bank, 2006a). This is long overdue to helping bring rural agriculture to mainstream economic diversification in creating market avenues for products.

2.4 Road Transport Infrastructure in Ghana

Transportation plays an important role in the economy of Ghana (NDPC, 2010, 2013). It facilitates the haulage of goods, movement of people and the general integration of the rural and urban economies (Tanko, 2013). Rural communities are linked to social and economic amenities, including schools, health centers, and markets, and also enable government services like electricity and water to reach rural areas. The NDPC indicates that among the various modes of transportation, road is the principal means of transport in the country “accounting for over 95% of total transport supply”. Giving the NDPC’s indication, Ghana is highly dependent on road transport for all its transport needs.

Jedwab and Moradi (2012) trace the history of roads in Ghana and make the assertion that roads only became a competitive transportation technology in Ghana in the late 1920s. The researchers reveal that most of the non-coastal roads served as feeders to the railway and that many coastal roads were class 2 roads (“roads suitable for motor traffic but occasionally closed”) that were used to transport cocoa beans from coastal producing areas to the coast. Roads were first complementary to the railway system as they were feeders to it (Hine, Ellis, Done and Korboe; Hine and Riverson). It is observed that roads were of poor quality until 1924 when the colonial government started the “Tarmet Program” which made roads suitable to motor traffic throughout the year (Gould, 1960). Roads then became serious competitor for the railway and also opened new areas to cocoa cultivation (Hill, 1963; Hine et al., 1983). As it has been observed even if no railway had been built, roads would have permitted the cocoa boom in Ghana (Hine et al., 1983). This underlines the important role road infrastructure played and continues to play in the economic transformation of the country.

Road transport since independence in 1957 has changed significantly in terms of road policy framework and the physical infrastructure. The road transport is currently the dominant transport system in Ghana. The NDPC describes the current road situation in Ghana (as of 2012) and states that Ghana’s road network consists of 68,067 kilometers of roads and this is further disaggregated as 42,190 km (62%) of feeder roads, 12,400km (18.2%) of urban roads and 13,477 km (19.8%) of trunk roads (NDPC, 2013). The road network links all districts and regions, and also provides access to a large number of settlements, and is considered adequate to meet the minimal requirements for sub-

regional integration (NDPC, 2010). There is however rapid deterioration of the roads. Extensive use of road transport in relation to other forms of transport and poor maintenance of roads has led to the early deterioration of the road network (ibid). Only 42% of the road network is considered to be in good condition, 28% in fair condition and 30% in poor condition (NDPC, 2013). The NDPC observes that there is poor connectivity in rural areas, where only one fourth of rural population lives within 2km of an all season road. The report shows that in 2012 only 33.5% of feeder roads were rehabilitated across the country (ibid). Continued expansion of the network is desired as well as giving priority to improving roads quality through the introduction of modern construction technology, better maintenance and regulation, and improving rural connectivity. It is imperative that the Road Transport Gap (RTG) is as a matter of urgency overcome through appropriate interventions by expanding the length, upgrading of road pavement and improved inter-connectivity of roads in all the three road sectors namely Highways, Urban and Feeder Roads across the country, (NDPC, 2010; Tanko, 2013). Table 2.1 below gives an important overview of Ghana's road transport sector which suggests that comparatively the country is doing well but still has to do more with rural accessibility.

Table 2.1: Ghana's road indicators benchmarked against Africa's low- and middle-income countries

Unit	Low-income countries	Ghana	Middleincome countries
Paved road density km/1000 km ² of arable land	86.6	158.1	507.4
Unpaved road density km/1000 km ² of arable land	504.7	804.0	1,038.3
GIS rural accessibility % of rural population within 2 km of all-season road	21.7	24.0	59.9
Paved road traffic Average annual daily traffic	1,049.6	1,314	2,786.0
Unpaved road traffic Average annual daily traffic	62.6	40.4	12.0
Paved network condition % in good or fair condition	80.0	75.0	79.0
Unpaved network condition % in good or fair condition	57.6	74.0	58.3

Source: (Gwilliam and others (2009) derieved from Foster and Pushak (2011)

2.5 Road Transport Infrastructure in Jaman South

The Jaman South District (JSD) has an extensive road infrastructure. This is however seasonally and in poor condition in most places. The surface of roads linking most communities is in a very deplorable state. Bridges on some roads are broken down cutting communities from the rest of the district. It is estimated that out of about 478 kilometers of road network in the district, less than 45 % is classified as “good” which are mostly urban areas (JSDA 2010; GSS, 2013). A few of the roads are in fair condition while majority of the roads are in poor condition. The main highway linking the district to Berekum municipality is almost rendered immotorable. It is difficult for one to describe it as either tarred or feeder as the deteriorated surface and potholes reveal. In other parts of the district there are quite a number of communities far away from a road. The populace use farm tracks and footpaths and walk very long distances to get to an „active road“. This suggests the enormous difficulties residents especially rural communities endure with transportation and haulage of goods.

Road network of the JSD comprise of high ways that link the district to Berekum Municipal and Jaman North (which is the only tarred road), and a number of secondary and minor (feeder) roads connecting rural access roads and tracks to the district capital and other major towns and linking different agriculture areas and market centers to each other (ibid). The majority of roads are unpaved, either gravel or earth roads, and these roads are more vulnerable to damage caused by heavy rains, soil erosion and traffic of heavy, overloaded vehicles. This is likely to have adverse influence on the main economic activities of the people particularly agriculture in the district.

2.6 Agricultural Development in Africa and South Saharan Africa

Agriculture is a key factor to Africa’s development. Agriculture is the backbone of Africa’s economy (World Bank, 2008; ECA, 2007). ECA, 2007 identifies the important role agriculture plays in the African economy as well as in the lives of her citizens. Among them are „in the provision of food for the increasing population; supply of adequate raw materials to a growing industrial sector; a major source of employment; generation of foreign exchange earnings; and, provision of a market for the products of the industrial sector among others“. About 70% of Africans and roughly 80% of the continent’s poor live in the rural areas and depend mainly on agriculture for their livelihood (ECA, 2007). The sector accounts for about 20% of

Africa's GDP, 60% of its labour force and 20% of the total merchandise exports (ibid). A NEPAD report in 2002 has it that since the 1960s, imports of agricultural products have been rising faster than exports and Africa as a whole has become a net agricultural importer since 1980. In 2000, African countries received 2.8 million tons of food aid, which is over a quarter of the world total (NEPAD, 2002). It appears then that with all the importance of the agriculture sector to Africa, the continent seems to be missing the opportunity of maximizing the sector's production and productivity that will inure to the benefit of the Africa economy.

In most areas of SSA reducing poverty through increased agricultural productivity remains a great potential, either through direct income benefits, indirect expenditure linkages or through consumer benefits. Hazell reports that agricultural productivity is not primarily constrained by a lack of available technologies, or of investment in agro-industry or agricultural machinery and equipment, which would need a commitment of major resources, but rather can be enhanced with relatively „low cost“ inputs. He continues that modern input-intensive farming is unlikely to become economic in SSA, until rural infrastructure (of which road is very essential), markets and agricultural input supply systems have caught up (Hazell, 2001). Faster agricultural growth has led the way of broader economic transformation process at least in many African countries. Rising farm incomes raising demand for industrial goods, lowering food prices, curbing inflation and inducing non-farm growth, and creating an additional demand for workers are identified by the World Bank. It is also noted that rising on-farm productivity also encourages broad entrepreneurial activities through diversification into new products, the growth of rural service sectors, the birth of agro-processing industries, and the exploration of new export market (World Bank, 2008). In Nigeria agriculture has been the fulcrum of the country's economy prior to the discovery of oil (Nchuchuwe & Adejuwon, 2012).

Gollin, Parente and Rogerson (2009; 2010) observe that rising agricultural development releases farmers for other activities, leading to structural transformation needed for Africa's income to catch up with more advanced economies. Agricultural development is influenced by factors as modern or improved crop varieties, use of chemical fertilizers, irrigation facilities, modern methods of weeds, pest and disease control and improved storage and market facilities (World Bank, World Development Report, 2008). It is imperative to have good infrastructure, especially roads, to facilitate

greatly access to the factors as identified by the WDR. In essence, agricultural development should be the priority towards Africa's economic development and building the necessary enhancing infrastructure is paramount.

2.7 Agricultural Development in Ghana

Agriculture is remains the bedrock of the Ghanaian economy (ADF, 2008; GoG, 2005; MoFEP, 2012) even after the discovery of oil. The above assertion is based on the fact that at independence in 1957, little was known of petroleum as a source of revenue for the Ghanaian economy. There was sustained emphasis on agriculture to the extent that Ghana was a major exporter of such agricultural products as, cocoa, timber, cotton and food crops (Easterling et al., 2008).

The sector still contributes more significantly (22.7% in 2012) to Ghana's gross domestic product (GDP) and employs a significant majority of the labor force (ADF, 2008; Easterling et al., 2008; Kolavalli et al. 2012; GoG, 2005; MoFEP, 2013; NDPC, 2013). Ghana's agriculture is made up, predominantly of subsistence smallholder farmers producing most of the crop and livestock products using underdeveloped technology (ADF, 2008; NDPC, 2010; Salami et al., 2010). Agriculture in Ghana is dominated by crop production, with crops other than cocoa accounting for nearly twothirds of the agricultural GDP (Easterling et al., 2008; NDPC, 2013) and the sector is characterized by low productivity, low income and un-competitiveness in production, processing and distribution (Anríquez and Stamoulis, 2007; NDPC, 2010), low inputs, and high dependence on rainfall (Asmah, 2011) in addition to the low level of technology identified earlier.

Agriculture in Ghana is transforming slowly (MoFA, 2002; GoG, 2005; Robinson and Kolavalli, 2010). It has been the backbone of Ghana's economy throughout the postindependence period until recent years, when the service sector began to dominate the economy (NDPC, 2013; Kolavalli et al. 2012). As it has been observed, the surest way the country can reach its ultimate development goal is to modernize and transform the agricultural sector (Salami et al., 2010; World Bank, 2007a; Easterling et al., 2008; Lay and Schuler 2007). It is often argued that modernized agriculture sector is expected to underpin the transformation of the economy through job creation, increased export earnings, food security, and supply of raw materials for value addition, and that rural development and reduction in the incidence of poverty is highly linked to this (World

Bank, 2007a; NDPC, 2010). The agricultural sector in the medium term under the Ghana Shared Growth and Development Agenda (GSGDA), 2010-2013 was expected to grow at an annual rate of at least 6% (NDPC, 2010). The overall growth rate of the sector has been however woefully below the targeted rate with 0.8% and 1.3% recorded in 2011 and 2012 respectively (NDPC, 2013). Raising productivity and expanding market access for output through increased access to a package of modern agricultural technologies – e.g., high-yielding varieties of seed, chemical fertilizers and pesticides, and irrigation – together with broader improvements in infrastructure, particularly transportation are therefore very important (Venkatachalam, 2003).

Inadequate innovations in small-scale agriculture and poor transport and distribution channels have all been identified as contributors to slow agricultural productivity growth (Aryeetey 2005; Lay and Schuler 2007). Both production and consumption linkages between sectors are important for growth, and they can be enhanced by promoting sectors with larger inter-sectoral linkages (Andrae 1981). Consumption linkages are particularly important in the early stages of transformation, when a majority of the population depends on agriculture for its livelihood (Mellor 1998). The forward linkages of agriculture to other economic sectors are stronger than the sector's backward linkages. A rapidly transforming agricultural sector can help the transformation of other sectors through linkages (Anríquez and Daidone, 2008).

In Ghana as is the case in many African countries, agriculture is dominated by smallholder farmers (Asmah, 2011; NDPC, 2010; Kolavalli et al., 2012). Smallholder farmers face key challenges among them road infrastructure and connectivity (AfDB, 2011; Diao et al., 2007; ECA, 2007). Food security continues to be real challenge and Salami et al. 2010 argue that this is despite the significant potential to boost agricultural production. Increasing the persistently low agricultural yields requires making agricultural inputs and outputs accessible. By utilizing their comparative advantages due partly and in no small measure to exposure to the outside world through access and connectivity, smallholder farmers would be able to specialize and exchange products through markets. Limited commercial and semi-commercial production also occurs in rural Ghana. Development and growth in agriculture enhances the income of the smallholder farmers and much more effective in reducing poverty than GDP growth of other sectors (World Bank, 2008; GSS, 2007; Jacoby, 2000). From the foregoing, it is obvious that the potential in the agriculture sector is as enormous as the challenges that

confront the sector dominated by smallholder subsistent farmers. Overcoming the challenges to make agriculture lucrative and attractive is not a one-off thing, rather it is a gradual and progressive determination to transforming the sector.

2.7.1 Agricultural Sector Reforms in Ghana

Agriculture in Ghana has seen a lot of policies and reforms over the years with the vision of making the sector more viable. The Medium Term Agricultural Development Programme (MTP) enrolled in 1991 addressed or guided sector-specific policies and programmes during the 1990s (Dordunoo and Dogbey, 2002). Ghana in conjunction with the World Bank rolled out agricultural development strategy aimed at establishing and supporting market-led growth in agriculture from 1991-2000. Subsequently, the government provided and developed infrastructure which included feeder roads, irrigation and marketing infrastructure. Dordunoo and Dogbey (2002) report that the agricultural sector was projected to annually grow at 4% under the MTP.

Under the Vision 2020 agricultural development featured prominently. Growth in the sector was estimated to rise from 2-3% to over 4%. The various sector policies focused on food security, adequate nutrition, supply of raw materials and other inputs for industry, and enhanced income for farmers (NDPC, nd.) and these are essentially the main thrust of agricultural development. The sector reforms in Ghana have not been able to achieve the expected outcome due to factors identified by Dordunoo and Dogbey as „lack of capital and facilities, regulatory constraints on fertilizer marketing, the slow growth of effective demand, and poor rural transport infrastructure“.

The Food and Agriculture Sector Development Policy (FASDEP II) and the MediumTerm Agricultural Sector Investment Plan (METASIP) had accelerated modernisation of agriculture and effective linkage between agriculture and industry as the main focus (FAO, 2012; NDPC, 2010). Low productivity in the agricultural sector has been a perennial problem. The NDPC outlines the causes, which include: Low level of mechanization; inadequate post-production infrastructure (i.e. storage, processing facilities, transport etc); low uptake of research findings by stakeholders; limited availability of improved technological packages, especially planting materials and certified seeds; limited participation of beneficiaries in extension programme planning and implementation; and limited access to guaranteed markets for farmers and producers, especially women. Other constraints are poor road networks linking production, processing and marketing centers.

