ACCESSIBILITY AND TRANSPORT CHALLENGES FACING RURAL PEOPLE LIVING ALONG FEEDER ROADS IN GHANA

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DECLARATION

I certify that, except where due acknowledgement has been made, the work is that of the author alone; the work has not been submitted previously, in whole or in part, to qualify for any other academic award; the content of this thesis is the result of work which has been carried out since the commencement date of the approved research programme; any editorial work paid or unpaid carried out by a third party is acknowledged; and ethics procedures and guidelines have been followed.

Asafo-Adjei Kwarteng Charles

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ABBREVIATION AND ACRONYMS

AI	Accessibility Indicator
AIAT	Alternative Impact Assessment Technique
AM	Access Mapping
AU	African Union
CBA	Cost-Benefit Analysis
DFR	Department of Feeder Roads
DFID	Department for International Development
EISQ	Expert Interview Schedule Questions
EU	European Union
FGISQ	Focus Group Interview Schedule Questions
HDM	Highway Development Management
IFPRI	International Food Policy Research Institute
IFRTD	International Forum for Rural Transport and Development
ILO	International Labour Organization
IMF	International Monitory Fund
IMTs	Intermediate Means of Transport
IRTP	Integrated Rural Transport Planning
LSMS	Living Standards Measurement Survey
MDG	Millennium Development Goal
RED	Road Economic Decision
SDG	Sustainable Development Goal

SEHHS	Socioeconomic Household Surveys
SEU	Social Exclusion Unit
TAM	Technology Acceptance Model
UN	United Nations
UNECA	United Nations Economic Commission for Africa
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNICEF	United Nations Children Fund

DEFINITION OF TERMS

Bad roads:	Roads with poor surface conditions due to potholes, cracks, gullies, slippery surface, and mud-covered surface.
Feeder roads:	Roads that branch off major highways providing the final connection to people living and working in villages or rural communities.
Good roads:	Roads with good surface condition and efficient for vehicle use
Human capital:	Knowledge, skills, competencies and attributes embodied in individuals.
IMTs:	Vehicles used or specially designed to fill the gaps in the availability of conventional vehicles for transport services.
Industrialisation:	Development of industries and business on a large scale.
Motorised IMTs:	Vehicles that are motor-powered or operate with the aid of engines used or specially designed to fill the gaps in the availability of conventional vehicles for transport services.
Non-motorised IMTs:	Vehicles not motor-powered or do not operate with the aid of engines used or specially designed to fill the gaps in the availability of conventional vehicles for transport services.
Sustainable roads:	Roads that are in good condition, efficient for vehicle use, and resilient to climate change.
Sustainable transport:	Availability of efficient, reliable, and convenient vehicles for transportation services.

PUBLICATIONS

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ABSTRACT

Research indicates that accessibility and mobility are major problems that confront rural communities and deprive rural people access to socioeconomic opportunities and development. This study contributes to research on rural transport studies as well as on-going policy debate in Ghana on the relevance of promoting good road infrastructure and the need to promote rural transport services to address rural accessibility and mobility needs and to improve quality of life for rural people.

Drawing from the Hagarstand's Time Geography Theory and Maslow's Hierarchy of Needs Theory, this study explored the road and transport needs of communities located along feeder roads in Ghana and investigated the effects of such needs on their socioeconomic wellbeing and access to essential services and their quality of life. The views and perceptions of feeder roads expert engineers and rural people constituted the primary data. The data were gathered from January 2015 to November 2017 and analysed using content analysis.

The findings indicated that there is a perception that availability of good roads and transport services creates employment opportunities, opens up rural communities for socioeconomic trade, improves accessibility and mobility through transport service availability, and facilitates the movement of people and goods. It was also found that communities with bad roads lacked suitable vehicles/IMTs for transport services, and consequently the people in those communities were largely deprived of access to viable socioeconomic activities. It was further revealed that IMTs are important and serve as alternative transportation services, particularly in communities where conventional

vehicles are unavailable. It was perceived that the rural people were unable to own the motorised IMTs for transportation and farm purposes due to affordability. Moreover, it was found that commercial use of IMTs such as motor tricycles and motorcycles have been banned in Ghana and such served as disincentive to their use.

It is recommended that resilient and sustainable transport infrastructure development be embraced in Ghana to ensure the attainment of Sustainable Development Goals 1 (No poverty), 3 (Good health and wellbeing), 4 (Quality education), 9 (Industry, innovation, and infrastructure), and 11 (Sustainable cities and communities) in rural communities in Ghana. Furthermore, road engineers ought to apply innovation in the design of roads to ensure that roads are resilient to climate change. Moreover, it recommended that the *Road Traffic Regulation 2012* (Legislative Instrument (LI) 2180), which prohibits the use of motorcycles and motor tricycles for commercial transport, must be reviewed to allow the use of motor tricycles for commercial transport purposes in rural areas.

CHAPTER 1:

INTRODUCTION

1.0 Introduction to the study

The researcher had noticed that in Ghana rural areas mostly consist of isolated farming communities with deprived socioeconomic development. One of the surest ways to boost the socioeconomic activities of people who live in deprived rural communities is to improve their mobility and access to basic amenities.

In Ghana, there is a degree of investment in rural roads; some rural roads are good while others are in a poor condition and inaccessible, especially during the rainy seasons. In discussing the issue of rural roads, stakeholders often ignore the major role that the availability of conventional vehicles could play in the provision of effective rural transport services on feeder roads.

The researcher had observed that there is a conspicuous absence of vehicles for rural transport services in Ghana, which hampers easy accessibility and mobility. To address this inadequacy in Ghana's rural transportation system, intermediate means of transport (IMTs) are worth considering. Specifically, motorised IMTs are an appropriate form of rural transportation for feeder roads. The successful use of IMTs thrives on good roads and the willingness of rural dwellers to embrace their usage and functionality.

IMTs can be classified as motorised and non-motorised types. The motorised IMTs are vehicles that are motor-powered (operate with the aid of engines) whereas the non-motorised IMTs are vehicles that are manually operated (not motor-powered) and so usage and operating it relies on human or animal strength. The motorised IMTs include but not limited to cars, motorcycles and motorised tricycles. On the contrary, examples of non-motorised IMTs are bicycles, tricycles, four-wheel platform push cart, wheelbarrow etc. In fact, the use and sustainability of motorised IMTs on feeder roads have the potential to promote the fast, easy and convenient transport of goods and people, provided that rural transport planning incorporates the adoption of IMTs. An essential requirement at this stage of planning is to incorporate the accessibility and mobility needs of people who live in communities that are located along feeder roads based on the appraisals conducted.

In the above context, it is necessary to determine the accessibility and rural transport needs of rural communities in Ghana to ensure that their socioeconomic needs can be met.

1.1 Background to the study

1.1.1 Feeder roads infrastructure-led development

Transport ministries in developing countries, particularly in Africa, have concentrated on road construction and maintenance as a measure to enhance rural accessibility and mobility, and to foster rural development and improve the quality of life for rural people. In Ghana, for example, in 2015, out of the total national infrastructure budget of GH₵ 2.06 billion (approximately US$822 million) to be shared among four ministries, the Roads and Highways Ministry alone was allocated GH₵ 931 million (approximately US$266 million). Similarly, in 2016, out of the total national infrastructure budget allocation of GH₵1.4 billion (approximately US$355 million), the Roads and Highways Ministry was allocated GH₵625 million (approximately US$156 million). The roads and highways sector comprises trunk roads, urban roads and feeder roads. These feeder roads, constituting more than 50% of the total road network, connect greater parts of rural communities, where about half of the nation's population lives.

It is clear from these data that accessibility and mobility in Ghana are heavily dependent on the availability of good roads. However, funding and development in the roads sector do not correlate with improvements in road transport services. Despite the significant socioeconomic opportunities and gains of rural populations as a result of constructed feeder roads, appraisal models largely ignore the role of transport services. Yet there is a need to consider accessible, appropriate, timely and affordable vehicles as core to the development of feeder roads.

The next section highlights the problems facing rural transport services as a result of neglect.

1.1.2 Problems with rural transport services

A sole focus on roads creates inadequacies in rural transport services because transport services in most rural places are left to road users, many of whom rely on bicycles and scarce conventional vehicles, a considerable number of which are unreliable and unsuitable.

In Ghana, access to rural transport services is a problem because people who live in rural communities are poor and cannot afford the services or to own their own vehicles. For instance, many rural dwellers are compelled to cover long distances on foot. Furthermore, transport service operators are unreliable as their ability to provide an uninterrupted service is usually constrained by low patronage levels, the high cost of maintenance and poor road networks.

The lack of efficient road and transport services in rural areas may suggest that many road users are unable to access healthcare, economic opportunities, educational services and other social needs. Where access to conventional transport services is difficult, IMTs are sometimes used as alternatives to fill transport service inadequacies.

The next section throws light on the need for IMTs.

1.1.3 The need for IMTs

IMTs are used to address conventional transport challenges in developing countries such as India, Pakistan, Sri Lanka, Kenya and Nigeria. Motorised and non-motorised IMTs used in these places include motorcycles, bicycles and tricycles.

In Ghana, various types of IMTs are used in rural communities to provide transport services, particularly in the northern part of the country, but less so in the forest or middle belt and the southern zones. That IMTs are less prevalent in some areas indicates that their value has not been fully acknowledged by stakeholders in transport planning and services or by the people in rural communities, especially those located in the forest belt, such as Brong Ahafo, Eastern, Ashanti and some coastal areas of Ghana.

1.2 Research problem

Despite the recognition that accessibility and rural transport are important factors shaping the socioeconomic improvement of the lives of people in Africa, and Ghana in particular, efforts to address the rural transport challenges have been woefully inadequate; perhaps in part because significant empirical studies have not been conducted to serve as policy guidelines. Against this backdrop, this thesis seeks to find a solution to the accessibility and transport needs of rural communities in Ghana.

In view of the above discussions, this study also seeks to bridge the gap in empirical research and contribute to knowledge on transport studies in Ghana.

1.3 Aim of the study

This study explores the accessibility and transport needs of rural communities in Ghana and investigates the effects of these needs not being met on socioeconomic services and the quality of life of people living in rural communities located along feeder roads in Ghana.

1.4 Objectives of the study

The following specific objectives were developed for the study:

1. To investigate the extent to which feeder roads contribute to the development of rural people and rural communities in Ghana.
2. To establish the types and suitability of vehicles or IMTs used on feeder roads by people in rural communities in Ghana.
3. To identify the challenges associated with accessibility and mobility along feeder roads in rural communities in Ghana.
4. To determine how feeder road investments are appraised to meet the accessibility and transport needs of people living in rural communities in Ghana.

1.5 Significance of the study

This study advocates for sustainable development through investment in rural transport which would lead to a positive impact on mobility and on the accessibility of social facilities like schools, hospitals and markets, as well as access to job opportunities, for rural communities in developing countries. Greater investment in the rural economy also increases access to the markets of beneficiary rural communities and contributes to the growth of the national economy.

Such investment also helps to alleviate poverty and moves more of the population into the higher- and middle-income brackets. This study contributes to existing knowledge that poverty can be alleviated through the provision of appropriate transport vehicles, improved mobility and efficient transport services, enabling rural communities to access essential services such as health, markets, education and agricultural extension.

It provides further evidence that investment in rural transport is highly beneficial to the targeted communities when it incorporates the provision of transport services. The findings of this study contribute to deeper understanding of the rural transportation issues and challenges facing developing countries, such as Ghana. They also highlight the major issues associated with rural road transport, including those related to mobility and accessibility and contribute to the body of knowledge regarding sustainable transport development in rural areas.

1.6 Research questions

To achieve the objectives underpinning the primary aim of this research, this study is guided by the primary research question: What are the accessibility and transport needs of rural communities in Ghana and what may be the effects of these needs not being met on socioeconomic services and the quality of life of people who live in rural communities located along feeder roads in Ghana? The subsequent research questions have been developed from the primary research question:

1. To what extent do feeder roads contribute to the development of rural people and rural communities in Ghana?
2. What types of vehicles and IMTs may be used on feeder roads and how suitable are they in addressing the transportation needs of people in rural communities in Ghana?
3. What are some of the challenges associated with accessibility and mobility along feeder roads facing rural communities in Ghana?
4. How are feeder road investments appraised to meet the accessibility and transport needs of people in rural communities in Ghana?

1.7 Research methods used

The study adopts an interpretivist worldview paradigm with phenomenological qualitative research methods. Expert and group interviews are used for data collection. Semi-structured expert interview schedules are used as data collection instruments for the expert interviews, whereas semi-structured focus group interview schedules are used as the data collection instrument for the group interviews.

Both the expert and group data collected are analysed using content analysis and the findings from the data analysis are presented in tables and in narrative format. The findings are discussed in view of the research questions, and by drawing links to the secondary literature reviewed. Based on these discussions, conclusions are drawn.

1.8 Relevant literature review

The literature reviewed covers rural community issues, rural road transport issues, and accessibility and mobility in rural transport. It is essential to understand the relevant rural community issues when considering the transport and accessibility challenges facing rural communities in Ghana. Likewise, there is the need to understand rural road transport issues, including the associated challenges and benefits. Lastly, it is important to include an understanding of accessibility and mobility issues, especially in relation to the use of IMTs to address accessibility and mobility challenges.

1.9 Structure of the study

The study is divided into ten chapters. Chapter 1 covers the introduction and is followed by the literature review presented over Chapters 2, 3 and 4. The theoretical framework is presented in Chapter 5, and the study design in Chapter 6. Chapter 7 explains the processes of data collection and analysis. Chapters 8, 9 and 10 present the findings, discussions and conclusion, respectively.

Chapter 1 sets the foundation of the research and the next three chapters review literature to show where inadequacies exist that has guided the research.

CHAPTER 2:

RURAL COMMUNITY ISSUES

2.0 Introduction

The aim of this study is to explore the transport needs of people living along feeder roads in selected rural communities in the Brong Ahafo and Eastern regions of Ghana (Figure 2.1 and Figure 2.2 are maps with road networks in the Brong Ahafo and Eastern regions). In this chapter, a review of the literature on some of the issues facing rural communities in Ghana is undertaken, which is essential to understand the transport and accessibility challenges experienced by these communities.

In this review, the effects of isolation on socioeconomic development are considered, as well as potential interventions to remedy rural isolation and the problems associated with such interventions.

The literature review begins with a discussion of the concept of rural community. This is followed by a consideration of social issues such as the effects of rural isolation on essential activities like access to healthcare, education, employment, infrastructure and industrialisation. The review then looks at interventions, in particular feeder road infrastructure development, aimed at addressing or eliminating the isolation of rural communities and promoting sustainable rural development. This is followed by a discussion of the problems associated with these interventions. The chapter ends with a summary of the literature reviewed.

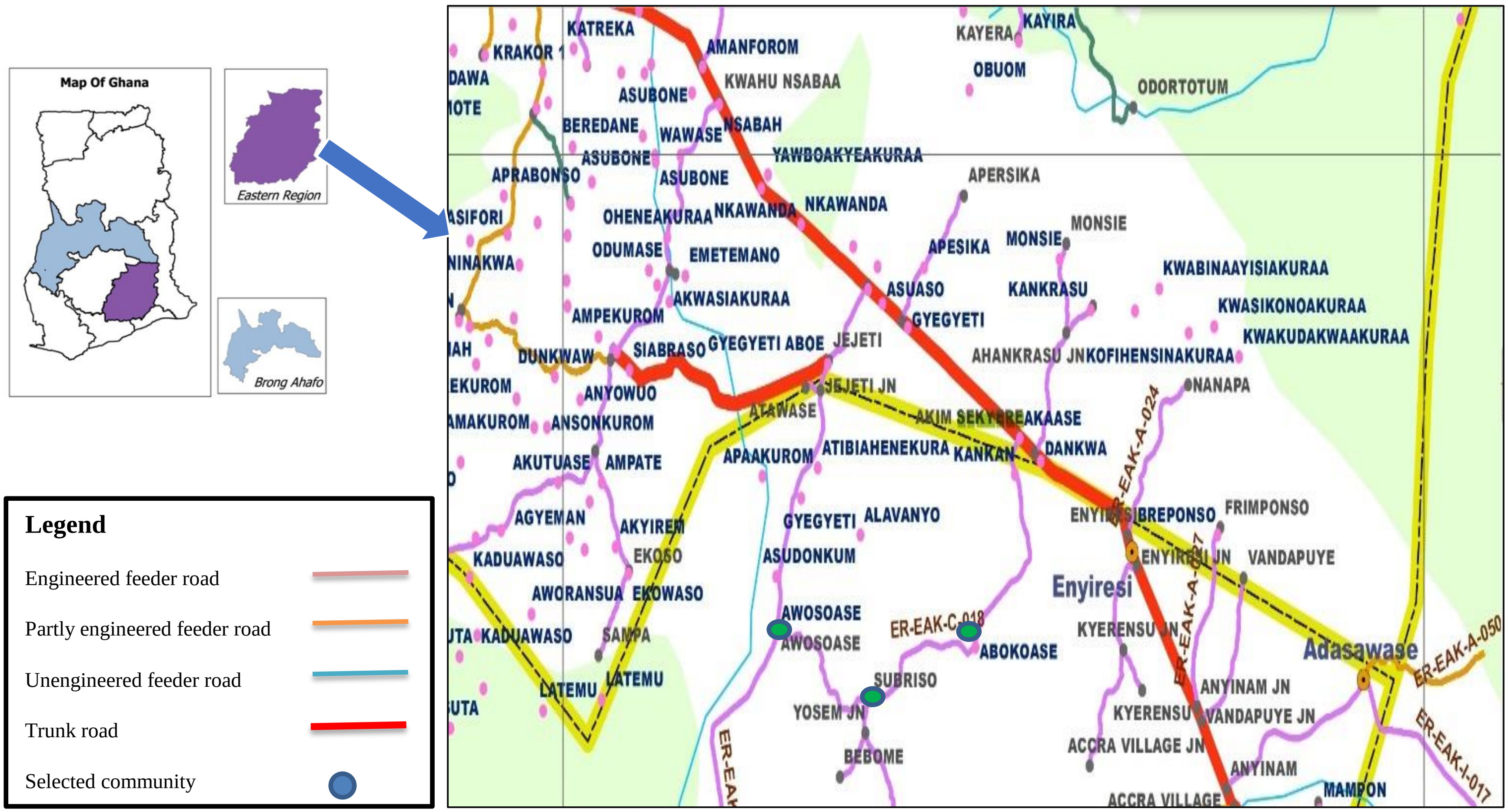

Figure 2.1: Area road network map in the Brong Ahafo Region;
Source: Adapted from Department of Feeder Roads Regional Map

Figure 2.2: Area road network map in the Eastern Region;
Source: Adapted from Department of Feeder Roads' Regional Map

2.1 Concept of rural community

An examination of the concept of rural community is necessary to inform the review of rural community road transport systems. Rural community is made up of two terms or concepts, namely community and rural, both of which are complex and ambiguous in nature, making the notion of rural community complex to analyse. To understand the term ‘rural community’, it is therefore important to first define the concepts of ‘community’ and ‘rural’ separately.

2.1.1 Concept of community

The term community is complex and ambiguous (Etzioni, 1995) because of the complexities involved in the formation or creation of a community (Shaw, 2008). Furthermore, the meaning of the term changes with time, influenced by ideological interpretation, political application and economic use.

Over time, the term community has been defined differently, with each definition expanding on previous definitions. The Oxford English Online Dictionary defines community as a group of people living in the same place or having particular characteristics in common, or a particular area or place considered together with its inhabitants. In the 14^{th} century, the term community was used to ‘refer to common people who are held together by their poverty and their culture’ (Mayo, 1994, p. 49; Nasibu, 2014). In the 16^{th} century, it was expanded to include the ‘quality of having something in common and the sense of common identity with shared characteristics’. In the 19^{th} century, it was further expanded to distinguish communities in terms of localities. More recently, Mayo (1994, p. 51) has defined community as ‘people who live in a common geographical area, and share common and diverse interests such as ethnic origin, religion, politics, and occupation'.

From these definitions, three main characteristics of community can be identified: place or locality, interest and function. Defining a community according to place or location is the most widely used approach (Tett, 2010). Notwithstanding, some sociologists, such as Ohmae (1991) and Castells (2010), are of the view that locality is not a defining feature of the 21st century use of the word 'community'. Their reasoning is that advancements in information and communications technology have paved the way for a new type of community based on networks and shared interest, where computer and phone contacts are used to network people who share a common interest/s.

In the context of this research, community is limited to locality, and is therefore taken to have the following features:

1. A community exists within the borders of a bigger community, which is the district, region, state or country.
2. A community has a well-defined geographical boundary that distinguishes its territories from those of other communities.
3. A community may be governed or managed by traditional authorities or governmental institutions, democratically elected leaders or imposed leaders.
4. The people in a community may be united by traditions, customs and practices.
5. The people in a community may or may not be united.

2.1.2 Concept of rural

The term or concept of 'rural', like community, is ambiguous and complex because its use can reflect a range of perspectives and can mean many things (Etzioni, 1995, Mayo, 1994). The Oxford English Online Dictionary defines 'rural' as an adjective used in, relating to, or characteristic of the countryside rather than the town. The concept is used to refer to remote or isolated locations (Saheed, 2017; Myrdal & Kristiansen, 2005). The concept is a modern one, receiving mention primarily in the context of urbanisation and modernisation. As per these socioeconomic concepts, massive urban development has occurred through technology, industry, transport service and socioeconomic infrastructure development, such as housing, universities, roads, theatres and hospitals (Myrdal & Kristiansen, 2005). The term 'rural' is used to reflect what is or may be obsolete, traditional, inferior, distant, natural, not urban, not modern, and undeveloped.

2.1.3 Rural community

Based on the above explanation of the concepts of community and rural, 'rural community' thus refers to localities characterised by the following:

1. Remote or distant from urban areas.
2. Lacks development.
3. Limited social and economic facilities and opportunities.
4. Lack of access to urban facilities such as cafes, restaurants, theatres and galleries.

These characteristics of rural communities pose challenges for the socioeconomic development of rural dwellers.

2.2 Rural isolation and its effects on rural socioeconomic development

This section considers rural isolation as a major characteristic of rural communities to highlight its effects on the socioeconomic development of rural people or communities. Isolation is a major feature of rural communities, especially those in developing countries such as Ghana in Sub-Saharan Africa. However, areas or communities may be located far from urban centres yet may not be isolated where accessibility and mobility are not limited.

Isolation refers to the situation where rural communities are deprived of adequate access to services or opportunities because of distance, poor road conditions, lack of or broken bridges, or inadequate transport (Narayan, 2000). Deprived access means that the people living in isolated communities are to an extent confined, as they are unable to travel or access other communities, or have access to markets, healthcare, education, employment, and other social activities found in urban centres or well-to-do communities.

Isolation may be external or internal. External isolation refers to localities or communities with deprived access and means of mobility to other localities or communities or urban centres. Internal isolation occurs as a result of rural community settlements being dispersed across vast territorial areas, with no developed road networks or paths and means of mobility.

In Ghana, for example, rural communities are often marginalised or isolated and virtually deprived of socioeconomic activities due to lack of connectivity (Afukaar, Damsere-Derry, Peters & Starkey, 2019; Berg & Ihlstrom, 2019; Atuoye, Dixon, Risworth, Galaa & Luginaah, 2015; Taiwo & Kumi, 2013; Danso-Wiredu, 2011; Adarkwa & Tamakloe, 2004; Donnges, 2003; Mahapa & Mashiri, 2001; Baker, 2000). Isolation creates a gap in the socioeconomic development between rural and urban communities, as indicated in Table 2.1.

Table 2.1: Urban–rural dichotomy in socioeconomic development indicators

Urban–rural dichotomy in socioeconomic development indicators			
Indicator	**National**	**Predominantly Urban**	**Predominantly Rural**
EMPLOYMENT (From November to December 2015)			
Employed population in informal sector (15 years and older)	90.0%	84.1%	96.2%
Unemployment rate	11.9%	13.4%	10.2%
Private sector employment	92.4%	88.8%	96.2%
Public sector employment	7.6%	11.2%	3.8%
EDUCATION (From November 2015 to December 2015)			
Literacy rate (11 years and older)	63%	74.5%	50.1%
Never attended school	100%	27.9%	72.1%
Ever attended school	100%	53.3%	44.7%
ECONOMIC (From November 2015 to December 2015)			
Economic activity participation rate of the population (15 years and older)	71.6%	68.9%	74.6%
Households engaged in agriculture activities	2,203,965	428,065	1,775,900
Number of people engaged in non-farm enterprise/business (mining, service, transport, etc)	8,564,434	7,251,577	1,312,857
Households source of lighting (electricity)	80.1%	93.7%	63%
Households main source of water supply for general use (pipe borne)	50.9%	72.8%	27.4%

Source: Republic of Ghana Statistical Service, 2016

The Table 2.1 presents data collected in Ghana in the year 2015 by the Republic of Ghana Statistical Service. The data covered socioeconomic development areas such as economic, education and employment from which development indicators are compared with the aim to outline urban–rural dichotomy in socioeconomic development. The indicators compared shows that urban communities are more developed than rural communities.

Economically, the data indicates that there are more households who are engaged in agriculture activities in rural communities than urban communities. The figure shows that about four times the number of households who are engaged in agriculture activities in urban communities can be found in the rural communities. This is an indication that farming is the main source of livelihood for people in rural communities in Ghana. Again, the indicator show that 1,312,857 out of a total population of 8,564,434 are people in rural communities engaged in non-farm enterprise/business such as mining, service, transport, etc. Furthermore, the data reveals that electricity is the major source of lighting for household in Ghana (80.1%). Out of the total of 80.1%, the data indicates that there are more households in urban communities that have access to electricity (93.7%) than households in rural communities (63%). Likewise, the data shows that pipe borne water is the main source of water used by households in Ghana (50%), however, more households in urban communities (72%) have access to pipe borne water than households in rural communities (27.4%).

The data presented under education show that education in urban communities are advanced than in rural communities. The literacy rate in Ghana for persons who are 11 years and older constitute 63%. However, literacy rate for persons who are 11 years and older in predominately urban communities in Ghana constitute 74.5%, and 50.1% for predominately rural communities. Furthermore, the data reveals that out of a total of 100%, a total of 72.1% are people in rural communities who have never attended school. Compared to rural communities, there are few people (27.9%) in urban communities in Ghana who have never attended school.

The employment indicators show that there is some level of unevenness in economic development of urban and rural communities. The national employment rate, for instance, is recorded 11.9%. However, it is recorded 13.4% for urban communities and 10.2% for rural communities. Again, the national private sectors employment rate is 92.4%; it is 88.8 % in urban communities, and 96.2% in rural communities in Ghana. Furthermore, the data indicates that there are more people in urban communities who are employed in the public sector than in the rural communities. This is probably because most state enterprises and departments are located in urban communities.

2.2.1 Effects of rural community isolation on education

Access to education implies equal opportunities for persons to be educated, regardless of location, gender and status (UNICEF and UNESCO 2007; UNESCO 2015a). Generally, the geographical locations of rural areas, particularly those in developing countries like Ghana, tend to deprive their inhabitants of access to opportunities and diminish the quality of the opportunities available (Chigu, Agheorghiesei, Vatamanu & Toader, 2018; Miller, 2015; Chigbu, 2013; Agyemang, 2009; Cobbold, 2006), such as quality education. Isolation deprives people living in rural communities in Ghana of access to quality education. Education plays a significant role in enhancing the lives of people and promoting development. It facilitates the building of human and social capital and can also be used to create other forms of capital such as financial (O'Leary, Burkett & Braithwaite, 2011).

Human capital encompasses the skills, talent and knowledge of community members (Haines, 2009). Hence, a lack of access to quality education for rural communities means a lack of human capital and social capital, leading to greater poverty among rural people. Inaccessibility serves as a major hindrance to Ghana's education policies such as ensuring equitable access to compulsory universal quality basic education (UN-country policy or program; UNESCO, 2015b; Africa Union, UN Economic Commission for Africa, African Development Bank, World Bank, & European Union, 2005) and achieving Sustainable Development Goal 4: Quality Education.

2.2.2 Effect of rural community isolation on health

One negative feature of isolation is the lack of sustainable and resilient infrastructure such as road and transport services to ensure access to the location of resources. This means that a lot of time must be invested in order to cover longer distances to access essential facilities and services, both within and outside communities in rural areas.

In Africa, for instance, a lack of accessibility and the long distances that must be covered in order to access health centres, coupled with a lack of adequate means of transport, deprive rural people of access to health centres (Republic of Ghana Geological Survey, 2015; Aminu, Romanus & Dinye, 2014; Sulemana & Dinye, 2014), or render such access onerous as people are forced to spend a great deal of time travelling long distances. In Tanzania, on average, rural people spend 1.5 hours travelling to access clinics and 5.5 hours to access hospitals (Ellis, 1997).

The lack of access, long distances and long travel times required to access health centres may affect attendance at health centres, regardless of the health condition of people (Edmonds, 1998). According to Howe and Roberts (1984), the likelihood of routine visits to clinics starts to diminish once the distance to such clinics exceeds four or five miles. While the high cost of medical treatment serves as a barrier to health access, distance and travel costs exacerbate the situation (Airey, 1992; 1991). In Morocco, it is reported, the improvement of rural roads and means of transport has increased the use of healthcare facilities (World Bank, 2000). Healthcare is a fundamental human need and is critical for development. A lack of access to healthcare results in an inability to receive treatment for diseases and illness, which exacerbates poverty as unhealthy persons will not be able to work.

2.2.3 Effect of rural community isolation on employment

Rural isolation confines rural people to social activities such as subsistence farming, fishing, hunting and livestock keeping (Witkiss, Hine & Ellis, 2001; Miller, 2015; Wiggins & Proctor, 2001). Farm products, livestock and fish are sold within the community or transported via difficult means to outside markets to be sold. In this context, rural employment in the informal sector is high compared to urban employment in the informal sector, and the incidence of poverty is high (World Bank & International Monitory Fund [IMF], 2013; Republic of Ghana Statistical Service, 2016; 2014; Coulombe & Wodon, 2007; Kabeer, 2009; Kabeer, 2000).

2.2.4 Effects of rural community isolation on market

A road can be classified into various types based on a number of factors which include but not limited to the material used for the road construction. The materials used for road construction vary and listed in order of quality and cost of construction are earth road, gravel road, bituminous road and concrete road. A road is said to be in poor condition if it has deteriorated such that vehicles find it difficult to ply on such road. A road that has poor condition may have developed any or a combination of features such as potholes, cracks, gullies, faded road markings, slippery surface, mud-covered surface, road debris, and missing or damaged signs.

Road transportation can be grouped into the transportation of goods and transportation of people. Transportation of goods and people are done with private or public (commercial) vehicles. Private vehicles are not accessible for use by the public or for the purpose of generating income. On the contrary, public vehicles are used to provide transport services to the general public with the aim of generating income. Whereas with private vehicles the user has the liberty to decide on time to move the vehicle and the choice of route, such decision in the case of public vehicles, is decided by the vehicle owners and the commercial transport unions.

The availability of good roads and transport services are required to promote rural markets. According to Porter (1995, 1997), where roads are poor and inaccessible, traders are often reluctant to travel to remote areas to do business unless the suppliers from more accessible areas are inadequate. Moreover, when urban-based traders reach out to these areas where access is difficult, there is often unfavourable negotiation, and therefore limited prices for local farmers, especially for perishable produce (Lyon, 1999).

In Ghana, a study conducted by the Department for International Development explored market opportunities in Ghana's off-road communities in the Central Region and the constraints placed on such opportunities for women and men in Gomoa and Assin districts (DFID Crop Post Harvest Programme Reports submitted under Project R7149). The study sampled four communities in Gomoa District and one community in Assin District. It collected qualitative data over a period of 13 months and found that Adabra, Sampa, Lome, Abora and Aworubo communities in the Central Region are deprived of adequate roads and that accessible transportation services are poor (DFID Crop Post Harvest Programme Reports submitted under Project R7149). The study further revealed that the communities have good road networks but that the roads were in poor condition, which hindered access to effective transportation.

In particular, the DFID reported that women at Adabra rural community lamented the difficulties of getting produce to the main market at Kasoa, located 15 miles away (DFID Crop Post Harvest Programme Reports submitted under Project R7149). Adabra once had its own market, but the market collapsed around 25 years ago, reportedly due to the deterioration in local road conditions. No transport service was based in the community, and on market days it was not common for a vehicle to pass through the settlement (DFID Crop Post Harvest Programme Reports submitted under Project R7149).

2.2.5 Effects of rural community isolation on infrastructure

Isolation can also have negative consequences for infrastructure development. In this regard, infrastructure can be divided into three categories: material, personal and institutional (Buhr, 2014; Nijkamp, 2000). Material infrastructure, also known as social amenities, public facilities and social overhead capital (Buhr, 2014), often requires huge capital investment and is mostly financed by government. Material infrastructure represents social and public facilities such as transportation, education and health facilities, buildings, and water and energy apparatus.

The availability of a good road network and transport services promotes transportation development. Indeed, various studies demonstrate the positive impact of transportation on economic growth and development (Cigu et al., 2018; UN ECOSOC, 2017; Dang & Sui Pheng, 2015; Akhmetzhanoy & Lustoy, 2013; Pradhan & Bagchi, 2013; Nobrega & Stich, 2012; Adler & Polsky, 2010; Sahoo & Dash, 2012; Stephan, 2001; Rietveld & Bruinsma, 1998; Munnell, 1992). Thus, where transportation is inadequate a lack of economic growth and development will result.

The availability of a good road network and transport services also facilitates personal infrastructure development. Personal infrastructure, also referred to as human capital (Buhr, 2014), is acknowledged as one of the most valuable assets belonging to a state, a community or an organisation (Fugar, Ashiboe-Mensah & Adinyira 2013). Human capital is defined by the Organisation for Economic Co-operation as the "knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being" (Organisation for Economic Co-operation, 2020, p. 29). Human capital is a significant construct for determining the success or failure of an organisation. It encompasses the knowledge, skills and capabilities of the population or members of an organisation (Deneulin, 2009; Bohlander, Snell & Sherman, 2001; Dess & Pickens, 1999). Personal infrastructure is an integral aspect of human capital refers to “the number and qualities of people in the market economy characterised by the division of labour with reference to their capabilities to contribute to their increase of the level and the degree of integration of economic activities” (Jochimsen, 1966, p. 133).