Easterling et al., 2008 in a report on factors affecting economic growth in Ghana indicate that in the last several years, the growth rate of agriculture has exceeded that of the total economy, a result that most economists would regard as anomalous. The Food and Agriculture Development Policy, seeks to promote changes in the agricultural sector that will make agriculture a leading sector in the march to middleincome status and consolidating it. The Youth in Agriculture Programme (YIAP) was introduced as an intervention to make agriculture attractive to the youth and create jobs and ensure food security (MoFEP, 2013). Going forward, linkages with other sectors especially transport and infrastructure should be boosted as well.

2.8 Condition of Road and Agriculture Development

From the discussion so far, poor infrastructure has been identified as major impediment to agricultural activities in Africa. This surfaces in the area of inadequate and poor conditions of the market facilities and transportation systems and infrastructure, including road. The road system, which is the most important for market development in terms of distribution of inputs and output to and from farms, is the most serious infrastructural bottleneck facing agricultural development (World Bank, 2007). According to the Bank's report, in sub-Saharan Africa, average postharvest losses are estimated to amount to over 40 percent, and even up to 70 percent in some fruits and vegetables. In Ghana underdeveloped rural roads and other key physical infrastructure have led to high transport costs for agricultural products to the market as well as of farm inputs, reducing farmers' competitiveness. Rising transport costs affects both output and input prices (World Bank, 2008; Omamo, 1998). This means addressing transportation bottlenecks inextricably can give agricultural development a face lift.

Roads are important for trade and for conveying people and goods from places to places. A group of researchers believe that positive influence of transportation on agriculture development and food production in the rural area is very minimal and insist that rural agriculture is rather negatively affected with improvement in transport infrastructure especially roads. Hine and Riverson, (undated) found little evidence to suggest that agriculture was adversely affected by inaccessibility. They argue that it appears that the more inaccessible villages concentrate more on agriculture than the more accessible villages. The latter have the advantage of their position to concentrate their efforts on nonagricultural sources of income such as marketing, rural industry and the provision of services. They failed however to anticipate how income generated from non

agricultural sources is reimbursed in agriculture. The linkages of agricultural sector with other sectors make agricultural development critical. Gollin and Rogerson (2010) identifies agriculture as a source of supply for key consumption goods, as a source of demand for non-agricultural products, as a potential source of labour and other productive resources (land, capital) and as an input into processing and other industries. Nchuchuwe & Adejuwon (2012) opine that agriculture has a high multiplier effect, which means that agricultural investment can generate high economic and social returns and enhance economic diversification as well as social development. Gollin is however emphatic that „rural transportation projects have little impact on yields or overall production, since income elasticity of demand for food is relatively modest“ in most developing countries and opines that „the big effect is that 20% of the total population is able to move out of subsistence agriculture“ (Gollin, 2012). Arguably, what Gollin calls „modest“ or „little“ impact can be a defining transforming factor in rural development of which agriculture is cardinal in that if farmers are able to sell the additional produce, it can translate to overall increase in farmers“ income.

Another school of thought, to which majority of researchers belong (at least per my review of various literatures), conversely believe otherwise. They insist that transportation infrastructure especially road transport infrastructure has a huge positive influence on rural agriculture due to the realities of enhancing several linkages to the non-farm sectors of an economy. Rigg, Asnan, and Trankell (1993:90) for example conclude that roads provide market opportunities that allow villagers to escape from subsistence agriculture. Benzinger (cited in Felloni et al., 2001) opines that road density and distance to the nearest cities positively affect the production of fertilizers per unit of land, machinery power per worker, as well as productivity of labour and land.

Roads enable the transport of bulky agricultural inputs and cash crops. Roads have made life in rural communities more complex, with more income options to choose from. Various researchers over the years have found that rural roads reduce poverty in connected villages, by integrating labor and goods markets, thus providing new economic opportunities to their inhabitants (Jedwab and Moradi, 2012; Leinbach, 1981; Robinson and Stiedl, 2001; Wanmali and Islam, 1995). They assert for instance, farmers obtain higher profits thanks to cheaper agricultural inputs and higher farmgate prices for their crops. Other researchers, for example Salami, Kamara and Brixiova, (2010) postulate that improved access to input and output markets is a key precondition for the

transformation of the agricultural sector from subsistence to commercial production. Road transport infrastructure is critical in improving farmers' access to input and output markets and instigating agriculture development. The argument of the various researchers invariably projects road transport as a key influencing factor in agricultural development especially among smallholder farmers.

Will other factors such as land tenure and innovative technology have more influence on the general performance of the agriculture sector? According to Salami et al. (cited above), the road system is the most important for market development in terms of distribution of inputs and output to and from farms and is the most serious infrastructural bottleneck facing agricultural development. As a result of poor road network, smallholder farmers depend on inefficient forms of transportation including use of animals, headloading, and use of bicycles. It has been estimated that India loses about 20 per cent of total agricultural output and 40 per cent of fruits and vegetables on the journey from farm to consumer as a result of weaknesses in transport and logistics services (ESCAP, 2005). The situation is even more bizarre in sub-Saharan Africa. In the sub-region, average post-harvest losses are estimated to amount to over 40 percent, and even up to 70 percent in some fruits and vegetables (World Bank, 2007a). This implies that even with a boom in agricultural production, if transport infrastructure is in deplorable form, it poses challenges to marketing produce and this greatly hampers agricultural development.

Gollin and Rogerson (2009), show that a reduction in the share of subsistence agriculture in Africa requires an increase in agricultural productivity and reduction in transport costs. Farmers are not able to fully pass on to buyers the high transport cost, resulting in reduced profits to farmers (Salami et al. 2012). Road is an important form of rural infrastructure providing cheap access to markets for agricultural output (Jacoby, 2000). It can be said that the production capabilities of the rural farmer can be enhanced when the farmer has improved access to rural transportation and is sure that produce will not rot in the bush but get sold in the market which can stimulate economic development.

In assessing the importance of road to rural development, Akangbe et al., 2012; World Trade Organization, 2004; World Bank, 1999) reveal that road and other transport improvements thus provide support to a range of rural development activities, such as, providing improved access to areas outside the village, so that agricultural surplus can

reach collection centers and markets more rapidly; reducing the time burden on family members, particularly (in some cultures) the younger and female members of the family; reducing damage to perishable crops during transport; reducing operating costs for vehicle users; and providing greater opportunities for social and educational journeys and providing more direct and cost-efficient access to public services, such as schools and health facilities. In their conclusion, the researchers observe that poor state of transportation facilities have a negative implication on agricultural development.

Frequency of trips is important for accessibility. It is observed that increases for each trip type are useful in assessing the overall impact of road upgrading and Leinbach, (1981) opines that improvement of transport services is a common result of road rehabilitation. Leinbach was however cautious and noted that road impact with respect to trip frequency increases may vary in places. Easterling et al., 2008 assert that most smallholder farmers are isolated from marketing centers due to their remote locations and/or poor roads leading to their farms. In many cases, farmers must carry their products as head loads to the nearest road before they can be transported to market. Distance from markets discourages the production of higher value more perishable crops, and reduces the linkages between these producers and more specialized markets. In order to achieve the broad goal of getting agricultural produce to the market, it is important vehicles frequently ply the rural communities and the quality of road infrastructure can determine the trip frequency.

Ghana's road network is inadequate, especially in rural areas. Furthermore, there is a general lack of feeder roads over which agricultural products can be transported. Major highways, particularly those linking the port of Tema with neighboring countries are congested and poorly maintained. Under the Millennium Challenge Account (MCA) Ghana Programme, a number of trunk roads and feeder roads in food growing areas were rehabilitated, and new ones constructed. "This is a prerequisite if Ghana is to be competitive in the agricultural trade market, since weak logistics infrastructure (in particular the generally poor condition of the feeder road network, and the absence of adequate storage facilities for food staples and an integrated cold chain for horticulture exports) has been frequently identified as a key weakness of Ghana's agribusiness sector" (GoG 2005).

Studies have shown, for example, that improved access to all-season roads enhances the use of inputs such as fertilizer, increases aggregate farm output and has a similar

positive influence on marketed surplus from rural areas (Ahmed and Donovan, 1992; Wanmali, 1992a; 1992b cited in Wanmali and Islam 1997). They observe that better access to towns has resulted in increased purchase of agricultural inputs, in addition to that of non-food goods and services. It was also found that households in the communal farming areas are more responsive to improvements in access to towns that provide goods and services they require, and that overcoming 'distance' is more important to them.

Transport costs matter and are sufficient to explain the cropping choices in smallholder farming (Omamo, 1998). Marketing of agricultural products is as crucial as producing the products. Agricultural production system cannot be healthy unless it is supported adequately by the strong market infrastructure for disposal of farm produce. Roads and transportation in general have been identified as part of market infrastructure significantly influencing production and growth in agriculture (Bhatia 1999).

2.9 Conceptual Framework

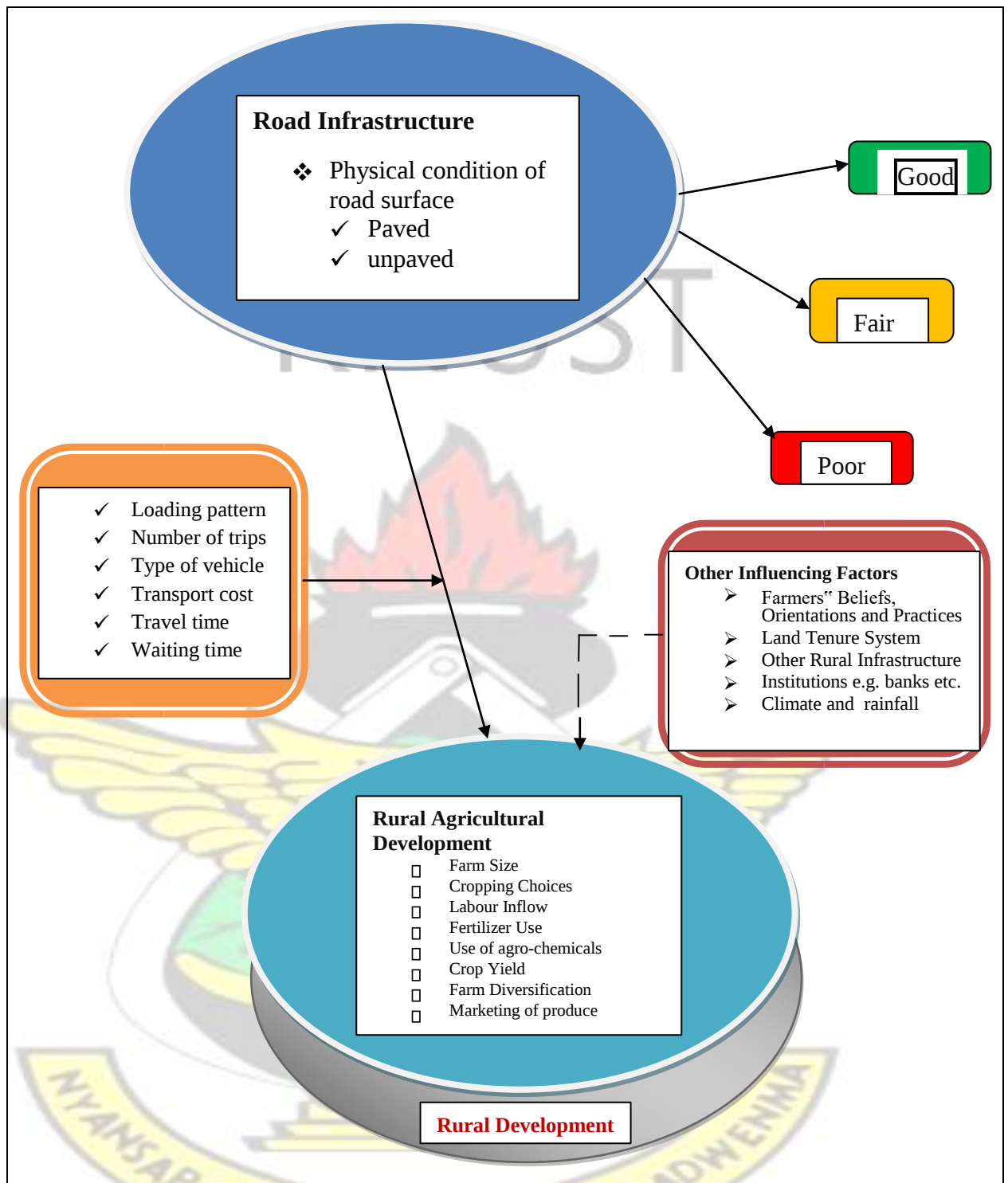
Figure 2.1 presents the conceptual framework within which the influence of road transport infrastructure on rural agricultural development is assessed. Rural Agricultural Development (RAD) is considered an important part of Rural Development. RAD is assessed (in this thesis) in the light of the following variables: increased farm size, farmers' choice of improved varieties of crops for cultivation (ie. food crops, fruit crops, and vegetables), availability of labour and utilization, farmers' use of fertilizer and agro-chemicals, increased crop yield, farmers ability or willingness to diversify their farms, and farmers ability to get their produce to the market. In diverse ways and at different levels, road infrastructure either in good, fair or poor shape exert influence on agricultural development. An improvement of road transport infrastructure would alleviate the negative effects of distance on farmer's productivity and make farming more attractive (Kassali, 2006). Poor road network increases production costs through transportation, reduces farmer's access to labour and income and an increase in the incidence of speculators at marketing stage meaning a reduced farm gate price and this makes the rural farmer more vulnerable (Upton, 1997). Distance and quality of road infrastructure matters as it reflects the cost of time and an increase in transport fare that reduces trade volume (World Trade Organization, 2004). Better access to an all-weather road contributes to more intensive use of labor, fertilizer, agro-chemicals and improved use of modern implements (Tanko, 2013). Rostow (1960) argues that

expansion and improvement of the transport and the infrastructure is considered as a necessary pre-condition for capital formation and increase in the production and productivity. Thus road infrastructure influence the loading of goods and passengers, number of trips made by vehicles per day, travel cost and time as well as the type of vehicles that ply the road and these in turn influence agricultural production and productivity.

It is important to draw attention here that other factors affect or exert influence on rural agricultural development. Factors such as deep rooted beliefs, orientations and practices of farmers, the prevailing land tenure system, other rural infrastructure, and institutions such as the banking or financial sector and credit facilities are identified however the study shied away from exploring them.

Figure 2.1: Conceptual Framework on influence of road condition on rural agricultural development.





Source: Author's construct based on various literatures, July 2014

2.10 Summary

The agricultural sector is the most important in developing countries and more so in sub-Saharan Africa. Rural agricultural development (RAD) in Ghana is faced with a myriad of challenges; from climate change effects to weak technology, poor access to funds to processing and storage problems, and from poor access to market to poor road

infrastructure inhibiting transportation of input and output of farmers resulting in high post harvest losses. Lingaitiene (2006) writing on the topic “The Analysis of Road Infrastructure Development Financing in Lithuania” states as follows: “Wellrun and effective transport is not only the service creating high value, but also the necessary preconditions of the successful development of other fields of economy and of the quality of human well-being. Road infrastructure is one of the fundamental factors predetermining the efficiency of transport activities.” Agricultural development as well as other sectors of the rural economy is thus fundamentally influenced by road transport infrastructure and services. Road maintenance is crucial for transport especially in our part of the world where most of the roads are very narrow and untarred and their safety which is an important indicator to the performance of road infrastructure, and which is one of the most important issues that planners look at when evaluating road conditions and selecting projects to improve road infrastructure, can not be guaranteed.

Rural areas in Ghana are mostly spatially dispersed, which affects the costs of transport, the quality of public services, and the reliance on subsistence production.

Ghana’s rural areas have good agricultural potential but lack the infrastructure to integrate into the wider economy. Two dissenting views come out discussing agriculture and road transport infrastructure. In some circles of research it has been argued that there is no or little evidence to suggest that rural agricultural development is adversely affected by road transport infrastructure. The argument is that good road infrastructure rather serves as a catalyst for rural labour to drift to urban agglomerations. The issues of rural economies of scale stemming from diversification of agriculture and agriculture related industry and businesses as a result of good road infrastructure have not been well catered for. The discussions have centered on increase in food production which agricultural development includes and goes beyond to cover other areas of the agricultural sector. Other researchers have found explicit evidence to suggest that rural agriculture is highly influenced by road transport infrastructure. They cite linkages to market, supply of input, transfer of technology, fertilizer application and safety of farm produce to the market as some of the issues that come up.

In this thesis, road transport infrastructure is mainly reviewed in terms of the extent and condition of the functional infrastructure for road transport. The term road network is used more or less as a synonym for road infrastructure. Rural population would benefit more if there were an extensive network of rural roads in good condition. In essence,

the basic problem of many rural areas is the lack of all-weather roads, non-availability of motorised vehicles, consequent isolation and poverty. Large populations are impeded from entering markets and basic services in the absence of adequate roads, and this is a major obstacle for the development of agriculture in those rural areas.

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CHAPTER THREE

THE STUDY AREA PROFILE AND RESEARCH METHODOLOGY

3.1 Introduction

This section describes the procedures used for the study. It describes in detail the profile of the study area (location and size, climate, topography and demographic characteristics), study type and design, data collection techniques and tools, study area, and study population. It also explains sampling techniques, sources of data, data collection instruments, data processing and analysis.

3.2 Profile of the study area

3.2.1 Location and size

The study was conducted in the Jaman South district of the Brong Ahafo Region. The Jaman South district is one of the twenty two (22) administrative districts in Brong Ahafo Region of Ghana. The Jaman District was established by the LI 1376 of 1988 and was calved out of the then Berekum District. By the LI 1777 of 2004, the Jaman District was further subdivided into Jaman South and Jaman North districts (GSS, 2010). The Jaman South District, where the study took place, has a total land area of 798 square kilometres. It shares common borders with Berekum Municipal to the south-east, Jaman North District to the North, Dormaa Municipal to the south and La Cote d'Ivoire in the west with Drobo as its capital. (JSDA, 2010).

3.2.2 Climate

The district lies within the wet semi-equatorial region, with a mean annual rainfall ranging between 1,200 -1,780mm and a double maxima rainfall pattern. The district has its major rainy season from April to June whiles the minor rains are from September to October. The month of August experiences a short dry season, with the prolonged one in the months of December to March. The average annual temperature is about 25°C. Relative humidity is also generally high between 70% and 80% during the rainy season (JSDA 2010).

3.2.3 Topography

The relief of the district is undulating and rises between 150 and 600 meters above sea level. The highest hills are located near Drobo, Bodaa, in the Southern and North

eastern parts of the district. There are two major types of vegetation in the district. These are the semi-deciduous forest and savanna woodland. The geological features together with vegetation influence give rise to two distinct soils. These are the forest ochrosols and the savanna ochrosols. The different soil types support different agricultural production (JSDA 2010). The district has five major transportation routes namely; Atuna, Kwamesekrom, Miremano, Zezera and Kofiko-Nsuansa. The study was conducted among farmers and transport operators along these five routes.

3.2.4 Demographic Characteristics

The district has 123 settlements, predominantly rural and the population of the district is estimated to be 92649 with slightly above a quarter (27.1%) of the population of the district living in urban areas, while the nearly remaining three quarters (72.9%) lives in the rural areas (GSS, 2010). Male population constitute about 47 percent while females constitute the remaining 53 percent. Ages between (0 -14) years constitute about 41 percent of the total population, while those 65 years and above constitute about only five percent of the entire population. Over half of the population is within the active age group (15-64), (JSDA 2010).

The district was selected for the study because of certain characteristics of interest. First, it has a very high rural population who are predominantly smallholder farmers. Secondly, the rural population in the area are faced with a myriad of challenges including transportation. Feeder roads and access roads connecting rural communities impinge on transportation of people and goods. It is therefore imperative to investigate in what ways transportation infrastructure influence the very economic activity of the rural people which is agriculture.

3.3 Research design

A cross-sectional design was used in assessing the influence of road transport infrastructure on agricultural development in the Jaman South District. A cross sectional view of farmers' and transport operators' perspective on the influence of road transport infrastructure on rural agricultural development were examined.

3.4 Sources of Data

Primary and secondary sources of data were used for the study. Primary data were collected from farmers and drivers using interview schedule. In-depth interviews with

the District Feeder Roads Engineer and key informants at the District Agricultural Office were also conducted. Secondary data was gathered from the District Agricultural Development Unit, the District Medium Term Development Plan (2010-2013), books, related research works and other relevant publications.

3.5 Study Population

The study population comprised rural households that are farmers and also transport operators (drivers) who ply the five main transportation routes in the District. The study also included staff of the District Agricultural Unit and also involved the district feeder roads engineer.

3.6 Sampling Methods and data Collection

Communities were sampled first. Out of the 117 rural communities in the area 30 were purposively sampled based on certain peculiar interest they presented such as being on a main road or far from a main road, the predominant crop produced in the community, proximity or otherwise to an urban community among others. Multi-stage random sampling technique was used to draw samples for the study. Firstly, the study area was stratified into five zones based on the five major transport routes linking the district capital comprising Drobo-Adamsu-Zezera, Drobo-Atuna, Drobo-Miremano, Drobo-Kwamesekrom, and Drobo-Kofiko-Nsuansa. The following samples were drawn from each of the five routes for the study based on the proportion of 11:5:7:4:3 respectively.

With an estimated rural farmer household population of about 12,588, a sample size of 387 households was used. This was arrived at using the mathematical formula below to compute it.

$$n = \frac{N}{1 + N(\delta)^2}$$
 Where, n = Sample size, N = Sample frame, 1 = Constant, δ is margin of error.

Thus N = 12588 and $\delta = 0.05$

For each sampled community a minimum of six (6) households were randomly selected (without recourse to population size of communities since there was no available data) to make the total sample size of 387 households from which relevant data were obtained. In order to obtain data for the study, structured questionnaire were administered randomly to household heads and these were completed through interview schedules by the researcher as well as enumerators (research assistants) hired and

trained for this purpose. Data collected included agricultural development data, labour use, produce prices, availability of rural roads, road quality, composition and nature of other road infrastructure, access to markets, and level of household farm income. Key informants from the District Agricultural Unit with in-depth knowledge on the nature of rural agricultural development in the District made up of two (2) District Agriculture Development Officers and three (3) Extension Officers were purposively sampled to establish their views on the influence of road transportation infrastructure on rural agricultural development.

Furthermore, transport operators (drivers) belonging to the local Ghana Private Road Transport Union (GPRTU) were sampled. Again using the mathematical formula (shown below), 84 drivers were sampled for the study with driver population of 107 who ply the five routes.

$$n = \frac{N}{1 + N(\delta)^2}$$
 Where, n = Sample size, N = Sample frame, 1 = Constant, δ is margin of error.

Thus N = 107 and $\delta = 0.05$

Through structured questionnaire their views were sampled to assess the state of road transport infrastructure in the district and how their operations impinge on rural agricultural development. The District Feeder Roads Engineer was also interviewed to get a clearer picture of the nature of road transport infrastructure in the district.

The road transport infrastructure variables measured within the study area included; accessibility index of nodes, length of roads in sample areas, percentage of paved and unpaved roads in sample areas, road quality rating, kilometers of paved and unpaved surface roads per population. The survey was conducted between January and August, 2014.

Table 3.1: Distribution of Sample Frame and Sample Size

Item	Population	Sample Size
Farmer Households	12,588	387
Drivers	107	84
Institutions:	District Agriculture Unit	
	District Feeder Roads Department	

3.7 Methods of Data collection

Both quantitative and qualitative methods were used in collecting data for the study. For the quantitative method structured questionnaire was used among sampled farmers selected from 30 communities along and around the five major transportation routes in the District. Qualitative method used was the in-depth interview. Staffs from the District Agricultural Unit and the District Feeder Roads Engineer were interviewed to ascertain their views in detail, factors challenging rural agricultural development in relation to road transport in the Jaman South District.

3.8 Instruments for data collection

Interview schedule (Appendix 1) was used to collect information from a sample of farmers selected from the sampled 30 communities around and along the five main transportation routes in the District. The interview schedule was chosen because it made it possible to obtain information from most of the respondents who were illiterate and offered high response rate. Interview schedule was also conducted using interview guide (Appendix 2) to obtain detailed information on how road transport infrastructure influence development of rural agriculture. In depth interviews were used to solicit the views of the agriculture officers and the feeder roads civil engineer in the district (Appendices 3 and 4 respectively).

3.9 Data processing and analysis

Statistical Package for Social Science (SPSS) Version 16 was used to analyse quantitative data obtained from the respondents. Descriptive statistics (frequency and percentages) were used to summarise the data gathered from the respondents. Summaries of data analysed were presented using tables and graphs. The Pearson Chi-Square was also employed in the analysis. It is a tool used in estimating the statistical significance of associations between variables. The chi-square was used to determine whether or not two attributes were associated. The chi-square was not used as a measure of the degree of relationship or the form of relationship between two attributes but to determine the significance of such relationship. Qualitative data analysis and description was used to explain the meaning and implication of data analysed. Qualitative data from the field were also analysed using the qualitative method of data analysis.

CHAPTER FOUR ANALYSIS OF DATA FROM THE FIELD ON CONDITION OF ROAD AND RURAL AGRICULTURAL DEVELOPMENT

4.1 Introduction

The chapter describes and analyses the various salient features addressing these issues from the perspective of farmers, drivers, agriculture officers and the district feeder roads engineer. The analysis was done in four sections; bio-demographic analysis of farmers, nature of road transport infrastructure in the district, nature of agricultural development in the district and the influence road infrastructure has on agricultural development in the district. The analysis was done primarily in both qualitative and quantitative terms. The combination of the two approaches gave the impetus to critically examine the views expressed by the various categories of respondents and to help present clearly data gathered from the field. The summaries of analyses were presented using tools and techniques of analysis such as tables, graphs, the chi square, frequency and percentages. The chapter assesses the implications of the empirical findings for the existing literature on transportation influence on agriculture.

4.2. Socio-Demographic Data of Farmers

Table 4.1 presents the socio-demographic characteristics of farmers.

Table 4.1: Socio-demographic data of farmers

Item		Frequency	Percentage
Gender:	Male	189	48.8
	Female	198	51.2
	Total	387	100
Educational Level:	No formal edu.	155	40.1
	Basic	184	47.5
	Secondary	44	11.4
	Tertiary	4	1.0
	Total	387	100
Age	Below 30	24	6.2
	30-39	52	13.4
	40-49	76	19.6
	50-59	159	41.1
	60 and above	76	19.6
	Total	387	100
Household size:	Below 4	26	6.7
	4-6	75	19.2
	7-9	232	59.9
	10-12	48	12.4
	13 or more	6	1.6
	Total	387	100

Source: Field Survey, July 2014

Data gathered from the field (Table 4.1) reveal that there are more female-headed household farmers (51.2%) in the area than male-headed households (48.8%). The household heads make decisions about the land use and what type of crop(s) are cultivated, marketing and where to market produce. The female dominance in the agriculture sector in the district reflects the critical role women play in increasing agricultural productivity, enhancing food security and improving nutrition as indicated by Nelson and Swindale (2013). The average household size in the area falls within a range of 7 to 9 persons which is higher than the national average of 5 (GLSS, 2008; GSS, 2012). This implies high endowment of physical capital in the form of family labour for food production (Pender and Gebremedhin, n.d). Education plays a big role in development including agricultural development.

The field survey reveals that a huge majority (87.6%) of smallholder farmers in the district either had no formal education or dropped out at basic level (Table 4.1). This suggests that the more educated people in the area do not find agriculture a lucrative venture and therefore hardly engage in farming.

Table 4.1 indicates that 60.7% of farmers in the area are aged 50 and above. The data revealed that majority of smallholder farmers are becoming aged and that less numbers of people who are below 40 years (19.7%) are engaged in farming. This phenomenon can have effect on the number of man hours spent on the farm as well as the farm size a farmer could cultivate. Efforts must therefore be made to encourage more young people to enter into Agriculture in the District.

4.3 State/Nature of Roads in the Area

In order to critically assess the nature of roads in the area, views from farmers and drivers who ply the routes were sought. Their responses were then aligned to a technical response from the District Feeder Roads Engineer. The study reveals that there is a total of over 478 kilometers of road network connecting communities in the area of which 210 kilometers are engineered. This indicates that there are adequate roads linking communities in the area. The study reveals that the condition of roads is generally poor. It was revealed that 50.9% and 58.3% of farmers and drivers respectively see road infrastructure as poor while 35.1% and 34.5% of farmers and drivers respectively see it as fair and only 14% and 7.1% of farmers and drivers respectively see road infrastructure in the area as generally good (table 4.2). This finding was similar to a

2012-2013 report by JSDA which indicated that out of about 478 kilometers of road network in the district, less than 45 % is classified as “good” which are mostly urban areas. This implied that road infrastructure in rural Ghana are generally in bad conditions and negatively affect road transportation.