One significant attribute of human capital is its versatility in moving to and from regions and places in accordance with where conditions are favourable or unfavourable. The migration of human capital may be facilitated and limited by the availability of good road and transport services and vice versa. For instance, a study conducted by Akhmetzhanoy and Lustoy (2013) demonstrated the links between transportation infrastructure and regional development driven by population movement. In this regard, isolation serves as an impediment to development because it hinders the migration of human capital.

Isolation also inhibits institutional infrastructure by making it difficult for established state institutions to function effectively, specifically insofar as it renders implementation and enforcement of legalised regulations, conventions and legislation difficult. Institutional infrastructure is comprised of the state’s institutions; legislation, rules and regulations; and the procedures used to secure and execute such laws, rules and regulations (Buhr, 2014).

2.2.6 Effects of rural community isolation on industrialisation

Road transportation infrastructure forms the basic foundation that supports all production. Accordingly, transportation is an essential variable that causes a change in other production variables such as the production costs and market prices of industrial output (Buhr, 2014). A resilient transportation infrastructure is required to promote and ensure sustainable industrialisation (United Nations Economic and Social Council, 2017; 2020); thus, isolation imposes a limitation on such industrialisation.

The United Nations Economic and Social Council (ECOSOC, 2017) discussed the role of transportation infrastructure in shaping inclusive and sustainable industrialisation in Africa. ECOSOC's analysis demonstrated a direct relationship between certain variables such as levels, types and patterns of industrialisation, on the one hand, and transport infrastructure – specifically, road, air, rail and water – on the other hand. ECOSOC (2017) concluded that the gradual development of economic infrastructure is critical for industrialisation in Africa. This raises concerns about the impact of isolation on industrialisation in this continent.

A lack of or inadequate roads and transport services is a major challenge in developing countries that continues to widen the infrastructure gap between urban and rural areas and consequently limits the investment needed to support and facilitate growth in industrialisation (UN ECOSOC, 2017). Other challenges include a lack of effective regulatory and policy frameworks. According to ECOSOC (2020), globally, the total financial flow for economic infrastructure in developing countries reached US$61 billion in 2018, out of which the transport sector received US$22.8 billion.

To promote industrialisation especially in developing countries, isolation is a major obstacle that must be addressed with transport infrastructure development.

2.3 Rural isolation interventions

Two main causes of rural community isolation are lack of accessibility and lack of mobility. In view of this, any intervention to address rural isolation must embrace accessibility and mobility. Access to the location of economic and social activities is needed to improve the development of local or deprived rural communities. To meet accessibility needs and facilitate development, roads are constructed to link rural communities to places or areas with better socioeconomic activities (Ngezahayo, Burrow & Ghataora, 2019; Khandker, Bakht & Koolwal, 2006; Airey, 1991; 1992; Ahmed & Hossain, 1990; Arethun & Bhatta, 2012; Bryceson, Bradbury & Bradbury, 2008; Bryceson & Howe, 1993).

Throughout Europe, America and Asia, there are in existence rural roads with asphaltic overlays that are fairly accessible (Champion, 1998). Most developing countries, including Ghana, see the provision of access to good roads as a major policy intervention to eliminate isolation in rural communities and to foster socioeconomic development (Khandker et al., 2006). Over the years, governments in many developing countries, with the support of foreign development partners, have made major investments in road infrastructure in line with their priority to support growth. In the quest to reduce poverty, especially in rural areas, donor funds for investment have been directed to developing countries including Ghana.

For social and economic reasons, Ghana, like many countries in Africa, has been spending a greater proportion of its national budget on the rehabilitation and maintenance of feeder (rural) roads (Republic of Ghana Ministry of Roads and Highways, 2014). These feeder roads connect greater parts of rural communities in Ghana where almost half of the population live. In most of these rural areas, accessibility and mobility are major problems.

In Ghana, like many countries in Africa, rural roads are the roads that branch off the primary and secondary roads, providing the final connection to people living and working in villages or rural communities (Mishra & Swaroop, 2017). Many rural roads are unpaved and have earth surfaces, and are referred to as feeder roads in many developing countries. In Ghana, feeder roads are classified as either engineered feeder roads or un-engineered feeder roads. Those classified as engineered feeder roads have relatively better surface conditions than the un-engineered feeder roads. The un-engineered feeder roads are the roads that have not received engineering investment and lack a good riding surface and basic drainage structures like culverts and bridges. Feeder roads provide the critical access from villages or rural areas and farms to markets and urban centres.

In Ghana, the un-engineered rural roads are not under the jurisdiction of any governmental agencies, although they play a vital role for rural dwellers. Most of the time, there are no funding provisions for their maintenance due to budgetary constraints. The engineered feeder roads, however, are maintained by the Department of Feeder Roads (DFR) in Ghana with funds from the Ghana Road Fund (Republic of Ghana Ministry of Roads and Highways, 2014; 2017). The DFR is the main agency of the Ministry of Roads and Highways in charge of the management of feeder roads in Ghana and the Road Fund is a dedicated source of revenue for the maintenance of roads in Ghana. The Road Fund is managed by a Board and a Secretariat. Its main sources of revenue are the fuel levy, vehicle examination fees, and bridge, road and ferry tolls (Republic of Ghana Ministry of Roads and Highways, 2014).

2.4 Problems with rural isolation interventions

In most developing countries in the world, although there is a need to invest in both rural roads and transport services, evidence show that much attention is paid to rural road investment whereas little or no attention is paid to transport service investment (Van de Walle, 2002; Calvo, 1998; Dawson & Barwell, 1993). In Ghana, for instance, where funds are available to government for investment in rural transportation, very often the available funds are channelled into physical road interventions like providing all-weather road accessibility to rural communities without equal interventions in providing transport services. Yet focusing only on road accessibility to rural communities, successive governments are confronted by the problem of ensuring the free movement of goods and services, especially of farm produce to market centres. Besides the accessibility and mobility problem, relying on investments in rural roads alone has not adequately stimulated economic growth to increase the income levels of the beneficiary communities and thereby to reduce poverty.

Several studies have shown the positive relationship between road infrastructure development and socioeconomic development (Wondemu & Weiss, 2012; Narteh, 2012; Kingombe, 2011; Weisbrod & Reno, 2009; Bryceson et al., 2008; Dercon, Gilligan, Hoddinott & Woldehanna, 2007; Essakali, 2005; Bhatta, 2004; Fan & Chan-Kang, 2004; Porter, 2002a; 2002b; Escobal & Ponce, 2002; Leinback, 2000; Calvo, 1998; Leinback, 1982). In contrast, Hine (2014), Creightney (1993) and Howe (1981) disagree that road investment necessarily leads to socioeconomic development. Evidence from their studies, which focused on the impact of roads on development and paid close attention to causalities, concluded that the impact of roads on social services or development is linked to successful transport interventions. The relevance of transport interventions is further outlined by a study conducted by Riverson and Carapetis (1991) on 127 World Bank projects incorporating a feeder roads component. The World Bank acknowledged that the full benefits of structural adjustment across Sub-Saharan Africa could not be realised due to inadequate transport services.

The need for enhanced transport services in addition to road infrastructure has diverted the attention of policy makers and the researcher towards a focus on rural transport issues, as reviewed in Chapter 3.

2.5 Summary of main issues raised in this chapter

Rural communities are localities that are remote or distant from urban centres and sometimes have deprived socioeconomic infrastructure development. Such communities (localities) become isolated or marginalised when there is a lack of or inadequate road infrastructure networks (accessibility) and transport services (mobility) to connect the communities to urban centres or to other communities with socioeconomic facilities. Isolation makes rural communities much more vulnerable in terms of socioeconomic development, hindering their access to healthcare, education, employment and infrastructure and the opportunities arising from industrialisation. Poverty increases and indeed thrives in isolated rural communities.

Rural isolation intervention is expected to address issues around accessibility and mobility. In Sub-Saharan African countries like Ghana, isolation interventions are geared towards road infrastructure development, and give little or no attention to transport services. Yet rural road transport is a fundamental requirement for combatting rural isolation and promoting rural development and modernisation.

The next chapter explores the main issues related to rural road transport and highlights rural road transport as a basic requirement for rural community development.

CHAPTER 3:

RURAL ROAD TRANSPORT ISSUES

3.0 Introduction

In Chapter 2, through a review of the relevant literature some of the major issues pertaining to rural communities were analysed, such as the concept of a rural community, rural isolation and its effects on rural socioeconomic development, rural isolation interventions, and the problems associated with such interventions. The literature review found that rural communities in Sub-Saharan African countries such as Ghana have inadequate socioeconomic infrastructure development. It also identified that rural isolation is a problem in Sub-Saharan African countries including Ghana. Rural isolation, according to the literature, occurs where communities are deprived of accessibility and mobility. It was also found that communities that are isolated are poor and people in such communities have deprived lives due to their limited access to socioeconomic services.

To date, major interventions in Ghana designed to address isolation and thereby improve the quality of life of people have focused on rural road infrastructure development such as the construction of feeder roads. This focus on feeder road construction raises the question of the extent to which feeder roads contribute to the development of rural people and rural communities in Ghana. The question also arises as to the role played by transport services. Furthermore, the effectiveness of the models used to appraise rural roads needs to be considered. To find a lasting solution to rural isolation and the problems of accessibility and mobility, there is a need to understand the issues surrounding rural transport and its impact on development.

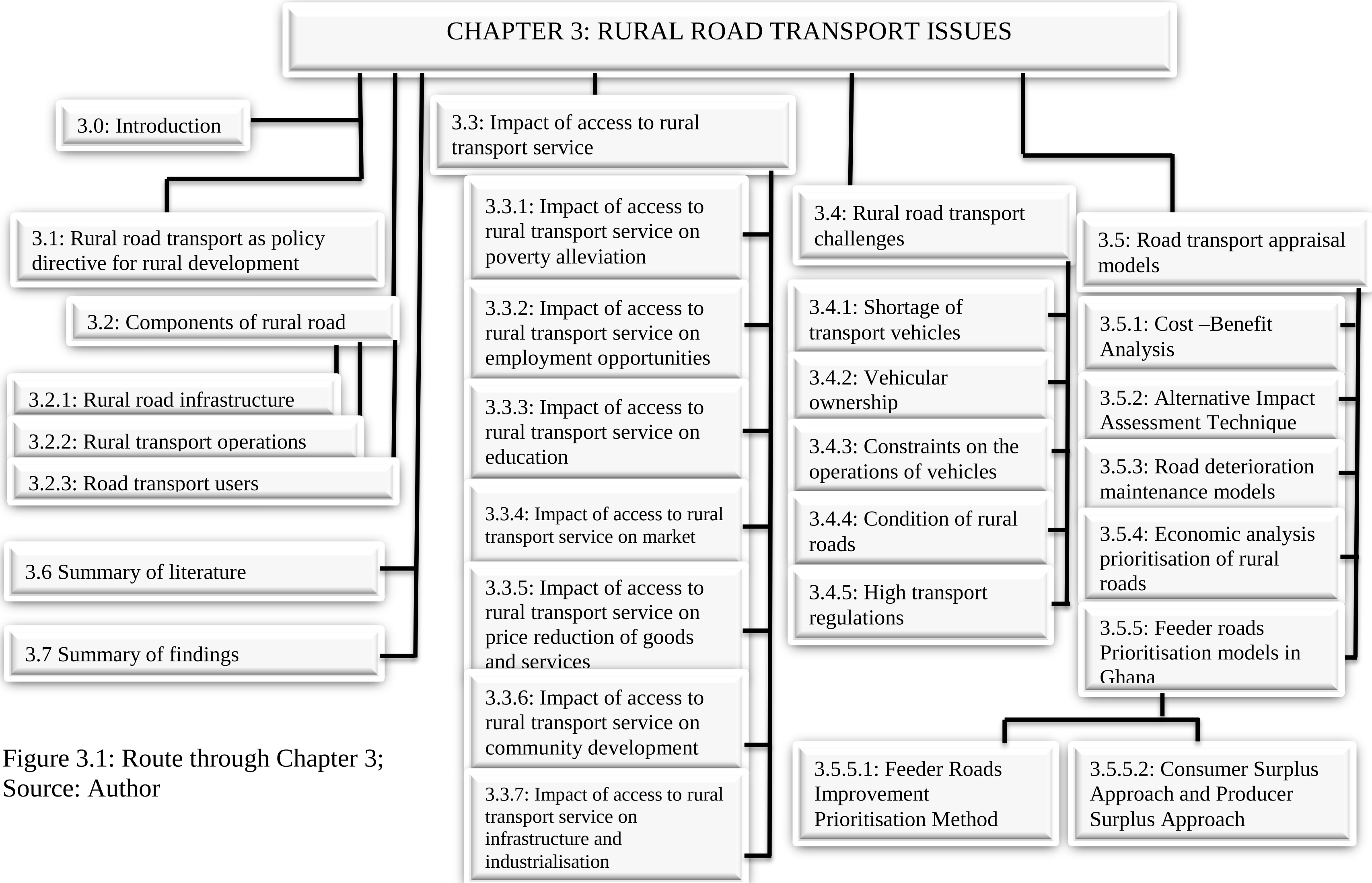

Figure 3.1: Route through Chapter 3; Source: Author

Figure 3.1 provides a route through the Chapter. In this chapter, the literature on rural road transport is explored to identify the major components that can impact rural isolation or problem of accessibility and mobility. The chapter covers major themes and issues such as rural development policy incorporating rural road transport, the components of rural road transport, the socioeconomic importance of rural road transport, the rural road transport challenges and road transport appraisal models. The review outlines the major findings and inadequacies in the literature in relation to road transport issues**.**

3.1 Rural road transport as a policy directive for rural development

Rural isolation is a major cause of poverty as it deprives rural people of access to essential services such as health, education, markets and employment, which are necessary for development and to improve the quality of life of rural people. To facilitate rural development, availability of transport services is very significant and it is established by the Rural Access Index as one of several headline transport indicators endorsed by the World Bank Transport Sector Board in 2003 (Calvo, 1994a).

The Rural Access Index was introduced by the World Bank in July 2005. It is defined as the number of rural people who live within two kilometres (typically equivalent to a walk of 20–25 minutes) of an all-season road as a proportion of the total rural population (Roberts, Shyam & Rastogi, 2006). According to the World Bank (2007), more than one billion of the world’s population living in rural areas do not have access to reliable transport, which is one of the basic needs for addressing rural isolation. Out of this population, 98% are in developing countries. Roberts et al. (2006) noted that communities without reliable access to social services or economic services are poorer than those with reliable access. They also acknowledged that, while sustainable access to rural transport is a good indicator when assessing the shortfall in rural transport, the full picture requires more detailed information. They further noted that more effort is required to understand rural communities transport needs to maximise the benefits provided by massive physical infrastructure developments.

The Asian Development Bank, in a study of its past projects, came to the conclusion that improving road infrastructure alone is not enough to reduce poverty and address other needs; hence, there is a need to find ways to more explicitly target the poor with complementary activities and services to enhance the livelihood opportunities available to them (Hine, 2019; Hettige, 2006). In drafting a proposal for the Post 2015 Developmental Agenda, Doczi, Dorr, Mason and Scott (2013) recommended the eradication of transport accessibility problems for the rural poor, whose access to health, education, markets, employment and other essential services is severely restricted. This recommendation was put to the United Nations for consideration (Doczi et al., 2013) as essential for rural development, especially in developing countries.

Providing rural road transport in developing countries is considered an important part of poverty reduction strategies (Banjo, Gordon & Riverson, 2012; Lucas, 2012; Bryceson, Bradbury & Bradbury, 2008; UN ESCO, 2007; Davis, 2005). However, shifting attention from the more visible urban problems to the problems impacting rural areas appears to be a difficult political move for most governments, for which the adverse impact of rural transport issues is rapid urbanisation confronting developing countries.

Public and private sector investment in road transport in developing countries, particularly Ghana, has been focused on developing urban transport to the extent that in most urban cities such as Accra, Tema and Kumasi, decongestion and efficiency appear to be the main objectives in recent times (Takyi, Kofi & Anin, 2013; Tackie, 2008; May & Marsden, 2011; Oppong, 2000; Abane, 1993). This leaves unaddressed the road transport needs of most of the rural population, who provide the bulk of agricultural produce, despite the fact that this inadequate accessibility restricts the movement and increases the isolation of these communities. Leaving rural dwellers or communities in isolation also means denied access to essential social services, economic activities and development.

3.2 Components of rural road transport

Every transport system is generally considered to consist of an origin and a destination (nodes), the linkage capacity (networks), the infrastructure and the volume frequency (Rodrigue, Comtois & Slack, 2006). Transport systems are incomplete in the absence of transport services as it is through the services that the system is managed efficiently (White, 2016; Rudestam & Newton, 1992). A rural road transport system, therefore, consists of the road transport infrastructure, the transport operations (services) and the transport users. In 2007, the Asian Development Bank asserted that for any transport system to function effectively, there must exist appropriate infrastructure, transport services, users, and traffic management and maintenance (institutions) systems. Therefore, any effective rural road transport policy must factor in the rural roads infrastructure, the vehicles or transport services, and the users.

3.2.1 Rural road infrastructure

The rural road infrastructure includes the trunk roads, feeder roads, tracks and paths. Paths and vehicular tracks networks connect villages, farms and water sources. Rural road infrastructure also includes lorry parks, bridges and culverts as well as the physical structures required by road administrative authorities and transport operators.

3.2.2 Road transport operations (services)

The main aim of a transport system is to facilitate the movement of people, goods and services from one geographic location to another. Road transport operations require the movement of goods and people on roads. This incorporates transport in both the rural and urban spheres. However, since this study is focused on rural road transport, the emphasis herein is on rural transport services. Rural transport services imply the various conventional vehicular means of moving goods and people along rural or feeder roads. Such services are provided by private individuals, institutions or organisations and the government (public). The vehicles used to provide these services are both motorised and non-motorised (Afukaar et al. 2019; De Bruijn, Van Dijk & Foeken, 2001; Willoughby, 2001; Ellis, 1997; Devan, 1996; IT Transport Limited, 1996).

In most countries in the world, transport services can be developed once the road infrastructure has been established. Examples of such countries are Egypt, India, Botswana and Thailand, where prior research has found that the provision of good road transport infrastructure consequently results in the provision of transport services (Howe & Roberts, 1984). However, in this previous research, no attention was given to the controls or factors that promoted the supply of vehicles after the roads were constructed.

Nevertheless, rural transport services will suffer as a result of the absence of institutional efficiencies, road infrastructural support and market discipline, which renders the service expensive and unreliable.

3.2.3 Rural transport users

Rural transport users include rural people, operators of for-hire transport services or commercial transport service operators, and government officials. In rural road transport, it is estimated that motorised transport used on rural roads comprises approximately 50 or fewer vehicles per day (Lebo & Schelling, 2001). This usage frequency suggests that these roads are utilised minimally. Furthermore, the use of non-motorised transport far exceeds the use of motorised transport.

3.3 Impact of access to rural transport services

In this section, the impact of access to rural transport services on the following is considered: rural poverty reduction; access to markets, education, employment opportunities and healthcare; rural community development, infrastructure and industrialisation.

3.3.1 Impact of access to rural road transport services on poverty alleviation

Rural road infrastructure development is known to have contributed to poverty reduction (Stifel, Minten & Koro, 2012; Wondemu, 2010; Menon & Warr, 2008; Levy, 2004; 1996; Escobal & Ponce, 2002). A study conducted in Ghana found that rural road transport investments reduced poverty (Adarkwa, 2003). Similarly, a comparative study conducted in China concluded that, when compared to express ways, feeder roads and other roads connecting rural areas made a great contribution to development and poverty alleviation (Fan & Chan-Kang, 2005). In addition, in 2007, a study conducted by the International Food Policy Research Institute (IFPRI) in India concluded that investment in rural road construction has reduced rural poverty to a significant extent compared to investment in agricultural research, development and education (Mohapatra & Chandrasekhar, 2007). What these above studies appear to do is equate rural poverty reduction with improved rural roads, but they neglect to consider other important factors such as availability and affordability of transport services. Such factors are found in a study by Adom-Asamoah (2016), who explored the extent to which road investments contribute to the achievement of the Millennium Development Goals (MDGs) (now superseded by the SDGs) in selected feeder roads in the Brong Ahafo and Ashanti regions of Ghana (the middle belt of the country). Adom-Asamoah’s research assessed the impacts of road investments on poverty reduction and the achievement of the MDGs on education and health (Goals 2 and 5), which have been incorporated into the SDGs, specifically Goal 3 (Good health and wellbeing) and Goal 4 (Quality education). The study revealed that improved corridors facilitated access to transport services, which led to a reduction in the cost of travel to market centres. This in turn increased productivity and crop harvest levels, generating significant income for rural households. Thus, access to transport services contributed to poverty reduction.

3.3.2 Impact of access to rural road transport services on employment opportunities

The labour-related impacts of rural road construction and improvement have been documented by several authors. Among them are Smith, Gorden, Meadows and Zwick (2001), who found that the rehabilitation of roads in rural Uganda enhanced service sector employment. A study conducted in the Tigray region of Ethiopia with the aim of gaining a deeper understanding of the impact of feeder roads on employment in Adiksandili found that the construction of feeder roads led to employment opportunities as a result of new transportation options, the establishment of small shops and cafes along the roads, greater ease of movement, temporary or permanent road workers, stone grinding activities, and service provision along the value chain (Beans, 2015). Thus, access to transport services enabled employment opportunities in a range of areas.

3.3.3 Impact of access to rural road transport services on education

Several studies have shown a positive relationship between road infrastructure and access to education (Bryceson et al., 2008; Bhatta, 2004). Furthermore, Bhatta (2004), in his Northern Ethiopian study, found that people with better access to roads have a higher educational attainment than those with poor access to roads. Bhatta’s study also revealed that road accessibility improvements significantly increase the likelihood of children being enrolled in school. This is because a lack of access hinders school attendance as well as the flow of information promoting school education among parents. It has also been found that road access facilitates access to other educational materials such as books, stationery and furniture, especially in remote areas of the developing world. A similar linkage between road transport investment and school attendance has been reported by a joint study of the African Union (AU) and the United Nations Economic Commission for Africa (UNECA), with the collaboration of the African Development Bank (AFDB), the World Bank and the European Union (EU). In a 2005 report titled *Transport and the Millennium Development Goals in Africa*, the group remarked that:

> Transport is an important input into education for carriage of pupils, teachers and supplies. The costs, dependability and safety of transport all affect school enrolment and attendance decisions directly and, especially in rural areas, also indirectly through their effect on the quality of teachers who can be recruited and on the extent to which inspectors will monitor the schools' operation. (p. 19)

Research carried out in the early 1990s, based on the Living Standards Measurement Survey (LSMS) data for Morocco, also led to the conclusion that the presence of a paved road in a community more than doubled girls' school attendance rate, from 21% to 48%, whilst boys' attendance rate increased from 58% to 76% (UNECA 2005, p. 19). Such research provides a strong indication that investment in rural transport produces positive results for the whole community.

3.3.4 Impact of access to rural road transport services on markets

Rural roads are significant because roads connect farmers to the markets where they can trade their goods (Minten, 1999). Gannon and Liu (1997) also found that investment in rural transport results in a reduction in production and transaction costs, which promotes trade through specialisation and enhances opportunities to propel economic growth. Lucas, Davis and Rikard (1996) have also shown that in Tanzania, the reconstruction and rehabilitation programme has led to a reduction in the costs related to passengers and goods accessing the markets. Other studies interested in how the quality of roads impacts different aspects of the rural community, such as the research of Ahmed and Hossain (1990), have revealed that villages with improved road accessibility experienced increases in agricultural production through a reduction in input prices and access to technical improvements, which in turn raised their incomes and increased the demand for labour; while the reverse was the case in the villages with poor access to the market. It is worth cautioning that the increase in agricultural productivity could have been a result of temporary factors which were not controlled in the study. Arethun and Bhatta (2012) also investigated the contribution of rural road accessibility to market participation in Northern Ethiopia, and revealed that locations with good access to rural roads had higher participation in market activities. However, in this critical relationship between access to roads and access to markets there is a hidden causal factor, which is the availability of transport services to enable the easy and safe transport of goods and people.

3.3.5 Impact of access to rural road transport services on price reduction of goods and services

Dercon et al. (2007) hold the view that if the major economic activity is agriculture, then improvement in roads has the potential to increase productivity through a reduction in the cost of inputs coupled with higher output prices. Khandker et al. (2006) conducted a study in Bangladesh where large increases in agriculture production, output prices and wages alongside a reduction in input costs and transport costs were recorded. Similarly, a study by Casaburi, Glennerster and Suri (2013) on rural roads and trade observed the impacts of improvements in rural road infrastructure on agricultural products and market prices in Sierra Leone. They found that those areas with improved rural roads had lower market prices for local crops, and vice versa. This is no surprise as Sierra Leone faces the unique problem of inland water bodies that are difficult to cross.

3.3.6 Impact of access to rural road transport services on community development

Rural road infrastructure and rural transport services have been used to facilitate rural community development in most countries in the world. It is established that investment in rural connectivity or feeder road construction has resulted in socioeconomic benefits such as a decline in the price of agricultural and consumer products, improved access to education, improved access to healthcare facilities, improved access to and expansion of markets, improved access to public transport and the creation of employment opportunities (Beans, 2015; Fan & Chan-Kang, 2004; World Bank, 2011; Anega, 2016; Afukaar et al. 2019; Berg & Ihlstrom, 2019).

3.3.7 Impact of access to rural road transport services on infrastructure and industrialisation

Economic development plays a decisive role in industrialisation and an essential factor driving economic development is transportation infrastructure. In his doctoral research, Agbigbe (2016) sought to understand the relationship between investment in road networks and economic development in Nigeria. His study was theoretically guided by Solow's economic growth theory and Frischmann's transportation infrastructure theory. Primary data was collected via the conduct of personal interviews with a purposive sample of 20 Nigerians, including previous and current public and private sector transportation employees directly involved in investment, management and policy administration. The findings suggested that investment in road networks promotes economic development and improves the standard of living of Nigerians.

Transportation infrastructure such as roads, railways, airports and waterways enable the transportation of materials and the flow of human capital that are critical for industrialisation, and influence production performance and investment in industry. Transportation infrastructure is essential for African manufacturers to procure input and to trade their output in a cost-efficient way (UN ECOSOC, 2017; Dimitriou, Mourmouris & Sartzetaki, 2015).

A very significant component of infrastructure development is the access to appropriate vehicles for transport services. Transport services, which are often overlooked, represent an indispensable factor and variable influencing manufacturing productivity, which promotes growth of industries, population and economy.

3.4 Rural road transport challenges

There are a number of issues confronting the effectiveness of rural road transport in Asian and Sub-Saharan African countries. These issues relate to a shortage of transport vehicles, vehicular (motorised and non-motorised) ownership, the high cost of transport fares, the poor condition of roads, and a lack of transport service regulation. In turn, these issues are discussed in context below to highlight their significance in undermining access to effective rural road transport.

3.4.1 Shortage of transport vehicles

Effective rural road transport requires the availability of appropriate or suitable vehicles (motorised and non-motorised) to meet the various transport needs of users. However, rural road transport can be undermined by a shortage of transport vehicles, especially motorised vehicles. In Zimbabwe, for example, it is established that the number of motorised trips per person per week in rural areas falls within the range of 0.2–0.5 in contrast to 3.5 in urban areas (Swedish Consultants, 1985; Ellis & Hine, 1998). In Ghana, Danso-Wiredu (2011) studied the problems affecting rural transport and the consequences for rural people, especially those living in villages that do not have regular access to transport systems. The study was conducted within the West-Akim District of the Eastern Region of the country (southern part of Ghana). Based on Danso-Wiredu's findings, most residents had to walk several kilometres to acquire basic daily necessities, with farmers having to carry their own farm produce on their heads to nearby roads or markets for sale. To alleviate this problem, Danso-Wiredu recommended improvements in conventional motorised transport services through such interventions as subsidies on targeted routes and community-owned transport, as well as increasing the provision of mobile transport services.

The reasons for the high rates of use of non-motorised vehicles in some parts of Ghana compared to the use of motorised vehicles relate to the challenges facing the rural transport system, such as the high cost of vehicular (motorised and non-motorised) ownership, the poor condition of roads and the lack of transport service regulation (Hine & Rutter, 2000; Fernando, 2000; Ellis, 1997; Ellis & Hine, 1995; Hine, 1993). As a result of these challenges, rural people rarely complement walking with the use of motorised vehicles, but otherwise mostly use non-motorised vehicles (GTZ, 2000; Chakwizira, Nhemachena, & Mashiri, 2010; Chakwizira, Nhemachena, Dube et al., 2010; Ellis & Hine, 1998; Calvo, 1994b).

3.4.2 Vehicular ownership

Vehicular ownership is a very significant factor determining the nature of rural road transport. Vehicles may be owned by the government (public), by rural dwellers for private use or by private individuals and organisations for commercial purposes. The vehicles that are privately owned may be motorised or non-motorised.

In rural Sub-Saharan Africa, rates of ownership of motorised and non-motorised vehicles are far below the levels found in Asian countries. For instance, the vehicular ownership rate in the rural areas of Sri Lanka is 14 times higher than that found in Ghana for non-motorised vehicles and 5 times higher than the rate in Zimbabwe for motorised vehicles (Ellis & Hine, 1995; Ellis, 1997). The reason for these low levels of vehicular ownership in Sub-Saharan Africa lies in the constraints on the operation of vehicles in rural road transport.

3.4.3 Constraints on the operation of vehicles

In Africa, especially Ghana, the constraints on the operation of vehicles include the limited availability of credit, the lack of competition in the transport market, limited information on the type of vehicles available, and limited availability of spare parts. Hence, any solution designed to enhance rural road transport must consider these constraints.

3.4.4 Condition of rural roads

The condition of rural roads affects rural transport. Road infrastructure developments differ across the rural areas of the world. In rural areas, which are typical of the United Kingdom and the United States, roads are paved and the main challenge facing rural areas is the lack of access to certain transportation facilities such as public transport systems due to the lower population densities in these areas. In contrast, in Africa, especially Sub-Sahara, rural communities are largely inaccessible; and in the few that are accessible, most of the roads are in poor condition, which hinders efficient and effective transport.

Sustainable roads that are resistant to climate change are required to enable efficient and effective transportation. One study has estimated that, from 2020 to 2100, it will cost Ghana US$473 million to maintain roads and repair the damage to them due to climate change and its impact on roads (Twerefou, Chinowsky, Adjei-Mantey & Strzepek, 2015). The mitigating factor here will be the need for appropriate designs that harness innovation in road construction (Twerefou et al., 2015). The roads in Ghana are affected by extreme weather conditions such as high temperatures during the dry season and heavy rainfall during the wet season.

A study conducted by the World Bank (1996) indicated that the average global temperature will increase by between $1.4^{o}{}_{C}$ and $5.8^{o}{}_{C}$ over the next 100 years if no interventions are universally introduced to control it. In Ghana, for example, a report from the Environmental Protection Agency (EPA), United Nations Development Programme (UNDP), United Nations Environmental Programme (UNEP) (2000) based on data collected between 1962 and 2001, envisaged that there will be a progressive rise in both maximum and minimum temperatures for all regions and a decreasing trend in rainfall patterns. The report specifically projected an average annual temperature increase of 0.8 by the close of 2020 and a temperature increase of 5.4 by the close of 2080. Furthermore, it is estimated that annual rainfall will decline by 1% in 2020 and by 20.5% in 2080.

The UN ECOSOC (2017) made some recommendations to guide the construction and maintenance of resilient and sustainable roads that would withstand climate change. The first recommendation directed road engineers to design roads to withstand extreme heat. The council also recommended an improvement in road emergency repairs procedures and a drainage systems upgrade, as well as the installation of fire barriers beside roads.

There is evidence that some roads in Ghana are in a deplorable condition, which negatively affects efficient transportation. Naazie, Braimah and Atindana (2018), for instance, investigated the impact of bad roads on the transportation system, and its maintenance and service costs, in the Gushegu District in the Northern Region of Ghana. Their study collected and analysed data from 150 drivers, driver assistants and transport owners, and found that the poor condition of roads in the district had resulted in the frequent breakdown of vehicles and increased maintenance costs. In view of their findings, Naazie et al. suggested that road infrastructure policy be developed to enhance the sustainability of road infrastructure and encourage public participation in road infrastructure provision and maintenance to promote development.

In another study, conducted in the Akwapim South District in the Eastern Region of Ghana, which explored the interrelatedness between rural transport and rural development, Okoko (2011) found that all the sampled feeder roads within the study area were in a deplorable condition of disrepair and therefore needed urgent rehabilitation. These roads were ordinary earth roads without any paved (bituminous or asphaltic) surface, which were severely eroded, dusty and dotted with potholes, so that the roads would become difficult to use during the wet season, inhibiting vehicular mobility. Angmor (2012) examined the relationship between road transportation and traditional markets in the Upper Manya District and Lower Manya District in Ghana. This study made use of a case study design and collected data in two traditional markets in Agormanya and Asesewa. The findings of Angmor's study established a strong linkage between road transportation and traditional markets but that the two have not been managed effectively for the past decade in these districts, limiting the potential benefits of transport services. The study also found that as a result of the poor condition of roads in the study areas, travel speed is low, leading to long travel times and high transport fares because drivers complain of vehicle damages due to the poor condition of roads.

Adom-Asamoah (2016) also conducted a study in Ghana and concluded that improvements in the condition of road corridors resulted in increases in average daily traffic volumes for motorised and non-motorised transport vehicles alike. Engagement in social and economic activities and the wellbeing of rural people are both tied to the state of the rural transportation service, which to a large extent can be affected negatively by the condition of roads in rural areas.

Morgan, Dogbey, Arimiyaw, Foster and Owusu (2019) identified the effects of poor road transport accessibility on the marketing of agricultural produce in the Kasena-Nankana West District of Ghana. Data were collected from farmers, transport operators from three communities (Babile, Chaina and Naania) and officials from the Department of Feeder Roads of the District Assembly, on the marketing of agricultural produce in the district. The study found that, as a result of the poor condition of roads, transport services providers charged high transport fares and vehicles were often overloaded with goods and passengers. Morgan et al. (2019) also found that farmers were compelled to sell their produce at lower prices at the farm gate because the poor condition of roads make it difficult to have access to vehicles to transport their produce to the markets.

3.4.5 High transport service regulation

Commercial transport services are essential to rural road transport. Commercial transport services make available to rural people various types of vehicles (mostly motorised), which help to bridge the divide between those who own vehicles and those who do not, particularly in Africa and Asia (Ellis, 1997). However, more often than not, commercial transport is highly regulated by transport service unions.

The transport service unions possess the authority to regulate transport services by determining the types of vehicles to ply various roads, controlling the price of transport fares, registering union membership, and determining the loading of passengers. An example of such a union is the Ghana Private Road Transport Union, which exerts a high level of influence over the types of commercial vehicles that can ply rural roads, on transport fares for rural transports and on vehicular movement schedules. In view of such union control, owners of commercial vehicles who are members of the union are not independent when it has to do with making decisions on commercial transport services.

3.5 Road transport appraisal models

Any appraisal of road transport must consider the components of road transport. In this section of the literature review, a number of road transport appraisal models are reviewed with the aim of understanding how those models holistically account for the components of road transport.

3.5.1 Cost-Benefit Analysis (CBA)

Derived from two words, ‘cost’ and ‘benefit’, a cost-benefit analysis is undertaken by comparing the cost of constructing a road with the direct benefits of the road to society (Lombard & Coetzer, 2007; Belay, Torp, Thodesen & Odeck, 2016; Pienaar, 2014; World Bank, 2000; Pearce, 1998). CBA is one of the oldest analytical models used to assess road transport and the most widely and frequently used analytical tool. In using this model, every possible gain and loss of a proposed road construction is identified, converted into monetary units and compared to the community benefits that will be derived from construction of the road, in order to decide whether the proposed road is necessary (Zerbe & Dively, 1994).

There are four ways to conduct CBA. These are ‘ex-ante’, ‘ex-post,’ ‘medias res’ analysis and ‘comparative CBA’ (Boardman, Mallery & Vining, 1994). The ‘ex-ante’ analysis is done before a road project is executed. After the project has been completed, the ex-post analysis is undertaken to holistically evaluate the project by identifying both its successes and failures (Boardman et al., 1994). ‘Medias res’ analysis is carried out in the course of project execution to decide whether or not to continue the project, and to forecast future ‘ex-ante’ by learning from the CBA. The last way, ‘comparative CBA’, is done to compare the ‘ex-ante’ to the ‘medias res’ or ‘ex-post’ (Boardman et al., 1994). The ‘comparative CBA’ is undertaken to generate tools for learning about the efficiency of CBA for decision-making (Boardman et al., 1994).

Carrying out a CBA is essential because road transport projects impact the following three main groups: 1) the beneficiaries of the road; 2) taxpayers or financial providers; and 3) parties who become aggrieved or incur losses when the project is executed. To ensure the efficient allocation of scarce resources and to address needs and challenges, all three parties must be identified; and losses and gains must be calculated to determine whether the road to be constructed is feasible from the standpoint of the community or society. There are various CBA Models such as Highway Development Management (HDM) - III Model and HDM IV.

HDM models were developed as software tools for high traffic road development and management. The first of such tools was HDM-III, a road management system and a decision-making tool intended for low-income economies, developed by the World Bank in the 1980s. Not long after the HDM-III was developed, the World Bank introduced HDM-IV as an enhancement of the HDM-III. The HDM-IV covered the following three levels of analysis: project, programme and strategic analysis. The HDM-III and HDM-IV software tools measured performance models for paved and engineered unpaved roads. The HDM-IV was favourable for high-volume roads with a vehicle per day count of more than 300. As a software tool, the HDM-IV required more complex input data and detailed economic evaluation.

The HDM-IV software tool did not account for non-motorised traffic benefits and gave limited allowance for the incorporation of economic analysis. The economic analysis carried out within the HDM-IV system measured or quantified the benefits and costs of the road to road users (Lombard & Coetzer, 2007). The HDM is used as a World Bank software tool to: 1) support decision-making, road management and the expansion of traffic capacity, 2) appraise road projects, 3) develop road programmes, and 4) evaluate long-term road system investment alternatives (Lombard & Coetzer, 2007).

HDM is useful for high traffic volume road appraisals, but not for feeder roads or rural roads with low traffic volumes (Lombard & Coetzer, 2007). In view of this, an Alternative Impact Assessment Technique (AIAT) was introduced to deal with feeder and rural roads.

3.5.2 Alternative Impact Assessment Technique (AIAT)

The AIAT is suitable for developing countries, especially those in Africa. It is more useful than the HDM for rural road analysis, where the roads are unpaved and have a lower traffic volume. The AIAT focuses on estimating both direct and induced benefits, and allows for diverse data collection methods and analyses. The methods of collecting data include Socioeconomic Household Surveys (SEHHS), which can be structured in a way that identifies perceived benefits. Lombard and Coetzer (2007) outlined the types of data that can be collected using SEHHS, which include:

- impacts on community activity
- constraints experienced due to deficiency in road investment
- relation between rural roads infrastructure and poverty, accessibility and mobility
- effect of investment on daily activities or living conditions
- influence of gender on rural investment

- whether access to facilities differs by income and location.

There are various AIAT analysis models, significant among them being the Roads Economic Decision Model (RED).

RED originated as a component of the Sub-Saharan Africa Transport Policy (SSATP). RED was developed by Rodrigo Archondo-Callao of the World Bank (Archondo-Callao, 1999; 2001) to fulfil four objectives: 1) to undertake an economic evaluation of low-volume roads, 2) to capture the economic benefits of projects, 3) to undertake risk analysis on low-volume roads, and 4) to produce good sensitivity, switching values, user impacts, and distribution of benefits evaluation (Archondo-Callao, 1999; 2001; Lombard & Coetzer, 2007; Gine, 2012). Unlike the HDM–III and HDM–IV, which focused primarily on high-volume roads, RED focuses on low-volume roads, economic development, uncertainty, the people served by the road, the importance of cargo, and social services (Archondo-Callao, 2001). The differences between HDM Models and RED are summarised in Table 3.1.

Table 3.1: HDM models and RED benefits

HDM models and RED benefits			
Benefits	**HDM –III**	**HDMM -IV**	**RED**
Vehicle operating cost generated traffic	Yes	Yes	Yes
Vehicle operating cost diverted traffic	No	Yes	Yes
Passenger time	Yes	Yes	Yes
Cargo delay time	Yes	Yes	Yes
Accidents	No	Yes	Yes
Non-motorised traffic	No	Yes	Yes
Social and other	External	External	External

Source: (Archondo-Callao, 2001)

RED is used as a software tool for analysis related to low-volume roads with a vehicle per day count of less than 200. It requires simple data input and simplified economic evaluation. The tool considers the benefits of non-motorised vehicles and also socioeconomic benefits derived from the road (Lombard & Coetzer, 2007; Archondo-Callao, 2001). Other appraisal techniques are used worldwide, including for road analysis. Generally, these models can be categorised as either road deterioration and maintenance models or economic analysis and prioritisation of rural roads. The next section summarises some of the road appraisal models used and the analyses conducted within them.

3.5.3 Road deterioration and maintenance models

Road deterioration and maintenance models are made up of various appraisal models. These include the following:

- Performance models developed in South Africa and Namibia: these models are used to analyse the performance of road materials and the deterioration rate of materials under different climates and traffic conditions (Piage-Green & Visser 1991; NITRR, 2009; Chamorro-Gine 2012).
- Maintenance and Design System Model: this model is used to predict gravel-loss, and to measure roughness progression and roughness after blading.
- HDM-III and HDM-IV: these models are used to analyse annual gravel lost, rate of roughness progression, and roughness after blading (Watanatada, Harral, Paterson, Bhandari & Tsunokawa, 1987; Gine, 2012).

- Road Investment Model for Developing Countries: this model is used to analyse the effect of road geometry on vehicle operating costs (Parsley & Robinson, 1982)
- Australian Model: this model is used to estimate grading and gravelling requirements. It is also used to analyse traffic, soil condition, and climate conditions on road.
- Canada Forest Engineer Research Institute Model: this model is used to predict road performance. It is designed for high-traffic forest roads (Provencher, 1995; Gine, 2012).

3.5.4 Economic analysis and prioritisation of rural roads

The Socioeconomic Impact Valuation Method entails a two-part analysis: a primary or direct measure, and secondary or indirect measure. The primary measure focuses on reduced travel time and savings in vehicle operating costs. The secondary or indirect measure focuses on increases in income and other dimensions of wellbeing, such as health, education, political participation and social interactions, all of which are impacted by road improvements (Gine, 2012).

- Rural Access Index: this analysis prioritises addressing rural isolation. It focuses on the need for access and mobility to reduce poverty in rural or socioeconomically deprived communities (Roberts et al., 2006). The index measures the percentage of rural populations that live within a 2-km radius of an all-season road (Gine, 2012).

- Basic Access Approach: this model prioritises the provision and maintenance of reliable all-season access road networks.
- Integrated Rural Accessibility Planning: this model uses a multi-sector and integrated planning tool. It prioritises the improvement of physical infrastructure, means of transport, location planning, and improving the quality of service (SSATP 2008; Gine 2012).
- Multi-criteria Analysis and Ranking Method: this method ranks road projects in order of importance via a point system such as proximity to healthcare, traffic levels, and access to education (Lebo & Schelling, 2001; Gine, 2012).

3.5.5 Feeder road prioritisation models in Ghana

The literature review identified the following three prioritisation models used in Ghana: the Feeder Roads Improvement Prioritisation Method, the Consumer Surplus Approach, and the Producer Surplus Approach. These models are used to analyse road investments, especially with regard to the construction of new feeder roads, the maintenance of feeder roads and the rehabilitation of feeder roads.

3.5.5.1 Feeder Roads Improvement Prioritisation Method

This model was developed jointly by the Department of Feeder Roads of the Ministry of Roads and Transport in Ghana and the United Kingdom Department of International Development, in the year 1999 (Hine, Ellis, Done & Korbe, 2001). This prioritisation method encompasses a series of stakeholder consultations, procedures, activities and selection processes aimed at prioritising poor or deplorable roads for improvement. It is based on a decentralised district-level system that involves the community in bottom-up decision-making on road policy (Hine et al., 2001).

The method divides each district into 10 areas and divides each area into 10 units. The selection process involves the nomination of roads by community members at each unit; the selection of two candidate roads from each unit; the ranking of all candidate roads from the areas of each district, from which a road each is selected as the district candidate road; and the ranking of district candidate roads in a descending order with the aid of a prioritisation index (where the total benefit of a road is divided by the cost of improving the road). The ranking and selection of roads at the unit, area and district levels are done by consensus or by pair-wise comparison using agreed criteria (Hine et al., 2001). The pair-wise criteria used include: the cost of providing access and full rehabilitation of road, the number of people living within road catchment areas, and the distance between the population and essential facilities.

The roads selected at the district level are allocated 50% of project funds, which distributed in a descending order until the funds are exhausted. The funds enable benefits such as opening up impassable roads, providing the local population with access to social services and facilities, and providing an easier passage for non-motorised vehicles (Hine et al., 2001). The remaining 50% of funding is used for other road improvement works in the entire project area. The roads considered for this funding are those considered as having a high incidence of poverty based on a prioritisation index that calculates a district poverty weighting (Hine et al., 2001).

Implementation of the model may seem complex, especially given the procedures undertaken at the unit, area and district levels and the number of stakeholder consultations carried out. However, the Feeder Roads Improvement Prioritisation Method combines components of several prioritisation analysis models such as the Road Access Index, Multi-Criteria Analysis and Ranking, and the Basic Access Approach, to improve feeder roads and address road infrastructure development challenges.

Essentially, the model ensures openness and fairness in road improvement decisions and prevents political interference in such decision-making processes, which are often otherwise considered to be corrupt and bias. Unlike the Consumer Surplus Approach to road improvements, this model has the merit of providing a roadmap for district road improvement that addresses the relevant road infrastructural needs of district communities.

3.5.5.2 Consumer Surplus Approach and Producer Surplus Approach

These are very old models used to prioritise road investment in agricultural zone areas. Under these models, the construction of roads, the maintenance of roads and the rehabilitation of roads are considered in farm areas or rural communities in order to reduce the cost of transportation and to facilitate production output. Essentially, areas with a high volume of food and cash crops such as maize and cocoa production are favoured. This is based on the idea that high transport costs affect produce costs and have an impact on production yield (Hine et al., 2001).

3.6 Summary of review of rural transport issues

Table 3.2 provides a summary of the findings of the literature review on rural transport issues.

Table 3.2: Summary of literature and gaps/findings on rural road transport

Summary of literature and gaps/findings on rural road transport	
Topic/sub-topic	**Findings/gaps identified**
Transport appraisal models	Appraisal models fail to cover the components of road transport such as transport services and transport service users. This includes the existing literature on models used to appraise feeder roads in Ghana.
Rural road transport challenges	Existing challenges found in the literature are a shortage of transport vehicles, the inability of rural people to own motorised vehicles, the poor condition of roads, and the limitations imposed by transport service regulation bodies or unions.
Relevance of rural road transport	Rural road transport impacts certain social issues such as education, employment, access to markets, poverty and prices of goods and services, based on a strong link between the three rural transport variables of road infrastructure, the availability of transport vehicles and the use of transport vehicles.
Components of rural road transport	Rural road transport is comprised on three main components which are interrelated, namely road infrastructure, transport services and users of transport services.
Rural road transport as policy directive	Rural road transport is backed by international and national policy directives

Source: Author

3.7 Summary of findings discussed in this chapter

Access to rural road transport is necessary for addressing rural isolation and promoting rural development. Improving such access is supported by international and national policy directives. However, most Sub-Saharan African countries, particularly Ghana, find it difficult to implement rural road transport policy.

Projects aimed at developing rural transport must attend to all of its components (road infrastructure development, transport services development and user needs) as they are all equally important and interrelated. The provision of rural transport in any community will promote access to healthcare, education, employment, markets and social services, which are significant factors determining the quality of life of rural people.

Effective rural road transport is, however, faced with multiple challenges in many countries in the world, particularly Sub-Saharan African countries like Ghana. These challenges include a shortage of transport vehicles, the inability of rural people to own motorised vehicles and the poor condition of roads. These challenges raise questions about rural accessibility and mobility.

The next chapter reviews the literature on rural accessibility and mobility, with a focus on the use of IMTs to bridge the accessibility inadequacies in rural transport.

CHAPTER 4:

ACCESSIBILITY AND MOBILITY IN RURAL TRANSPORT

4.0 Introduction

In Chapter 3, the literature on rural transport issues was reviewed. The review covered themes relevant to the present study such as the components of rural road transport, relevance of rural road transport and the challenges facing rural road transport challenges. The findings of the literature review indicated that access to rural road transport is a basic requirement for addressing rural isolation, promoting development or improving the quality of life of rural people. It was also identified that promoting road transport entails developing its three components: road infrastructure development, the provision of transport services for rural people, and acceptance and use of transport services by rural people (users). Likewise, it was found that certain challenges pertain to the promotion of rural road transport, such as a shortage of conventional transport vehicles, the inability of rural people to own motorised vehicles and the poor condition of roads. These challenges in turn raise concerns about the impact of a lack of accessibility and mobility.

In this chapter, rural accessibility and mobility issues are reviewed, highlighting the need for and use of IMTs to bridge the accessibility and mobility gap in rural communities. The review presented in this chapter is in line with the second research question: *What types of vehicles and IMTs may be used on feeder roads and how suitable are they to address the transportation needs of the people in rural communities in Ghana?* The review begins with a discussion of the concepts of accessibility and mobility. The literature review then considers rural accessibility and Integrated Rural Accessibility Planning (IRAP), based on which IMTs are acknowledged as key solutions to the rural accessibility and mobility challenges in rural transport planning. Next the review covers other areas such as IMTs as solutions to rural accessibility and mobility challenges, types of IMTs, the state of IMTs in Africa, and issues affecting IMT implementation. A summary of the reviewed literature on accessibility and mobility in rural transport is then provided, followed by a discussion of the key gaps and findings identified.

4.1 Concepts of accessibility and mobility

Accessibility and mobility are explored in order to give premium to time, distance, and cost as variables to be considered in rural transport planning. Consideration of time, distance and cost is essential to determine the various IMT-related interventions appropriate to address rural transport needs. The terms *accessibility* and *mobility* have been widely used in the literature with various contextualised meanings. The two terms are sometimes used interchangeably, because they are often referred to together and have a close relationship. However, the two are not identical in meaning; rather, mobility can be seen as an aspect of accessibility. In this review, the two concepts are explained in order to outline their role in promoting rural transport development.

4.1.1 Concept of accessibility

The concept *accessibility* may be defined as the ease of access to a facility or place, or how a place or facility can be reached from another location. Perhaps a clearer description of accessibility has been provided by the Social Exclusion Unit (SEU) of England (SEU, 2003). The SEU sees accessibility as the ease of accessing key services at a reasonable cost in a reasonable time. According to this view, accessibility can be understood in relation to the existence of transport between people and a service, and people's awareness of that transport service. The SEU is of the opinion that providing transport is not sufficient to ensure access, and that locating the services at places where they can be physically accessed is also necessary (SEU 2003).

4.1.2 Concept of mobility

Unlike **accessibility,** which conveys ease of access, **mobility** relates to the ease of movement whether by public transport, private motor vehicle, cycling, walking, or animal carts, to name a few examples. Mobility depends on the availability, affordability and efficiency of such transport systems. It encompasses both spatial and temporal dimensions, which exist in numerous forms from the local to the global spheres (De Bruijn et al., 2001). Mobility, therefore, is a broad concept and should be viewed as a normal part of life, with immobility being an anomaly (Sheller & Urry, 2006). The term **mobility** refers to the ability to move and the ease of moving goods and services. In the context of transportation planning, mobility has been defined as the potential for movement, and the ability to move from one place to another (Handy, 1994). It is sometimes also measured by actual movement, either in terms of the number of trips made or the total kilometres travelled. Handy (2002) posits that potential movement can exceed actual movement since actual movement is not necessarily an accurate measure of potential movement, for example, if individuals decide to drive less than they could.

Furthermore, an increase in actual movement may lead to a decrease in potential movement, as is the case when roads are congested. Mobility also relates to the speed with which a vehicle can reach a destination.

4.1.3 Components of accessibility and mobility

Accessibility has two main components: non-transport interventions and transport interventions (Litman, 2020; 2011; 2010; 2007). The first component of accessibility relates to ensuring that facilities or essential services are located close enough to users such that users will not have to travel a long distance, spend much time travelling and the journey will not be too costly in order to reach and use the facility or service (Litman, 2007; 2020). For example, accessibility requires that facilities such as schools, health centres and markets are established close to and within reach of users, to avoid distance travel, time loss and high travel costs. The second component emphasises the need to make transport available and accessible.

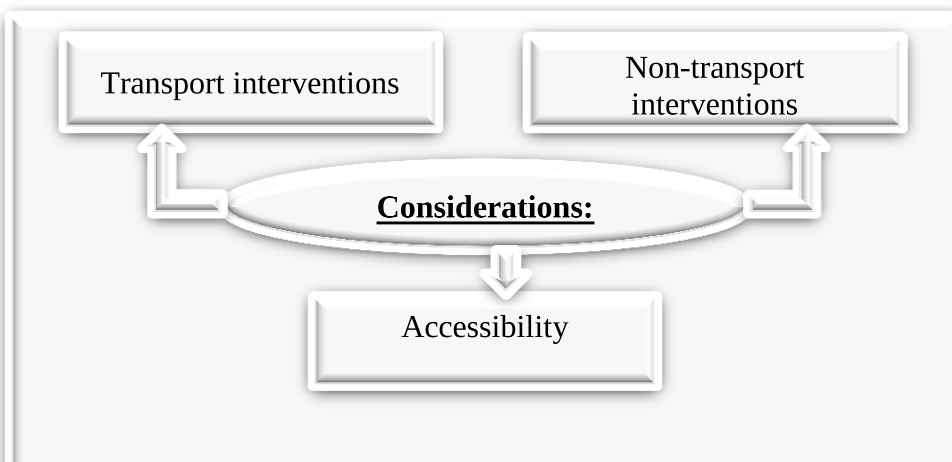

Figure 4.1: Accessibility component; Adapted from Litman, 2007; 2002

Unlike accessibility, mobility relates to transport vehicle types, and the speed and time used to cover a distance or to reach a facility or essential service. Improving mobility depends on removing all factors or elements that delay movement and improving factors or elements that facilitate speed in movement. Improving mobility, for example, will prioritise certain transport measures such as the use of motorised vehicles rather than non-motorised vehicles in rural road transport, the construction of new motorable roads, and the maintenance or rehabilitation of existing roads (Litman, 2017).

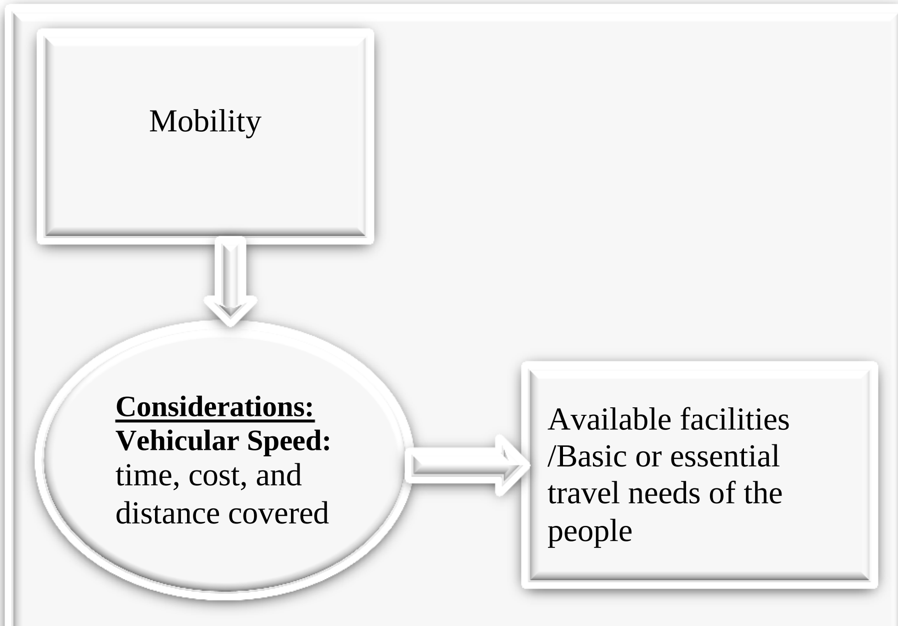

Figure 4.2: Mobility component; Adapted from Litman, 2020; 2007

In countries such as the UK and US, the use of motorised vehicles is high, as it is in some Asian countries. However, the opposite is the case for developing countries, especially Sub-Saharan African countries where only a small proportion of the population has access to motor vehicles (Hine et al., 2001).

Many Sub-Saharan African countries face the daunting task of having to apportion limited resources to meet the high demand for energy, water and housing infrastructure and resources, which are vital for the growth of their economies (Hine et al., 2001) and quality of life. To make optimal use of limited resources, facilities or essential services such as health centres, schools and markets are strategically located to serve several communities within a catchment area. Access to vehicles or transport services poses a challenge in these countries. Furthermore, the use of non-motorised vehicles is high in certain parts of Sub-Saharan Africa compared to the use of motorised transport.

Accessibility and mobility provide critical support for a country's economic development (Bryceson, Bradbury & Bradbury, 2008). The ability to reach basic services with ease is crucial for the improvement of the livelihoods of rural dwellers.

4.2 Rural accessibility and Integrated Rural Accessibility Planning (IRAP)

Social and economic development in rural areas is influenced by many factors, a particularly significant one being the ability of people in rural areas to access transport infrastructure and services. This is essential as, without transport, goods and services cannot be conveyed to the people who need them, agricultural produce cannot be taken to markets, residents cannot attend school and people cannot access medical care. Indeed, the vibrant and diverse exchange between rural and urban areas depends on an effective transport system.

To evaluate the role played by transport in the development of rural areas, there is a need to focus on rural accessibility and its associated challenges. The Population

Division of the United Nations Department of Economic and Social Affairs identified that, since 2009, the number of people living in urban areas globally (3.42 billion) has surpassed the number living in rural areas (3.41 billion). A similar scenario is seen in Ghana, where 51% of people live in urban areas and 49% in rural areas, since 2011(Republic of Ghana Statistical Service, 2012; Moller-Jensen & Knudsen, 2008). This divide, which contrasts with the population structure of the country 10 years prior, has to be managed effectively in terms of the economic productivity of both urban and rural people. In this regard, the widely accepted rural accessibility benchmark is discussed below.

During the 1960s, in Ghana, most resources were allocated towards the development and improvement of extensive infrastructure such as primary healthcare, the national road network, educational facilities and, more importantly, the economy. Most of these investments were directed towards urban areas, which had already been developed to an appreciable level, while investment in rural areas was given second priority. A growing awareness of this imbalance led to the International Labour Organization (ILO) seeking new approaches to rural transport in general, which prompted the establishment of the discipline of rural transport planning. Initially, the objective of the methodology for such planning, known as Integrated Rural Transport Planning (IRTP), was to identify the transport patterns and transport needs of rural households. This new approach was incorporated into a number of pilot projects largely within Africa and Asia.

The success of the IRTP gave more impetus for the improvement of mobility and accessibility in rural areas through the following (Donnges, 2003):

1. The improvement of rural transport services.
2. The development of a local transport infrastructure.
3. The provision of facilities that would reduce transport needs.
4. The use of IMTs.

Experts applying the new approach in pilot projects in Asia were of the view that the original blueprint of the programme had been modified and that the scope of the methodology had also been broadened by the ILO. They also noticed that they were focusing on using complementary non-transport interventions to reduce the need for transport rather than focusing only on transport as was intended by the IRTP (Donnges, 2003).

Since the scope of the methodology had been widened to include other externalities, the ILO decided to name the new model Integrated Rural Accessibility Planning (IRAP), to replace the title Integrated Rural Transport Planning (IRTP). IRAP, over the years, has developed into a set of comprehensive planning procedures that observe transport, access and mobility from a broader viewpoint. It has evolved to become an essential tool for rural access planning that is used by development organisations and local governments alike, promoting the optimal use of local resources such as labour and community participation (Donnges, 2003).

The methodology of IRAP explains the access needs of rural households in relation to the social, economic and basic services that a household requires (such as health, water, fuel wood, agricultural fields, markets, education and employment). IRAP is a flexible participatory and integrated planning approach that has been applied successfully in several countries, in certain cases leading to its nationwide incorporation into local-level planning systems. The IRAP methodology ultimately leads to the development of comprehensive information on the use, condition and location of rural infrastructure and services and the identification of appropriate access interventions and investments (IFRTD, 2000).

The IRAP process varies by country in line with each country's unique characteristics. The International Forum for Rural Transport and Development (IFRTD) classifies the process as generally consisting of the following three phases:

1. Data collection – This phase is aimed at collecting information required to evaluate the situation in relation to accessibility. The process of primary data collection, through household interviews and questionnaire interviews, is paramount at this stage. Similarly, the participation of the representatives of the relevant communities is equally important as it provides the data required for the planning process. The kinds of data collected include the travel and transport patterns of households related to their accessing different facilities and services. Data on the characteristics of the existing structures and services is also collected in this phase. Due to the location-based nature of IRAP, mapping tools are employed to ascribe particular data to their respective locations.
2. Data analysis – This phase evaluates the accessibility problems and identifies possible interventions through sector and spatial analysis. Two additional tools are incorporated in this stage: the Accessibility Indicator (AI) and Access Mapping (AM). The former is a formula calculated to determine the level of access of a particular community or group of

communities to a particular service or facility. It is calculated based on the number of households seeking access and the average travel time required to access the particular service or facility. Sometimes, other ancillary factors such as mode of transportation, travel time, trip frequency and weighting factors are integrated into the formula to improve the accuracy of the calculation. The second tool (AM) is required to visualise the spatial nature of rural accessibility. Through this mapping process, the planner and the community members are able to explain, discuss and understand the various aspects of accessibility, as well as the impact of potential interventions. Geographic Information Systems and Remote Sensing play a critical role in the mapping process.

3. Project preparation – Within this final phase, interventions are identified and prioritised for the improvement of accessibility within the planning areas. This includes interventions aimed at making transport as efficient and cost effective as possible and reducing the need for transport (via the use of non-transport interventions such as improving the proximity of services or facilities). The outcome of this phase is a prioritised list of interventions, which are discussed and shared with representatives of the communities. For every intervention listed, a project is prepared and various systems are developed to assess and monitor its impact on accessibility.

4.3 IMTs as a solution to rural accessibility and mobility challenges

In this section, various aspects of IMTs are reviewed with the aim of proposing IMTs as a solution to rural accessibility and mobility challenges.

4.3.1 Meaning of IMT

There are various types of vehicles designed for specific purposes such as transporting passengers, goods and patients to hospitals and for personal or recreational use. Some vehicles are made for long-distance journeys whereas others are made for short-distance journeys. Vehicles have specifications regarding the number of people they can carry or the weight of goods they are designed to carry. When vehicles with the right specifications are available and used for the right purposes to meet mobility needs, IMTs are not required. IMTs are used to fill the gaps in the availability of conventional vehicles or of the vehicles required to meet accessibility and mobility needs. According to Porter (2002b), they are an intermediate form of transport because they fill the transport services gap between human walking and large-scale transport. For example, due to the unavailability of an ambulance to transport sick people to hospitals or health centres, a minibus may be redesigned or converted to provide ambulance services. Similarly, in situations where conventional vehicles such as buses or taxis are not available, motor tricycles may be designed to provide transport services.

In Uganda and Western Kenya, it has been found that rural people have converted bicycles into taxis to transport people to and from the village and the market (Maganya, 1997). The bicycles were converted by strengthening the spokes and fixing durable brakes, and adding passenger chairs and footers (Iga, 1999). Similarly, in Burkina Faso and Ghana, load carriers are fixed on the back wheels of bicycles and used to carry loads to and from the market and the village (Porter, 2002b). Bicycles are also converted and used to carry loads by rural people in Tanzania (Sieber, 1998), Togo (White, Erlank & Matthews, 2000) and Nigeria (Olukayo, 2001). Such bicycles are forms of IMT. IMTs are described as local transport solutions that increase transport capacity at a relatively low capital cost (Starkey, 2001). In some rural areas in the Netherlands, self-driving buses are used as IMTs to provide transport services where transportation is lacking (Bos, 2017).

4.3.2 IMTs as technological innovations

The specified uses of various vehicles are converted to meet or address various gaps in transport services, especially in rural areas. The act of redesigning or converting vehicles to meet other needs embraces technology. Leinback (1982), for example, posits that the use of applicable technology is essential in this context, employed as a gap-filling measure to address transport problems in the short term. Developing new technologies to address needs or problems is necessary. However, it can be challenging to persuade people to accept and use the new technology. In fact, the issues related to user and attitudes towards new technologies have resulted in the development of theories on technological acceptance, particularly the Technology Acceptance Model (TAM). These theories focus on the human aspects of technology usage, not only in terms of technology impacts, but also in relation to acceptance and use.

Propounded by Davis (1989), TAM specifies the causal relationships between system design features, perceived usefulness, perceived ease of use, attitude toward using, and actual usage behaviour of a new technology. Technological innovations are only significant and relevant when they are actually accepted and used. This necessitates conscious efforts to sensitise and train or educate users in relation to such technological innovations.

4.3.3 Adoption of IMTs on feeder roads

Generally, in the rural areas of Ghana, suitable vehicles are not available to meet the various transport service needs of the people, especially along feeder roads. Where transport needs are not adequately met in rural areas, it makes people spend more time to access essential social facilities by means of walking, which results in less time left for other productive activities. Including the provision of rural transport services within feeder road investment projects enables small businesses to start up, improvements in the movement of goods and services, and increased accessibility of critical services like health, markets and education. It also addresses the food insecurity problems facing rural communities through access to improved agricultural extension services and cheaper sources of energy (Hettige, 2006).

Porter (2002b) recommended the adoption of IMTs to address the transport vehicle needs of rural communities in Sub-Saharan Africa. She highlighted the advantages of IMTs in facilitating personal travel and exposing rural people to education and economic opportunities. Yet, significantly, Porter's research threw light on the failed IMT interventions in Ghana. Some of the reasons for this failure, according to Porter, are the high capital cost of vehicles, the low load carrying capacity of IMTs, the poor marketing to support their adoption, and the weak structural components of IMTs, resulting in the poor quality of locally manufactured IMTs compared to imported IMTs from advanced countries.

Indeed, IMTs provide solutions to feeder roads transport challenges (Starkey, 2001; Porter 2002a; 2000b; Starkey, Ellis, Hine & Ternell, 2002; SelfHelp Ghana, 1999; SSATP, 1997). IMTs represent a viable alternative for the transportation of both small and medium loads, which may be difficult for human beings to carry (Starkey, Cartier van Dissel & Veron-Okamoto, 2015; Amposah, Turner, Grieco, Kabbalah & Guitink, 1996; Anchirinah & Yoder, 2000; Anchirinah, Dapaah, Addison & Yiridoe, 2000; Anchirinah & Addison, 1998; Hoyle, 1988). Recognition of the potential of IMTs in Sub-Saharan Africa emerged in the 1980s, even though it is only in recent times that research and development in this area has been significant (Starkey et al., 2013; White et al., 2000; Kwakye & Sharan, 1994). The main IMTs identified in the late 1980s were bicycles, tricycles, oxcarts and water carriers (Hoyle, 1988).

Transport services in most rural settings along feeder roads are delivered by means of animal-drawn carts, bicycles, motorcycles, tricycles or taxis. These are the primary means of transport for rural people in most developing countries. An interesting observation is that IMTs as a means of transport are often ignored even though they play a critical role in the mobility of rural people. While providing access to markets, healthcare and educational facilities, IMTs also provide employment for the operators (Dinye, 2013; Nelson, 2016; Fasakin, 2001; Porter, 2002a; Porter, 2000c; Iga, 1999; Okoth, 2005; Ellis & Hine, 1998; 1995; Ellis, 2013; Buabeng, Sarfo-Mensah & Dennis, 1995).