Table 4. 2: Physical Condition of road surface connecting community

Respondents	Response	Frequency	Percentage
Farmers:	Poor	197	50.9
	Fair	136	35.1
	Good	54	14
	Total	387	100
Drivers	Poor	49	58.3
	Fair	29	34.5
	Good	6	7.1
	Total	84	100

Source: Field Survey, July 2014

On the type of road connecting communities to the nearest urban market, 329 (85%) of farmers responded that they reside in communities connected to the nearest urban market by unpaved road and 58 (15%) indicated that their communities were connected by paved road to the urban market. This was consistent to Gollin (2012) who made the point that roads in rural communities are poor and rural connectivity is very low. He intimated that evidence suggests that in many countries of sub-Saharan Africa only about 20-40% of rural areas are accessible by roads and that, of the existing rural roads, 60% are in poor condition and only 3% paved. This was shown in table 4.3. This meant that road infrastructure in the rural are not easily accessible during the raining season.

Table 4.3: Type of road that connects community to nearest urban market

Type of road that connects community to nearest urban market	Frequency	Percentage
Unpaved	329	85
Paved	58	15
Total	387	100

Source: Field Survey, July 2014

On the issue of estimated farm distance from the community to the nearest main road or nearest market in kilometres, it was found out that 64.2% of the farmers estimated that the farm distance from their community to the main road was about 2-3 km, 20.7% of the farmers also indicated that the distance between their community to the main road or nearest market was less than 2km, 13.5% indicated 4-5km whereas 1.6%

indicated that the farm distance was 6 to 7 km (Table 4.4). The analysis revealed that, the average farm distance from the community to the main road or nearest market was approximately 2.5km. The average farm distance of 2.5km is long enough to be paved in order to facilitate easy movement of farm produce especially during raining season.

Table 4.4: Estimated farm distance from community to the nearest main road

Farm distance from community to the nearest main road	Frequency	Percentage
less than 2km	80	20.7
2-3km	248	64.2
4-5km	52	13.5
6-7km	7	1.6
Total	387	100.0

Source: Field Survey, July 2014

In terms of means of getting farm produce to market, it was observed that the most common means of transporting farm produce was by head portorage as indicated by 27.4% of farmers. It was further observed that other means of transporting farm produce were by the use of tricycle (26.9%); bicycle or motorcycle (18.1%); minibus (12.1%); taxi (10.3%) and truck (5.2%) as shown in Table 4.5. The high incidence of the use of head portorage as the means of transporting farm produce can be attributed to the fact that road network in Ghana is inadequate, especially in rural areas, coupled with the general lack of feeder roads over which agricultural products can be transported. This is consistent with Easterling et al., (2008) who asserted that most smallholder farmers must carry their products as head loads to the nearest road before they can be transported to market due to their remote locations and poor roads leading to their farms.

Table 4.5: Means of getting farm produce to market

Means of getting farm produce to market	Frequency	Percentage
Head Portorage	106	27.4
Bicycle Or Motorcycle	70	18.1
Tricycle	104	26.9
Taxi	40	10.3
Minibus	47	12.1
Truck	20	5.2
Total	387	100

Source: Field Survey, July 2014

In estimating the total number of trips made by farmers in a day from their communities to the Drobo Market, it was found that 27.6% of farmers indicated 6 to 10 trips a day, 24.8% said vehicles embarked on 11 to 15 trips a day, 23.8% revealed drivers made 1-

5 trips a day, 13.4% responded vehicles made 16-20 trips, whereas 10.3% said vehicles made more than 20 trips in a day to the Drobo market. The analyses revealed that the average number of trips made by vehicles to the respective communities to the main Drobo market according to the farmers was approximately 11 trips. However, 41.7% of drivers interviewed indicated that they made more than 20 trips a day, 31% made more between 16 to 20 trips a day, 15.4% made between 1 to 5 trips, 7.1% made between 6 to 10 trips a day, whereas 4.8% made between 11 to 15 trips in a day. This analysis is seen in Table 4.6. It was observed that, whereas in the farmers' view vehicles made an average of 11 trips a day, the drivers indicated they made an average of 17 trips a day.

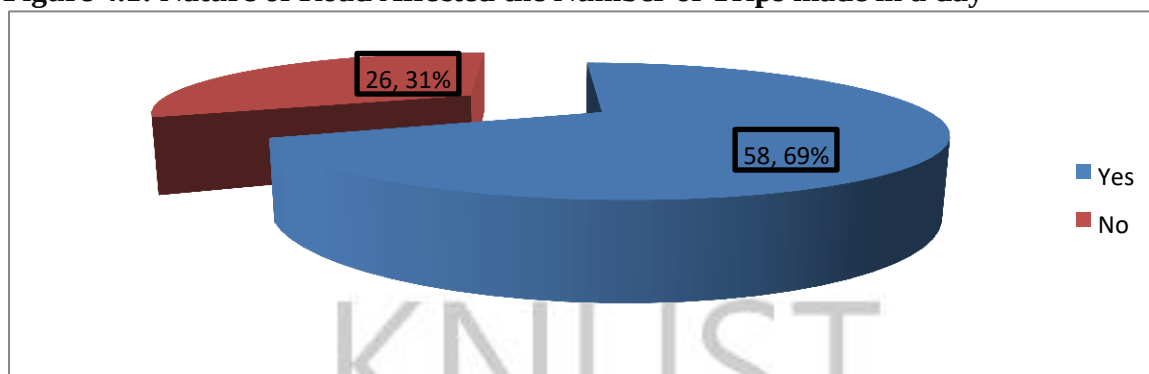
Table 4.6: Estimated total number of trips made by vehicles per day

Respondents	Response	Frequency	Percentage
Farmers:	1-5	92	23.8
	6-10	107	27.6
	11-15	96	24.8
	16-20	52	13.4
	Above 20	40	10.3
	Total	387	100.0
Drivers	1-5	13	15.5
	6-10	6	7.1
	11-15	4	4.8
	16-20	26	31.0
	Above 20	35	41.7
	Total	84	100.0

Source: Field Survey, July 2014

The frequency of trips is useful in assessing the overall impact of road infrastructure on agriculture. Leinbach (1981) opined that improvement of transport services is a common result of road rehabilitation. Based on the statement above, the researcher asked the drivers whether nature of infrastructure influence number of trips they made in a day. The responses obtained is shown in figure 4.1

Figure 4.1: Nature of Road Affected the Number of Trips made in a day



Source: Field Survey, July 2014

Figure 4.1 showed that 69% of drivers indicated that the nature of road affected the number of trips they made in a day, whereas 31% indicated that the number of trips made in a day was not influenced by the nature of roads. Going by the majority of the responses, it can be concluded that the number of trips made by drivers in a day was influenced by the nature of the roads. This was consistent with the findings of Leinbach, (1981). Various reasons were given by the drivers concerning how the nature of road influenced the number of trips that were made in a day. One respondent indicated that *“Because the road is good, a lot of cars ply on it and this reduces trips an individual driver makes per day.”* Another also indicated that *“If the road is good, drivers are able to go as many trips provided passengers are available and can take normal load.”* Another driver also said that *“When the road is bad you go through the mud, potholes and wind down to the communities and back it will be late and you cannot get a lot of trips but when the roads are good you can ply different routes and get more trips.”*

One driver who indicated that the nature of road did not influence the number of trips he made in a day indicated that *“The number of trips made in a day depends on the availability of passengers and load and also the number of vehicles that ply the road.”*

Table 4. 7: Cross tabulation between nature of road and travel time in hours

			Estimated travel time to Drobo in hours		Total
			Less than 1 Hour	1-2 Hour	
Type of road that connects community to nearest urban market	Unpaved	Count	205	124	329
		% of Total	53.0%	32.0%	85.0%
	Paved	Count	58	0	58
		% of Total	15.0%	.0%	15.0%

Total	Count	263	124	387
	% of Total	68.0%	32.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2sided)
Pearson Chi-Square	32.167 ^a	1	.000
Likelihood Ratio	49.496	1	.000

Source: Field Survey, July 2014

A cross tabulation analysis of the relationship between the type of road that connects community to nearest urban market and the estimated travel time to Drobo in hours revealed that, 68% of farmers spent less than 1 hour to travel to Drobo, whereas 32% spent about 1 to 2 hours to travel from their respective communities to the Drobo (Table 4.7). The analysis further revealed that the type of road connecting the communities to the market had a significant relationship with the estimated travel time to Drobo. This was indicated by a Chi square value ($X^2=32.167$), $p=0.00$ establishing a strong relationship between the type of road and the estimated travel time. It was found that, farmers who used paved road to travel used lesser travel time than those who used unpaved roads.

In assessing how road infrastructure influenced how drivers load passengers and goods, it was observed from Table 4.8 that road infrastructure highly influenced how the drivers load passengers as indicated by 65.5% of drivers, 15.5% indicated that the road infrastructure did not affect how they loaded goods and passengers whereas 19% said road infrastructure sometimes affected how loads and passengers were loaded.

Table 4.8: Road Condition Influenced How Drivers Load Passengers and Goods

Road condition influenced how drivers load passengers and goods	Frequency	Percentage
Highly	55	65.5
Sometimes	16	19.0
No	13	15.5
Total	84	100.0

Source: Field Survey, July 2014

Table 4.9 shows that an improvement in road infrastructure would change the number of trips and loading pattern of drivers. This was indicated by 78.6% of drivers who said that there would be much change in the number of trips, loading patterns and charges

when the roads are all-season roads. Only 2.7% of drivers felt there would not be change at all, whereas 14.9% believed such change would not be that much. Going by the majority of the responses, it can be concluded that, an improvement in the road infrastructure would change the number of trips, loading patterns and charges.

The study went further to enquire how the physical conditions of the roads affected the operations of drivers in the district. It was indicated that poor road “*reduce number of trips per day*” indicated one driver. Another also responded that they are “*Unable to load a lot of farm produce because car gets stuck in the mud and spoils engine, or the base of car drag, sometimes spoiling the fuel tank due to poor roads.*”

Some also indicated that when it rains drivers are heavily unable to go to the communities to pick passengers and farm produce. This can take up to a week when the rains are continuous. In this case, only few strong trucks are able to take the risk to go there which adversely affect agriculture production in the area. Due to poor road, few vehicles ply route and sometimes drivers overload because there would not be any vehicle to pick passengers and produce. Similarly, one driver indicated that “*Broken bridges make it impossible to ply road when it rains heavily.*” In this regard, farmers have to pay a lot for few produce drivers are able to take due to difficulty in plying road. Nonetheless, a truck driver indicated that when the road is good, a driver “*Can go to the communities at any time even in the night provided there are passengers or goods.*”

Table 4.9: Effect of improved road condition on the number of trips, loading pattern, and/or charges (Views from Drivers)

	Frequency	Percentage	Cumulative Percent
Very much	23	27.4	27.4
Much	43	51.2	78.6
Not much	14	16.7	95.2
Not at all	4	4.8	100
Total	84	100	

Source: Field Survey, July 2014

4.3.1 Road Infrastructure improvement in Jaman South District

An interview with the feeder roads civil engineers revealed that, maintenance of roads in the district are carried out 2 times a year on most of the inter district roads and the connectors but it can take 1 to 2 years to officially carry out maintenance works on most

of the access roads which are minor feeder roads. This response was juxtaposed with the responses of the farmers shown in Table 4.10.

Table 4.10: Frequency of road maintenance (Views of Farmers)

Frequency of road maintenance	Frequency	Percentage
Twice a year	24	6.2
Once a year	100	25.8
Once in 2 years	51	13.2
Once in 3 years	122	31.5
Once in 4 years or more	90	23.3
Total	387	100

Source: Field Survey, July 2014

Table 4.10 established that 31.5% of farmers indicated that road maintenance in the district took place once in three (3) years, 25.8% of farmers indicated that road maintenance took place once a year, 23.3% indicated maintenance took place once in 4 years or more, 13.2% indicated that maintenance work occurred once in two years. However, only 6.2% of farmers indicated that maintenance work occurred twice a year on the road connecting their community. This finding revealed that road maintenance work at Jaman South District was not very frequent and not done on regular bases.

Road maintenance is crucial for transportation especially in rural areas where the roads are very narrow and untarred and their safety cannot be guaranteed. Road maintenance is essential in order to preserve the road in its originally constructed condition and provide efficient, convenient travel along the route.

The feeder road engineer indicated that the irregular nature of road maintenance was because *“rehabilitation is done when funds are available and this did not happen often.”* The unavailability or inadequacy of funds to the district’s feeder roads department contributes to the low rate of road rehabilitation in the district. The last time new feeder roads were constructed was about 5 or 6 years ago as indicated by the Feeder road civil engineer. In choosing which road to construct or rehabilitate, the feeder road civil engineer indicated the following:

- i. Patronage (usage) of road; where a road has average daily traffic (ADT) of more than 50 is considered high and less than 50 is considered low;
- ii. Amount of food or crops produce in the area and the potential of agriculture in the area; and

iii. Priority of assembly members and the district assembly.

In the short to medium term, the Feeder road department will continue to put roads in good shape, indicated the district engineer. The program for the department is to construct and maintain every road to connect every community in the district. In implementing the plans and programmes of the department, several challenges are encountered. Some of the challenges in improving road infrastructure are summarized below:

- i. Capital intensive (equipment);
- ii. Labour intensive (require more hands for construction and maintenance); and
- iii. Technology to maintain the road is not available to the local people so that they could take their own initiative.

4.4 Association between Road Condition and Travel Cost to Drobo

In estimating the cost of travel to Drobo, it was established that 43.7% of farmers considered the travel cost to be high. Out of those who considered the travel cost to be high 38.5% travelled on unpaved roads whereas 5.2% travelled by paved road. Similarly, out of the 32.0% farmers who considered the cost of travel to be very high, 31.5% used unpaved road whereas 0.5% used paved road. It was further found that 24.3% of farmers considered the travel cost to Drobo to be moderate as shown in Table 4.11. This indicated that, the cost of transportation was highly influenced by the nature of road used as revealed by a Chi Square value X^2 (df=2) of 58.817, and $p=0.000$. It is therefore expected that, paving the road networks in the district will among other things reduce the travel cost from the various communities to the Drobo market.

Table 4.11: Cross tabulation between type of road and travel cost to Drobo

			Travel cost to Drobo			Total
			Moderate	High	Very high	
Type of road that connects community to nearest urban market	Unpaved	Count	58	149	122	329
		% of Total	15.0%	38.5%	31.5%	85.0%
	Paved	Count	36	20	2	58
		% of Total	9.3%	5.2%	.5%	15.0%
Total		Count	94	169	124	387
		% of Total	24.3%	43.7%	32.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2sided)
Pearson Chi-Square	58.817 ^a	2	.000
Likelihood Ratio	58.512	2	.000

Source: Field Survey, July 2014

Easterling et al., (2008) indicated that underdeveloped rural roads in Ghana have led to high transport costs for agricultural products to the market as well as of farm inputs. Rising transport costs affects both output and input prices. With regards to the statement above, the researcher enquired about the cost of transporting a 50kg sackfull load of farm produce to Drobo market.