4.4 Types of IMTs

Various types of IMTs are used, but can be broadly categorised as either mechanical (motorised and non-motorised) or mon-mechanical (animal-drawn) (Ellis, 1997; Porter, 2002b). The various types are discussed below.

4.4.1 Motorised IMTs

Various types of motorised IMTs are used in Asian and African countries to transport people and load. The motorised IMTs used include motorcycles, improvised buses and tractors, power tillers and improvised pickups. Table 4.1 lists the types of motorised IMTs and the countries in which they are used.

Table 4.1: Types of motorised IMTs and countries where used

Types of motorised IMTs and countries where used	
Type of IMT	Countries
Motorcycle	Sri Lanka, Thailand, Nigeria, Ghana, Burkina Faso
Improvised bus	Pakistan, Sri Lanka
Improvised pickup	Thailand, Pakistan, Zimbabwe
Improvised tractor	Sri Lanka, Pakistan, Thailand, Zimbabwe, Ghana
Power tiller	Thailand, Sri Lanka, Ghana, Cote d'Ivoire

Source: Ellis, 1997; Porter, 2002b

4.4.2 Non-motorised IMTs

Non-motorised IMTs are used extensively in Asian countries and are operated for commercial purposes. For example, a survey conducted in Bangladesh in 1986 reported that 94% of commercial vehicles were non-motorised IMTs (Dawson & Barwell, 1993 cited in Ellis, 1997; Barwell, 1996). The non-motorised IMTs used include trucks, bicycles, bicycles with trailers, and tricycles, as indicated in Table 4.2.

Table 4.2: Types of non-motorised IMTs and countries where used

Types of non-motorised IMTs and countries where used	
Type of IMT	**Countries**
Pushcarts (trunks)	Thailand, Pakistan, Ghana, Togo
Bicycles	Sri Lanka, India, Tanzania, Kenya, Zambia, Zimbabwe, Ghana, Uganda, Nigeria
Bicycle with trailer	Sri Lanka, India, Tanzania, Kenya, Zambia, Zimbabwe, Ghana
Tricycles	Peru, Cuba, Tanzania, Ghana

Source: Ellis, 1997; Porter, 2002b

4.4.3 Animal-drawn IMTs

Animal-drawn carts are useful IMTs for transporting loads in rural areas. For example, in India, it is estimated that 15 million animal drawn carts were used in the 1980s for transportation purposes (Hazarika, 1987). Various types of animal-drawn carts used in Asian countries include bullock cart, horse cart, pack camel and camel cart. In Africa, the oxcart is used in some rural communities in Zambia and Zimbabwe. In Ghana, donkey carts are sometimes used.

4.4.4 IMTs used in Ghana

The various IMTs used in Ghana are summarised in Table 4.3.

Table 4.3: Various IMTs used in Ghana

Various IMTs used in Ghana			
Type of IMT	**Specifications**	**Specified use**	**General remark**
Bicycles with one or two seats	Maximum load: 75 kg Speed: 3–15 km/hr (depending on nature of road)	Personal transport.	Operated by one or two persons depending on the model. Used by both males and females.

Various IMTs used in Ghana			
Type of IMT	**Specifications**	**Specified use**	**General remark**
Tractor with trailer	Maximum load: 1000–1500 kg Speed: 10–15 km/hr Range: 15–25 km	Multipurpose use: for pulling trailers, for farm purposes, to carry passengers, to carry goods.	Mostly preferred by farmers and farm groups. Higher incidence of accidents when used at night because the single headlight can mislead road users to think it is a motorcycle. Requires training and licence to operate. Mostly used by males.
Wheelbarrow	Maximum load: 120–180 kg Speed: 3–5 km/hr Range: 1 km	Used to carry goods.	Not for long distance. Requires much strength and skill depending on load. Mostly used by males.
Two-wheel hand cart	Maximum load: 100 kg Speed: 4 km/hr Range: 1 km	Used to carry goods.	
Animal-drawn cart (donkey cart)	Maximum load: 400 kg Speed: 2–6 km/hr Range: 15 km	Used to carry people and goods.	
Bicycle trailers	Maximum load: 200 kg Speed: 10–15 km/hr (depending on nature of road) Range: 15–20 km	For carrying load.	Operated by one person, either male or female.

Various IMTs used in Ghana			
Type of IMT	**Specifications**	**Specified use**	**General remark**
Four-wheel platform pushcart (Trucks)	Maximum load: 150 kg Speed: 4 km/hr (depending on nature of road) Range: 5 km	For carrying load.	Pushed by one or more persons. Not good for long-distance travel. Heavy for women to manoeuvre. Mostly used by men.
Tricycle	Maximum load: 150–200 kg Speed: 12 km/hr (depending on nature of road) Range: 12 km	For carrying goods and passengers.	Not suitable on rough roads or muddy roads. Used by both male and female.
Motorcycles	Maximum load: 100 kg Speed: 40–49 km/hr Range: 100 km	Personal transport, used as taxi, used to carry load.	Suitable for long-distance travel. Requires training and licence to operate. Used by both males and females.
Motor tricycles	Maximum load: 250 kg Speed: 40–49 km/hr Range: 60 km	Used to carry passengers and goods.	Requires training and licence to operate. Used by both males and females.

Source: Porter 2002

For the purposes of easy identification, photos of some IMTs are provided below.

Figure 4.3: Motor tricycles (uncovered and covered); Source: Author

Figure 4.4: Motorcycle with metal carrier and motor tricycle taxi; Source: Author

Figure 4.5: Motorcycles; Source: Author

Figure 4.6: Bicycle with carrier and bicycle with designed seat; Source: Author

Figure 4.7: Bicycle with front carrier for load and wheelbarrow; Source: Author

Figure 4.8: Two-wheel hand carts (open and covered types); Source: Author


Figure 4.9: Four-wheel platform pushcart;
Source: Author

4.4.5 Advantages of motorised IMTs over non-motorised IMTs

Motorised IMTs offer advantages over non-motorised IMTs. Particularly considering the poor condition of feeder roads in rural communities, the use of motorised IMTs is most appropriate for the following reasons:

1) Motorised IMTs are more convenient and less stressful to use since less effort is required to operate them.
2) Motorised IMTs provide higher resistance on bad roads compared to non-motorised IMTs.
3) Motorised IMTs have higher loading capacity than non-motorised IMTs.
4) Motorised IMTs travel at higher speeds than non-motorised IMTs, and therefore reduce the time spent on the road.
5) Motorised IMTs are more convenient for long-distance travel.

The availability of motorised IMTs is essential for effective rural transport as it facilitates the transportation of people and goods at a more affordable cost, and this enables engagement in economic activities. Evaluating the different road types and transaction of goods transported, Escobal (2000) studied two geographically different locations in Peru with different levels of accessibility. One area was connected to the market through motorised IMTs while the other was linked to the same market through non-motorised IMTs. The author measured the transaction costs related to the transport and sale of potatoes and found that the cost when potatoes were transported via a non-motorised IMT was higher than when they were transported by a motorised IMT. Furthermore, Escobal (2000) found that those with motorised IMTs enjoyed better returns on their produce sold and had a better quality of life than those with non-motorised IMTs. This finding is in line with the results of Hine, Riverson and Kwakye (2019) Ghana-based study, where the cost of transporting the same quantity of goods by motorised IMT over the same distance was cheaper than transporting via head loading (ie. people transport goods by carrying on the head/back – people engage in head loading as their livelihood). The study by Hine, Riverson and Kwakye (2019) examined accessibility, transport costs and food marketing in the Ashanti region of Ghana. The study revealed that due to lack of accessibility and mobility, farmers resort to head loading harvested maize from the village through a footpath to the roadside, a distance of 5km. According to the findings, it cost the farmer more to transport more bags of maize to a distance of 5km than by providing accessibility and mobility. With availability of road and motorised vehicles (IMTs with more loading capacity) closer to the farmers, more maize (five bags or more) can be transported to the same 5km distance which the cost will be cheaper compared to head loading.

Literature reviewed also establishes some advantages of non-motorised vehicles when compared to the motorised vehicles. The non-motorised vehicles such as cargo bikes have proved to be useful in consideration to loading capacity, operating cost (does not use fuel) and emissions (Greehalgh, 2020; Pearce, 2016). In the United States for instance, cargo bikes are used for essential delivery of food, medical supplies, and during the covid lockdown for distributing mattresses (Greehalgh, 2020).

Considering the findings from these two studies, it is clear that the use of motorised IMTs offers significant advantages for rural road transport; hence, there is a need to promote it.

4.5 The state of IMTs in Africa

Unfortunately, most government officials in Africa do not approve of IMTs as a means of addressing the transportation problems facing rural people (Starkey, 2001). Yet IMTs are not new in Africa. Several countries, such as Angola, Ghana, Kenya, Nigeria, Uganda and Zambia, have promoted the adoption of IMTs, even though the adoption of IMTs has faced challenges. Some of these challenges include not one or the other equipment, poor paths or roads, a lack of consumer appeal, the high cost of acquisition and a lack of access to finance. For example, people lacking access to loans to purchase IMTs has been a very significant challenge for most of these countries, especially Ghana.

Currently, all of the bicycles and motorcycles used in Ghana are imported from Asia. In particular, China and India seem to be making headway as far as the introduction or adoption of IMTs is concerned. In this regard, the assumption underlying the construction of roads in developing countries is that, if roads are constructed, the private sector will automatically take advantage by developing transport services along these roads. Yet this has not eventuated as, in most cases, the roads have been built but only a few people are actually utilising them, since there no conventional transportation systems are available on those roads. It is important for governments in developing countries to look for innovative ways to address the transport challenges facing rural people through proper and effective planning.

4.6 Challenges of adopting IMTs

Porter (2002b) observed that the poor state of roads used by IMTs, coupled with the lack of adequate maintenance facilities in rural areas, made the adoption of IMTs as an alternative mode to conventional transport difficult for road users. She also added that the absence of financial or credit schemes to support individual or group ownership was a major contributory factor to the low use of IMTs. Early studies by Ellis (1997) attributed the slow adoption rate for IMTs in Africa to factors such as the low population density, low incomes, the long distance to market and a lack of institutional support.

Witkiss et al. (2001), also suggested that the main challenges facing the development of rural transport services are the low demand for transport, the poor state of infrastructure, the absence of a diversity of vehicle types, the lack of competitive transport markets and the lack of appreciation by major stakeholders of the inherent benefits for rural communities of ensuring that there are reliable and efficient transport systems in place. These authors argued that there is a need for a higher level of political commitment to develop policies on rural transport in developing countries. Witkiss et al. (2001) furthermore suggested that there is a need to encourage the adoption of IMTs and to open the rural transport market up to competition so as to stem monopolistic practices such as the control of transport stations and transport fare groupings employed by the transport associations and unions. To stop such monopolistic practices, they further proposed that governments and private individuals and organisations should own IMTs for transport services.

Interventions by governments to provide funds or support to enable people who live in rural communities to purchase IMTs for rural transport services will offer alternative transport services. Accessibility and mobility will be enhanced via such government intervention, which in turn will impact positively on the socioeconomic activities and poverty alleviation in rural communities (Witkiss et al. 2001).

4.7 Summary of review of accessibility and mobility issues

Table 4.4 summarises the findings of the various themes reviewed on accessibility and mobility issues.

Table 4.4: Findings of themes on accessibility and mobility issues

Themes and the findings	
Themes	**Findings/inadequacies identified**
Concept of accessibility and mobility	Time, distance and cost are essential variables influenced by the vehicular types used for transportation and the location of existing facilities. Accessibility and mobility have one common variable, which is the type of vehicles used for transport services.
Rural accessibility and IRAP	IMTs can address accessibility and mobility needs in rural transport planning.
IMTs as a solution to rural accessibility and mobility challenges	IMTs are technological transport service innovations which have been used in various ways to address accessibility and mobility challenges in countries throughout the world.

Themes and the findings	
Themes	**Findings/inadequacies identified**
Types of IMTs	Various types of motorised, non-motorised and animal-drawn IMTs are used, such as bicycles, tricycles, trucks, motorcycles, tractors, donkey carts and oxcarts. Motorised IMTs are more durable and convenient to use in terms of speed, distance and load.
The state of IMTs in Africa	IMTs are widely used throughout the world. Yet little is done to promote their use, especially in Sub-Saharan African countries.
Challenges of adopting IMTs	The poor state of roads used by the IMTs, the lack of adequate maintenance facilities in rural areas, the absence of financial or credit schemes to support individual or group ownership, the low population density, low incomes, the long distance to market, a lack of institutional support, the low demand for transport, the poor state of road infrastructure, the absence of a diversity of vehicle types, a lack of competitive transport markets and a lack of appreciation of the value of IMTs by major stakeholders.

Source: Author

4.8 Summary of issues discussed in this chapter

IMTs represent a viable, effective and affordable form of transport feeder roads to address the accessibility and mobility challenges facing rural people. The ease of use of IMTs, for both men and women, and in terms of the time needed for the trip, the distance of the trip and the cost of the trip, is important in addressing these challenges. In addition, the types of IMTs used determine the time, distance and cost required to be able to access a service or facility or otherwise fulfil one's travel needs.

Motorised IMTs are fast, convenient and durable to use in rural areas, and are particularly useful considering the poor condition of many feeder roads in rural areas. In the absence of conventional vehicles, IMTs can be adopted to cover long distances, and have a range of loading capacities. Most motorised IMTs require training and a licence to operate and are used by males.

The adoption of IMTs is not without its challenges, and so any efforts towards adoption must be accompanied by measures that address those challenges. IMTs are used all over the world and can therefore be adopted in any rural community to address accessibility and mobility challenges. The literature review on these issues was carried out in cognisance of the research questions set for the study.

The next chapter presents the research design of this study.

CHAPTER 5:

THEORETICAL FRAMEWORK

5.0 Introduction

In Chapters 2, 3 and 4, the relevant literature was reviewed, identifying the knowledge gaps related to the research questions of this study. The theoretical framework adopted in this study is informed by this literature.

A theoretical framework provides a broad spectrum of ideas in the form of models that are well developed, designed and accepted (Adom, Hussien, & Agyem, 2018; Tamene, 2016). It evolves from existing theories drawn from the literature that have been empirically tested and validated (Imenda, 2014; Adom et al., 2018), and serves as a guide to the researcher. Grant and Osanloo (2014), state that theoretical frameworks consist of principles, constructs, concepts and features of a theory. The constructs or variables in theoretical frameworks can be used to explain phenomena in various human endeavours (Brondizo, Leemans & Solecki, 2014).

A theoretical framework is required to represent the academic viewpoint, it helps to maintain the research focus, and defines the boundaries of the research (Adom et al., 2018; Imenda, 2014; Lantham, 2017; Kumar, 2011). Furthermore, it contributes to the meaning of the research by explaining graphically the main variables and conceptual issues to be studied and the connections among them (Bloomberg & Volpe, 2008; Jabareen, 2009; Miles & Huberman, 1994). Lastly, it serves as a working tool that provides an emerging structure for the data collection and analysis, and interpretation and synthesis of the findings (Bloomberg & Volpe, 2008). According to Imenda (2014), the theoretical framework evolves from the literature reviewed.

In this study, the theoretical framework is influenced by the secondary literature reviewed and existing theories. It describes and explains the patterns of relationships between the conceptualised issues and variables drawn from the literature that are related to the research questions. The development of the theoretical framework for this study began with an identification of the inadequacies in the literature that respond to the research questions, as presented in the next section. The chapter then outlines the relevant constructs and variables derived from the literature that respond to the research questions. This is followed by a review of the theories that explain the relationships between these constructs and variables (Kumar 2011). This chapter ends by presenting the theoretical framework developed for the study.

5.1 Inadequacies identified from the literature review

This section summarises the inadequacies identified in the reviewed literature that correspond to the research questions. The literature revealed that a lack of accessibility and mobility contributes to the isolation of rural communities. Isolated rural communities are deprived of socioeconomic benefits such as education, market, healthcare and employment. Most communities deprived of education, markets, healthcare and employment activities are negatively affected by the absence of these socioeconomic benefits and exhibit high levels of poverty and lower living standards.

One of the inadequacies identified in the literature review is that, in providing solutions to address isolation, governments, donor funding agencies and development partners focus on rural road infrastructure development rather than on rural transport. It is established that rural communities that have accessibility and mobility engage in vibrant socioeconomic activities whereas rural communities facing accessibility and mobility challenges engage less in socioeconomic activities (Afukaar et al., 2019; Asafo-Adjei, Iyer-Raniga & Aranda-Mena, 2018; Asafo-Adjei, Iyer-Raniga & Aranda-Mena, 2017; Adom-Asamoah, 2016; Beans, 2015; Casaburi et al., 2013; Arethun & Bhatta, 2012; Van Wee, 2009; Bryceson et al., 2008; Dercon et al., 2007; Bhatta, 2004; Van Wee & Maat, 2003; Smith et al., 2001; Booth, Hanmer & Lovell, 2000; Ellis, 2000; Ellis, 1996; Creightney, 1993; Airey, 1992; Ahmed & Hossain, 1990). In view of the above inadequacy, the first research question of this study is: *To what extent do feeder roads contribute to the development of rural people and rural communities in Ghana?*

The literature review indicated that conventional transport services in rural communities are unreliable and not suitable due to certain challenges such as the inadequate supply of transport vehicles, the inability of rural people to purchase vehicles, the poor condition of roads, and the limitations imposed by transport service regulation bodies and unions or associations. The literature also showed that IMTs are frequently proposed as technologically designed transport service innovations and used as a means of transport to address accessibility and mobility challenges in developing countries. The literature also revealed that, although IMTs are acceptable in Asia and some parts of Africa, little is done to promote their use, especially in Sub-Saharan African countries like Ghana. In view of the inadequacies identified in the literature on the availability and use of vehicles and IMTs for rural transport, the second research question asks: *What types of vehicles and IMTs may be used on feeder roads and how suitable are they to* *address the transportation needs of people in rural communities in Ghana?* In addition, in order to identify and explore other transport service challenges apart from those raised in the literature, the third research question asks: *What are some of the challenges associated with accessibility and mobility along feeder roads facing rural communities in Ghana?*

The literature identified that one of the factors hindering the promotion of rural transport services is a lack of institutional support and appreciation by major stakeholders. Institutional support and appreciation by major stakeholders thrive on higher-level support from rural road policy advisors, technocrats and, to a great extent, political commitment to change policies on rural transport. The challenges confronting the promotion of rural transport services also include the appraisal and evaluation procedures adopted by institutions in charge of project screening and selections. In this regard, rural transport issues can be made prominent and embedded within the methodology and variables considered in models used for project appraisals, as identified in the literature review. Thus, the fourth research question asks: *How are feeder road investments appraised to meet the accessibility and transport needs of people in rural communities in Ghana?*

Table 5.1 highlights the emerging themes and rationale for this study, with reference to the relevant literature reviewed.

Table 5.1: Summary of relevant literature by themes and rationale

Summary of relevant literature by themes and rationale		
Theme/category	**Purpose of review/rationale**	**Relevant literature**
Concept of rural community	The study looks at rural accessibility and transport needs. It is necessary to have an operational definition of, understand and have a view of the concept of rural community to guide the study.	Etzioni 1995; Shaw, 2008; Nasibu, 2014; Mayo, 1994; Tett, 2010; Ohmae 1991; Myrdal & Kristiansen, 2005; Wondemu & Weiss, 2012.
Rural isolation and its effects on rural socioeconomic development	Access to socioeconomic services is necessary to improve quality of lives. Since isolation is a major feature of some rural communities, it is necessary to determine its effect on socioeconomic development and on the lives of rural people.	Wiggins & Proctor, 2001; UNICEF & UNESCO, 2007; Miller, 2015; Cobbold, 2006; O'Leary et al., 2011; Haines, 2009; Howe & Roberts, 1984; Airey, 1992; Wiggins & Proctor, 2001; Miller, 2015; World Bank & IMF, 2013; World Bank & IMF, 2013; Afukaar et al., 2019; Berg & Ihlstrom 2019; Mahapa & Mashiri 2001; Airey 1991; Airey 1992; Arethun & Bhatta, 2012; Bryceson et al., 2008; Bryceson & Hove 1993; Lyon, 1999.
Rural isolation interventions	To determine what has been done with regard to measures to address rural isolation.	Khandker et al., 2006; Ngezahayo, et al., 2019; Khandker et al., 2006; Airey, 1991; 1992; Ahmed & Hossain, 1990; Arethun & Bhatta, 2012; Bryceson et al., 2008; Bryceson & Howe, 1993.
Problems with rural isolation intervention	To determine the gaps in interventions that have been made to address rural isolation.	Van de Walle, 2002; Bryceson et al., 2008; Bhatta, 2004; Porter, 2002; Creightney, 1993; Hine, 1993

Summary of relevant literature by themes and rationale		
Theme/category	**Purpose of review/rationale**	**Relevant literature**
Rural road transport as policy directive	Transport plays a major role in addressing rural isolation. It is necessary to understand and appreciate the role of policy in promoting rural road transport.	World Bank, 2007
Components of rural road transport	To understand all relevant aspects of rural road transport that can be developed.	Rodrigue et al., 2006; Rudestam & Newton, 1992
Relevance of rural road transport	To determine from empirical studies the relevance of rural road transport.	Khandker et al., 2006; Beans, 2015; Fan & Chan-Kang, 2004; Mohapatra & Chandrasekhar, 2007; Adom-Asamoah, 2016; Smith et al., 2001; Bryceson et al., 2008; Bhatta, 2004; Porter, 2002a; 2000b; 2000c; Gannon & Liu, 1997; Ahmed & Hossain, 1990; Arethun & Bhatta, 2012; Casaburi et al., 2013
Rural road transport challenges	To determine the challenges associated with rural transport by surveying the literature.	Swedish Consultants, 1985; Ellis, 1997; Danso-Wiredu; 2011; Ellis & Hine, 1995; Hine & Rutter, 2000; Champion, 1998; Okoko 2011; Adom-Asamoah, 2016

Summary of relevant literature by themes and rationale		
Theme/category	**Purpose of review/rationale**	**Relevant literature**
Accessibility and mobility	In relation to transport, time, cost and distance covered by vehicles is important. Likewise, access to vehicles and socioeconomic services is also important. Therefore, surveying the literature in order to understand the issues associated with accessibility and mobility is necessary.	De Bruijn et al., 2001; Sheller & Urry, 2006; Handy, 2002; Litman, 2017; Hine et al., 2001; Bryceson, Bradbury & Bradbury, 2008
IMTs as solution to rural accessibility and mobility challenges	To determine if IMTs are an appropriate solution to rural accessibility and mobility challenges.	Maganya, 1997; Sieber, 1998; Olukayo, 2001; Leinback, 1982; Davis, 1989; Hettige, 2006; Hoyle, 1988; Starkey, 2001; White et al., 2000; Guyer, 1997; Fasakin, 2001; Porter, 2002a; Iga, 1999
Types of IMTs	To identify the various types of IMTs and emphasise the need for motorised IMTs.	Ellis, 1997; Ellis & Hine, 1998; 1995; Ellis, 2013; Porter, 2002b
The state of IMTs in Africa	To determine the use and acceptance of IMTs by surveying the literature.	World Bank, 2007
Challenges of adopting IMTs	To determine the challenges of adopting IMTs by surveying the literature.	Porter, 2002b; Ellis, 1997; Witkiss; et al., 2001

Source: Author

In the next section, a summary of the main constructs and variables that respond to the research questions is provided.

5.2 Constructs and variables derived from the literature

The main constructs and variables adopted in this study to respond to the research question are discussed in this section, derived from the literature reviewed in Chapters 2, 3 and 4. The literature review identified issues that are significant in relation to rural isolation. Seeking to understand these issues will inform efforts to promote accessibility and mobility and ensure economic growth and development. These issues are framed as constructs, which form the basis of the variables obtained from the literature on rural isolation, the development of rural transport components (accessibility and mobility), access to socioeconomic services, and development or improved quality of life. To aid understanding, the constructs and variables have been incorporated into a framework and their relationships are depicted in Figure 5.1.

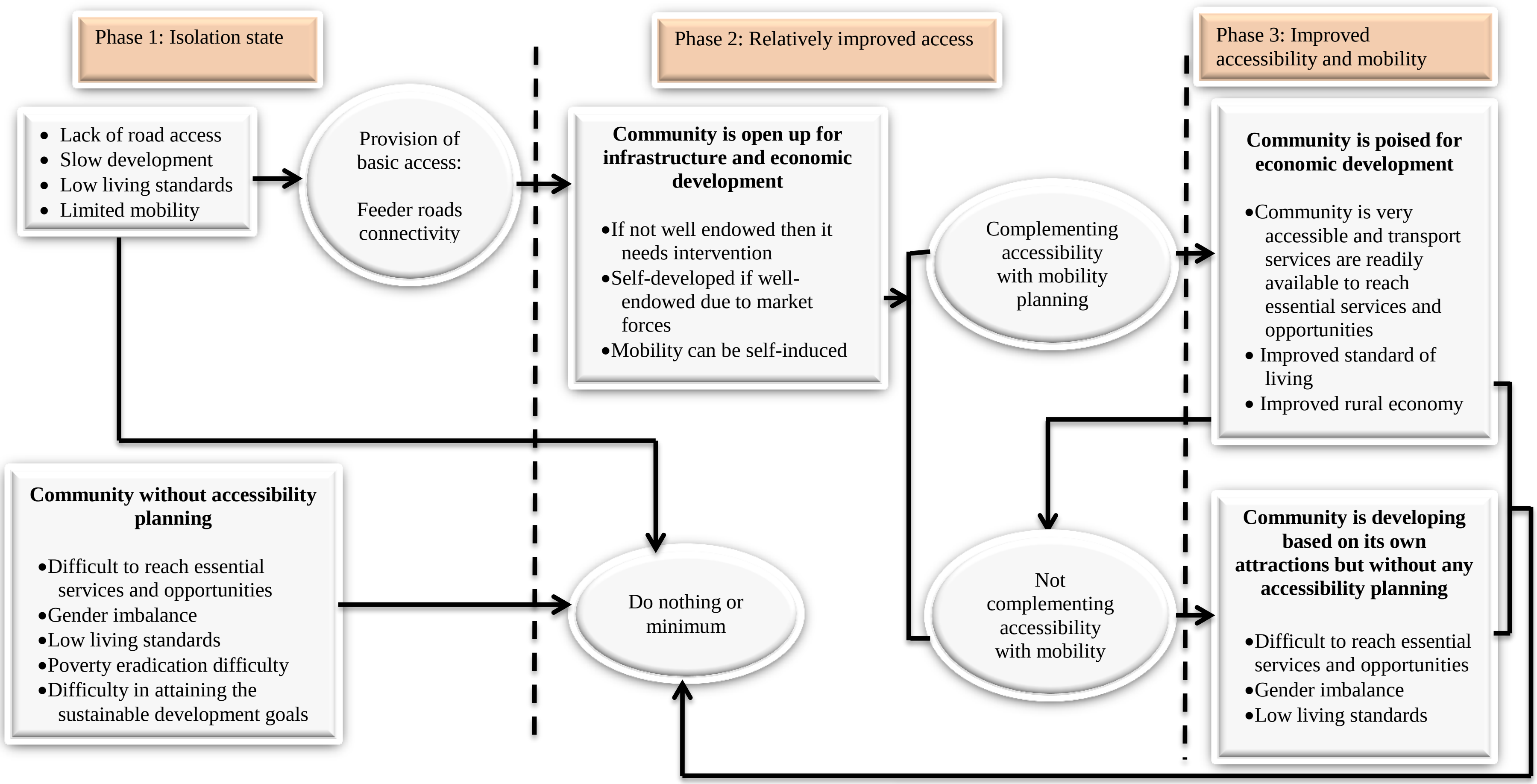

Figure 5.1: Feeder roads transport accessibility and mobility; Source: Author

Figure 5.1 represents three types of communities, which have been created for the purposes of this research. These communities are: (1) isolated communities, (2) communities with relatively improved access, and (3) communities with improved accessibility and mobility. A lack of access to roads, slow development, low living standards and limited mobility are the characteristics of communities in an isolated state. Their lack of access to roads makes it difficult for them to access essential social and economic services and opportunities, which in turn makes it difficult for them to eradicate poverty and achieve any meaningful growth. However, by improving their access, rural communities may be able to move beyond their natural resources such as opening up to broader interests and markets and thereby accelerating their development. Thus, isolated communities may be transformed by relatively improved access, through the provision of basic accessibility infrastructure like feeder road connectivity. This may enable connection with other infrastructure such as electricity, water and telecommunication services. In most cases, funding for infrastructure and economic development is dependent on community's inherent attractions and natural resources. If a community is not naturally endowed, then it will need government intervention and support to ensure infrastructural and economic development.

In communities with relatively good access (better feeder road connectivity than the community described above), mobility is better and it is less difficult to access essential social and economic opportunities. The standard of living is also better and the community responds favourably to poverty eradication programmes, allowing the community to connect with essential social and economic opportunities. Communities with relatively improved access may be transformed into communities with improved accessibility and mobility by complementing accessibility with mobility. The interventions required for such a change must be introduced in a sustainable and continuous manner. The conceptual framework developed for this study incorporates the attributes of the feeder road transport accessibility and mobility for the three types of communities discussed above.

The conceptual framework supports time tested theories that explain how rural communities that are isolated lack access to healthcare services, educational services, market opportunities, employment opportunities and other socioeconomic services (Wiggins & Proctor, 2001), which invariably diminishes their quality of life. It is widely agreed that healthcare, education, markets and employment, among others, represent essential socioeconomic needs of rural people (Porter, 1995; 1997; Lyon, 1999; O'Leary et al., 2011; Haines, 2009; Wiggins & Proctor, 2001; Miller, 2015; World Bank & IMF, 2013). Additionally, it has been established that accessibility and mobility are necessary for socioeconomic development and therefore need to be provided to rural communities (Bryceson et al., 2008; Bhatta, 2004; Porter, 2003).

The next section discusses the selection of theories that can contribute towards answering the research questions and how they form the basis of the theoretical framework.

5.3 Selection of theories

Section 5.2 explained how accessibility and mobility can transform communities and the quality of life of people. Promoting accessibility and mobility implies promoting improvement in the socioeconomic lives of people. This is best explained by the relationships between the variables and constructs discussed in section 5.2. In this section, the theories underpinning the theoretical framework used in the design of this study are introduced.

The selection of theories involved a three-step process. The process began with general, abstract review of theories, followed by a specific, in-depth review, and ended with the selection of theories using a ranking method.

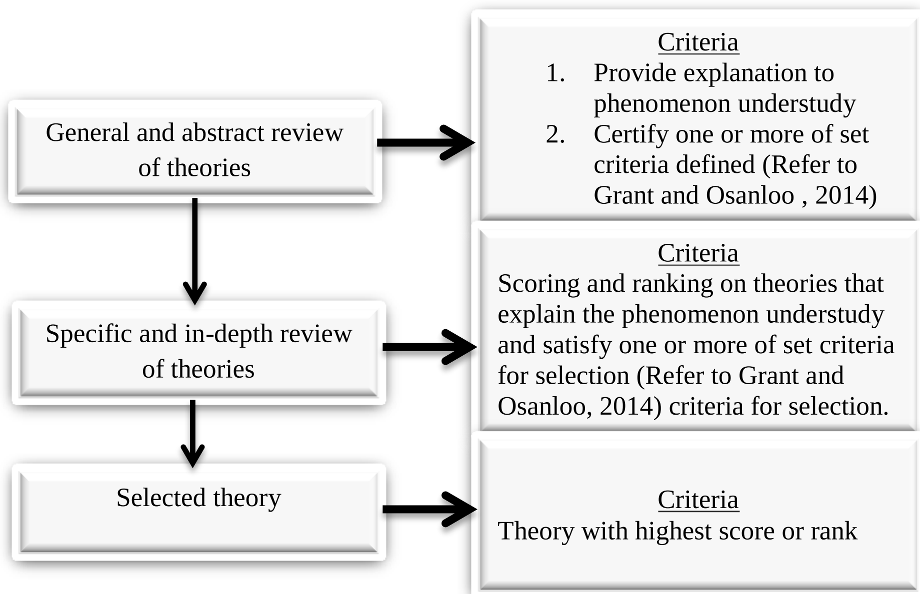

Figure 5.2: Framework for theory selection; Source: Author

The entire selection process was guided by Grant and Osanloo's (2014) criteria for theory selection, as follows:

1. The discipline(s) in which the theory will be applied.
2. Whether the specific theory selected meets the objective(s) of the study.
3. Whether the theory informs the literature review.

4. Whether the theory conforms with the research methodology and analysis plan chosen.
5. Whether the theory supports the conclusion and recommendation based on data analysis.

As shown in Figure 5.2, the general and abstract review focused on theories that best explain the phenomenon under study. Theories that explained the phenomenon under study and satisfied one or more of the set of criteria were then considered for the in-depth review. The theories were then scored and ranked based on a set of criteria, and those that received the highest scores were used to develop the theoretical framework of the study.

The initial selection of relevant theories began with a general, abstract review of theories including Maslow's Hierarchy of Needs Theory (Maslow, 1943), Hagerstrand's Time Geography Framework Theory (Hagerstrand, 1970), Bertalanffy's General Systems Theory (Bertalanffy, 1968), Trist's Socio-Technical Theory (Trist, 1981), Soja's Socio-Spatial Dialectic (Soja, 1980) and Davis's Technology Acceptance Model (Davis, 1989).

The Time Geography Theory explains that, more often than not, people are restricted from travelling within space and time to other communities due to certain constraints. Such constraints may be accessibility and mobility challenges. In other words, for people to be able to travel within time and space to access socioeconomic services, the constraints on time and space (that is, accessibility and mobility challenges) must be addressed. Similarly, Maslow's Theory of Self-Actualisation was reviewed to explain how the satisfaction of basic needs such as access to feeder roads and transport services may lead to the attainment of desired goals such as self-fulfilment in terms socioeconomic wellbeing, health and financial stability. Bertalanffy's Systems Theory can be used to explain the harmonious relationship that must exist between the various actors and stakeholders in rural transport planning to ensure the provision of good roads and transport services. Likewise, Trist's Socio-Technical Theory highlights the significance of interactions among stakeholders as a requirement for achieving optimisation in rural transport planning. Equally, Soja's Socio-Spatial Dialectic further posits the importance not only of actors and stakeholders but also of their commitment to work by constructing roads and providing transport services in order to transform the lives of people. Lastly, Davis's TAM defines ease of use and relevance of use as conditions determining the acceptance of new technologies, like IMTs.