Table 4.12: Cross Tabulation between Estimated travel distance from community to Drobo and Estimated cost of transporting a 50kg sackfull load of produce to Drobo market

			estimated cost of transporting a 50kg sackfull load of produce to drobo market					Total
			less than 2 cedis	2-4 cedis	5-7 cedis	8-10 cedis	above 10 cedis	
Estimated travel distance from community to Drobo	less than 5km	Count	4	17	16	12	16	65
		% of Total	1.0%	4.4%	4.1%	3.1%	4.1%	16.8%
	5-9km	Count	0	10	54	48	26	138
		% of Total	0%	2.6%	14.0%	12.4%	6.7%	35.7%
	10-14km	Count	0	4	22	36	42	104
		% of Total	0%	1.0%	5.7%	9.3%	10.9%	26.9%
	15 or more	Count	0	4	22	36	42	104
		% of Total	0%	1.0%	5.7%	9.3%	10.9%	26.9%

Total	Count	0	2	18	28	32	80
	% of Total	0%	.5%	4.7%	7.2%	8.3%	20.7%
	Count	4	33	110	124	116	387
	% of Total	1.0%	8.5%	28.4%	32.0%	30.0%	100.0%

Source: Field Survey, July 2014

The analysis from table 4.12 revealed that, 32% of farmers spent 8 to 10 cedis to transport a 50 kg sack full of produce to Drobo market over a distance of between less than 5 kilometers and 15 kilometers, 30% spent above 10 cedis to transport 50 kg sack-full load of produce to the Drobo market, 28.4% spent 5 to 7 cedis, 8.5% spent 2 to 4 cedis, whereas only 1% spent less than 2 cedis. The table revealed that, the further the distance from the Drobo market, the more costly it was to transport farm produce to the market. These gave an indication that, the cost of transporting farm produce to the Drobo market is directly related to the distance from the farm to the market.

4.5 The Nature of Rural Agriculture Development in Jaman South District

The nature of rural agriculture can best be described based on the agriculture practices that are used. Rural agriculture uses rudimentary equipments and labour intensive. Crop production is not on a large scale and constrained by infrastructure challenges.

The problems of post harvest losses especially for fruits and vegetables influence the type of crops that are cultivated by the rural farmers. It is noted that the most common crops cultivated in Jaman South District are Yam, Cassava, Plantain, Cocoyam, Maize, Pepper, Garden Eggs, and Citrus. The district is however noted for the production of three key cash crops: cocoa, cashew and oil palm.

Aside the cash crops which have a ready market, the farmers have to find the means of selling the food crops to the retailers. The sale takes place at three different places: farm gate (where the retailers travel to the farm to buy the farm produce at a relative lower price); local community market; or secondary market at Drobo (where the farmers transport the farm produce to the main district market to sell to retailers at a relative higher price). The price charged for the same farm produce differs in relation to location in which the sale is made.

Table 4.13 shows the prices of farm produce at the respective locations. It was found that the prices of the farm produce at the farm gate for each produce was generally cheaper and increased progressively as the farmer moves to the secondary market at Drobo. The average price for a bag of maize was 55 cedis at the farm gate and increased to 60 cedis at the local market. However, the average price of a bag of maize increased by 45% to 100 cedis at the secondary market. The difference in distance from the various communities to the main Drobo market and nature of roads connecting the communities accounted for the variation in prices. This implied that the price of farm produce increases further away from the farm gate towards the secondary market.

It was also observed from Table 4.13 that the average price of a bag of cassava increased by 150% from 9 cedis at the farm gate to 22.5 cedis at the Drobo market. The average price of a basket of cocoyam, increased by 96.4%, from 14 cedis at the farm gate to 27.5 cedis at the Drobo market. Similarly, the average price of a 100 tubers of yam increased by 110%, from 50 cedis at the farm gate to 105 cedis at the Drobo market. The same can be seen of the averaged price of rubber of pepper and bunch of plantain which increases by 16.3% and 200% respectively. Where the farm produce were sold had significant impact on the price of the produce. When produce are sold at the farm gate, farmers receive less income from their farms and could negatively affect their livelihood and the rural economy as a whole.

Table 4.13: Cost of Selected Produce at Various Sales Points

Crop Type	Point of Sale	Price of Farm Produce (GH ¢)		Average Price (GH ¢)
		Min Price	Max Price	
A bag of maize	Farm Gate	50	60	55
	Local Market	50	70	60
	Secondary Market (Drobo)	80	120	100
A bag of Cassava	Farm Gate	8	10	9
	Local Market	9	12	10.5
	Secondary Market (Drobo)	20	25	22.5
A basket of Cocoyam	Farm Gate	12	16	14
	Local Market	14	20	17
	Secondary Market (Drobo)	25	30	27.5
100 Tubers of Yam	Farm Gate	40	60	50
	Local Market	50	70	60
	Secondary Market (Drobo)	80	130	105
A rubber of dried Pepper	Farm Gate	--	--	--
	Local Market	18	25	21.5

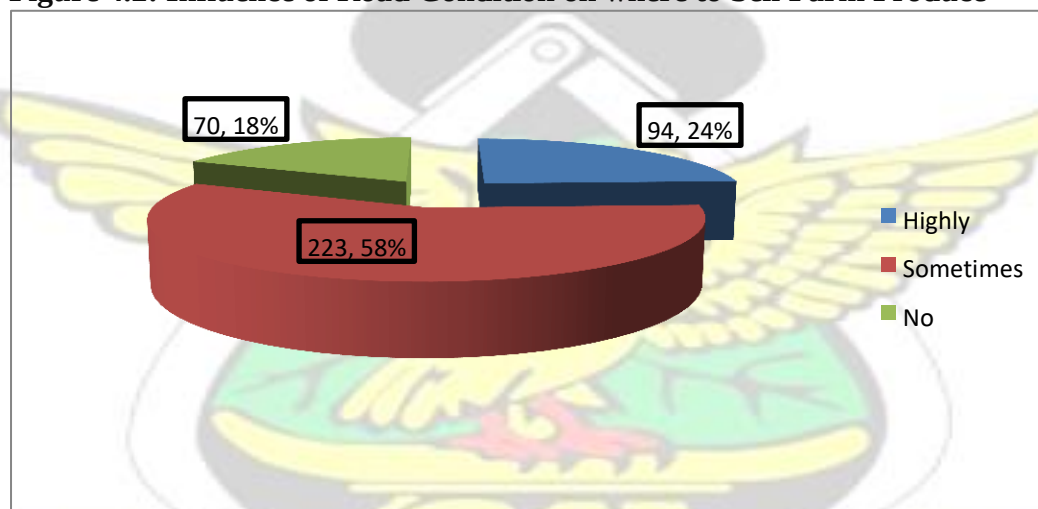
	Secondary Market (Drobo)	20	30	25
A bunch of Plantain (apuntu)	Farm Gate	2	3	2.5
	Local Market	3	5	4
	Secondary Market (Drobo)	5	10	7.5

Source: Field Survey, July 2014

4.5.1 Influence of Road Condition on where to Sell Farm Produce

Figure 4.2 shows the extent to which road transport infrastructure influence where farmers sell their produce. Figure 4.2 established that 58% of farmers indicated that road infrastructure sometimes influenced their decision on where to sell their farm produce; 24% indicated that road infrastructure highly influenced their decision on where to sell, whereas 18% of farmers indicated that, road transport infrastructure had no influence on where to sell.

Figure 4.2: Influence of Road Condition on where to Sell Farm Produce



Source: Field Survey, July 2014

The farmers who indicated that road infrastructure highly influenced where they sold their produce indicated that: “Drivers do not want to load produce because they fear their vehicles will stuck in the mud or the base will drag or spoil their vehicles and so farmers sell at the local community market” reported one famer; another indicated that “farmers do not get vehicles coming to community often and so have no means of transporting produce to the market outside”.

Those who indicated that road infrastructure sometimes influenced where they sold their produce indicated that “It is too expensive to transport produce to market outside the

community during rainy season, but it becomes less difficult and moderate to transport farm produce during dry season” reported one farmer. It was also identified that “When the rains stop and vehicles are able to ply road without getting stuck in the mud. Produce are sent to market outside community”. Another farmer also reported that “price differentials sometimes determine where produce are sold and not road infrastructure”

The farmers who said No, indicated that they “ do not produce so much and therefore able to carry produce to local community market without difficulty”; and “buyers do not often pay up front or early when they buy from the farm gate and so prefer to sell in the big market at Drobo.”

4.5.2 Influence of Nature of road on choice of crops

Table 4.14 established that the nature of road highly influenced the type of crops that were cultivated by the farmers in Jaman South District. This was indicated by 62.5% of all the farmers who said their choice of crops were influenced by the type of road infrastructure, 26.1% indicated that the nature of road infrastructure sometimes affected their choice of crop whereas 11.4% indicated the nature of road did not affect their choice of crop at all.

The finding establishes that road transport infrastructure has a huge positive influence on rural agriculture due to the realities of enhancing several linkages to the non-farm sectors of an economy. Rigg, Asnan, and Trankell (1993) for example conclude that roads provide market opportunities that allow villagers to escape from subsistence agriculture. Benzinger (cited in Felloni et al., 2001) opines that road density and distance to the nearest cities positively affect the production of fertilizers per unit of land, machinery power per worker, as well as productivity of labour and land. Roads enable the transport of bulky agricultural inputs and cash crops.

Table 4. 14: Influence of Nature of road on choice of crops

Influence of nature of road on choice of crops	Frequency	Percent
Highly	242	62.5
Sometimes	101	26.1
No	44	11.4
Total	387	100.0

Source: Field Survey, July 2014

A cross tabulation analysis between the nature of road that connects the community to the nearest urban market and type of seed or planting material used was necessary to assess the extent to which these two variables are related. It was established that 93.8% of farmers used local seeds or planting material used. It was further observed that, out of the total number of farmers who used local materials, 81.9% were connected by unpaved road to the nearest market whereas 11.9% were connected by paved road to the nearest market. Table 4.15 also shows that only 6.2% of respondents used improved or certified seeds or materials. This underlines the fact that farmers in Jaman South preferred local seeds and planting materials to improved seeds and materials for agriculture cultivation and this can have a negative effect on crop yield and quality of produce affecting output of farmers.

A chi square analysis of Table 4.15 also established a significant relationship between the nature of road and type of seed and planting materials used by the farmers. This was indicated by a chi square value ($X^2 = 24.619$, $p=0.000$). An improvement in road infrastructure could influence farmers to use improved seeds and planting material for cultivation as revealed by the strong relationship between the phenomena as indicated by the chi square value above. This can have a positive effect on agricultural development regarding crop yield, quality of produce and resistance to diseases.

Table 4.15: A Cross Tabulation between Nature of Road and Type of Seed or Planting Material Used

			Type of seed or planting material used		Total
			Local	Improved or certified	
Type of road that connects community to nearest urban market	Unpaved	Count	317	12	329
		% of Total	81.9%	3.1%	85.0%
	Paved	Count	46	12	58
		% of Total	11.9%	3.1%	15.0%
Total		Count	363	24	387
		% of Total	93.8%	6.2%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	24.619 ^a	1	.000
Likelihood Ratio	17.775	1	.000

Source: Field Survey, July 2014

4.5.3 Influence of Nature of Road on Farm Size

Table 4.16 shows the estimated sizes of farm in acres as provided by the farmers.

Table 4.16: Estimated size of farm in acres

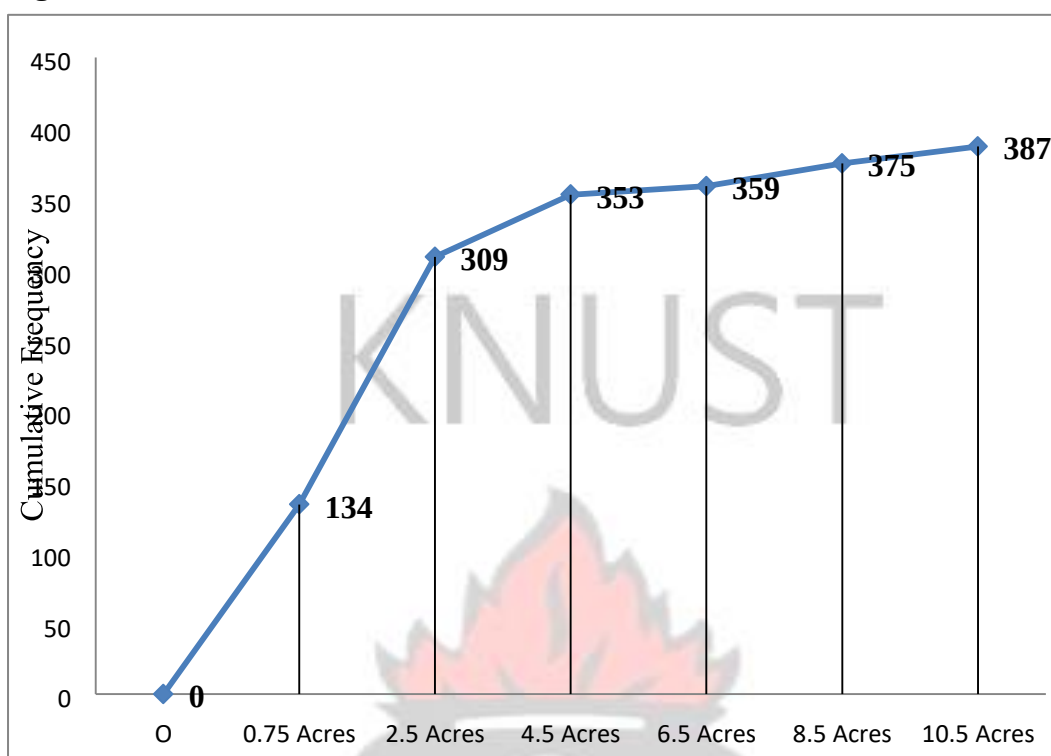
Estimated size of farm in acres	Frequency	Percent
Less than 2	134	34.6
2-3	175	45.2
4-5	44	11.4
6-7	6	1.6
8-9	16	4.1
10 or more	12	3.1
Total	387	100

Source: Field Survey, July 2014

As indicated in Table 4.16, the farm size of the farmers differed considerably. It was found that 45.2% of farmers had a farm size of between 2 to 3 acres, 34.6% had a farm size of less than 2 acres, 11.4% had a farm size of between 4 to 5 acres, 4.1% had a farm size of between 8 to 9 acres, 3.1% had more than 10 acres of farm size whereas 1.6% had a farm size of 6 to 7 acres. The average land size owned by the farmers was 2.6 acres showing that agriculture production in the district was characterised by farmers who owned small farm lands. Farmers are hence only able to produce little volumes of farm produce for subsistence use. This can have a toll on attempts to commercialize agriculture in the area.