5.3.1 Time Geography Theory

The Time Geography Theory was developed in 1970 but its roots can be traced to the 1953 doctoral research of Torsten Hagerstrand (Hagerstrand, 1953; Hagerstrand, 1970). His research investigated migration in Sweden and emigration to the United States from Asby, a small parish in the southeast of Sweden in the 19th century. Hagerstrand's study focused on the movement of people between dwellings in Asby and their use of local resources, and considered the spread of technological innovations in the parish. Hagerstrand's research laid the foundation for further studies on migration, migration chain and time geography (Hagerstrand, 1970).

The idea of time geography originated from a seminal address on the research conducted by Hagerstrand at the Regional Science Association (Hagerstrand, 1970; Ellegard & Svedin, 2012). His address called for a return to a focus on the individual in research into human behaviour. Hagerstrand proposed a framework for examining the relationships between various constraints and human activities in a space-time context, which he termed 'time geography'. Adopting an integrated space-time system, time geography uses the concept of a space-time path to describe an individual's trajectory in physical space over time, and the concept of a space-time prism to depict the extent of physical space and time that is accessible to an individual under certain constraints. With these concepts, the framework provides an effective approach to studying human activities in a space-time context, such as the focus of this study.

Researchers have frequently used Hagerstrand's framework to study the spatial and temporal characteristics of human activities in physical space (Lenntorp, 1976; Parkes & Thrift, 1980; Carlstein, 1982; Ellegård, 1999; Ellegard & Svedin, 2012). Every individual human activity takes place in a particular space-time context, making space and time the two major factors that constrain an individual from carrying out certain activities (Golledge & Stimson, 1997). Time, according to Hagerstrand, is as essential as space and should be explicitly included in the investigation process. Therefore, his conception of 'time geography' employs a two-dimensional space as a base map to which time is added as a vertical dimension to conceptualise the time-space paths of individuals both 'upwards' and 'sideways' through this three-dimensional diagram as they carry out their daily tasks. Hagerstrand argues that for each individual, depending on his or her access to travelling facilities, there is a time-space prism that defines the boundaries of what activities are possible from his or her home base.

Time geography incorporates two basic concepts – the space-time path and the space-time prism – to portray human activities according to their spatial and temporal characteristics in an integrated space-time system (Hägerstrand, 1970). A space-time path is the trajectory of an individual’s movements in physical space over time. This path can be considered a linear feature in the 3D space-time system, which provides a continuous representation of the history of an individual’s location in space. A space-time prism depicts the extent in space and time that can be accessed by an individual under a specific set of constraints (Lenntorp, 1976; Ellegard 2017). The prism forms a continuous space in the orthogonal space-time coordinate system defined in time geography.

Transportation serves as a means to trade time for space since movements in physical space take time (Miller & Shaw, 2001). Given a specific location and time period, a person may choose to stay at the location for the entire time duration. If he or she wants to move to a new location, the physical movement uses time and the time available for activities at the new location is shortened accordingly. If we project a space-time prism onto a 2D plane, the result will be a region, which is known as potential path area.

The shape of a space-time path or a space-time prism is conditioned by the three types of constraints defined in the framework. Miller (2005, p. 19) describes three types of spatial and temporal constraints on human behaviour:

a. The person’s capabilities to trade time for space through movement (such as via access to private or public transport).
b. The need to cope with others at particular locations for given durations (such as for a meeting), thus limiting the ability to participate in activities at other locations.
c. The ability of public or private authorities to restrict physical presence for some locations in space and time (such as gated communities or shopping malls).

By disregarding the time and geographic bound nature of constraints on individual actions, Miller suggested, we are missing the critically important role of context in explaining individual behaviour. This landscape of matter embedded within space and time trajectories is responsible for the unintended outcomes of intentional actions modelled as errors in aggregate economic analyses, and instead constitutes an important research area (Hagerstrand 1970; Ellegard, 2019).

Hagerstrand’s concept of space-time was powerful because it was simple. Although its inspiration was derived from the study of human migration patterns, it quickly took hold across the social science spectrum during the 1970s. Space-time geography revolutionised the study of transportation accessibility largely because of its ability to represent individual behaviour in a reasonably accurate manner. In 1976, Lenntorp, one of Hagerstrand’s associates at Lund University, studied how increasing bus services in the city of Karlstad could increase the number of areas within the city that would be accessible to a person given a particular individual ‘activity programme’ (Hagerstrand's, 1970). Drawing on Innovation Diffusion Theory and time geography, Pred (1978) analysed the impact of the telegraph on people’s role and life experience in 19th-century United States. Tornqvist (2004) used time geography to problematise the influence of places, institutions and people on Noble Laureates.

Time Geography Theory, although powerful and relevant for understanding the limitations on human participation in activities that require allocating scarce available time to access and conduct these activities, has been criticised. According to Miller (2005), the nature of the theory makes it difficult to ascertain a rigorous analytical definition of basic time geography entities and relationships. This ‘limits abilities to make statements about error and uncertainties in time geographic measurement and analysis' (Miller, 2005, p. 17). In addition, the nature of this theory makes it difficult to draw any comparison among different time geographic analyses or to develop standard time geographic computational tools (Miller, 2005). The theory has also been criticised for its inability to capture and explain the events that lead to engagement in specific activities (Richardson, Castree, Goodchild, Kobayashi, Liu & Martson, 2017).

In this study, Time Geography Theory is used to explore how the availability of good feeder roads and transport services affects and influences the ability of people and goods to be transported from one place to another. That is, the construction of feeder roads alone is not enough but there must also be available vehicles that facilitate the movement of rural people and goods from one geographical area to another. Indeed, the importance of feeder roads highlights the significance of transport services, to the extent that it is not just the roads that matter but also the availability of various vehicles which serve as means of transport to enable people and goods to move from one area to another within a specific time period.

In rural communities where roads are bad and transport services lacking, the movement of people and goods from one geographical area to another will be limited compared to communities that have good feeder roads and transport services. Similarly, the type of vehicles available, whether motorised or non-motorised, and the cost of the fare for travelling from one location to another may all motivate and influence the movement of people from one place to another, as can the desire to travel, ability to travel and the number of trips a person is able to undertake within a specific timeframe.

5.3.2 Maslow's Hierarchy of Needs Theory

Abraham Maslow was an American psychologist who developed the Hierarchy of Needs Theory in 1943 (Maslow, 1943; McLeod, 2020). Maslow's theory comprises two main concepts: basic needs and self-actualisation. The theory has a simple framework based on the assumption that the satisfaction of basic needs leads to self-actualisation. The theory divides human needs into deficiency needs and being needs. The latter represent the ultimate needs of self-actualisation that one aspires to attain. Self-actualisation is the level of attainment of desired goals such as self-fulfilment, peace, knowledge, health and understanding (Maslow 1943; 1962; 1970; McLeod 2020). Deficiency needs are made up of four basic needs which, if not met, create tensions within humans. The four basic needs, in hierarchical order, are physiological, safety, love and esteem needs. Maslow's theory explains that for a person to attain self-actualisation, the four types of lower needs must first be met. The deficiency needs follow a hierarchical order, thereby emphasising on the meeting of one need before another need in a sequence (Maslow, 1943; 1970). According to Maslow's theory, a person is driven to satisfy the lower needs but drawn to meet the higher needs. In relation to the deficiency needs, the most basic drives are the physiological needs, followed by the need for safety, then the desire for love, and finally the pursuit of esteem (Maslow 1943; 1970).

According to this theory, humans crave basic needs or physiological needs such as the need for food, water and freedom of movement. However, when such needs are not satisfied or met, humans tend to feel distress or pressure from the resultant deficiency, such as hunger, thirst or confinement. This distress, tension or pressure produces drives that generate restlessness until such basic needs are met. Once basic physiological needs are met, humans then crave safety, which operates mainly at the physiological level. A desire for love and belonging is pursued after one's physiological and safety needs are met, which is motivated by the desire to give love in return for receiving love. Attainment or satisfaction of physiological, safety and love needs leads to the drive for esteem needs (Maslow 1943; 1970). Esteem gives a sense of power, control or authority, which is attained from developing self-esteem or gaining the attention or recognition of others. When basic deficiency needs are satisfied, the need for self-actualisation becomes the ultimate goal. Maslow describes the need for self-actualisation as 'the desire to become more and more what one is, to become everything that one is capable of becoming' (Maslow, 1943, p. 382).

The next couple of paragraphs explain Maslow's framework in relation to the conceptual categories of rural transport components, accessibility and mobility, access to socioeconomic services and improved quality of life.

Maslow's theory is well regarded and frequently adopted in view of the fact that previous empirical research has identified the motivational forces that drive the satisfaction of human needs. Notwithstanding, Maslow's hierarchical arrangement of needs and the principle of a dominant need have been criticised for accurately capturing reality. Studies have disproved its assertion that needs and satisfaction differ and can be affected by various factors such as attitudes, values, aspirations, opportunities and life situations (Kaur, 2013; Daneulin & Shahani, 2009; Vallentyne, 2005; Stewart, 1995; Sen, 1785, 1987; Basu, 1987)

Regardless of the criticisms, the theoretical framework is significant to the present study. In this study, Maslow's theory is used to explore how the availability of good feeder roads and transport services affects and influences the ability of people and goods to be transported from one place to another, and also improve the quality of life of people.

The deficiency needs used in Maslow's theory are not limited to the only individual as there are also group, community, national and international deficiency needs. Deficiency needs is adapted in this research to attach premium to needs that cannot be overlooked. Deficiency needs are also known as basic needs and serve as a foundation for other needs (being needs) or self-actualisation. For instance, food, shelter and clothing are defined as the basic needs for human life. Basic needs do not detract from the importance of other needs but serve as necessary conditions for achieving those other needs, as reflected in Maslow's hierarchy of needs (Maslow, 1943; 1970; McLeod, 2020). In armed conflict situations, peace (ceasefire) is considered as a deficiency need or a basic need to resolve the conflict. Similarly, in a situation where rural isolation (due to a lack of accessibility and mobility) has led to a poor quality of life or lack of development, addressing accessibility and mobility is a basic need. In this study, the variables or categories of rural transport components, accessibility and mobility, and access to socioeconomic services can be seen as deficient basic human needs that must be met to attain self-actualisation.

Self-actualisation also implies the attainment of a certain level of development or a good quality of life. The provision of rural transport components meets the basic need that drives the attainment of other objectives (or needs) such as accessibility and mobility, which in turn enables access socioeconomic services, and then ultimately enhanced development or improved quality of life. The fulfilment of self-actualisation may be understood as comprising two aspects. In the first, self-actualisation is attained as people in rural communities with good feeder roads and transport services are able to access good healthcare, meet their travel needs and engage in various forms of socioeconomic activity. In the second, self-actualisation is attained as the ability to access good healthcare, ability to meet travel needs and ability to engage in various forms of socioeconomic activity improve the quality of life of people.

The attainment of desired goals such as socioeconomic wellbeing, good health and financial stability may be attributed to the fulfilment of basic needs such as the need to access good roads and transport services. Conversely, road and transport challenges may serve to hinder the fulfilment of needs because the ability to transport people and goods from one place to another is limited.

5.3.3 Systems Theory

Systems Theory originates from biology but is applicable to many fields of study. It is based on the development of scientific principles to aid understanding of dynamic systems with highly interactive parts (Bertalanffy, 1968). Systems Theory involves the basic idea that objects in the world are interrelated to one another (Whitchurch & Constantine, 1993). Systems theorists argue that the system needs to be looked at as a whole rather than as individual components. The theory is valuable for the analysis of complex structures. In this regard, it is useful for geographers, especially within the transport milieu.

A system thus can be defined as a group of elements organised such that each one is in some way interdependent (either directly or indirectly) with every other element. In addition, Systems Theory is based on the assumption that systems have a function, goal or purpose. Harvey (1969) defines a system as consisting of:

a. A set of elements identified with some variable attribute of objects.

b. A set of relationships between the attributes of objects.

c. A set of relationships between those attributes of objects and the environment.

The structure of a system is essentially composed of elements and links between elements. Elements are the basic unit of a system but it is important to note that the elements of systems are the states or conditions of things, not the things themselves (Harvey, 1969).

It is also important to note that when the various components of the system do not function, both independently and collectively or in harmony, it will give rise to negative feedback, leading to inefficiencies in the system. Systems may, however, be embedded in bigger systems, such that an element at one level of analysis may itself be a system at another level of analysis. This encompasses super systems and subsystems. Therefore, systems require redefinition across the different resolution levels.

It is possible to investigate the structure and behaviour of some systems only if the boundaries of that system are first identified. The boundary represents the part of the system that separates it from its environment, and determines what is considered to be part of the system and what is not. A related concept is the idea of an open versus a closed system. A closed system is one where interactions occur only among the system components and not with the environment, while an open system is one that receives input from the environment and/or releases output to the environment. The more open the system is, the more energy or information will be allowed into and out of that system. In some cases, it is not easy to define a system's boundaries clearly, and therefore boundaries are imposed on the basis of judgment as to where the system begins and ends.

There are three general approaches for evaluating subsystems. The holistic approach involves examining the system as a complete functioning unit. The reductionist approach looks downward and examines the subsystems within the system. The functionalist approach looks upward from the system to examine the role it plays in the larger system. All three approaches recognise the existence of subsystems operating within a larger system. All three approaches emphasises the overall operational process occurring within a system. A description of such a system involves the specification of inputs and outputs, and a model relating to inputs, outputs and system state in time. Thus, one must understand the interaction among various components to explain the system. The next paragraph concludes the discussion on Systems Theory by explaining its significance.

The relevance of Systems Theory cannot be overstated. In many disciplines, it provides a scholarly method of evaluating a situation. An even more important characteristic, however, is that it provides a universal approach to systems that is applicable to all sciences. Systems Theory helps to analyse complex structures and is particularly useful for geographers dealing with phenomena that are highly interconnected such as transport networks. It helps to explain outcomes and deals with complex issues that are interrelated. It is also more effective than simple analysis at identifying and analysing cause and effect relationships. Given the multivariate nature of geographical problems, systems analysis represents an appealing framework for exploring these problems. A key area in which systems theory has been shown to be useful is the field of transport studies (Larsson, Dekker & Tingval, 2010). For the present research, Systems Theory offers a framework for analysing the categories or variables by looking at the harmony, dependency and relationship between them.

As applied in this study, Systems Theory explains the harmony that must exist among all stakeholders responsible for providing road and transport services. It explains how the activities of stakeholders in rural transport planning aimed at ensuring accessibility and mobility can only be referred to as part of a system if they work together in harmony and depend on one another. Thus, rural transport infrastructure development activities must complement each other. To put it differently, if the effectiveness of stakeholders responsible for constructing roads is not accompanied by a corresponding effectiveness in the provision of transport services, then the rural transport planning system cannot be described as efficient.

5.3.4 Socio-Technical Theory

Socio-Technical Theory presents a framework for achieving optimisation or success by harnessing social and technical systems. It is about designing social and technical systems to work in tandem. It is concerned with the social aspects of people and society and the technical aspects of institutional or organisational structures and processes. The theory focuses on the interrelatedness of the social and technical aspects of organisations. Socio-Technical Theory was developed in World War II era by Eric Trist, Ken Bamforth and Fred Emery based on their experience studying English coal mines while at the Tavistock Research Institute in London (Mumford, 2006; Trist & Murray, 1993).

Socio-Technical Theory is founded on two ideas, not principles as such: interaction and optimisation. According to the theory, interaction is crucial such that the nature or type of interaction between social and technical factors is a precondition for success or failure in organisational performance. Three main types of interaction are: linear, non-linear and complex interactions. Linear interaction describes the activities, functions and roles performed by people within an organisation that directly affect the success of the organisation. The non-linear interaction is the direct opposite of linear interaction. The complex interaction considers both linear and non-linear interactions and goes beyond to look at activities, function and roles of other people outside the organisation, or activities of other organisations and stakeholders that directly or indirectly affect its success. The theory posits that linear, non-linear and complex interactions must be present when technical elements are put together for optimal outcome. According to the theory, the optimisation of social and technical (joint optimisation) elements is necessary to determine not only the outcomes of unpredictable, unforeseen relationships, but also the outcomes of relationships that are injurious to the system's performance or success of the organisation.

Socio-Technical Theory is best used in designing different kinds of organisations, specifically those in which the relationships between social and technical elements affect productivity and wellbeing. The theory is also used in studies (action research) relating to innovation in organisational work practices. Likewise, it is used to study the application of new technologies in organisations as well as worker or staff management and development. Socio-Technical Theory is best known for its principle of interrelatedness in the achievement of optimisation of situations or resources within an organisation.

Applied in this study, the theory presents a simple framework that explains the phenomenon under study and the relationship between the variables or constructs derived from the literature review – that is, the relationship between accessibility and mobility, on the one hand, and isolation and socioeconomic development, on the other. In terms of rural transport planning and development, Socio-Technical Theory highlights the interactions and relationships that exist among the various actors, such as rural people (road and transport users), the government, donor countries, transport service providers, and organisations such as rural communities, the Ministry of Roads and Transport, the Department of Feeder Roads, and the Ghana Private Road Transport Union. According to this theory, interactions must be partly linear and partly non-linear as well as complex to achieve optimization.

Linear interactions give room for a good relationship between the actors in terms of how they affect one another, taking into account their strengths and weaknesses. Non-linear interactions between actors may lead to unpredictable outcomes. Complex interactions between actors refer to multiple interactions or engagements. According to Socio-Technical Theory, success or optimisation thrives when the social and technical elements are put to work. The social and technical element is used to refer to the quality of human resources and how efficient they are and the structures that exist to enable them work or perform effectively. The theory also posits that a distinction must be drawn between the social and technical dimensions of actors' interactions. In this regard, technical refers not only to procedures and knowledge but also to structures and technicalities.

In this study, features of the Socio-Technical Theory, especially on the need for interaction and optimisation, helps in understanding the rural transport challenges such as the poor condition of roads and inadequate vehicles for effective rural transport services. In this regard, the fusion of the Ministry of Transport and the Department of Feeder Roads can perhaps be seen as facilitating the design of social and technical systems to work in tandem in rural transport planning. This may help to ensure that feeder road appraisal models will be targeted to achieve optimisation in rural transport planning. Such optimisation will pave the way for greater interaction between all stakeholders in the road and transport sector, such as the World Bank, the Ghana Private Road Transport Union and vehicle owner associations in planning rural transport. Such interactions are needed to ensure not only the outcomes of unpredictable, unforeseen or undersigned relationships but also the elements that are detrimental to appraisal models and rural transport planning. In other words, more effective interactions and coordination will pave the way for a more holistic appraisal focused on structures and methodologies that promote rural transport. In turn, this will ensure that the types of roads that respond to the socioeconomic needs of people will be constructed and regularly maintained and that the requisite transport services will be provided to enable people to travel and transport goods from one area to another.

5.3.5 Socio-Spatial Dialectic Theory

Socio-Spatial Dialectic Theory was propounded by Soja (1980) as a response to the Marxist theoretical position on ‘space’ and ‘time’ in urban production. Marxist political economists like David Harvey and Manuel Castells are of the view that, unlike ‘time, ‘space’ has no material relevance. According to Lefebvre (2003), urban space is a place where assembly and simultaneity occur, and where capitalism blossoms yet also encounters concrete contradictions that undermine it, initiate historical change and stimulate political resistance. Space, in the view of Marxism, is reduced to anything dead and non-productive. The opposite is said of ‘time’, which is deemed to give richness and life. In contrast, in the socio-spatial dialectic, Soja (1980) presents space as a material product that is theoretically and practically relevant to the relations of production.

Space and time, according to Socio-Spatial Dialectic Theory, are equally relevant in production. The theory maintains that in production relationships, neither space nor time dominates but are dialectically intertwined and inseparable. Emerging urban issues or problems, according to Soja, have hindered industrialisation or capitalism as the driving force of social change. Socio-Spatial Dialectic Theory seems to provide a solution to the theoretical dilemma of how the social relation of production and the social relation of space function together to enable capitalism not just to survive but to thrive. This is, however, in contradiction to Lefebvre’s assertion that capitalism overcame its internal contradictions and continued to expand by occupying and producing space.

Socio-Spatial Dialectic Theory is embedded in the framework of historical materialism, and explains that space has both material and non-material characteristics. In other words, space is both a material and non-material product. According to the theory, human life commences with the body, practically in the construction and performance of the self, or the human subject – an assertion that lays the foundation for space as a material product and ‘a product of human action’ (Soja, 1980, p. 210; Massey, 2005). The incorporation of human action introduces a third force or actor between space and time. In his action network theory, Latour (2005) affirms that actors come into being when actions occur. His theory places actions and actors within networks and explains that an actor becomes relevant when an action carried out influences a network. A change in network relationship implies that an action has taken place and an actor has come alive. When there is no change in network relationships, this means that no action has occurred and, practically or theoretically, no actor exists.

Actors are classified as material and non-material. Material actors are human beings whereas non-material actors are non-humans. Human actors comprise individual actors, state actors, multinational corporations, and various social movements whose actions cause a change in social networks or relationships. In this study, theoretical explanations of actor networks are used to understand social relations in terms of the role played by actors in rural transport planning. For example, a lack of accessibility and mobility makes communities isolated, yet isolated communities may be transformed into communities with improved accessibility and mobility or communities with relatively improved access. This can be achieved by providing basic access like feeder road connectivity or by providing accessibility and mobility. This requires actions by actors such as governments and feeder road expert engineers. These actors operate according to their defined roles, duties or powers to implement change. According to Socio-Spatial Dialectic Theory, if the actions of actors who are performing their roles or duties do not cause any change in the network, then it can be concluded that such actors have not come into being (non-performing) and that their actions (decisions, models or policies) are not relevant. This conceptualisation of actors and space drives us to think about them as dynamically related, or some such. Thus, on this account, actors and space are manifest only when network relationships are transformed.

5.3.6 Technology Acceptance Model

The Technology Acceptance Model (TAM) is a theory propounded by Davis in 1989. It explains the causal relationships between system design features, perceived usefulness, perceived ease of use, attitude towards using and actual usage behaviour. Davis (1989) explains that perceived ease of use has a substantial influence on perceived usefulness, behaviour, attitude, intention and actual use.

According to Davis, people tend to use or not use certain technological innovations with the objective of improving their performance at work – perceived ease of use. However, even if the person understands that technology is useful, they may choose or not use it if it is too complicated. That is, users will use a technology if they believe that its use will provide positive results, given its perceived ease of use and perceived usefulness (Davis, 1989). Given the criteria used to select the theoretical frameworks in this study, the TAM does not offer a comprehensive explanation of the phenomenon under investigation but is limited to the use and acceptance of IMTs. Notwithstanding, since technology cuts across almost every discipline and/or field of human endeavour, TAM is sufficiently versatile to be incorporated into any theoretical framework to explain any phenomenon for which the acceptance and use of technology is an integral aspect. However, despite the usefulness of this theory, it has faced certain criticisms.

First, although the theory is widely accepted, some empirical evidence does not support it, especially on the relation between perceived ease of use and perceived usefulness (Bajaj & Nidumolu, 1998; Chau & Hu, 2001; Subramanian, 1994; Hu, Chau, Sheng & Tam, 1999; Jackson, Chow & Leitch, 1997). According to Keil, Beranek and Konsynski (1995), Agarwal and Prasad (1997), Lucas and Spitler (1999), Szajna (1996) and Gefen and Keil (1998), there is no empirical evidence to support the relation between perceived ease of use and actual use. Moreover, Subramanian (1994), Chau (1996), Hu et al. (1999) and Lucas and Spitler (1999) have found no relation between perceived ease of use and behaviour intention. In addition, Chau (1996) reported that there is no significant direct relationship between perceived ease of use of technology and intention to use it, implying that whether or not the technology is easy to use does not influence the user's intention to use.

The TAM provides a framework that explains why a technology or an innovation is accepted and used. This framework is used to explain the acceptance of IMTs, which are proposed as alternatives to conventional vehicles to facilitate access to services or facilities. Considering the fact that IMTs are alternatives to supplement or address the challenges related to conventional transport services, their user acceptance is important. IMTs are not just vehicles but new technological innovations. Hence, their acceptance implies an acknowledgement of a new technology that is significant in facilitating access to services or facilities, which is influenced by user behaviour. According to Venkatesh, Morris, Davis and Davis (2003), technological innovations need to be accepted and used. The acceptance and use of technological innovations in transport, such as IMTs, will inevitably suffer from the issues of user behaviour that have led to the development of theories on technology acceptance, particularly the TAM.

5.3.7 Criteria for the assessment and selection of theories

The theories reviewed are Maslow's Hierarchy of Needs Theory, Hagerstrand's Time Geography Theory, Bertalanffy's General Systems Theory, Trist et al.'s Socio-Technical Theory, Soja's Socio-Spatial Dialectic, and Davis's TAM. In this section the theories are scored and ranked on a scale of 1 (lowest) to 4 (highest) according to the degree to which they satisfy the selection criteria (see Table 5.2). The weightings applied are based on the subjective opinion of the researcher. While the analysis is subjective, nevertheless, it provides a basis for filtering and assisting in guiding the research in selecting the best framework for answering the research questions.

Table 5.2: Criteria for theory assessment and selection

Criteria and assessment for theory selection				
Theories	Selection criteria			
	Is it significant to the phenomenon under study?	Does it satisfy theoretical / conceptual variables?	Is it related to transport study?	Does it meet the objectives set for the study?
Time Geography	4	4	3	4
Hierarchy of Needs	4	4	2	3
Socio-Technical	3	3	2	2
Systems	3	3	2	2
Socio-Spatial Dialectic	3	2	2	2
TAM	1	1	2	2

Scale*: 4 (Highest); 3 (High); 2 (Low); 1 (Lowest);* Source: Author

In Table 5.2, Hagerstrand's Time Geography Theory is ranked highest followed by Maslow's Hierarchy of Needs Theory, Trist et al.'s Socio-Technical Theory, Bertalanffy's General Systems Theory, Soja's Socio-Spatial Dialectic Theory, and Davis's TAM Theory in ranking order.

To draw on the strength of these theories and to test for the most appropriate theory for this study, the assessment was guided by the theoretical framework provided in Figure 5.3.

The framework presented in Figure 5.3 is as further development of the phases depicted in Figure 5.1, incorporating the major stakeholders, theories and constructs that are significant to the study.

The theoretical framework (Figure 5.3) explains that addressing rural isolation and promoting rural socioeconomic development (ensuring the attainment of self-actualisation) requires transport development (availability of rural road infrastructure development and transport services or vehicles). It further demonstrates that transportation improves accessibility (access to healthcare, markets, education and employment and consequently development (poverty alleviation, good health and social wellbeing). For rural roads and rural transport services to be developed, it is necessary that road and transport services be given priority in the rural road transportation appraisal models used.

The theoretical framework shown in Figure 5.3 serves as a guide for the researcher in exploring the accessibility and transport needs of rural communities in Ghana and investigating their effects on socioeconomic activity and the quality of life of rural people living along feeder roads in Ghana. It further serves as guide in answering the primary research question: *What are the accessibility and transport needs of rural communities in Ghana and what may be their effects on socioeconomic services and quality of life of rural people living along feeder roads in Ghana*? The framework also serves as a guide for the data collection, data analysis and discussion of findings to answer the supplementary research questions. To serve as a reminder to readers, the supplementary research questions are:

1. To what extent do feeder roads contribute to the development of rural people and the rural communities in Ghana?
2. What types of vehicles and IMTs may be used on feeder roads and how suitable are they to address the transportation need of the people in rural communities in Ghana?
3. What are some of the challenges associated with accessibility and mobility along feeder roads in rural communities in Ghana?
4. How are feeder road investments appraised to meet the accessibility and transport needs of people in rural communities in Ghana?

As outlined in the theoretical framework (Figure 5.3), the data analysis and discussion of the findings for the first research question are focused on the ability to travel within time and space and its impact on the lives of rural people, and vice versa. To explain further, this process draws on the appropriate theory to determine and explain how rural people are able or unable to fulfil their basic needs, dependent on the availability or non-availability of roads to enable travel from one geographic location to another.

Similarly, to answer the second research question, the theoretical framework requires that data collection, analysis and discussion concentrate on the various transport services and mobility means that are accessible and suitable to allow people to trade time for space (by moving people within a specified time period to a specific or preferred location); the data analysis and interpretation focus on the type of vehicles used, including IMTs, their ease of use as a means of travel, and the time spent on travel. To explain further, this process draws on the strengths of the appropriate theory to ascertain and explain how the availability of suitable vehicles represents an essential need that must be fulfilled to enable rural people to commute from one geographic location to another, in turn facilitating the fulfilment of their socioeconomic development needs.

To answer the third research question, data has to be collected, analysed and discussed in relation to the constraints impacting accessibility and mobility. These constraints are understood as obstructing essential transportation needs, and thereby hindering the social and economic development of people.

To answer the fourth research question, the data collection, analysis and interpretation in relation to feeder roads appraisal models must consider the incorporation of accessibility and mobility as appropriate features of appraisal models for transport planning. Thus, in terms of ensuring accessibility and mobility, the analysis focuses on how rural transportation stakeholders can work together to address road infrastructure and transport service needs of the people in the rural communities.

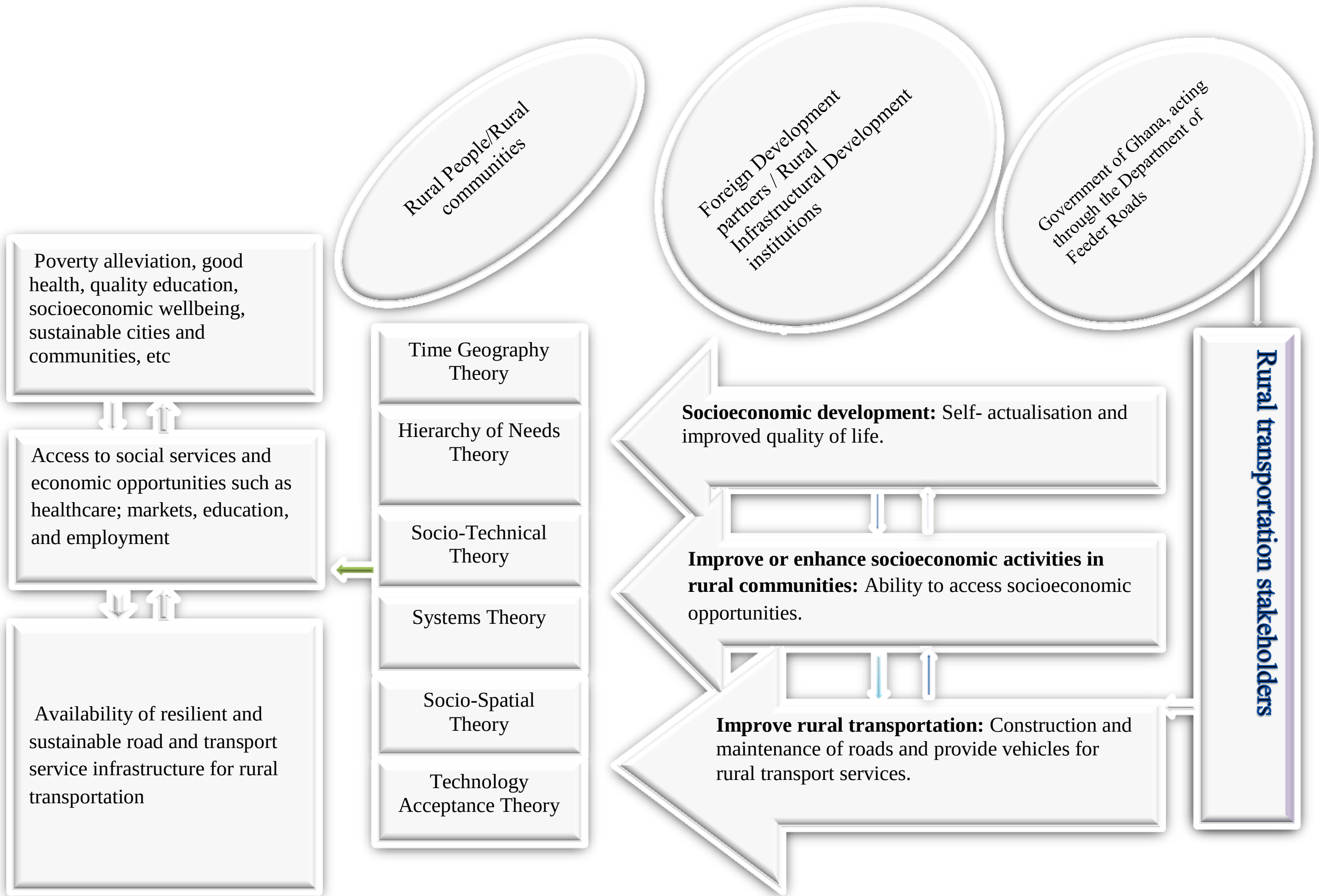

Figure 5.3: Rural transportation and socioeconomic development framework

The theoretical framework presents the key stakeholders in relation to rural road transport, mainly the Department of Feeder Roads and rural people. Other stakeholders include various foreign agencies, institutions or donor countries that support rural development by providing grants and loans to the Government of Ghana in support of rural developmental projects. The next section provides a summary of the issues discussed in this chapter.

5.4 Summary of issues discussed in this chapter

This chapter outlines gaps in literature reviewed and uses them as guide to select the theoretical framework that guides the study. The gaps identified include lack of good roads and suitable vehicle for rural transportation, inability to engage in socioeconomic activities due to bad roads and poor transport services, and lack of socioeconomic development and unimproved quality of life of rural people.

Theories such as Maslow’s Hierarchy of Needs Theory, Hagerstrand’s Time Geography Theory, Bertalanffy’s General Systems Theory, Trist et al.’s Socio-Technical Theory, Soja’s Socio-Spatial Dialectic, and Davis’s Technology Acceptance Model are considered with the strength of each accessed as to how rural accessibility and mobility can be improved, socioeconomic activities improved, socioeconomic development attained and quality of life improved in rural communities.

The theory selection process ranked Hagerstrand’s Time Geography Theory highest, followed by Maslow’s Hierarchy of Needs Theory, Trist et al.’s Socio-Technical Theory, Bertalanffy’s General Systems Theory, Soja’s Socio-Spatial Dialectic Theory, and lastly Davis’s Technological Acceptance Model. With consideration to the theoretical ranking, the theoretical framework (Figure 5.3) is developed to serve as guide to the study and to test the theories.

The next chapter takes into consideration the research questions and the rural transportation and socioeconomic development framework provided in Figure 5.3 to develop the research design of the study.

CHAPTER 6:

RESEARCH DESIGN

6.0 Introduction

In Chapter 5, informed by the literature review and the research questions, the theoretical framework of the study was developed to illustrate the relationships between the theoretical constructs and selected theories. The theories were selected based on the criteria and assessment presented in Table 5.2. The theories selected and ranked in order were Hagerstrand's Time Geography Theory, Maslow's Hierarchy of Needs Theory, Trist et al.'s Socio-Technical Theory, Bertalanffy's General Systems Theory, Soja's Socio-Spatial Dialectic Theory and Davis's TAM.

This chapter presents the research design used for this study and the overall process and procedures followed, based on which the research questions are answered and the theories tested. The testing and final selection of the theories are guided by the following assessment: (1) Does the theory conform to the research methodology and analysis? (2) Does the theory support the conclusions and recommendations?

The research design is explained under the following sections: research paradigm, research method, sources of data, data collection methods, data collection instruments, link between research questions and questions on research instruments, data analysis, validity and reliability, ethics considerations, and a summary that is provided at the end of the chapter.

6.1 Research paradigm

The main conceptual issues under study and the relationships among them are explained in the theoretical framework. Also included in the theoretical framework are selected theories that help to explain the phenomena.

The similar way to begin research is to establish the appropriate paradigm to underpin the study (Mertens, 2007; Lincoln & Guba, 1994). This is necessary because every scientific study is guided by the norms, assumptions, beliefs and values of the paradigm chosen. A paradigm connotes the philosophical perspective or a particular way of viewing knowledge that the researcher uses to inform a study (Walsham, 1995). It also provides the basis for understanding a researcher’s worldview. A paradigm defines for the researcher what the research is about as well as what falls within and what falls outside the limits of the research (Kivunja & Kuyini, 2017; Aliyu, Singhry, Adamu & Abubakar, 2015; Lincoln & Guba, 1994; Lincoln & Guba, 1985). Aliyu et al. (2015) and Lincoln and Guba (1994) outlined the elements of a research paradigm as epistemology, ontology, methodology and axiology.

Epistemology is concerned with the nature of human knowledge and what the researcher can comprehend in order to extend and deepen current understanding in their arena of study (Kivunja & Kuyini, 2017). Epistemology leads researchers to four sources of knowledge: intuitive knowledge, authoritative knowledge, logical knowledge, and empirical knowledge (Kivunja & Kuyini, 2017). According to Perrt (1995), ontology refers to ‘a shared understanding of some domains of interest which is often conceived as a set of class (concepts), relations, functions, axioms and instances’. Methodology is ‘an articulated, theoretically informed approach to the production of data’ (Ellen, 1984, p. 9).

It informs the strategy, plan of action and process as well as the choice of a research method and how the research should be conducted (Crotty, 1998; Grix, 2004). Axiology refers to the ethical issues to consider when conducting a research. It shows the right and the wrong procedures in conducting research or the principles guiding the application of research methodology, especially when dealing with respondents and data.

There exist many diverse research paradigms, which are distinguished from one another based on their epistemological elements, ontological elements and methodological elements. Most research adopts one of two major research paradigms: positivism and interpretivism. The positivist paradigm is also known as rationalist, normative and quantitative analysis (Smith, 2008; Smith & Liehr, 1999), whereas the interpretive paradigm is also known as social constructivism and qualitative analysis (Johnson & Onwuegbuzie, 2004; Thanh & Thanh, 2015). This research adopted an interpretivist worldview with ontological, epistemological, methodological and axiological strands, as outlined in Table 6.1.

The positivist paradigm takes a more rigid methodological approach, which would have posed challenges for the present study, due to the nature of the research questions which required a more flexible methodological approach. In view of this, the interpretive paradigm, which embraces flexible research methodological approach, was chosen.

The next section discusses the research method used.

Table 6.1: Ontological, epistemological, methodological strands and axiological strands of the study

Ontological, epistemological, methodological and axiological strands of the study	
Worldview element	**Interpretivist worldview of this research**
Epistemology (what is the relationship between the researcher and that being researched?)	The epistemological basis of the research is authoritative knowledge. This is based on the rationale that the researcher's source of knowledge rests on data or information gathered from people with personal experience of the research topic and experts with authority on the research topic.
Ontology (what is the nature of reality?)	The ontological strand of the research is based on the fact that social realities are relative to the experiences of people in time and space. In view of this, participants were visited in the field by the researcher to administer the research instruments. Quotes are provided by the researcher to illustrate the participants' diverse perspectives on the accessibility and transport needs of people living along feeder roads in Ghana.
Methodology	The methodology used in this study is qualitative in nature. It builds on the subjective views of the respondents, uses content analysis and makes a generalisation. It does not build theory but explains the generalisation by drawing on existing theories.
Axiological strands	The axiological strand adopted in this study is based on the ethical procedures approved by the RMIT University Human Research Ethics Committee.

Source: Author

6.2 Research method

The qualitative research method was chosen for this study over a quantitative research method due to the nature of the research questions, which required a more flexible data collection method, more flexible data collection instruments and more flexible data analysis. Such flexibility cannot be achieved with quantitative methods as they generally require rigid procedures. The qualitative method was chosen on the rationale that it involves realistic methods that comprehend the phenomenon or subject under study in a specific context without influencing the characteristics of that phenomenon or subject (Rehman & Alharthi, 2016; Saunders, Kuhnimhof, Chlond & Rodrigues da Silva, 2008; Johnson & Onwuegbuzie, 2004; Golafshani 2003; Yuksel & Yildirim, 2015; Johnson, Onwuegbuzie & Turner, 2007; De Vaus, 2002; Taylor & Bagdon, 1998).

Qualitative types of research include phenomenological research (focus on understanding how one or more individuals experience a phenomenon), ethnographical research (focus on describing the norms, values, practices, language and material of a group of people), grounded theory research (focus on generating theory from collected data), ethnomethodology, conversation analysis, and interpretive phenomenological analysis. In this study, in order to obtain rich data and in-depth knowledge on the issues under examination, an ethnographic qualitative methodology was therefore selected. However, given the study's limitations in terms of time, resources and the skills required, consideration was given to a phenomenological approach. Phenomenological approaches provide a platform for data collection methods like focus group interviews or discussions and expert interviews to collect the views and opinions of the participants (Denscombe, 1998; Pelin & Yildirim, 2015). The phenomenological research approach allows for participants to share their experiences and perceptions through discussions and expert interviews, facilitating the collection of rich data. The choice of data collection methods and instruments is dependent on the types of sources of data used. In the next section, the sources of data used in this study are discussed.

6.3 Sources of data

Answering the research questions of the study require a review of the secondary literature, supported by primary data. The first, second and third research questions require primary data, supported by the secondary literature, which strengthens the empirical findings by comparing them to the findings of other empirical research. The fourth research question requires primary data. The secondary literature is obtained from the review of the literature on rural community issues, rural transport issues, and accessibility and mobility issues in rural transport.

In light of the insights from the literature and the data required to answer the research questions, the primary data were collected from stakeholders, as identified in Figure 5.3. The stakeholders deemed suitable for this study were feeder road expert engineers in Ghana and people living along feeder roads in rural communities in Ghana. The theoretical framework (Figure 5.3) focuses on rural accessibility and transport planning, for which feeder road expert engineers are identified as major stakeholders. The data gathered from the feeder road expert engineers in Ghana are the main primary data, supported by the data obtained from people living along feeder roads in rural communities in Ghana. The next section explains the primary data collection methods used.

6.4 Data collection methods

Phenomenological research involves the in-depth study of personal experiences of respondents who have knowledge on or are affected by the phenomenon under study (Yuksel & Yildirim, 2015; Cohen, Manion & Morrison, 2000; Lester, 2005). In this section, the methods used to collect the two sets of data (from the expert engineers and the rural communities) are explained.

Questionnaires, interviews and observations are the primary data collection methods used in qualitative research. A questionnaire comprises questions and a choice of answers to each question from which respondents must choose one answer (Atindanbilla, 2013; Kumar, 2011; Elmusharaf, 2012; Bryman, 2007; 2001; 1988; Tashakkori & Tedllie, 2003; Burns, 2000). Questionnaires are less expensive than interviews and offer participant anonymity. However, questionnaires are not the best method for in-depth studies such as phenomenological research (Tewksbury, 2009; Silverman, 2000; Brown & Dowling, 1998; Silverman, 2000; 2006) because they do not allow for questions to be probed.

According to Kumar (2011), observation is a purposeful, systematic, selective way of viewing and listening to an interaction or phenomenon as it evolves. Observation offers the researcher the chance to be present and collect data on a phenomenon as it takes place. Nevertheless, observation has several limitations. The first limitation is that interpretations drawn from observation may vary from observer to observer. Second, there is a high tendency for bias to emanate from observed data that cannot be easily verified. Third, there is a tendency that some significant elements may escape the observer during the process of observing, as well as the chance of some elements being overly observed. Considering the purpose of the present study, which relies on the personal experiences of feeder road expert engineers and people living along feeder roads in rural communities, observation is not considered the best method.

An interview is a form of conversation conducted in a most rigorous way in order to ensure reliability and validity (i.e. trustworthiness) (Kvale, 1996; Riessman, 2002). According to Riessman (2002) and Kvale (1996), an interview is a verbal interaction between an interviewer and interviewee/s, in which the interviewer asks questions to elicit information, beliefs or perceptions from the interviewee/s. The use of interviews can be expensive and time consuming, especially when it demands travelling from one place to another and sitting for long hours to interview people. However, it is best used to collect complex and sensitive data such as the personal experiences of people in relation to a phenomenon. In studies such as phenomenological research, interviews are best used to collect in-depth information because questions can be probed. Interviews are mostly used as a means to collect qualitative data from experts or people in various roles and situations. In this study, interviews are used to collect the primary data. This is based on the rationale that the study is phenomenological and requires in-depth information on the personal experiences of the participants (refer to section 5.6 for an outline of the research instruments).

There are two types of open-ended interviews: individual interviews; and focus group interviews, also known as focus group discussions. Individual interviews are 'repeated face-to-face encounters between the researcher and informants directed towards understanding informants' perspectives on their lives, experience or situation as expressed in their own words' (Taylor & Bagdon, 1998, p.77; Wilkinson, 1998). A focus group interview or discussion, according to Kumar (2011), is used to explore the perceptions, experiences and understanding of a group of people who share common experiences of a phenomenon, situation or event, often in a discussion form where recordings or salient notes are made.

Individual interviews were used as the data collection method for the feeder road expert engineers in Ghana (expert interviews), whereas focus group interviews were used as the data collection method for people living along feeder roads in rural communities in Ghana. This choice of method was made in consideration of the socio-demographic characteristics of the respondents. The socioeconomic status of feeder road expert engineers is such that they occupy high positions in their occupations and work at various places and under busy time schedules; hence, it would have been difficult to conduct group interviews with these respondents. The people living along feeder roads in rural communities in Ghana, although possessing diverse socio-demographic characteristics, live together in their communities. Focus group interviews were therefore deemed appropriate and convenient for this participant group, which saved time having to move from one person to another. The next section explains the data collection instruments used.

6.5 Data collection instruments

In this section, the data collection instruments used for the individual and group interviews are explained. Data collection instruments differ according to their structure, content and questions developed to collect data in order to answer the research questions (Kumar, 2011; Wilkinson & Birmingham, 2003; Kvale, 1996).

Interview instruments may be structured, unstructured or semi-structured. Structured interview schedules are those whose structures, content and questions are rigid. Thus, the process follows or adheres strictly to a defined set of questions outlined. Unstructured interview schedules have flexible structures, content and questions, and all questions are generated through the process of conducting the interview. In between the structured and unstructured is the semi-structured interview, which does not follow or adhere strictly to a defined set of questions.

This study could have used either a structured or unstructured interview schedule. Semi-structured individual interview schedules were chosen to collect the data from the feeder road expert engineers and semi-structured focus group interview schedules were used to collect the data from people living along feeder roads in rural communities.

The rationale for using semi-structured interview schedules was to enable the researcher to follow a defined set of questions while also being able to probe the participant responses by asking other questions not included in the defined questions (Myers, 2009; Pathon & Cochran, 2002; Wilkinson & Birmingham 2003). This supported the quest for richness of data. Sub-sections 6.5.1 and 6.5.2 outline the structure, content and questions of the interview schedules, and sub-section 6.5.3 provides information on the methods used to administer the research instruments.

The interview schedules were pre-tested to ensure clarity in the questions, determine sensitive questions, and determine the time required to administer them.

6.5.1 Semi-structured expert interview schedule

The semi-structured expert interview schedules were arranged according to segments covering the questions and expected activities to be undertaken during the interviews (refer to Appendix A for a copy of the expert interview schedule). The segments aided clarity in the order of activities. They also helped in the drafting questions to reflect the various research questions, and guided transition questions. The main questions contained within the semi-structured expert interview schedules are provided in Table 6.2.

Table 6.2: Questions in the semi-structured expert interview schedule

Questions in the semi-structured expert interview schedule	
SECTIONS	**INTERVIEW SCHEDULE QUESTIONS**
General feeder roads construction and maintenance	IQ1: In your opinion, do you think there is the need for feeder road construction and maintenance? a) Has Ghana constructed enough feeder roads? b) Should more feeder roads be constructed? c) Do road investments include transport vehicles? d) Do you think it is important that transport vehicles are included in road investment? e) Whose responsibility is it to ensure that the rural people are provided with road transport? f) Who decides whether rural transport is included in the rural road investment?
Types of vehicle on rural road	IQ2: What type of vehicles do you normally use on feeder roads? a) What types of vehicles are normally used on feeder roads by rural communities? b) Do you think there are types of vehicles that are more suitable for the movement of: (i) goods, (ii) people, (iii) children to school, (iv) people travelling for leisure, and (v) emergency vehicles to transport people to hospital on feeder roads? c) What type of vehicle(s) would you recommend for journeys less than 5 km on feeder roads? d) What type of vehicle(s) would you recommend for journeys longer than 5 km on feeder roads?

Questions in the semi-structured expert interview schedule	
SECTIONS	**INTERVIEW SCHEDULE QUESTIONS**
Intermediate means of transport	IQ3: What is your view about intermediate means of transport (IMTs)? a) Do you see them as a good transport vehicle on rural roads to carry people? b) Do you see them as a good transport vehicle to carry goods? c) Do you see them as a good transport vehicle to carry school children? d) Do you see them as a good transport vehicle for emergency services? e) Is there any particular type of IMT you would recommend to be used on feeder roads? f) At what condition(s) would you recommend the usage of IMTs on feeder roads with respect to: (i) quality, (ii) cost, (iii) distance, (iv) road condition, and (v) speed? g) Do you think IMTs can be used for public transport on feeder roads? h) Do you see any limitations of IMT adoption on feeder roads? i) Would you consider the promotion of IMTs on a rural road as a good policy? j) What would you consider the possible side effects or drawbacks of such a policy if it were adopted? k) In the absence of conventional vehicles like buses and taxis, can IMTs be used as the main vehicles on rural roads?

Questions in the semi-structured expert interview schedule	
SECTIONS	**INTERVIEW SCHEDULE QUESTIONS**
Motorcycle transport	IQ4: Is there any sign of motorcycles being used on feeder roads?
	a) What is your view of motorcycles being used on feeder roads?
	b) Do you see them as a good transport vehicle on rural roads to carry people?
	c) Do you see them as a good transport vehicle to carry goods?
	d) Do you see them as a good transport vehicle to carry school children?
	e) Do you see them as a good transport vehicle for emergency services?
	f) Are there any particular types of transport vehicles that you would recommend on feeder roads?
	g) Under what condition(s) would you recommend the usage of motorcycles on feeder roads with respect to: (i) quality, (ii) cost, (iii) distance, (iv) road condition, and (v) speed?
	h) Do you think they could be used as taxis on feeder roads?
	i) Do you see any limitations of motorcycles on feeder roads?
	j) Would you consider the promotion of motorcycles on rural roads as good policy?
	k) What would you consider the possible side effects or drawbacks of such policy if it were adopted?

Questions in the semi-structured expert interview schedule	
SECTIONS	**INTERVIEW SCHEDULE QUESTIONS**
Transport appraisal models	IQ5 a): Are you familiar with the road/transport appraisal models?
	b) What type of appraisal models does the Department of Feeder Roads generally use?
	c) Have you used any of the appraisal models?
	d) Does it cover all rural road transport investment?
	e) Is there any issue you would like to be included in road appraisals?
Accessibility and mobility challenges	IQ6: (a) Do you have a personal experience where you or close friends or relatives have encountered difficulties in accessing opportunities due to a lack of transport on a feeder road?
	1Q6: (b) Can you share the experience?

Source: Author

6.5.2 Semi-structured focus group interview schedules

The semi-structured focus group interview schedules were arranged according to segments covering the questions and expected activities to be undertaken during the interviews (refer to Appendix B for a copy of the group interview schedule). The questions within the semi-structured focus group interview schedules are provided in Table 6.3.

Table 6.3: Questions in semi-structured focus group interview schedule

Questions in semi-structured focus group interview schedule	
SECTIONS	**FOCUS GROUP DISCUSSION GUIDE**
1	FGQ 1: What has been the importance of the road to the community, and its contributions to community and to your own life (welfare and livelihood)?
1	FGQ 2: What do you do when the road is not through or blocked? Where do you normally go or not go because the road is blocked?
2	FGQ 3: Can you recount situations in the community through your personal experience where, because of the availability of transport, opportunities were opened to you or you have lost opportunities due to the absence of transport vehicles?
2	FGQ 4: Looking at the situation and the state of the road, what type of vehicle and modes of transport are more affordable to your household and to the community?
2	FGQ 5: Can you recount any situation where persons who required emergency healthcare service were saved or loss their lives due to availability or lack of vehicle to transport them to the hospital or health centre?
2	FGQ 6: Let us hear your views in general about your experience with the types of transport vehicles you find more useful in this community?
3	FGQ 7: Which of the recounted experiences do you find more common here and which ones do you think we can solve without external help?
3	FGQ 8: Which of them do you need support in?
2	FGQ 9: Looking at the situation and the state of the road, what types of vehicle and modes of transport are more affordable to your household and to the community in a sustainable way? Which of them can also be used as emergency vehicles? FGQ 9a: to go to work? FGQ 9b: to facilitate the movement of your children to school? FGQ 9c: to go to the market? FGQ 9d: Why are they not being used in the community?

Sources: Author

6.5.3 Methods used to administer research instruments

In this section, the methods used to administer the research instruments are explained. Section 6.5.3.1 explains the methods used to administer the semi-structured expert interview schedules and section 6.5.3.2 explains the methods used to administer the semi-structured focus group interview schedules.

6.5.3.1 Semi-structured expert interview schedules

The semi-structured expert interview schedules were administered on feeder road expert engineers. These interviews could have been conducted either face-to-face or via telephone, and each method has its advantages and disadvantages, as outlined below.

The face-to-face method can enhance the quality of the data obtained, as it enables researchers to know and where appropriate rephrase questions that are sensitive to the respondents. Furthermore, face-to-face interviews can be better controlled in terms of asking questions, probing answers, taking notes and recording interviews. The method also allows the interviewer to build rapport with the interviewee, making it easier to obtain honest answers, which improves the quality of the data. Notwithstanding its merits, the face-to-face method is time intensive, particularly when the interviewer has to travel long distances to conduct interviews. Likewise, if not well handled, the presence of the interviewer can sometimes intimidate interviewees to the extent that their answers to sensitive questions may be lost, which can affect the quality of the data.

Unlike the face-to-face method, the telephone method is best used when respondents cannot be directly contacted. Moreover, it is appropriate to use if short answers are required. Compared to the face-to-face method, the telephone method is also sometimes cost and time effective, particularly if the cost of travelling to meet respondents is excessive. Apart from its merits, the telephone method is sometimes not ideal for in-depth research because the quality of the data may be reduced. A number of factors such as an inability to read body language to determine participant responses to sensitive issues and difficulties in effective moderation of interviews are some of the downsides of telephone interviews.

In this study, both the face-to-face and the telephone methods were used to administer the expert interview schedules. The face-to-face method was used to ensure the quality of the data collected, whereas the telephone method was used because a few of the respondents could not be directly contacted.

The next section explains the method used to administer the semi-structured focus group interview schedules.

6.5.3.2 Semi-structured focus group interview schedules

The semi-structured focus group interview schedules were used as instruments for the group interviews with people living along feeder roads in rural communities in Ghana. Similar to the methods used to administer the semi-structured expert interview schedules, the methods used to administer the semi-structured focus group interview schedules could have been either direct or indirect.

The indirect method takes the form of online panel discussions where the respondents answer the questions in the research instrument with the help of audible communication devices such as microphones and speakers. The indirect method may also take the form of conference calls, where the interviewer and interviewees are linked up in a group phone call. These indirect methods are effective in places with advanced communication technology and in situations where it is difficult to conduct direct group discussions or group interviews. However, these indirect methods come with challenges that can affect the quality of the data. Some of these challenges include the difficulties of moderating the group discussions, recording failures or difficulties in hearing due to bad speakers, and the inability to note or identify responses to sensitive subjects by reading the participants' body language.

Unlike the indirect methods, the direct or face-to-face method is where the interviewer directly communicates with the group participants by asking the questions from the research instrument and receiving their answers to the questions. The direct method is effective for group discussions or interviews, yet it requires special skills to moderate the group discussions to ensure the quality of the data collected. In light of the pros and cons of the direct and indirect methods, this study made use of the direct method for the group interview schedules to ensure the quality of the data collected.

The next sections outline the link between the research questions and the questions included in the two research instruments.

6.6 Link between research questions and questions in research instruments

This study seeks to answer four research questions as indicated in Chapter 1, under section 1.6. To answer the research questions, it draws on the secondary literature and the primary data. The primary data were obtained from feeder road expert engineers in Ghana and were supported by data gathered from people living along feeder roads in rural communities in Ghana.

To collect the primary data, as shown in Table 6.4, two sets of research data collection methods were used, which allowed for two sets of research instruments to be designed. Expert Interview Schedule Questions (EISQ) and Focus Group Interview Schedule Questions (FGISQ) are the research instruments designed to collect the data used to answer the research questions.

This section links the Research Questions (RQs) to the EISQ and the FGISQ. The aim of establishing this link is to highlight the respective links in the research instrument that address the research questions.

The next section explains how the two sets of data collected have been analysed.

Table 6.4: Link between research questions and questions in research instruments

Link between research questions and questions in research instruments			
No.	Objective	Research question	Related questions on research instruments
1	Determine the extent to which feeder roads contribute to the development of rural people and rural communities in Ghana	To what extent do feeder roads contribute to the development of rural people and the rural communities in Ghana?	EISQ1, a, b; FGISQ 1, FGISQ 2
2	Determine the types and suitability of IMTs used on feeder roads by people in rural communities in Ghana	What types of vehicles and IMTs may be used on feeder roads and how suitable are they to address the transportation need of the people in rural communities in Ghana?	EISQ 2, a – d; EISQ 3, a – h; EISQ 4, a – j; FGISQ 3, FGISQ 4, FGISQ 5, FGISQ 6, FGISQ 9

Link between research questions and questions in research instruments			
No.	Objective	Research question	Related questions on research instruments
3	Determine the challenges associated with accessibility and mobility along feeder roads in rural communities in Ghana	What are some of the challenges associated with accessibility and mobility along feeder roads facing rural communities in Ghana?	EISQ 3, I – k; EISQ 6, a, b; FGISQ 7; FGISQ 8
4	Determine how feeder road investments are appraised to meet the accessibility and transport needs of rural people in rural communities in Ghana	How are feeder road investments appraised to meet the accessibility and transport needs of people in rural communities in Ghana?	EISQ 1c – f; EISQ 5, a –e

Source: Author

6.7 Data analysis

Two sets of research instruments were designed to collect the data used to answer the research questions: the expert interview schedules and the focus group interview schedules. This section explains how the two sets of data collected were analysed.

Leedy and Ormrod (2005) opine that after qualitative data has been collected, a rigorous analysis of the data commences to identify the characteristics that may lead to the categorisation or development of themes. In view of this, qualitative data analysis is explained as the move away from data towards meanings or representations, or towards a stage where explanations, understanding or interpretations of the people or phenomena under study can be provided (Flick, 2013). According to Flick (2013), qualitative data analysis is subject to the researcher's epistemological forecast, ontological strand and methodological approach, which are all done with the aim of addressing the research questions.

This study is phenomenological and therefore, by its nature relies on data collected on the respondents' experiences in relation to rural accessibility and transport needs in Ghana. In phenomenological studies, the qualitative data collected are best analysed by identifying themes and making generalisations based on how a particular phenomenon is perceived or experienced (Connor & Gibson, 2017; Tewksbury, 2009; Creswell, Plano, Gutman & Hanson, 2003; Travers, 1992; Thome, 2000; Silverman, 2000; 2006). Analysis can be done manually or with the help of a computer software programme, such as ATLAS.ti, Hyper Research, Max, Weft and NVivo.

In this study, the phenomenological analysis of the data from the focus group interviews and expert interviews was carried out manually and with the help of NVivo 12 Plus, a software programme for qualitative data analysis. NVivo 12 Plus was chosen because it is modern, relatively inexpensive and has features that provide ease of use and quality of data analysis. The NVivo software is used to generate nodes and make categorisations. It is also helpful as it can efficiently store data, organise data, manage data, and reconfigure data to enable analytic reflection (Bazeley, 2004; 2007; 2013). The next section explains the validity and reliability of the findings obtained from the data analysis.

6.8 Validity and reliability

The data captured from the focus group interviews and expert interviews were analysed to generate two sets of findings (findings from the expert interview analysis and findings from the focus group interview analysis). In qualitative research, it is paramount for researchers to ensure the trustworthiness of the findings. This section explains the validity and reliability of the findings obtained in this study. According to Golafshani (2003), validity and reliability are ensured not only by the trustworthiness of the findings but also by the rigorousness of the process and hence the quality of the research. Whereas validity has to do with the application of methods (Golafshani, 2003), reliability has to do with consistency across the findings (Kvale, 1996). There are several methods of ensuring or increasing the validity and reliability of a research finding, including the triangulation method, the member checking method and the deviant cases method (Pathon & Cochran, 2002). Each method is described in turn below.

Triangulation entails seeking data evidence from a wide variety of sources and comparing the findings from the diverse sources (Pathon and Cochran 2002; Yin, 2014). Yin (2014) outlines four types of triangulation: theory triangulation, data triangulation, methodological triangulation and investigator triangulation. According to Yin (2014), theory triangulations are explained by using two or more theories to interpret the data; data triangulation entails collecting data from several sources such as by conducting expert interviews and focus group interviews or discussions; methodological triangulation involves different methods of data collection such as using both a qualitative method and a quantitative method; and investigator triangulation encompasses two or more independent researchers collecting data and comparing the results or findings. Unlike the triangulation method, the member checking method is used to maximise validity and reliability by feeding back the findings of the analysis to the participants or respondents to allow them to consider whether or not the data reflects their perspectives. The last method, deviant case, is used to maximise validity and reliability by permitting and not excluding cases and findings that do not fit the conclusions, but instead explaining why they differ (Pathon & Cochran, 2002). Pathon and Cochran (2002), in providing a guide added transparency (the use of clear methods such that others can repeat the research), comparability (comparing findings to other studies), or some such.

In this research data and theory triangulation were considered to ensure validity and reliability of the research findings. Some findings that reflected perceptions from the expert and the participants from group interviews were compared and where appropriate the similarities and differences were outlined. In addition, theory triangulation was made as the study did not only aim to have theories tested but explained the findings using appropriate theories. Furthermore, aspects of the findings made in some instances were compared to similar studies conducted in Ghana. This research ensured rigorousness as the theoretical and conceptual frameworks of the study and methods used are explicit. Other form of validations such as member checking and deviant case methods were not considered due to time limitation.

6.9 Ethics of the study

In qualitative research, ethics are of significance and describe the acceptable practices to which researchers must adhere throughout the research process (Brinkmann

& Kvale, 2009; Dowling, 2000). In the present study, the researcher acknowledges the significance of ethics in research and obtained ethics approval from the RMIT University Human Research Ethics Committee prior to data collection (Copy of the ethic approval is provided as Appendix G). This study was conducted based on approved ethical guidelines or procedures set by the RMIT University Human Research Ethics Committee. RMIT ethics approval is required because this study is an academic work that leads to the award of Doctor of Philosophy degree by RMIT University.

6.10 Summary of issues discussed in this chapter

The research design used to answer the research questions was developed in cognisance of the theoretical framework (Figure 5.3). Two sets of data collection methods – the expert interviews and the focus group interviews – were used to collect the primary data. In addition, two sets of data collection instruments – the semi-structured expert interview schedules and the semi-structured focus group interview schedules – were designed in consideration of the research questions and were administered using both the face-to-face and telephone methods. The two sets of data required to answer the research questions were analysed manually and with the help of NVivo software, through which nodes and themes or categories can be developed to answer the research questions. The data collection and analysis were carried out in accordance with the ethical procedures approved by the RMIT University Human Research Ethics Committee.

CHAPTER 7:

DATA COLLECTION AND ANALYSIS

7.0 Introduction

The previous chapter outlined the research design adopted for the study. As stated in Chapter 6, the research is designed to use primary data collected from feeder road expert engineers and people living along feeder roads using the following two sets of data collection methods: (1) individual expert interviews, and (2) focus group interviews. The data collection methods used necessitated the design of two sets of research instruments: (1) semi-structured expert interview schedules, and (2) semi-structured focus group interview schedules. The two sets of data collected were analysed both manually and through the use of the NVivo qualitative data analysis software. The processes of data collection and analysis followed the ethical procedures approved by the RMIT University Human Research Ethics Committee.

This chapter describes how the research was carried out as per the research design presented in Chapter 6. Specifically, the chapter provides insight into how there expert and group interview data were collected and analysed. The data collection was informed by: (1) the profile of Ghana and its administrative regions from which the group interview respondents were chosen, and (2) the profile of the institutions from which the expert interview respondents were selected.

7.1 Profile of Ghana and its administrative regions

The respondents for the group discussions are people living along feeder roads selected from some of the rural communities located in two regions in Ghana. To explain how these two regions and communities were selected, this section briefly provides information on the profile of Ghana and its administrative regions.

Ghana is a sub-Saharan African country located along the Gulf of Guinea and the Atlantic Ocean with a land area of 238,535 km^2 (92,099 sq mi). It is sandwiched by three countries; it shares a northern border with Burkina Faso, to its west lies the Ivory Coast and its east is bordered by Togo. In 2019, Ghana had an estimated population of 30,417,856 with a growth rate of 2.19% (Worldometer, 2020).

Until December 2018, Ghana was administratively divided into 10 regions (now 16 regions). The regions can be classified into three zones depending on their locations, climate and geographical features. The three classifications are north (savanna), middle (forest) and coastal regions. The north regions comprise the Upper West, Upper East and Northern Regions. The middle regions are Ashanti, Brong Ahafo and Eastern Regions. Western, Greater Accra, Central and Volta are the coastal regions (refer to Figure 6.1 for an administrative map of Ghana). New regions have been created out of Volta, Brong Ahafo, Northern and Western regions. These regions are the Bono, Bono East and Ahafo regions (created out of the Brong Ahafo Region); the Oti and Volta regions (created out of the Volta Region); the Savanna, Northern and North East regions (created out of the Northern Region); and the Western and Western North regions (created out of the Western Region).

The regions are divided into 260 local district assemblies for administrative purposes. The districts are categorised into three types according to the number of people living in an area, which are metropolis districts, municipal districts and ordinary districts. Metropolis districts are areas with a minimum population of 250,000, municipal districts are areas with a minimum population of 95,000, and ordinary districts have a minimum population of 75,000. Districts are made up of communities and towns ranging in size, population and socioeconomic growth, as highlighted in section 2.1.1. These communities and towns are classified as rural or urban depending on the level of development.

Some of the communities and towns are accessed by various means of transportation such as road, marine and water, rail and aviation (air). Road transport is the most common means of transportation in Ghana and so receives much of the budget allocation for transport sector development (Republic of Ghana Ministry of Transport, 2014; 2012; 2008; Republic of Ghana Ministry of Roads and Highways, 2017; 2014). The road network coverage in Ghana comprises feeder roads, urban roads and trunk roads. Across the three road networks, feeder roads (also known as rural roads) receive the biggest part of the road budget allocation. Notwithstanding, rural transportation is known to be a challenge in Ghana.

The next section looks at the profile of the institutions from which the expert interview respondents were selected.