Figure 4.3 is a cumulative frequency showing the estimated size of farm in acres. It can be noted from the figure that, more than half of the total farmers contacted for this survey had a farm size of less than 2.5 acres indicating that farming in the Jaman South District was labour intensive involving large number of farmers working on small portions of land. This raises the issue of farmer productivity which could be very low.

Figure 4.2: Estimated size of farm in acres



Source: Field Survey, July 2014

The farmers were further asked to indicate whether the farm size was influenced by their ability to transport farm inputs to farm and get produce to the market in order to establish how road infrastructure affected the farm size. Table 4.17 showed that 54.8% of the farmers indicated that their farm size was sometimes influenced by the ability to transport farm inputs to farm and get produce to market, 34.9% indicated their farm size was not influenced by the ability to transport farm inputs to farm and get produce to market. Only 10.3% indicated that their farm size was highly influenced by the ability to transport farm inputs to farm and get produce to market. The evidence from the field survey indicated that the farm size of the farmers in Jaman South District was not influenced by the road infrastructure but other important factors such as land prevailing tenure systems in the communities.

Table 4.17: Influence of ability to transport farm inputs to farm and get produce to market on farm size

Influence of ability to transport farm inputs to farm and get produce to market on farm size	Frequency	Percent
Highly	40	10.3
Sometimes	212	54.8
No	135	34.9
Total	387	100

Source: Field Survey, July 2014

The farmers were further asked to indicate who owned the lands they farmed on. This was to help the researcher understand the prevailing land tenure system in the district and how it influenced the land size of the farmers. Table 4.18 shows that 38% of farmers farmed on family lands, 21.7% rented the farm lands, 21.7% also obtained the farm lands through the traditional “Abunnu” system where owners of farmlands gave their lands to farmers to cultivate with the view of sharing the proceeds by a certain proportions once the crops are harvested. However, only 18.6% of the farmers owned the farm lands they cultivated on. This meant that, the most prevailing land tenure system at the district was communal land tenure system where family lands are distributed among the family members. This practice had influence on the size of land available for farmers for cultivation. Consequently, farmers who have the ability and the capacity to increase their farm size are constrained and the rippling effect could be little output and less farmer income even in the face of abundant capacity. This could make the farmer especially the youth with the strength to increase farm size with the aim of increasing yield and subsequently get high income, left frustrated and could leave farming altogether as unproductive and unattractive. This could partly explain why only 19.6% of farmers in the area were below 40 years (Table 4.1).

Table 4.18: Showing Ownership of Farm Lands

Who Owns the farm Lands	Frequency	Percent
Myself	72	18.6
Family	147	38.0
Rented	84	21.7
Other (Abunnu)	84	21.7
Total	387	100.0

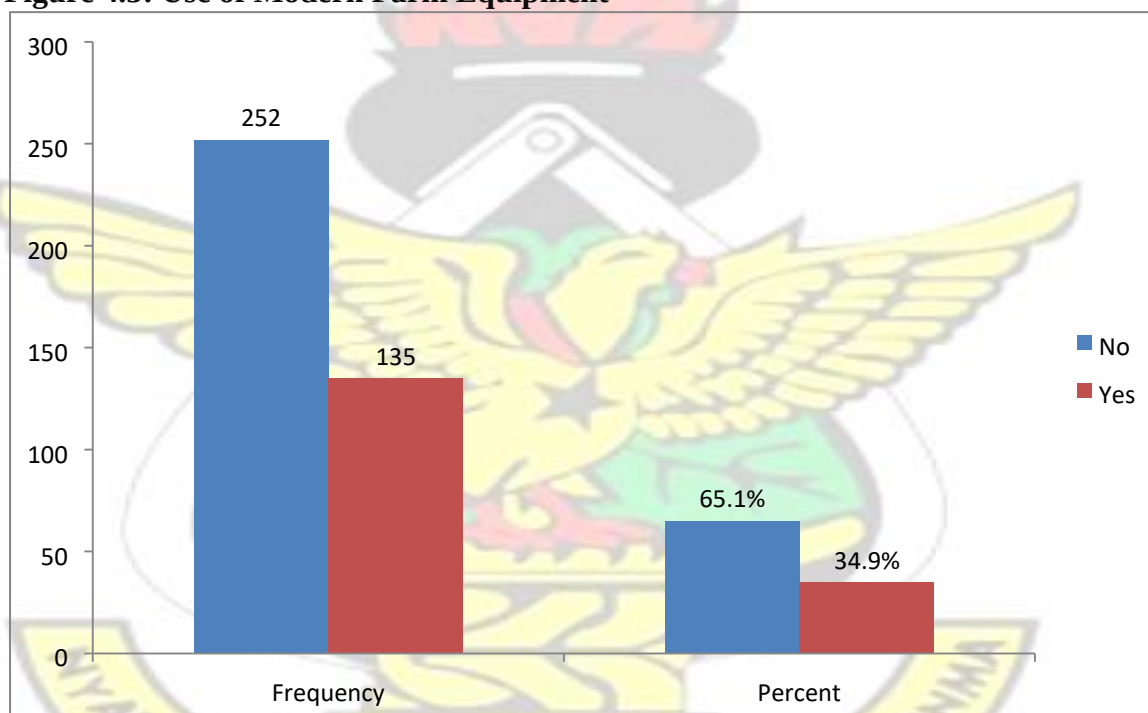
Source: Field Survey, July 2014

4.5.4 The Influence of Road Condition on the Application Modern Methods of Agriculture

Agricultural development is influenced by factors such as modern or improved crop varieties, use of chemical fertilizers, irrigation facilities, modern methods of weeds, pest and disease control and improved storage and market facilities (World Development Report, 2008). Based on the above statement, the farmers were asked to indicate whether they used modern implements in farming and whether they applied fertilizer in farming. Figure 4.4 shows the number of farmers who use modern farm implements. The figure established that 65.1% of farmers did not use modern farm equipment in

crop production whereas 34.9% answered in the affirmative that they used modern equipment in crop production. This gave an indication that the use of modern farm equipment in Jaman South District was still low and effort must be made to encourage farmers to use modern farm equipments in order to boost crop yield and promote agriculture development in the district. Farmers can be supplied with basic modern implements like sprayers by the Ministry of Food and Agriculture through the District Agriculture Unit and pay in bits over an affordable period. This can help farmers who could not afford paying upfront to acquire such equipments to access them. The District Agriculture Unit can also start to experiment using tractors for farming as there was not a single farmer in the area who used tractor in their farming activities.

Figure 4.3: Use of Modern Farm Equipment



Source: Field Survey, July 2014

Table 4.19 shows the number of farmers who use fertilizers and those who do not.

Table 4.19: The use of Fertilizer

The use of Fertilizer	Frequency	Percent
Yes	74	19.1
No	313	80.9
Total	387	100.0

Source: Field Survey, July 2014

Table 4.19 shows that majority of farmers (80.9%) indicated that they did not use fertilizer in farming whereas only a few (19.1%) of the farmers used fertilizers in farming. The analysis above revealed that the use of fertilizer by farmers in Jaman South District was generally low and several factors could account for this including the nature of road infrastructure.

The researcher went further to ask the farmers whether their use or otherwise of fertilizer was influenced by transport infrastructure. Table 4.20 shows how road infrastructure affects the use of fertilizer by farmers.

Table 4.20: Influence of Road Condition on the use of Fertilizers by Farmers

Influence of Road Condition on the use of Fertilizers by Farmers	Frequency	Percent
Highly	136	35.1
Sometimes	181	46.8
No	70	18.1
Total	387	100.0

Source: Field Survey, July 2014

Table 4.20 depicts that 46.8% of farmers indicated that road infrastructure sometimes influenced their use of fertilizers, 35.1% indicated road infrastructure highly influenced their use of fertilizer whereas 18.1% said road infrastructure did not influence their use of fertilizer at all. From the responses, it can be noticed that road infrastructure was more likely to influence the use of fertilizers by farmers. Road infrastructure had a strong influence on whether farmers used fertilizer or not. Drivers often felt reluctant to convey bags of fertilizer from the district capital Drobo to the rural communities due to the condition of the existing road infrastructure fearing that their vehicles would break down or get stuck in the mud during the rainy season and it is normally during this period that farmers need fertilizer the most.

The researcher further enquired about the use of agro chemicals by the farmers. A cross tabulation was used to assess how the use of agro chemicals was influenced by road infrastructure. This is shown by Table 4.21.

Table 4. 21: Cross tabulation between the use of agro-chemicals and road condition

			Does use or otherwise of agro-chemicals influenced by road condition?			Total
			Highly	Sometimes	No	
Do you use agrochemicals?	Yes	Count	8	95	200	303
		% of Total	2.1%	24.5%	51.7%	78.3%
	No	Count	2	16	66	84
		% of Total	.5%	4.1%	17.1%	21.7%
Total		Count	10	111	266	387
		% of Total	2.6%	28.7%	68.7%	100.0%

Source: Field Survey, July 2014

Table 4.21 established that 78.3% of farmers used agro chemicals for crop production, whereas 21.7% did not use agro chemicals for crop production. The Table further revealed that 68.7% of farmers believed that, their use of agro-chemicals was not influenced by road infrastructure, 28.7% indicated road infrastructure sometimes affected their use of agro chemicals whereas only 2.6% of the farmers indicated that road infrastructure highly influenced their use of agro chemicals. The responses obtained could be interpreted that although most of the farmers applied agrochemicals in their crop production, this was not influenced by the road infrastructure. The common agro-chemicals used by the farmers were found to be weedicides and pesticides for weeds and pest control. Farmers explained that the agro-chemicals they bought were not bulky and were easily transportable even on a bad road.

The responses from the farmers were aligned with that of the responses of the interview with the District Agriculture development officer. He indicated that the extension officers of the district gave extension services to farmers in the rural communities on a daily basis. He however, indicated that farmers did not employ modern tools or implements and technology in their activities since most of the farmers are peasant farmers. The agric officer also indicated that the farmers often expressed ill-concern about distance they walk to their farms. He also indicated that, the farmers often experienced post harvest losses due to the difficulty to transport farm produce to market. However, he believed that, an improvement in the road infrastructure and the adoption of other modern techniques would play a major role in reducing the incidence of post-harvest losses and improve agriculture production in the district. The District Agriculture Development Officer also gave an indication that the ratio of the extension officers to the farmers in the district was 1:3400. The limited number of extension officers attending to so many farmers meant that even though the Agriculture Extension

Agents (AEA) and other officers offered daily services to farmers yet a lot of farmers could still barely had access to extension services. The problem was further compounded by a myriad of challenges that confronted the District Agriculture Unit which included a frequent breakdown of the only pick up truck they had and motor bikes for extension services and a general transportation difficulties as outlined by the District Agriculture Development Officer. The resultant effect would be that farmers had less access to modern farming technology which is often transferred to them from Extension Agents. This can affect negatively farmers' productivity and crop yield.

4.5.5 Total Crop Yield and Income per Year

An analysis of the total crop yield and income per year helped the researcher to assess level of agriculture development in the district. Table 4.22 indicated that 39.3% of farmers produced about 500 to 900 kilograms of farm produce a year, 23.8% of them produced 1000 to 1400 kilograms of farm produce per year, 20.9% produced below 500 kilograms of farm produce yearly, 11.9% produced between 1500 to 1900 kilograms of farm produce whereas only 4.1% of the farmers produced more than 2000 kilograms of farm produce. Table 4.22 also revealed that in terms of income 24.3% of the farmers earned more than 2000 cedis from their farm produce, 22.2% earned between 1000 to 1400 cedis annually from their farm produce, 20.7% earned between 1500 to 1900 cedis from their farm produce, 19.6% earned between 500 to 900 cedis annually and 13.2% earned below 500 cedis annually. This shows that farmers in the district earned very small income from their farms. Farmers with no access to non-farm income sources could find it extremely difficult supporting their families and meeting their financial obligations. This could have dire consequences on farmers' livelihood as revealed by ECA (2007) that about 80% of Africa's poor live in the rural areas and depend mainly on agriculture for their livelihood.

Table 4.22: Total Crop Yield and Income per Year

Attribute	Category	Frequency	Percentage
Estimated total crop yield per year in kilograms	Below 500	81	20.9
	500-900	152	39.3
	1000-1400	92	23.8
	1500-1900	46	11.9
	2000 or more	16	4.1
Total		387	100
Estimated farm income per year in cedis	Below 500	51	13.2
	500-900	76	19.6
	1000-1400	86	22.2

	1500-1900	80	20.7
	2000 or more	94	24.3
Total		387	100.0

Source: Field Survey, July 2014

4.5.6 The Influence of Road Condition on Farm Diversification

Farmers' ability or willingness to diversify their farms is one way of assessing Rural Agricultural Development. The farmers were asked whether they would want to diversify their farm and go into cultivation of other crops like fruits and commercial vegetables production (horticulture). Table 4.23 shows the responses.

Table 4.23: Diversification of Farm to cultivate other crops like fruits and commercial vegetables production

Diversification of Farm	Frequency	Percent
Yes	252	65.1
No	135	34.9
Total	387	100.0

Source: Field Survey, July 2014

The responses in Table 4.23 showed that 65.1% of farmers were willing to diversify their farm and go into cultivation of other crops like fruits and commercial vegetables production (horticulture), 34.9% were not willing to diversify their farms. The indication is that, if all impediments were removed farmers would be willing to divert into the cultivation of other crops like fruits and commercial vegetables. This can change the face of traditional subsistence agriculture and propel agricultural development which farm diversification is an important component as indicated by a number of studies including World Bank, 2007a, 2008; Salami et al., 2010; and Hazell, 2001.

Table 4.24 established that, the decision of farmers to diversify or not had no direct relationship with road transport infrastructure as only 12.9% of farmers indicated that road transport infrastructure could highly influence their decision to diversify their farms. However, 78.3% indicated that road infrastructure could sometimes influence their decision to diversify, whereas 8.8% were emphatic that their decision to diversify was not influenced by road transport infrastructure. The analysis is an indication that, although farmers are willing to diversify their farms and go into the cultivation of other crops like fruits and commercial vegetables; this decision was not mainly dependents

on road transport infrastructure although it can play a role. Farmers gave diverse reasons other than road transport infrastructure as major factors which could influence their decision to diversify their farms. Their responses were further discussed beneath Table 4.24.

Table 4.24: Influence of Road Transport Infrastructure on Decision to Diversify

Influence of Road Transport Infrastructure on Decision to Diversify	Frequency	Percent
Highly	50	12.9
Sometimes	303	78.3
No	34	8.8
Total	387	100

Source: Field Survey, July 2014

The respondents were asked to further explain their answers. Those who indicated that road infrastructure highly influenced their decision to diversify indicated that: *“Some crops are perishable and need careful handling. Hence good roads are essential for this to get to the market early”*; and the fact that *“When there are good roads connecting the farm and the market, farm would be diversified because vehicles can come to the farms to take produce to the market.”*

The farmers, who indicated that road infrastructure sometimes affected their decision to diversify, explained that: *“If the road infrastructure supports easy access to market as well as profitability of other crops then they were willing to diversify”*; and *“good roads do not give farmers money to buy new crops”*. Hence the decision to diversify also depends on the ability of the farmers to buy new seedlings or planting materials of a different crop.

For the farmers who answered in the negative, it was explained that: *“capital to diversify”*, *“availability of market”*, *“security of produce”* and *“knowledge about other crops”* influenced their decision to diversify and not rural infrastructure.

4.5.7 The influence of Road Condition on Labour Accessibility

One additional component of Rural Agriculture Development is the accessibility and utilization of labour. Table 4.25 shows that 29.5% of farmers found labour accessibility in their villages to be difficult and 19.6% found it to be very difficult. On the other hand,

27.9% of the farmers thought labour accessibility was easy and 23% felt labour accessibility in their communities was very easy. The table did not emphatically establish the ease or otherwise of accessing labour in the district, although more than half of the farmers (50.9%) of the farmers found labour accessibility to be easy.

Table 4.25: Labour Accessibility in Jaman South District

Labour Accessibility in Jaman South District	Frequency	Percent
Very easy	89	23
Easy	108	27.9
Difficult	114	29.5
Very difficult	76	19.6
Total	387	100

Source: Field Survey, July 2014

Table 4.26 further looks at the cost of hiring labour in the district. Table 4.26 established that the cost of hiring labour in a day was very high as compared to the annual income of the farmers. It was observed that, 57.6% of the farmers said that the cost of hiring labour in their community ranges from 10 to 14 cedis. Out of this number, 44.2% of them earned average income of less than 2000 cedis annually. This low income of farmers would prevent these farmers from hiring labour to support farming activities. The table further established that 21.2% indicated that the cost of hiring labour in the community ranged from 4 to 9 cedis, whereas additional 21.2% indicated that the cost of labour in their community ranged from 15 to 19 cedis.

Table 4. 26: Cross Tabulation between farm income per year in cedis and cost of hiring a labourer per day

			Estimated cost of hiring a labourer			Total
			5-9 cedis	10-14 cedi	15-19 cedis	
Estimated farm income per year in cedis	Below 500	Count	14	29	8	51
		% of Total	3.6%	7.5%	2.1%	13.2%
	500-900	Count	18	36	22	76
		% of Total	4.7%	9.3%	5.7%	19.6%
	1000-1400	Count	18	46	22	86
		% of Total	4.7%	11.9%	5.7%	22.2%
	1500-1900	Count	8	60	12	80
		% of Total	2.1%	15.5%	3.1%	20.7%
	2000 or more	Count	24	52	18	94
		% of Total	6.2%	13.4%	4.7%	24.3%
Total		Count	82	223	82	387
		% of Total	21.2%	57.6%	21.2%	100.0%

Source: Field Survey, July 2014

The researcher further enquired about the influence of road infrastructure on the ease of accessing labour in the district. It was established in Table 4.27 that 33.9% indicated that road infrastructure sometimes influenced labour accessibility in the district, 32.6% indicated that road transport infrastructure did not influence labour accessibility in their communities, 28.9% were not sure about the influence of road transport on labour accessibility, whereas 4.7% were categorical that the labour accessibility and cost were highly influenced by road infrastructure. This can be concluded that road transport infrastructure in Jaman South District sometimes influenced the accessibility to farm labour.

Table 4.27: The influence of Condition of Road on Labour Accessibility

Influence of Road Transport Infrastructure on Labour Accessibility	Frequency	Percent
Highly	18	4.7
Sometimes	131	33.9
No	126	32.6
Not Sure	112	28.9
Total	387	100

Source: Field Survey, July 2014

The researcher further asked the respondents to explain their answers. The farmers who indicated that road infrastructure highly influenced labour accessibility and cost indicated that: *“Where labourers have to walk very long distances to farm, they feel reluctant to go and work and when eventually you get people they charge higher but do not work enough”*; and *“where labourers can get vehicles to farm or even get closer to farm they are more easily accessed but you pay extra because of their fares.”*

The farmers who indicated that road infrastructure sometimes influenced the cost and accessibility of labour indicated that: *“Sometimes, people come here looking for farm work. Some do not care the distance or nature of road infrastructure but for some they will charge extra when they are walking far. Some also sometimes charge to include what would be used to transport them to farm.”*

Whereas those who answered negative indicated that: *“It depends on the time or season of the year; sometimes it is easy to get labourers and sometimes difficult. It is not about the road; and “cost of hiring a labourer per day is periodically determined by the traditional leaders of community and road infrastructure was not considered.”*

CHAPTER FIVE

SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSION

5.1 Introduction

The previous chapter provided the presentation and analysis of the data collected from the various respondents on the influence of road transport infrastructure on rural agriculture development. This chapter presents summary of the major findings from the analysis. This chapter also includes the recommendations which are in conformity with the findings as well as the conclusion of the research.

5.2 Summary of Findings

Data for this study were gathered from farmers in the Jaman South District, drivers, agriculture officers and the district feeder roads engineer. The state and nature of road infrastructure improvement in Jaman South profile and the association between road infrastructure and the cost of doing agriculture in the district were discussed. Also discussed was the influence of road transport infrastructure on various variables of rural agriculture development. The following subsections consider the summary of the research findings on the influence of road transport infrastructure and rural agricultural development in the Jaman South District.

5.2.1 State of transportation infrastructure in the Jaman South District

The study established that there is a total of over 478 kilometres of road network connecting communities in the area of which less than 45% was classified as good roads. It was revealed that only 210 kilometres of the road network in the district were engineered. This indicated that there were adequate roads linking communities in the area although of road infrastructure was perceived to be generally poor. Majority of the farmers in the district (about 85%) were connected to the nearest urban market by unpaved road. This was consistent to Gollin (2012) who made the point that roads in rural communities are poor and rural connectivity is very low. The analysis revealed that, the average farm distance from the community to the main road or nearest market was approximately 2.5km.

The study found out that the most common means of transporting farm produce was by head portorage. It was further observed that other means of transporting farm produce were by the use of tricycle; bicycle or motorcycle; minibuss; taxi and truck in order of usage. The high incidence of the use of head portorage as the means of transporting farm produce can be attributed to the fact that road network in Ghana is inadequate,

especially in the remote areas of the district, coupled with the general lack of feeder roads over which agricultural products can be transported.

5.2.2 Road Infrastructure improvement in Jaman South District

The study established that road maintenance work at Jaman South District was not very frequent and not done on regular bases. Road maintenance is crucial for transportation especially in rural areas where most of the roads are very narrow and untarred and their safety cannot be guaranteed. Road maintenance is essential in order to preserve the road in its originally constructed condition and provide efficient, convenient travel along the route.

The feeder road engineer indicated that the irregular nature of road maintenance was because rehabilitation was done only when funds were available and this did not happen often. The unavailability or inadequacy of funds to the district's feeder roads department contributes to the low rate of road rehabilitation in the district. The last time new feeder roads were constructed was about 5 or 6 years ago as indicated by the Feeder Road Civil Engineer.

5.2.3 Influence of the Nature of Road on the Number of Trips made in a day In estimating the total number of trips vehicles made to the communities in a day, it was found that 27.6% embarked on 6 to 10 trips a day from the communities to the Drobo market, 24.8% embarked on 11 to 15 trips a day, 23.8% made 1-5 trips a day, 13.4% made 16-20 trips, and 10.3% made more than 20 trips in a day to the Drobo market. The analyses revealed that the average number of trips made by farmers from their respective communities to the main Drobo market was approximately 11 trips. The study found out that the number of trips made by drivers in a day was influenced by the nature of the road infrastructure. Various reasons were given by the drivers concerning how the nature of road influenced the number of trips that were made in a day. The study revealed that when the road is good, a lot of cars ply on it. Also, when the road is good, drivers are able to go as many trips provided passengers are available and can take normal load. It was revealed that when the road is bad vehicles go through the mud, potholes and by the time drivers wind down to the communities and back it will be late and cannot get a lot of trips.

The study showed that an improvement in road infrastructure would change the number of trips and loading pattern of drivers. This was indicated by 78.6% of the drivers who

indicated that there would be much positive change in the number of trips, loading patterns and charges when the roads are all-season roads.

The study established that poor roads affected road transportation in several ways. It was revealed that poor roads reduced the number of trips made by drivers per day; drivers are unable to load a lot of farm produce because the car gets stuck in the mud and spoils engine, or the base of car drag, sometimes spoiling the fuel tank due to poor roads; drivers are unable to go to the communities to pick passengers and farm produce during raining season. It was also revealed that due to poor roads, sometimes drivers overload because there would not be any vehicle to pick passengers and produce. However it was established that when the road is good, drivers can go to the communities at any time even in the night provided there are passengers or goods to pick.

5.2.4 Relationship between Nature of Road and Travel Time in Hours

The study revealed that, the type of road connecting the communities to the market had a significant relationship with the estimated travel time to Drobo. This was indicated by a Chi square value $X^2=32.167$, $p=0.00$ establishing a strong relationship between the type of road and the estimated travel time. It was found that, farmers who used paved road to travel used lesser travel time than those who used unpaved roads.

5.2.5 Relationship between Condition of Road and Travel Cost to Drobo Market The study established that the cost of transportation was highly influenced by the nature of road used as revealed by a chi square value X^2 (df=2) of 58.817, and $p=0.000$ indicating a strong relationship between the two variables. It is therefore expected that, paving the road networks in the district will among other things reduce the travel cost from the various communities to the Drobo market. This finding was consistent with Easterling et al., (2008) who indicated that underdeveloped rural roads in Ghana have led to high transport costs for agricultural products to the market as well as of farm inputs. Rising transport costs affects both output and input prices.

5.2.6 The Nature of Rural Agriculture Development in Jaman South District

It was noted that the most common food crops cultivated in Jaman South District were Yam, Cassava, Plantain, Cocoyam, Maize, Pepper, Garden Eggs, and Citrus. The district is however noted for the production of three key cash crops: cocoa, cashew and oil palm. The farmers sell their farm produce at three different places: farm gate; local

community market; and/or secondary market at Drobo. The price charged for the same farm produce differs in relation to location in which the sale is made. It was found that the prices of the farm produce were generally cheaper at the farm gate and increased as the farmer moves to the secondary market at Drobo. The study found out that, when transporting the farm produce from the farm gate to the main Drobo market, the prices of the produce increased by about 45% to as high as 200% by the time the produce get to the Drobo market. The study established that road infrastructure influenced farmers' decision on where to sell their farm produce.

An analysis of the total crop yield and income per year helped the researcher to assess level of agriculture development in the district. It was established that more than half of the farmers produced less than 1000kg of farm produce annually as indicated by 39.4% who produced about 500 to 900 kilograms of farm produce a year and 20.7% who produced below 500 kilograms of farm produce yearly. In terms of income of farmers, the study revealed that, about 76% of the farmers in the district earned less 2000 cedis annually which was considered to be very low.

5.2.7 Influence of Condition of Road on Choice of Crops

The study established that the nature of road highly influenced the type of crops that were cultivated by the farmers in Jaman South District. The finding indicated that road transport infrastructure has a huge positive influence on rural agriculture due to the realities of enhancing several linkages to the non-farm sectors of an economy.

A chi square analysis of Table 4.15 also established a significant relationship between the nature of road and type of seed and planting materials used by the farmers. This was indicated by a chi square value ($X^2 = 24.619$, $p=0.000$).

5.2.8 Influence of Nature of Road on Farm Size

Evidence from the study revealed that more than half of the total farmers in the district had a farm size of less than 2.5 acres indicating that farming in the District was labour intensive involving large number of farmers working on small portions of land. It was however established the farm size of the farmers in Jaman South District was not influenced by the road infrastructure but other important factors such as land prevailing tenure systems in the communities.

5.2.9 Influence of Road Condition on the use of Fertilizers and agro chemicals by Farmers

The results of the analysis on the influence of road infrastructure on the use of fertilizers by farmers revealed that 80.9% of farmers in the district did not use fertilizer in farming indicating a generally low patronage of fertilizer usage by farmers in Ghana. It was noticed that road infrastructure was more likely to influence the use of fertilizers by farmers. It is therefore expected that an improvement in road infrastructure will among other things influence farmers to apply more fertilizers to their crop productions.

The study also found out that 78.3% of the farmers used agro chemicals for crop production. It was also revealed from the survey that 68.7% of the farmers believed that, their use of agro-chemicals was not influenced by road infrastructure which implied that although most of the farmers applied agro-chemicals in their crop production, this was not influenced by the road infrastructure. This was because the extension officers of the district gave extension services to farmers in the rural communities on a daily basis as revealed by the Agriculture Development Officer of the District.

5.2.10. The influence of Road Condition on Farm Diversification

The analysis of the field survey established that 65.1% of farmers were willing to diversify their farm and go into cultivation of other crops like fruits and commercial vegetables production. It was also found that, the decision of farmers to diversify or not had no direct relationship with road transport infrastructure as only 12.9% indicated that road transport infrastructure could highly influence their decision to diversify their farms. The analysis established that, although farmers were willing to diversify their farms and go into the cultivation of other crops like fruits and commercial vegetables; this decision was not primarily dependents on road transport infrastructure although it can play a role.

Those who indicated that road infrastructure highly influenced their decision to diversify indicated that: “some crops are perishable and need careful handling. Hence good roads are essential for this to get to the market early”; and the fact that “when there are good roads connecting the farm and the market, farm would be diversified because vehicles can come to the farms to take produce to the market.”

5.2.11. The influence of Condition of Road on Labour Accessibility

The study established that the cost of hiring labour in a day was very high as compared to the annual income of the farmers. It was observed that, 44.2% of farmers who earned an average income of less than 2000 cedis annually had to pay between 10 to 14 cedis to hire labour. Sometimes, it cost farmers 19 cedis to hire labour for a day.

Some farmers indicated that road infrastructure influenced the cost and accessibility of labour in the district while others did not see any relationship between the two. The farmers who indicated that road infrastructure highly influenced labour accessibility and cost indicated that: “where labourers have to walk very long distances to farm, they feel reluctant to go and work and when eventually you get people they charge higher but do not work enough”; and “where labourers can get vehicles to farm or even get closer to farm they are more easily accessed but you pay extra because of their fares.”

Whereas those who answered negative indicated that: “It depends on the time or season of the year; sometimes it is easy to get labourers and sometimes difficult. It is not about the road; and “cost of hiring a labourer per day is periodically determined by the traditional leaders of community and road infrastructure was not considered.”