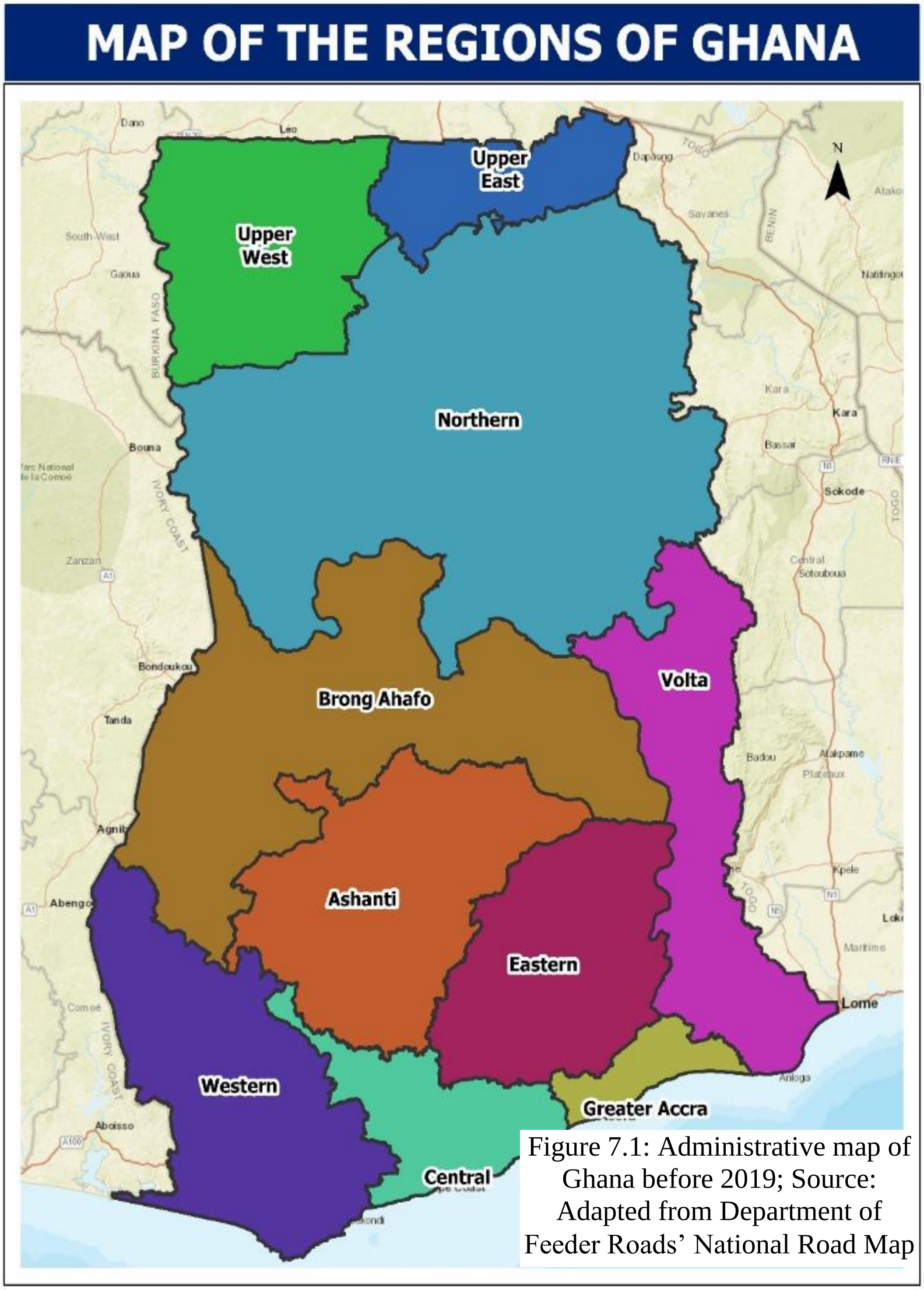

Figure 7.1: Administrative map of Ghana before 2019; Source: Adapted from Department of Feeder Roads' National Road Map

7.2 Profile of institutions from which expert interview respondents were selected

The respondents (feeder road expert engineers in Ghana) were drawn from Ghana's Ministry of Roads and Highways, Department of Feeder Roads, and Institution of Engineering. This section provides brief background information on these institutions.

1) Ministry of Roads and Highways

The establishment of the Ministry of Roads and Highways in Ghana was precipitated by the need to revive and revamp Ghana's road and transport sector. It is the vision of the ministry to provide an integrated, efficient, cost-effective and sustainable road transportation system that is responsive to the needs of society, supports growth and poverty reduction, and is capable of establishing and maintaining Ghana as a transportation hub of West Africa (Republic of Ghana Ministry of Roads and Highways official portal, 2019). To revive and revamp Ghana's road and transport sector, the ministry has been mandated to provide leadership in road construction and maintenance works in Ghana through policy formulation, monitoring, evaluation and coordination activities. Its jurisdiction of work covers road infrastructure development and maintenance, road safety and environment, road maintenance financing and training (Republic of Ghana Ministry of Roads and Highways, 2014; 2017).

To carry out its functions, the ministry has various departments and agencies that function directly under its ambit. In the area of road infrastructure development, maintenance, road safety and environment, the ministry works with three agencies charged with administrative, planning, control, development and maintenance responsibilities. They are the Ghana Highways Authority, the Department of Feeder Roads and the Department of Urban Roads. Other agencies are the Ghana Road Fund

Secretariat (which falls under road maintenance financing) and the Koforidua Training Centre (which falls under training).

The Ministry of Roads and Highways is administered by the chief director; under his supervision are various directors (civil servants and professional civil engineers with vast experience) and other staff. The chief director is accountable to and reports to the Minister, who is the political head of the ministry.

2) Department of Feeder Roads

The Department of Feeder Roads, the agency responsible for administration, planning, control, development and maintenance of feeder roads, is part of the Ministry of Roads and Highways. To ensure efficiency in carrying out its responsibilities and functions, the agency operates at the national, regional and district levels. The national level serves as the head office and is in Accra (the capital city of Ghana). Administratively, the head office is headed by a director (appointed by the government) who is a civil engineer with significant experience who has risen through the rank and file of the agency. The head office supervises all activities at the regional level and their staff include experienced feeder road engineers, some of whom have served as regional managers. The agency, at the regional level, is headed by the regional managers who are civil engineers with experience who have risen through the rank and file at the regional administrative level. The district level falls under the jurisdiction of area engineers who operate from the regional offices.

3) Ghana Institution of Engineering

The Ghana Institution of Engineering was established in 1968 as a professional body of engineers in Ghana. It is an autonomous and non-political entity that derives its authority from the Engineering Council Act 2011, Act 819 and the professional bodies registration decree of the National Redemption Council Degree 143 of 1973. It aims to promote professionalism and excellence within the profession of engineering. Its professional functional parameters cover career development in all fields of engineering, all fields of management and education through the provision of seminars, workshops and educational short courses. It also serves as a facilitator in undertaking and sharing engineering research works for its members and the general public. In performing its functions, the institution envisages its mission as a leader in the development of science, engineering, and technology at all societal levels. The institution provides a platform for engineers to share knowledge and instils in its members professionalism and ethical practices. It also establishes structures to promote a positive corporate image for its members (Ghana Institution of Engineering official portal, 2019).

Membership of the institution is open to all engineers from recognisable fields and institutions with diverse qualifications and years of experience in the science and practice of engineering. Also included in the membership are students of the Ghana Institution of Engineering from various engineering fields, and others as indicated in Figure 7.2. Very significant to its membership are experts and professional feeder road engineers. The institution annually organises a conference for its members. The next section provides information on data collection.

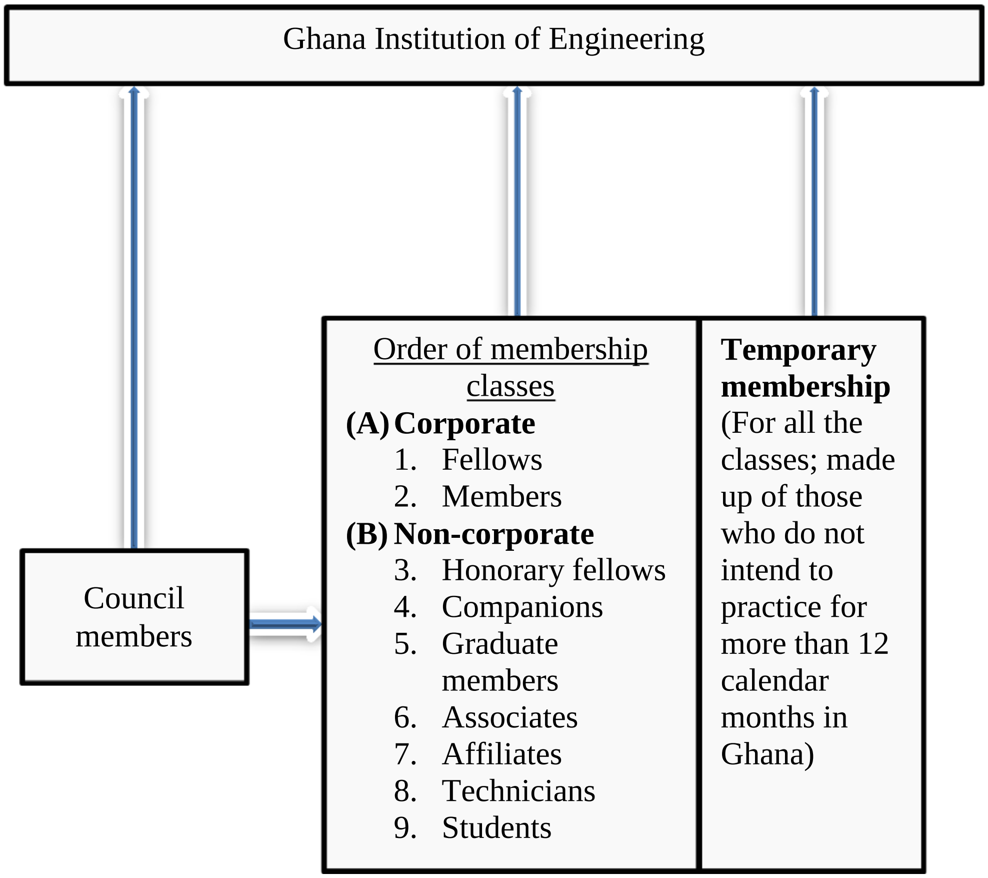

Figure 7.2: Membership structure of the Ghana Institution of Engineering; Source: Author

7.3 Data collection

As explained in Chapter 6, expert interviews and group interviews were used as the methods to collect data. This section explains how the data collection was undertaken, looking at the focus group interviews and expert interviews in turn.

7.3.1 Focus group interview data collection

Section 6.4 in Chapter 6 explained why focus group discussion was chosen as the appropriate method to collect data from people living along feeder roads in rural communities in Ghana. As discussed in sections 6.5.2 and 6.5.3.2, semi-structured focus group interview schedules were designed and administered using the face-to-face (direct) method. This section details how the focus group data were collected using the research instruments designed, under the following sub-sections: (1) the selection of rural communities, (2) the group interview respondents selected, (3) the process of selecting respondents, (4) how the group interviews were conducted, (5) where the group interviews were conducted, (6) the time period when the group interviews were conducted.

7.3.1.1 Selection of rural communities

The explanation of how the rural communities were selected is important as a background to how the group interview respondents were chosen. To select the group interview respondents, two regions in Ghana were first selected, after which five rural communities were then chosen from the two regions. The Eastern and Brong Ahafo regions of Ghana were chosen from among the then 10 regions in Ghana. From the Eastern Region of Ghana, three rural communities were selected, and from the Brong Ahafo Region two communities were selected (the regions selected are listed in Figure 7.3).

These regions and communities were conveniently and purposively selected based on expert advice and data on daily traffic volume and road surface conditions available from the office of the Department of Feeder Roads.

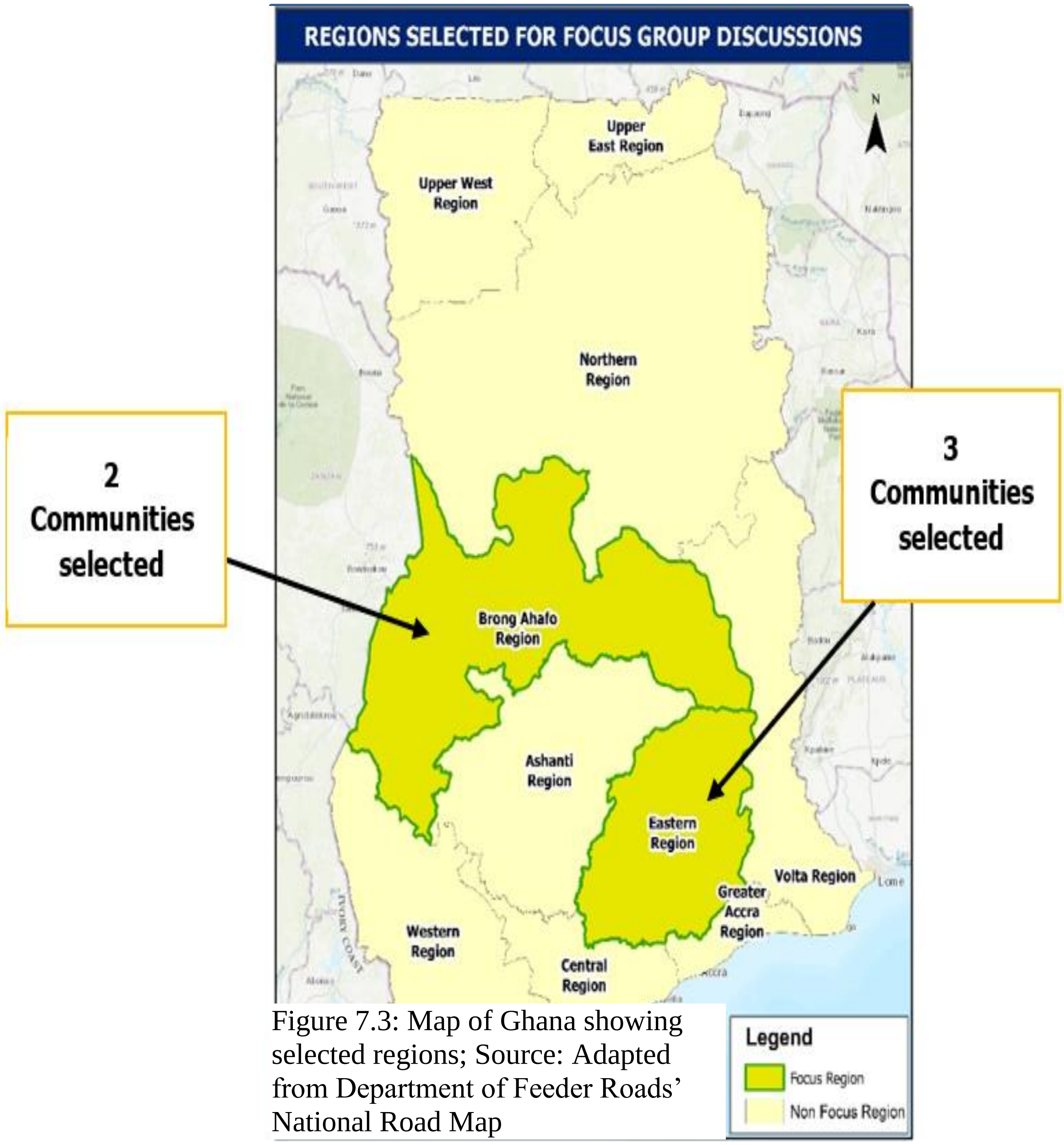

Figure 7.3: Map of Ghana showing selected regions; Source: Adapted from Department of Feeder Roads' National Road Map

The selection of regions and communities was aimed at choosing feeder roads serving communities that are only accessible by road and that have sections of improved road infrastructure and improved mobility. The rationale was to have easy access to rich data that presents balanced information to enable all possible outcomes and trends to be identified and analysed. Table 7.1 provides information on the communities selected and their respective regions. The next section provides information on the group interview respondents selected.

Table 7.1: Regions, communities and number of respondents selected

Regions, communities and number of respondents selected			
Eastern Region	**No. of respondents**	**Brong Ahafo Region**	**No. of respondents**
Awosoaso community	15	Tuobodom community	15
Abokoase community	14	Offuman community	14
Subriso No. 2 community	14		

Source: Author

7.3.1.2 Group interview respondents selected

A total of 72 respondents were selected from Awosoaso, Abokoase, Subriso, Tuobodom and Offuman communities using the voluntary sampling method. There are various probability and non-probability sampling methods that could have been used to select the 72 respondents.

These probability sampling methods include simple random sampling, cluster sampling and stratified sampling (Kumar, 2011). The probability sampling methods are best used when the sampling frame is known, and the sample is devoid of bias. They also provide an equal chance for respondents to be selected from the sampling frame. However, probability sampling methods are not ideal to use where the sampling frame is unknown and the nature of the study requires that respondents who are willing to share their lived experience are purposefully selected (Kumar, 2011).

Non-probability sampling methods such as voluntary sampling, convenient sampling and purposive sampling (Pathon & Cochran, 2002; Elmusharaf, 2012; Kumar, 2011) are appropriate to use in phenomenological studies (Moustakas, 1994). Convenient sampling allows the researcher to select respondents based on convenience until the sample size is achieved. Purposive sampling allows the researcher to select respondents based on their relevance in terms of expert knowledge on the research topic. Voluntary sampling allows respondents to self-select and volunteer themselves as samples for a study.

Phenomenological design requires that respondents who have experience with the phenomenon under investigation are selected. In this research, people living along feeder roads in the selected rural communities were chosen as participants. Pathon and Cochran (2002) outline four procedures for selecting participants for group interviews: (1) asking for volunteers from the population of interest, (2) asking for help from community gatekeepers (leaders) to invite participants, (3) systematically recruiting participants from a sampling frame from a population of interest, and (4) selecting an already existing (natural) group. In this study, the participants were selected via volunteerism with the help of community assembly heads (community elected leaders) who were key informants. Yin (2014) refers to informants as 'docs' and considers them relevant persons that can provide insight into a phenomenon and facilitate access to other participants who can provide either supportive or contrary evidence.

Considering the phenomenological nature of this study and the group interview method of data collection, the voluntary sampling method was considered most appropriate because it enabled the selection of respondents who were connected to the subject and were willing to share their opinions in group discussions.

The next section explains the process through which the respondents were selected from the communities.

7.3.1.3 Process through which group interview respondents were selected

This section explains the process through which the 72 group interview respondents were selected. A week prior to the day set for conducting the group interviews, the researcher visited the community. A formal introduction was made to the assembly heads (community elected leaders), which encompassed the researcher introducing himself, declaring the purpose of the visit, and requesting assistance and support. The assembly men officially introduced the researcher to the chiefs (traditional rulers in the communities). The researcher explained the purpose of the visit and requested the consent of the chiefs and assembly men on the specific dates and time when the group interviews were to be conducted. Invitation notices were placed on walls and notices boards requesting voluntary participants (respondents). On the date set for the interviews, volunteers who turned up were considered.

The next section explains how the group interviews were conducted.

7.3.1.4 How the group interviews were conducted

Guided by Pathon and Cochran (2002), the rule of thumb in qualitative research is that the only point at which a researcher should stop collecting data is when additional data collection no longer generates new understanding, that is, when data collection reaches a saturation point. Pathon and Cochran (2002) further explain that the decision to stop collecting data is dependent on the questions being asked and their context, and what will be credible for the audience. The standard practice in qualitative research is that a researcher can conduct as many group discussions as possible until the saturation point is reached (Elmusharaf, 2012; Pathon and Cochran, 2002; Krueger, 2000; Neuman, 2000; Catterall & Maclaran, 1997). In this study, five group interviews were conducted at different locations within the selected communities.

Guided by Pathon and Cochran (2002) and Neuman (2000), three group discussion processes were used, namely (1) the start, (2) the discussion starter, and (3) the discussion itself following (1) and (2). Pathon and Cochran (2002) explain that the starter involves asking 'ice breaking' questions such as asking the participants to introduce themselves; that this should be followed by an open general question put to all the respondents on the topic, to start the discussion; and finally that the participants are asked to respond to the questions on the research instrument. This process was followed across the five group interviews conducted in the present study. Before the ice breaking questions were asked, the researcher extended handshakes to greet and welcome the participants and thanked them for volunteering for the group discussions.

The researcher made known to the participants those involved in the research, what the research was about, and the questions to be addressed by the research. The participants were taken through the participant information consent form, which they then completed and signed (refer to Appendix C for the Participant Information Consent Form). To begin the discussions, the participants responded to the question: If you had sufficient funds (money) what type of vehicle/s would you buy for this community? The researcher ensured all participants were involved in the discussions. The questions asked included (refer to Appendix B for Group interview schedule):

1. What has been the importance of the road to the community: its contributions to community and to your own life (such as welfare and livelihood)?
2. What do you do when the road is not through or blocked? Where do you normally go (or not go) because the road is blocked?
3. Can you recount situations in the community through your personal experiences where, because of the availability of transport, opportunities were opened to you or you have lost opportunities due to the absence of transport vehicles?
4. Looking at the situation and the state of the road, what type of vehicles and modes of transport are more affordable to your household and to the community?

To check the authenticity and accuracy of the data collected, during the interview a verbal summary was provided after all discussion on a particular topic had been exhausted and before moving on to another topic. This was repeated for all topics until the end of the interview, after which summaries were drawn up on flip charts. In summarising, some of the questions asked and the associated answers (views and opinions) provided were written down for the participants to confirm. Different views and experiences were shared and documented. All information was checked and double-checked for authenticity.

In most sessions, the participants sat facing one another in a circle, horseshoe or a rectangular configuration. In all the discussions, both English and Twi (a Ghanaian language predominantly used by natives from the middle or forest belt) were used and this paved the way for easy and free expression and understanding. Pictures were taken on some occasions during the discussions.

Figure 7.4: Group interview picture taken at Abokoase; Source: Author

Figure 7.5: Group interview picture taken at Awosoaso; Source: Author

Figure 7.6: Group interview picture taken at Offuman; Source: Author

7.3.1.5 Time period when group discussions were conducted

Five group discussions were conducted in the following five communities: Awosoaso, Abokoase, Subriso, Tuobodom and Offuman (as illustrated in Table 7.1). For greater convenience and to minimise the cost of travelling from one region to another, the planning around the timing of data collection took into account the location of the communities selected, such that different time periods were allocated for the interviews conducted in Tuobodom and Offuman (located in the Brong Ahafo Region) and for the interviews conducted in Awosoaso, Abokoase, and Subriso (located in the Eastern Region).

The focus group data collection began in the second week of October 2015 and ended in the first week of December 2015. To make room for various categories of respondents to participate in the discussions, and to avoid inconvenience to respondents, group discussions were held on weekends – specifically Saturday afternoons. Data collection began in the Eastern Region where three weekends were used to collect data from respondents at the Awosoaso, Abokoase and Subriso communities. Two weeks were used to reorganise and prepare for data collection in the Brong Ahafo Region, where data collection took two weekends.

In conducting the group discussions, a maximum of two hours and thirty minutes (2hrs, 30 mins) and a minimum of two hours (2hrs) were recorded. At the Offuman and Awosoaso communities, the group interviews lasted for two hours and thirty minutes (2hrs, 30mins); at the Tuobodom community, the group discussion lasted for approximately two hours and twenty minutes (2hrs, 20mins); and at the Subriso and Abokoase communities, it lasted for approximately two hours (2hrs).

The group interviews were held in classrooms, church halls and market sheds. The next section outlines how the expert interview data were collected.

7.3.2 Expert interview data collection

Expert interviews were used as a data collection method, as explained in section 6.4. As outlined in sections 6.5 and 6.5.1, semi-structured expert interview schedules were designed and administered using face-to-face and telephone methods. This section presents information on how the expert interview data were collected, according to the following categories: (1) selection of expert interview respondents, (2) how the expert interview respondents were selected, (3) how the expert interviews were conducted, (4) where the expert interviews were conducted, and (5) the time periods in which the expert interviews were conducted.

7.3.2.1 Selection of expert interview respondents

Individual interviews were conducted with feeder road expert engineers in Ghana, to form the primary data used in this study (as discussed in section 6.3). The data were obtained from 18 selected feeder road expert engineers from Ghana's Ministry of Roads and Highways, the national head office of the Department of Feeder Roads, the regional head office of the Department of Feeder Roads, and the Ghana Institution of Engineering (as indicated in Table 7.2).

Table 7.2: Respondents selected for interview

Respondents selected for interview	
Respondents	No. of Respondents
Expert engineers from the head office of the Department of Feeder Roads	9
Expert engineers from the Ghana Institution of Engineering (one of whom was a director at the Ministry of Roads and Highways)	5
DFR regional engineer (1)	1
DFR regional engineer (2)	1
DFR regional engineer (3)	1
Director at the Ministry of Roads and Highways (also a former director of feeder roads)	1

Source: Author

7.3.2.2 How the expert interview respondents were selected

A total of 18 feeder road expert engineers were selected. This section explains how the selection was carried out.

1. Expert engineers from the head office of the Department of Feeder Roads

An invitation letter was sent to the Director of the Department of Feeder Roads, which asked for consent to conduct the interviews and respondents for the interview (a copy of the DFR invitation letter for expert engineers is provided as Appendix D). A reply letter was received with a recommended list of 10 experienced and knowledgeable engineers and their phone numbers. Phone calls were made to all 10 engineers to seek their consent, and they all agreed to be interviewed. However, of the 10 engineers only 9 were interviewed, as one of the engineers was not available because he was occupied with other duties. All of the interviews conducted followed ethical research procedures.

2. Expert engineers from the Ghana Institution of Engineering

At an annual conference organised by the Ghana Institution of Engineering, held in the Brong Ahafo Region of Ghana, which the researcher attended as a member, invitation letters were sent to some feeder road experts for their consent to be interviewed (a copy of the respondent invitation letter is provided as Appendix E). Five experienced engineers (one of whom served as one of the directors at the Ministry of Roads and Highways in Ghana) gave their consent, and so were selected and interviewed.

3. Regional engineers at the Department of Feeder Roads

The three regional engineers from the Department of Feeder Roads were all recommended by some of the experts interviewed and so invitation letters were sent to them. The three all agreed to participate, and were selected and interviewed.

4. Director at the Ministry of Roads and Highways

One of the directors at the Ministry of Roads and Highways (also a former director at the Department of Feeder Roads) was recommended by some of the experts interviewed. He was invited to participate and consented, after which he was interviewed. The next section explains how the expert interviews were conducted.

7.3.2.3 How the expert interviews were conducted

The expert interviews were conducted face to face and by telephone, as detailed as follow.

1. Face-to-face interviews

Each interview followed three stages: commencing with an introduction session, followed by questions from the research instrument, and ending with a summary session.

During the introduction sessions, handshake greetings were extended to the respondents. The researcher introduced himself and thanked the respondents for agreeing to be interviewed. Although much information about the research was provided in the invitation letter, at the interview the researcher again informed the respondents of who was involved in the research, what the research was about and the questions being addressed by the research. Where the respondents had been referred, the persons who had referred them were acknowledged by making them known to the respondents.

The respondents were informed that their expert views and experience were relevant to the study, and in some cases they were informed that the discussions would be recorded with an audio tape recorder to provide back-up to the information recorded in the form of written notes. The participant information consent forms – which provided detailed information on the research that the respondents were required to know – were completed and signed. The respondents were informed about the purpose of the interview, motivation, and timelines for the interview, as detailed below (refer to Appendix A for a copy of the expert interview schedule).

‘A’. (**Establish Rapport**) [shake hands]. My name is ***Charles K. Asafo-Adjei, I am conducting research at RMIT University, Australia***. Based on your experience with feeder roads management you have been referred by Mr/Ms … to enable me to seek your opinion on ‘transport and accessibility challenges facing the rural people living along feeder roads in Ghana’. Your view will contribute to the general position the experts on feeder roads have about rural transport and accessibility challenges.

‘B’. (**Purpose**) I would like to ask you some questions about the type and mode of transport vehicles you will consider to be accessible for travel by the communities that use feeder roads for their mobility needs.

‘C’. (**Motivation**) I hope to use this information as a guide in outlining the issues to be included in interviews, to seek the experiences of the feeder road users to identify the challenges they go through in meeting their mobility needs.

‘D’. (**Timeline)** The interview should take about 45 minutes. Are you available to respond to some questions at this time?

To transition from the introductory session to the main research questions, the respondents were asked to answer questions by commencing with a **transition question:** Let me begin by asking you some questions about how long you have been involved in the management or issues with feeder roads.

The interview questions followed the order provided in the interview schedule. When questions were exhausted on a topic, the respondents were informed and their attention was then directed to the new topic and the associated set of questions until all the topics and questions on the interview schedule had been addressed. For all questions, the respondents answered a question at their own pace before the next question was asked. Where it mattered, the researcher was able to probe answers given to seek further explanations or elaboration. To check the authenticity and accuracy of the information collected, the researcher provided a verbal summary of the information collected at the completion of discussion on each topic.

2. Telephone interviews

The interviews conducted over the telephone followed a similar process to that used for the face-to-face interviews, although the introduction sessions did not of course include handshake greetings and the participant information consent forms were replaced by verbal consent.

The next section provides information on the time period when the expert interviews were conducted.

7.3.2.4 Time period when the expert interviews were conducted

The expert interview data was collected between January 2015 and November 2017. All the interviews lasted for less than an hour.

The experts from the Ghana Institution of Engineering were interviewed one-on-one in the conference hall of the hotel where the Institution's conference was held. A Director of the Ministry of Roads and Highways was interviewed in his office. Out of the nine engineers from the Department of Feeder Roads, eight were interviewed in their offices and one was interviewed in a guest room in a hotel where he was staying at the time. How the data were analysed is the focus of the next section.

7.4 Data analysis

This section describes how the group interview data and expert interview data were analysed.

7.4.1 Expert interview data analysis

As explained in section 6.3, the data collected from the feeder road expert engineers constitute the main primary data used to answer the research questions. The data was captured from 18 expert interviews using semi-structured interview schedules as indicated in section 6.5. The theoretical framework (Figure 5.3) guided the analysis of the data. This section explains how this analysis was carried out.

As discussed in section 6.7, the data analysis was conducted manually and with the help of computer software (NVivo). The expert interview data analysis followed a four-stage process, as indicated in Figure 7.7. The researcher had a close interaction with the data during the process of analysis, which was circular and non-linear, and iterative and progressive.

There are various types of qualitative data analysis including narrative analysis, discourse analysis, framework analysis, grounded theory analysis and content analysis (Burnard, Gill, Stewart, Treasure & Chadwick, 2008; Bryman, 2007; Silverman, 2006; Yin, 2014). Narrative analysis is appropriate to use when the focus of analysis is to reformulate stories presented by respondents in a different context based on their experience (Yin, 2014).

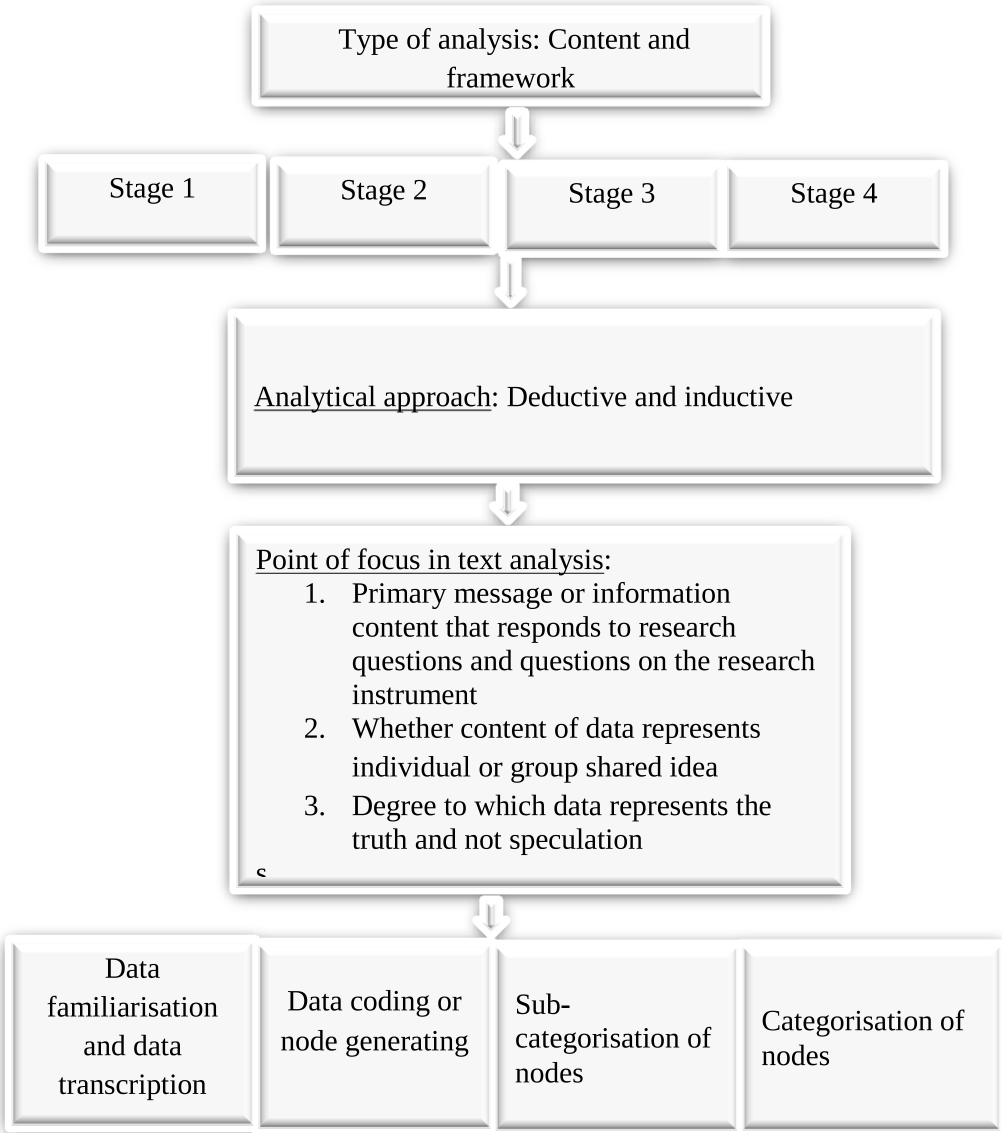

Figure 7.7: Framework for expert interview analysis; Source: Author

Discourse analysis is appropriate to use when the analysis is focused on understanding how people express themselves verbally in everyday social life (Yin, 2014). Grounded theory analysis is appropriate to use when the analysis is focused on generating theories based on the findings (Yin, 2014).

Content analysis is best when the aim is to categorise verbal or behavioural data for the purposes of classification, summarisation and tabulation (Burnard et al., 2008; Yin, 2014). Framework analysis entails the development of frameworks to guide analysis in a structured form with a focus on generating codes, themes, patterns and explanations emerging from the data. In this study, framework analysis and content analysis were adopted. Content analysis was used because it is the most common and convenient way of analysing text data, while framework analysis was used to generate a structured order of codes and themes. To analyse the texts, both inductive and deductive procedures were employed (Burnard et al., 2008; Azungah, 2018). The deductive procedure was chosen because of the time limitations and it enabled the researcher at some point in the analysis to use the research questions and questions on the research instruments to group the data and look for similarities or differences in the generation of codes and themes. The inductive approach, also used at some point in the analysis, allowed the researcher to use emergent frameworks to group the data and identify relationships.