In terms of the first objective of the study, which was assess the state of transportation infrastructure in the Jaman South District, it was concluded that less than 45% of the road network in the district was properly engineered and classified to be good. Most of the road networks linking the various communities to the main market were unpaved and immotorable during the raining season. It was concluded that, the average farm distance from the community to the main road or nearest market was approximately 2500m out of which approximately 1,375m was in bad shape. The study also concluded that the irregular nature of road maintenance and rehabilitation was because funds were not made available regularly for such projects hence the last time new feeder roads were constructed was about 5 or 6 years ago.

In relation to the second objective which was to assess the nature of rural agriculture development in the district, the study concluded that the most common food crops cultivated in Jaman South District were Yam, Cassava, Plantain, Cocoyam, Maize, Pepper, Garden Eggs, and Citrus. Farming in the district was characterised by farmers who owned small portions of farm size and used rudimentary methods of agriculture hence produce just enough farm produce to cater for themselves and their families. This

accounted for the reason why most of the farmers earned less than two thousand (2000) cedis a year from their farm produce.

In terms of the third objective of the study which was to assess the nature of influence of road transport infrastructure on rural agricultural development in the Jaman South District, it was concluded that road infrastructure influenced some key components of rural agriculture development in the district. It was concluded that road transport infrastructure influenced: the type of crops planted by the farmers; the use of fertilizers by farmers; farmers' willingness and ability to diversify their farms; and the cost and accessibility to labour in the district. It was however concluded that other factors rather than road transport infrastructure influenced the small farm size of the farmers.

5.3 Recommendations

Based on the findings of this research, the researcher suggested the following policy recommendations to help address the gap in the district.

5.3.1 Development and Expansion of Road Infrastructure in Jaman South District The major recommendation that can be drawn from the recent debate over agriculture and infrastructure as seen from the literature review, and from the analysis presented in this study, is that rural road transport infrastructure development projects should be appraised in a more holistic way and should consider investments in hard infrastructure (Well Engineered Road Network) to address systemic inefficiencies that decrease the competitiveness of agricultural value chains in the district. Also, farmers, retailers and consumers will benefit greatly if transport and transaction costs are reduced simultaneously. The development and expansion of road infrastructure in Jaman South District making use of local resources and technology for sustainability is crucial to boost agricultural development which will further augment farmers' income and general well-being. It is recommended that rural communities are galvanised and supported by the Department of Feeder Roads to create access roads to link cluster of farms in the communities that will facilitate easy transportation of farm inputs to farms and produce from farms.

5.3.2 Opening up the District to Cote d'Ivoire

Again, the study recommends that roads linking the district to Cote d'Ivoire are upgraded and regularly maintained to boost trade in agricultural input and output. The proximity of the district to Cote d'Ivoire presents an untapped opportunity for farmers

to access bigger market for their produce and also to expose them to new farm practices and technology through interaction with farmers in that country.

5.3.3 Encouraging the Use of Modern methods of Agriculture through Proper Sensitization Programmes

It is further recommended that, a carefully planned sensitization programme on the use of modern methods of agriculture will help the farmers depart from the use of crude and outmoded farming practices. The extension services in the district must be boosted by adequate budgetary allocation from the central government instead of the adhoc nature in which sensitization is done. Fertilizer must also be subsidised for the low income farmers to afford.

5.3.4 Suggestions for Further Research

The research focused on the influence of road transport infrastructure on rural agriculture development and did not consider how the cultural practices of the people also affected rural agriculture development. However, the researcher observed that the cultural values of the farmers played in major role in the some components of rural agriculture development, for example, farm size of the farmers is influenced by the communal land tenure system in the communities. It is therefore recommended that future studies into rural agriculture development must investigate into the role of socio-cultural practices on rural agricultural development.

5.4 Conclusion

Several studies have analysed the impact of transport infrastructure in enhancing rural development and agriculture. This study however focused on the influence of road transport infrastructure on rural agricultural development. It was found that road transport infrastructure was poor and influenced: the type of crops planted by farmers; the use of fertilizers by farmers; farmers' willingness and ability to diversify their farms; and the cost and accessibility to labour in the Jaman South District. The District has a great economic advantage that can be built around agriculture. With its proximity to Cote d'Ivoire, there is the opportunity for a bigger market for farmers to explore that could benefit agricultural development in the area. The study gives an indication that with improvement in the road transport infrastructure in the district there would be a positive change in agricultural development. There is therefore the urgent need for road network expansion, rehabilitation and routine maintenance to be pursued vigorously to

help boost agricultural development in the district, enhance smallholder farmers' productivity and incomes of rural households, and strengthen the linkages between the rural economy, agriculture and market.

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APPENDICES

APPENDIX 1: SURVEY QUESTIONNAIRE FOR FARMERS

Please, answer the questions that follow by ticking the appropriate option (if provided) or writing for open - ended questions. Please answer all questions freely but objectively.

The information is only for academic purposes to assess the influence of road infrastructure on agricultural development and will be treated with the strictest confidentiality as the exercise is guided by the principle of anonymity of the interviewee. Thank you for your cooperation.

Bio-Data of Respondents

Name of Community

- 1) Sex of household head Male ☐ Female ☐
- 2) Age Below 30 ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐ 60 and above ☐
- 3) Educational level No formal education ☐ Basic ☐ Secondary ☐
Tertiary ☐ Other ☐
- 4) Household size Below 4 ☐ 4-6 ☐ 7-9 ☐ 10-12 ☐ 13 and above ☐

Questionnaire on Transportation

- 5) What type of road connects your farm? Footpath ☐ Farm track ☐ Simple compacted earth road ☐ Graveled road ☐ Paved road ☐
- 6) What is the estimated farm distance from your community or the nearest main road in kilometers? Less than 2 ☐ 2-3 ☐ 4-5 ☐ 6-7 ☐ 8 or more ☐
- 7) By what means do you get your produce to the market? Head portorage ☐
Bicycle or Motorcycle ☐ Tricycle ☐ Taxi ☐ Minibus ☐ Truck ☐
- 8) What type of road connects the community to the nearest urban community?
Unpaved road ☐ Paved road ☐
- 9) How would you describe the physical condition of the road surface connecting your community? Poor ☐ Fair ☐ Good ☐
- 10) How often are road maintenance works carried out on this road?
Twice a year ☐ Once a year ☐ Once in 2 years ☐ Once in 3 years ☐ Once in 4 years or more ☐
- 11) What vehicles often ply this road? Taxis ☐ Minibuses ☐ Trucks ☐ Other ☐
- 12) What is the estimated total number of trips made by vehicles per day? 1-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ Above 20 ☐
- 13) What is the estimated travel distance from this community to Drobo? Less than 5km ☐ 5-9km ☐ 10-14km ☐ 15km or more ☐
- 14) What is the estimated travel time to Drobo in hours? Less than 1 ☐ 1-2 ☐ 3-4 ☐
5 or more ☐
- 15) How long do you have to wait for a vehicle to Drobo? Less than 1hr ☐ 1-2hrs ☐
3-4hrs ☐ 5hrs or more ☐

- 16) How would you generally describe the travel cost to Drobo? Low ☐ Moderate ☐ High ☐ Very high ☐
- 17) How much would it cost to transport a 50kg fertilizer sack-full load of farm produce to Drobo market? Less than GHC 2 ☐ GHC2-4 ☐ GHC 5-7 ☐ GHC 8-10 ☐
- 18) How would you describe the way vehicles load goods to the market?
Do not overload ☐ Slightly overload ☐ Overload ☐ Highly overload ☐

Questionnaire on Farming Activities

- 19) What crop(s) do you cultivate? List at most five (5) major crops
1. 2.
3. 4.
5.
- 20) What type of seed or planting material do you use or purchase for planting?
Local ☐ Improved or certified ☐
- 21) Is your choice of crops influenced by the type of road infrastructure connecting your farm and/or community? Highly ☐ Sometimes ☐ No ☐
- 22) What is the estimated size of your farm in acres? Less than 2 ☐ 2-3 ☐ 4-5 ☐ 6-7 ☐ 8-9 ☐ 10 or more ☐
- 23) Is your farm size influenced by the ability to transport farm inputs to farm and also get your produce to the market? Highly ☐ Sometimes ☐ No ☐
- 24) Who owns the land you farm on?
Myself ☐ Family ☐ Rented ☐ Other (Please Specify).....
- 25) Do you use fertilizer in farming? Yes ☐ No ☐
- 26) Does your use or otherwise of fertilizer influenced by transport infrastructure? Highly ☐ Sometimes ☐ No ☐
- 27) Do you use agro-chemicals? Yes ☐ No ☐
- 28) Does your use or otherwise of agro-chemicals influenced by road transport infrastructure? Highly ☐ Sometimes ☐ No ☐
- 29) What is your estimated total crop yield per year in kilograms? Below 500 ☐ 500-900 ☐ 1000- 1400 ☐ 1500-1900 ☐ 2000 or more ☐
- 30) What is your estimated farm income per year in cedis (GHC)? Below 500 ☐ 500-900 ☐ 1000-1400 ☐ 1500-1900 ☐ 2000 or more ☐

- 31) Where do you often sell your produce? Farm gate ☐ Local community market ☐ Drobo market ☐ Other ☐
- 32) How much do you sell the following selected produce? (Please answer where applicable)
- A) A bag of maize at
1. Farm gate 2. Community market 3. Drobo market
- B) A basket of cocoyam at
1. Farm gate 2. Community market 3. Drobo market
- C) A bag of cassava at
1. Farm gate 2. Community market 3. Drobo market
- D) 100 tubers of yam at
1. Farm gate 2. Community market 3. Drobo market
- E) A bag of dried pepper at
1. Farm gate 2. Community market 3. Drobo market
- F) A bunch of plantain (apantu) at
1. Farm gate 2. Community market 3. Drobo market
- 33) Does road transport infrastructure influence where you sell produce?
Highly ☐ Sometimes ☐ No ☐
- 34) Briefly give reasons for your answer in (32) above.
- 35) Would you want to diversify your farm and go into cultivation of other crops like fruits and commercial vegetables production etc.? Yes ☐ No ☐
- 36) Would road infrastructure influence your decision to diversify or not to diversify your farm? Highly ☐ Somewhat ☐ No ☐ Not sure ☐
- 37) Briefly give reasons for your answer in (35) above.
- 38) Are you able to readily access labour here to help in your farm? Very Easy ☐ Easy ☐ Difficult ☐ Very Difficult ☐
- 39) What is the estimated cost of hiring a labourer per day? GHC 5-9 ☐ GHC 10-14 ☐ GHC 15-19 ☐ GHC 20 or more ☐
- 40) Is labour accessibility or otherwise and cost influenced by road infrastructure in this area?
Highly ☐ Sometimes ☐ No ☐ Not Sure ☐
- 41) Briefly give reasons for your answer above. 42) Do you use modern farm implements? Yes ☐ No ☐

43) Mention the modern farm implement(s) you use?

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APPENDIX 2: QUESTIONNAIRE FOR DRIVERS

Please, answer the questions that follow by ticking the appropriate option (if provided) or writing for open - ended questions. Please answer all questions freely but objectively.

The information is only for academic purposes to assess the influence of road infrastructure on agricultural development and will be treated with the strictest confidentiality as the exercise is guided by the principle of anonymity of the interviewee. Thank you for your cooperation.

Route of operation.....

- 1) What vehicle do you drive? Taxi ☐ Mini Bus ☐ Truck ☐
- 2) How would you describe the condition of roads linking communities around the route you often ply? Good ☐ Fair ☐ Poor ☐
- 3) How many trips do you make per day on the average? 1-2 ☐ 3-4 ☐ 5-6 ☐ Above 6 ☐
- 4) In your estimation how many vehicles often ply this route per day? 1- 5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ above 20 ☐
- 5) Does the nature of road infrastructure influence or determine the number of trips you make per day? Highly ☐ Sometimes ☐ No ☐
- 6) Briefly give reasons for your answer in 6 above
- 7) Does the nature of road infrastructure influence the number of vehicles that often ply this route? Highly ☐ Sometimes ☐ No ☐ Not sure ☐
- 8) How does the physical condition of roads linking communities in the area affect your operations?
1
2
3
- 9) Do you overload your vehicle? Often ☐ Sometimes ☐ No ☐
- 10) Would you say that the road infrastructure in the area influence how you load passengers and goods? Highly ☐ Sometimes ☐ No ☐
- 11) Would there be any change in terms of increase in number of trips, normal loading, and reduction in charges where you have all-season roads? Very much ☐ Much ☐ Not much ☐ Not at all ☐ Thank you for your responses.

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APPENDIX 3: INTERVIEW GUIDE FOR AGRICULTURE OFFICERS

The information is only for academic purposes to assess the influence of road infrastructure on agricultural development and will be treated with the strictest confidentiality as the exercise is guided by the principle of anonymity of the interviewee. Please answer all questions freely but objectively. Thank you for your cooperation.

- 1) Please what is your position in the department?
- 2) For how long have you been working in the district as an officer?
- 3) How often do you give extension services to farmers in the rural communities?

- 4) Does the road infrastructure in the district influence that? Please how?
- 5) Do farmers employ modern tools or implements and technology in their activities?
- 6) How would you describe agricultural development in the district?
- 7) Do farmers express ill-concern about distance they walk to their farms?
- 8) What is the nature and extent of influence of road infrastructure on agricultural development in the district?
- 9) Are there adequate farm input shops close to farmers in the rural communities?
- 10) What is the nature and level of post harvest losses in the district?
- 11) Would you say that the road infrastructure in the district play a major part in this?
- 12) What are the main challenges of agricultural development in the district?
- 13) What influence would road infrastructure have on these challenges?

Thank you very much for your responses.

APPENDIX 4: INTERVIEW GUIDE FOR DEPARTMENT OF FEEDER ROADS

The information is only for academic purposes to assess the influence of road infrastructure on agricultural development and will be treated with the strictest confidentiality as the exercise is guided by the principle of anonymity of the interviewee. Please answer all questions freely but objectively. Thank you for your cooperation.

- 1) Please what is your position in the department?
- 2) For how long have you been working with the feeder roads sector in the district?
- 3) Would you say that there are adequate roads that link farming communities and hamlets in the district?
- 4) With your rich experience in the district, how would you generally describe the nature of road infrastructure in the district?

- 5) How often are maintenance works carried out on rural roads?
- 6) How often are new roads constructed in the district?
- 7) What informs your choice of a road for construction, rehabilitation or maintenance?
- 8) Does the department have any policy or programme towards developing road infrastructure in the district in the short to medium term?
- 9) What are the main challenges of the department regarding improving road infrastructure?

Thank you for your responses.