The data analysis procedure began with the process of data familiarisation and data transcription. Data collected in the form of written notes were read thoroughly and audio recordings were listened to (numerous times) so that a general idea of the participants' responses was obtained (Connor & Gibson, 2017). Transcripts were generated for all the 18 participants and stored as Word documents on a computer. The initials EEA to EER were used to provide anonymity to the 18 feeder road expert engineers, and to distinguish between the respondents and their responses. The first two initials (EE) represented 'Expert Engineer', whereas the third initial (A to R) represented the coded identity of the respondent. The transcripts contained the various questions and the participant responses. The transcription offered the researcher a first-hand opportunity to recognise how data were interpreted and presented; it encouraged theoretical sensitivity (Strauss & Corbin, 1990), and paved the way for critiques and improvements. The transcripts were produced in Microsoft Word and stored on a computer.

In a qualitative study, ‘valid analysis is immensely aided by data displays that are focused enough to permit viewing of a full data set in one location and systematically arranged to answer the research questions at hand’ (Huberman & Miles, 1994, p432). In view of this, full transcripts that were stored on the computer were imported from the computer into NVivo after they had been cleaned. With the data imported, the researcher was able to assess and view the specific questions and the corresponding responses they gave. Appendix F provides a screenshot of the transcript imported into NVivo.

This was followed by micro-analysis (Corbin & Strauss, 2008; Bryant & Chormaz, 2007; Chormaz, 2004) conducted in which the data were assessed for word frequencies and similarities between words, with the help of NVivo. Using NVivo, a word cloud was generated that provided general information on the types of words or phrases used and the frequencies with which they were used by the participants, as shown in Figure 7.8. In the word cloud, the larger the word, the more it had been used. The word cloud informed the coding of the data.

Coding is the process of grouping several elements (statements and observations) under one label (Elliot, 2018; Saldana, 2016; Flick, 2013; Auerbach & Silverstein, 2003). Codes can be generated manually or through auto coding. Auto coding is very easy to generate using NVivo as compared to manual coding, which requires much reading and thinking. In this study, the coding was carried out manually in consideration of the questions on the research instrument and the transcribed data, and because the sources of data did not run into the hundreds.

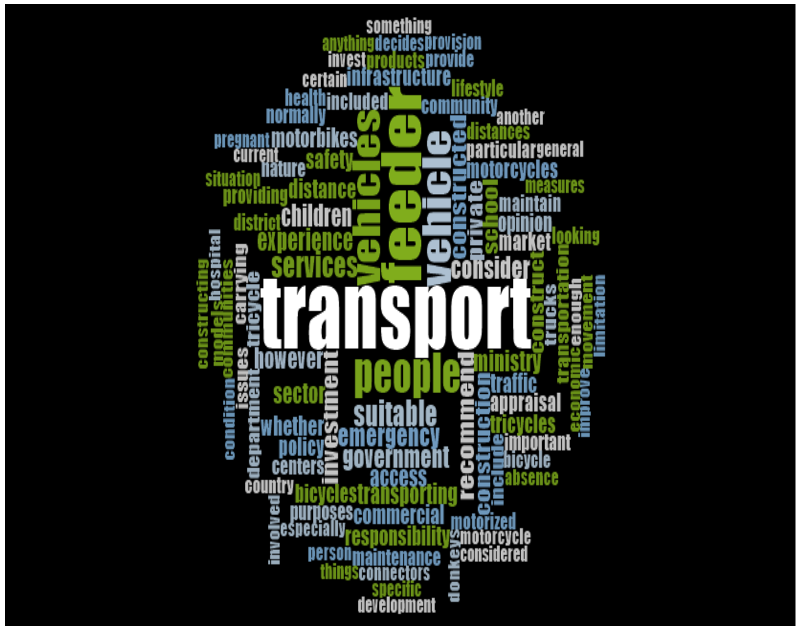

Figure 7.8: Word cloud retrieved from NVivo; Source: Author

To code manually, the data were reorganised by grouping all the participants’ responses based on specific questions asked. This enabled the researcher to obtain a view of each specific question and all of the relevant participants’ responses to each question. Guided by the questions and transcripts, nodes were then created by highlighting significant information (in the form of text) and dragging it into specified nodes using NVivo. The text highlighting took into consideration a number of factors such as primary message or information content that responds to research questions and questions on the research instrument, as outlined in Figure 7.7. Nodes were generated for each specific question on the research instrument and the transcripts, and were labelled in a manner that describes the node for easy identification. The labels (names) of nodes were based on the phrasing used in the questions on the transcripts and the research instrument. The list of nodes generated is provided in Table 7.3 in the next page.

Table 7.3: Nodes generated for expert interviews

Nodes generated for expert interviews	
No	**Name of node**
1	Opinions on the need for feeder road construction and maintenance
2	Views on the quantum of feeder roads constructed
3	Why the need for feeder road construction and maintenance
4	Responsibility for providing road rural transport
5	Inclusion of transport vehicles in road investment
6	Vehicles used by experts on feeder roads
7	Vehicles used by rural people
8	Vehicles suitable for transporting people and goods
9	Vehicles suitable for transporting people
10	Vehicles suitable for transporting children
11	Vehicles suitable for travel for leisure
12	Vehicles suitable for emergency services
13	Vehicles suitable for journeys of less than 5 km
14	Vehicles suitable for journeys of more than 5 km
15	Use of IMTs as transport for people
16	Use of IMTs as transport for goods or loads
17	Use of IMTs as transport for children
18	IMTs recommended for feeder roads
19	Quality and speed affecting the usage of IMTs on feeder roads
20	Distance and cost affecting the usage of IMTs on feeder roads
21	Use of IMTs as public transport on feeder roads
22	IMT adoption limitations
23	Policy and promotion of IMTs usage
24	Effects on or drawbacks for policy and promotion of IMT usage
25	IMT acceptance in absence of conventional vehicles
26	Motorcycle usage and suitability for transporting people
27	Motorcycle usage and suitability for transporting goods or loads

Nodes generated for expert interviews	
No	**Name of node**
28	Motorcycle usage and suitability for transporting children
29	Motorcycle usage and suitability for emergency services
30	Types of motorcycles recommended for feeder road usage
31	Quality affecting the usage of motorcycles on feeder roads
32	Speed affecting the usage of motorcycles on feeder roads
33	Cost affecting the usage of motorcycles on feeder roads
34	Distance affecting the use of motorcycles on feeder roads
35	Road condition affecting the usage of motorcycles on feeder roads
36	Usage of motorcycles as commercial (taxi) transport
37	Types of road appraisal models
38	Feeder road appraisal models used in Ghana
39	Views on road appraisal models used in Ghana
40	Views on road transport investment
41	Recommendations on road appraisal models
42	Significance and effects of lack of transport services

Source: Author

The creation of nodes was followed by the sub-categorisation of the nodes. Categorisation is the process of sorting, grouping and forming parent nodes, also known as themes. Sub-categorisation is simply the grouping of nodes into sub-parent nodes, which is carried out in consideration of: (1) the relationship between the nodes, (2) the frequency of the codes, and (3) the concept underlying the node. Using common phrases identified from the grouped nodes, the sub-categories were labelled for easy identification. Table 7.4 presents the sub-categories and grouped (merged) nodes.

Table 7.4: Sub-categorised nodes for expert interviews

Sub-categorised nodes for expert interviews		
No.	**Sub-parent nodes**	**Nodes merged (refer to Table 7.3 for numbers and names of specific nodes)**
1	Feeder road construction and significance	1, 2, 3, 4
2	Vehicles used as transport on feeder roads	6, 7
3	Suitable vehicles to use as transport on feeder roads	8, 9, 10, 11, 12, 13, 14
4	IMTs used as transport and their suitability	15, 16, 17
5	Recommended IMTs and conditions for their usage	18, 19, 20
6	IMT adoption and acceptance	21, 22, 23, 24, 25
7	Motorcycle usage, suitability and types recommended	26, 27, 28, 29, 30
8	Acceptance and conditions affecting motorcycle usage on feeder roads	31, 32, 33, 34, 35, 36
9	Road transport investments, significance and effects	5, 40, 42
10	Road/feeder road appraisal models and recommendations	37, 38, 39, 41

Source: Author

Using the deductive and inductive approaches, nodes were categorised and some were developed into parent nodes. Parent nodes were developed by further grouping of some sub-parent nodes, guided by the research questions of the study. Nodes that were re-categorised were labelled to aid easy identification and groupings that addressed specific research questions. Table 7.5 provides information on the final categorisation of the sub- parent nodes developed.

Table 7.5: Categorised nodes for expert interviews

Categorised nodes for expert interviews		
No.	**Parent nodes**	**Sub-parent nodes merged and renamed** (refer to Table 7.4 for numbers and names of specific nodes)
1	Contribution of feeder roads to development	1
2	Types and suitability of vehicles and IMTs on feeder roads	2, 3, 4, 5, 7, 8
3	Feeder road accessibility and mobility challenges	6
4	Feeder road accessibility and mobility appraisal	9, 10

Source: Author

The next section provides information on how the group interview data collected were analysed.

7.4.2 Group interview data analysis

Section 7.4.1 describes how the data collected from the feeder road expert engineers in Ghana were analysed as the main primary data used to answer the research questions. The data analysed comprised five different groups of data collected from communities living along feeder roads with distinctive characteristics essential to the study. The framework provided in Figure 7.9 served as a guide for the analysis of the group interview data. The data analysis process commenced with data familiarisation and generation of initial nodes, followed by data transcribing, data re-coding and categorisation of nodes.

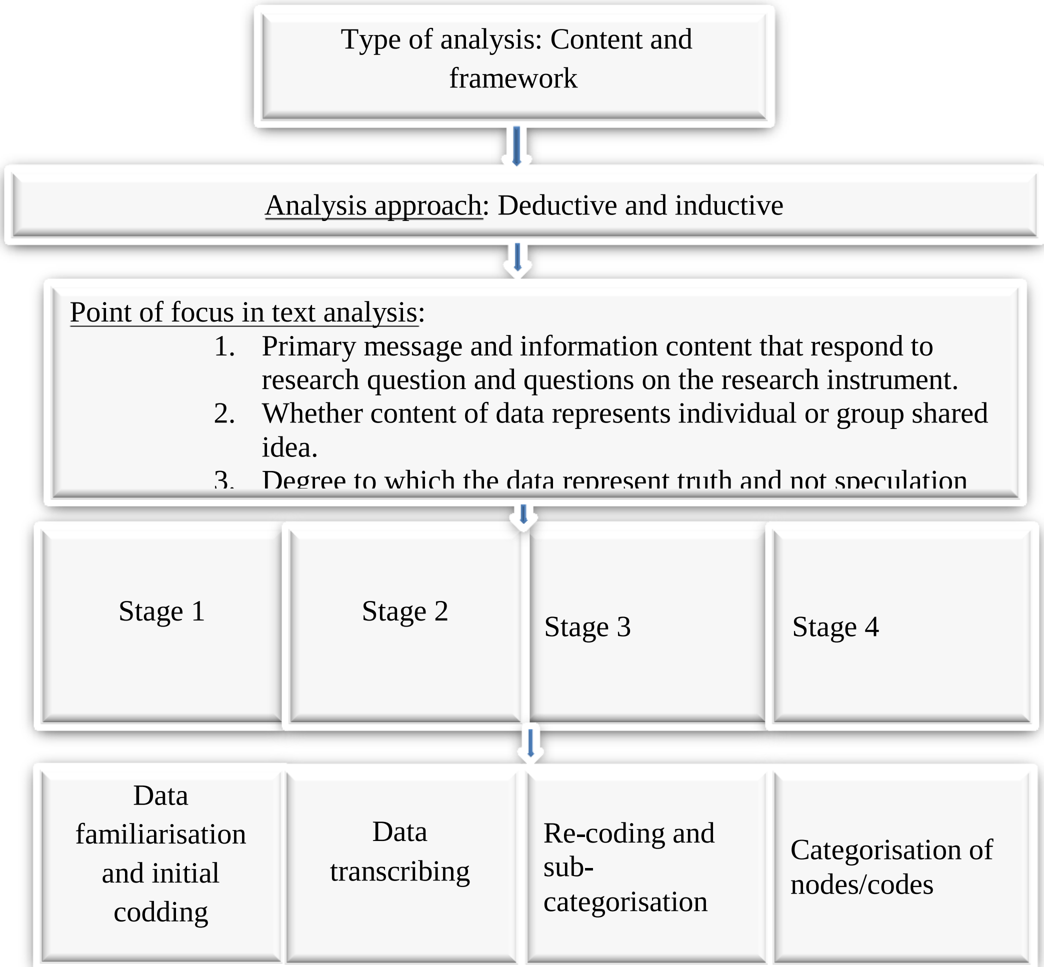

Figure 7.9: Framework for group interview data analysis; Source: Author

The data were collected using a semi-structured interview schedule and were stored in the form of written notes to be reviewed and audio recordings to be listened to attentively, which provided an overview of the nature of the data. To ensure that the data gathered answered the research question of the study, the deductive approach was used, which allowed for initial nodes to be developed guided by the questions on the research instruments. The initial nodes generated are presented in Table 7.6.

Table 7.6: Initial nodes generated from group interview data

Initial nodes generated from group interview data	
No.	**Name of node**
1	Importance of feeder roads to the community
2	Importance of feeder roads to individual welfare
3	Importance of feeder roads to individual livelihood
4	Effects of bad roads on individual activities
5	Opportunities provided due to transport availability
6	Opportunities lost due to transport unavailability
7	Vehicles available due to state or nature of road
8	Modes of transport available due to state or nature of road
9	Cost of transport due to state or nature of road
10	Modes of transport affordability due to nature of road
11	Types of vehicles and affordability due to nature of road
12	Positive impact of nature of road transport on health/emergency issues
13	Negative impact of nature of road transport on health/emergency issues
14	Useful transport vehicles required in community
15	Useful transport vehicles available or common in community
16	Useful transport vehicles for which communities require support to purchase
17	Useful transport vehicles for which communities do not require support to purchase
18	Nature of road and vehicles useful as emergency vehicles
19	Nature of road and vehicles useful to transport workers
20	Nature of road and vehicles useful to transport children to school
21	Nature of road and vehicles useful to transport people to market
22	Nature of road and vehicles useful to transport goods or load
23	Reasons why vehicles that are useful are not used in community

Source: Author

The generation of initial nodes was followed by the transcription of the data generated from the five group interviews. The generation of transcripts involved a rigorous process of reading through the notes and listening to the audio recordings in all instances. The transcripts had extracts identified that corresponded to the initial nodes developed. The anonymity of the respondents from the selected communities was ensured and their responses were distinguished from one another by using a system of codes to identify the respondents, with the first two letters of the code based on the name of the community, followed by letters that represented the identity of group participants, as illustrated in Table 7.7. These codes communicate the identity of the communities while still ensuring the anonymity of the respondents.

Table 7.7: Community and respondents' codes

Community and respondents' codes			
Name of community	**AlphabetInitials for community**	**No. of respondents**	**AlphabetInitials for respondents**
Awosoaso	AW	15	A – O
Abokoase	AB	14	A – N
Subriso No. 2	SU	14	A – N
Tuobodom	TU	15	A – O
Offuman	OF	14	A – N

Source: Author

The transcribing of the group interview data was more challenging and slower than the transcribing of the expert interview data because the researcher had to search through the different responses to questions in the notes and in some cases had to listen to different voices on audio recordings to extract the relevant answers to specific questions, a process that was relatively straightforward during the expert interview data transcription.

The transcribed data provided a much deeper insight into the participants' responses and the transcripts generated were thoroughly read and compared. Similarities and differences in responses were identified and documented through a process of comparing some of the transcripts generated. It was noticed that the communities with good feeder roads had similar responses, and that communities with bad feeder roads also had common responses. Such similarities and differences in the responses influenced how the data were analysed in the next stage of re-coding or re-generating the nodes.

The stage of re-coding involved the transcripts being imported into NVivo, data cleaning and scraping, renaming and integrating the nodes. The imported transcripts from the interviews with communities with good feeder roads were grouped, as were the imported transcripts from the interviews with communities with bad feeder roads. The groupings enabled responses to be compared under similar nodes (refer to the rationale for selecting communities in section 6.3.1.1), and the data were reorganised by grouping all the participants' responses under the respective nodes generated. This allowed the researcher to obtain a comprehensive view of all the participants' responses under the nodes generated. This was followed by the grouping and renaming of nodes, which involved a similar process and criteria used to group the nodes during the expert data analysis. The grouped nodes were labelled using common phrases identified from the nodes for easy identification as indicated in Table 7.8.

A thorough review was carried out based on which the nodes and grouped nodes were further grouped (categorised) and labelled. Further groupings of the sub-categorised nodes were guided by the research questions of the study. The categorised nodes are presented in Table 7.9.

Table 7.8: Re-coded and sub-categorised nodes

Re-coded and sub-categorised nodes		
No	**Re-coded/sub-parent nodes**	**Nodes merged (refer to Table 7.7 for the numbers and names of specific nodes)**
1	Impact of feeder roads	1, 2, 3, 4
2	Impact of transport	5, 6, 12, 13,
3	Nature of road and types of vehicle available/required	7, 14, 15, 16, 17
4	Activities and types of IMTs required	18, 19, 20, 21, 22
5	Nature of road and cost of transport	9, 11
6	Transport challenges	23
7	Alternative modes of transport	8, 10

Source: Author

Table 7.9: Categorised nodes for group interviews

Categorised nodes for group interviews		
No.	**Parent nodes**	**Sub-parent nodes merged and renamed** (refer to Table 7.8 for numbers and names of specific nodes)
1	Contribution of feeder roads to development	1, 2
2	Types and suitable vehicles and IMTs on feeder roads	3, 4
3	Feeder roads accessibility and mobility challenges	5, 6

Source: Author

The next section (Section 7.5) provides a summary of the main findings discussed in the chapter.

7.5 Summary of main findings presented in this chapter

This chapter began with explanations of how the group interview data were collected. It then provided information on how the instruments designed in the previous chapter were used. It also gave insight into how the face-to-face expert and group interview data were collected and analysed.

A total of 18 expert interviews were conducted and the data obtained were analysed. In addition, 72 respondents were selected from Awosoaso, Abokoase, Subriso, Tuobodom and Offuman to engage in a total of five group interviews conducted in these communities. The conduct of the interviews and the administration of research instruments followed approved ethical procedures.

The next chapter presents the findings of the data analysis, which was carried out in cognisance of the nodes generated in this chapter.

CHAPTER 8:

FINDINGS

8.0 Introduction

Chapter 7 described how the face-to-face expert interview and group interview data were collected and analysed. The expert interview data were obtained from 18 feeder road engineers (experts in feeder road management in Ghana) as the primary data used to answer the research questions, and were supported by data from five focus group interviews with a total of 72 respondents. The interviews were conducted in the following five communities located along feeder roads in Ghana: Awosoaso, Abokoase, Subriso, Tuobodom and Offuman.

Chapter 7 also outlined how the data were analysed – first manually and later with the help of computer software (NVivo) – and how content and framework analysis were used for the data analysis. The detailed analysis of the expert interview data involved a four-stage process: (1) data familiarisation and data transcription, (2) data coding and node generating, (3) sub-categorisation of nodes, and (4) categorisation of nodes. Furthermore, Chapter 7 illustrated how the group interview data analysis entailed the processes of data familiarisation and initial coding, data transcribing, re-coding and sub-categorisation of nodes, with categorisation of nodes as the final step.

Section 7.4.1 of Chapter 7 explained how the initials EEA to EER were used to provide anonymity to the 18 feeder road expert engineers, and to distinguish between them. The first two alphabet initials (EE) represented ‘Expert Engineer’, whereas the third alphabet initials (A to R) represented the coded identity of the respondents.

Similarly, the group interview respondents were assigned codes to protect their anonymity and distinguish their responses, using the first two letters in the name of their community, followed by letters representing each participant, as indicated in Table 7.8.

This chapter presents the findings from the analysis of the interview data. According to Burnard et al. (2008), the findings of a qualitative study can be written in two forms. The first approach entails reporting the key findings under the main categories or themes developed. This can be done using verbatim or non-verbatim descriptions of the findings, after which a separate chapter discusses the findings in relation to the reviewed literature (Burnard et al., 2008; Fisher, 2007; Huberman & Miles, 1994; Marshall & Rossman, 1995; Perrt, 1995). The second approach involves reporting the key findings under the themes developed from the data analysed in verbatim or non-verbatim style, with attendant discussions undertaken alongside the reviewed literature (Bricki & Green, 2007; Bloomberg & Volpe, 2008; Creswell, 1998; 2013). This thesis adopts the first approach, with the findings provided in tables and in descriptive forms incorporating both verbatim and non-verbatim presentation styles.

This chapter begins with a discussion of the findings from the expert interview data analysis and ends with a discussion of the findings from the group interview data analysis.

8.1 Expert interview findings

The key findings, as stated above, are to be reported under the main categories (themes) developed. Four main categories are developed for the expert interview data, as indicated in Table 7.6 in Chapter 7. The categories are the contribution of feeder roads to development, the types and suitability of vehicles and IMTs on feeder roads, feeder road accessibility and mobility challenges, and feeder road accessibility and mobility appraisal. This section presents the findings under these four main categories.

As listed in Table 7.4 in Chapter 7, the issues raised in the expert interviews include the participants' views on the need for feeder road construction and maintenance, the number of feeder roads constructed, the need for feeder road construction and maintenance, suitable vehicles for transporting goods or loads, suitable vehicles for emergency services, the IMTs recommended for feeder roads, acceptance of IMTs in the absence of conventional vehicles, the road conditions affecting the use of motorcycles on feeder roads, and the road appraisal models used in Ghana. In the sections below, a brief discussion of a number of these issues is provided for the purpose of ensuring clarity and understanding.

The section begins with the findings presented under the first theme. The findings comprise the contribution of feeder roads to development, the types and suitability of vehicles and IMTs on feeder roads, feeder road accessibility and mobility challenges, and feeder road accessibility and mobility appraisal.

8.1.1 Contribution of feeder roads to development

The findings on the contribution of feeder roads to development answer the first research question of the study: *To what extent do feeder roads contribute to the development of rural people and the rural communities in Ghana?* As indicated in Tables 7.6 and 7.7 in Chapter 7, the contribution of feeder roads to development falls under only one sub-theme – 'feeder road construction and significance'. This sub-theme covers the following issues: the need for the construction and maintenance of feeder roads, the number of feeder roads constructed, the need for the construction and maintenance of feeder roads, and the responsibility for providing rural road transport. Based on these nodes, the findings are presented below.

8.1.1.1 Need for feeder road construction and maintenance

The views of the experts were sought to determine whether there was a need to construct new feeder roads and maintain existing ones. From the data analysed, the experts shared the view that there is a need for feeder roads to be constructed and maintained to ensure not only that they meet the pressing need for more feeder roads in rural communities but also that feeder roads last longer and are motorable at all times. According to the experts, both engineered and un-engineered feeder roads must be constructed and maintained by the Government of Ghana. This was reflected in some of their comments:

> I think there is the need to construct and maintain feeder roads. This is because most of our foodstuffs come from the rural area and to reduce poverty, there is the need to transport foodstuff from the rural area to urban centres. So we need good feeder roads and as you are also aware, Ghana is an agricultural country and one of our traditional export commodities is cocoa and it is in the rural areas. So we need to cart the cocoa from the rural area to the urban centres so that we will be able to export. (EEC)

> We have constructed enough feeder roads. However, there is the need to construct more. Even for those that we have constructed, we need to maintain most of them, so we need more feeder roads and we need to maintain the existing ones too. (EEI)

> In actual fact, there is a need to construct more but it should be based on the availability of funds. I think it would be prudent for us to concentrate

> on the maintenance of the existing ones because we have about 43,000 kilometres of feeder roads. (EEM)

8.1.1.2 Number of feeder roads constructed

The experts were further questioned on the number of feeder roads that had been constructed. This question was necessary to substantiate why there was a need to construct more feeder roads. From the answers received, all experts were of the view that more feeder roads need to be constructed in Ghana. According to the experts, although more feeder roads have been constructed in recent years, more are required. The experts' views on the number of roads constructed and the need to construct more feeder roads are conveyed in the following comments:

> Feeder roads are community-based rural roads. The more you construct feeder roads, the more communities spring up and the need for more feeder roads increases. So far, we have constructed enough feeder roads but there is still more to be done. (EEA)

> The current feeder roads network is over 42,000 kilometres and so we have to try and maintain the 42,000 kilometres network before we proceed to construct new ones. (EEO)

> Looking at our network and what we have done so far, there are a few roads we have not touched; about 20%. If you look at our road condition mix, we have about 20–25% in the poor class. So, I think more roads should be constructed. (EEB)

> Yes; at least with the vision of 2 kilometre accessibility index, I think now accessibility is around 66% and it's not too bad. There is a need for more feeder roads, especially within the areas where agriculture is practised because with some of those areas, we have not been able to construct the roads. (EEQ)

> If we could secure funds to maintain what we have now, then it will be sufficed [sic] for now. That is to say, if we can maintain the feeder roads with good surface condition and those that are bad, periodically we should get funds to maintain those ones. For the roads that are not engineered, we need to improve them; the ones that are engineered but are bad, we need to maintain them as well. (EER)

8.1.1.3 Why there is a need for feeder road construction and maintenance

The experts were of the opinion that the government constructs and maintains feeder roads with the aim of providing and improving accessibility and mobility. They explained that improvement in accessibility and mobility creates various job opportunities along the road such as employment for transport drivers, buying (often by drivers, passengers and other commuters on the roads) and selling (often engaged by rural community people). Likewise, the construction of feeder roads is needed to open up rural communities to each other and to urban communities to facilitate trade. Moreover, construction removes barriers to transport and creates room for various types of transport services, facilitating the movement of people from one place to another, including to health centres, markets and farms. The ability to transport goods such as farm produce reduces post-harvest losses and increases the revenue of rural farmers. Finally, the availability of roads leads to improvements in the social infrastructure in rural communities. The importance of feeder roads was explained by the experts as follows:

> Roads are important for good and swift transport. Also, we find that whenever a road is constructed, economic activity booms in the community. Again, there is improvement in social infrastructure. (EEC)
>
> The construction of roads facilitates movement of individuals as well as movement of produce from farms. It creates job opportunities and exposes communities to open market. It also reduces the cost of transport. (EEL)
>
> Actually, I am of the opinion that the construction of a road brings about development activities in areas that the road is constructed. When you develop the road, all other developments such as new buildings, new houses, other amenities spring up. (EEP)
>
> The essence of constructing roads in rural areas is to reduce poverty in these areas. As such, in constructing roads, it is important to provide means of transportation as, without transport means, it would not be possible to transport food stuff from the rural area to urban centres. (EEA)

The reasons why there is a need for feeder road construction and maintenance are listed in Table 8.1.

Table 8.1: Views of experts on the importance of feeder roads

Views of experts on the importance of feeder roads
Importance of feeder roads
1. Creates various job opportunities. 2. Opens up rural communities to each other and to urban communities, facilitating trade. 3. Removes barriers to transport and creates room for various types of transport services. 4. Facilitates the movement of people and goods. 5. Reduces post-harvest losses and increases the revenue of rural farmers. 6. Enhances social infrastructure development in rural communities.

Source: Author

8.1.1.4 Responsibility for providing rural road transport

Given that the availability of transport services is instrumental in rural transport, the views of the experts were sought regarding whose responsibility it is to provide rural transport.

According to the experts, the provision of rural transport is a shared responsibility of government (through the Ministry of Transport), private institutions and individuals. The experts explained that the government only intervenes to provide transport services when the community is under threat of being cut off from the rest of the society. The construction of roads is more the focus of government as access to good roads will allow people to have access to vehicles to transport them to services and facilities, as well as to promote and facilitate the exchange of human and material resources.

The views of some of the experts on whose responsibility it is to provide rural transport are provided below:

> In Ghana, when it comes to transport, it is the private people who normally invest in it. We have had situations when the government ventured into the business of providing transport some years back and people mismanaged the affairs of that particular company and for that reason, I would prefer private people to go into transport issues and leave government completely out of it. (EEN)
>
> Our objective at the DFR is to provide means [roads] for which those in the rural areas are able to transport agricultural produce from the farms to the various markets. For us, providing transport services is purely for the private sector such as the Ghana Private Road Transport Union. (EEG)
>
> Well, since we have the Ministry of Transport, which is taking care of transport services, we can be of help by advising in terms of the source of transport mode which could be used for transporting goods and people. (EEB)
>
> Well, I think in the country as of now, providing transport falls mainly in the hands of the private sector; they have been helping a lot in that area. Government is doing very little with the mass transport buses. But mostly the majority is in the hands of the private sector. (EEM)
>
> In Ghana it is purely a commercial entity. Once the government provides the infrastructure, the private transporters will get the vehicles to take the goods, because we have the farmers, market women and transporters on the one hand and government on the other hand provides infrastructure. If the infrastructure is there, then the farmers will also take advantage and then once there are goods, naturally there will be transport to go there. (EEI)

The experts were of the opinion that rural road transport should be provided by private organisations such as the Ghana Private Roads Transport Union, one of the transport unions in Ghana responsible for overseeing the activities of private commercial transport service operators. The experts further explained that various unions and private organisations in rural communities can also own vehicles and provide transport services. Likewise, individuals are also expected to own vehicles.

The findings on the types and suitability of vehicles and IMTs on feeder roads are covered in the next section.

8.1.2 Types and suitability of vehicles and IMTs on feeder roads

The findings on the types and suitability of vehicles and IMTs on feeder roads answer the second research question: *What types of vehicles and IMTs may be used on feeder roads and how suitable are they to address the transportation need of the people in rural communities in Ghana?* As outlined in Table 7.5 in Chapter 7, the data obtained were classified according to six sub-themes. These sub-themes are as follows: vehicles used as transport on feeder roads, suitable vehicles to use as transport on feeder roads, IMTs used as transport and their suitability, recommended IMTs and the conditions appropriate for their use, motorcycle usage suitability and types, and acceptance and conditions affecting motorcycle usage. The sub-themes were derived from 26 nodes, as indicated in Tables 7.4 and 7.5 in Chapter 7. In this section, some of the nodes are merged for ease of understanding.

8.1.2.1 Vehicles used as transport on feeder roads

In the preceding section, the experts' opinions were collected on the responsibility for providing rural transport on feeder roads, and the responses indicated that the government, private institutions and individuals are all responsible to some degree. Since the type of vehicles used is crucial in transportation, the opinions of the experts were sought to determine which vehicles are used by experts on feeder roads and which vehicles are used by rural people.

1) Vehicles used by experts on feeder roads

Various types of vehicles are used by experts, as indicated in Table 8.2. The experts disclosed using various motorised vehicles but no non-motorised means of transport. According to the experts, four-wheel-drive vehicles such as pickups and other station wagons, mostly owned by the government, are used for official purposes such as assigning road works to contractors, conducting road construction inspections and monitoring ongoing works. In most situations, four-wheel-drive vehicles are used because the rural areas visited by experts often have bad and undeveloped roads, as explained in the following comments:

> because we are always aiming at undeveloped roads, we go with four-wheel-drive vehicles. Because our target is not on the good roads, our target is on the undeveloped roads which we want to develop. (EEN)

> Most often we use the 4x4 vehicles; either a pick-up or cross-country vehicle. (EEC)

Table 8.2: Vehicles used by experts on feeder roads

Vehicles used by experts on feeder roads		
	Types of vehicles	
	Motorised vehicles	Non-motorised vehicles
Vehicles used by experts on feeder roads	Pickups Station wagons (Land Cruisers, Pajeros) Motorcycles Taxis Minibuses Saloon cars	

Source: Author

The experts also explained that, on some occasions, the government-owned vehicles are also used for unofficial travel. In addition, they use their own private vehicles to travel on the feeder roads. When the need arises and they do not have their official or private vehicles, they may use commercial vehicles such as taxis and minibuses to travel on feeder roads.

2) Vehicles used by rural people

The experts were of the opinion that various motorised and non-motorised vehicles are used by rural people to meet their various transport needs, and that the use of any particular vehicle is dependent on the nature of the road. The nature of a road is essential in determining the type of vehicles to be used because the design of a vehicle makes it convenient or inconvenient when used on particular types of roads, as explained by one of the experts:

> The issue is that we have some of the rural roads which can be considered as good in terms of the surface conditions on the road. Some are fair and some are bad. Depending on the surface nature of the road, different vehicles can be used. Some are classified as rural roads, yet it has been well done and vehicles can move with convenience at 50 kilometres per hour or 80 kilometres per hour. We also have rural roads for which one reason or the other it is difficult to travel 15 kilometres per hour; therefore it may not be good for certain vehicles. You need well-built vehicles. So to have or pick a type of vehicle, it may depend on the level or the stage to which the road has been developed. (EEH)

The types of vehicles which, according to the experts, are used by rural people are listed in Table 8.3. In communities where the roads are good, various types of motorised vehicles are mostly available and used by people. On the other hand, the presence of bad roads in a community deters the use of most motorised vehicles, thereby making non-motorised vehicle usage predominant.

It is worth noting that, whereas most of the motorised vehicles require more skills, a licence and less human effort to operate, the non-motorised vehicles require fewer skills, often no licence, but much human effort to operate. This means it is difficult for women, children, older persons and persons who are physically challenged to use the non-motorised vehicles.

Table 8.3: Vehicles used by rural people

Vehicles used by rural people		
	Type of vehicles	
	Motorised vehicles	Non-motorised vehicles
Vehicles used by rural people	Motorcycles	Wheelbarrows
	Motorised tricycles	Two-wheel hand carts
	Minibuses/vans	Bicycles
	Tractors	Bicycles with trailers
	Tractors with trailers	Donkey carts
	Tipper trucks	Four-wheel platform push carts
	Taxis	Tricycles
	Cars	

Source: Author

The non-motorised vehicles are mostly owned by rural people and are used to transport people and goods to and from various places such as farms, market centres, healthcare centres and schools.

Motor vehicles such as taxis, minibuses/vans, motorcycles and motorised tricycles are used to provide commercial transport services on some feeder roads. Such vehicles are also used to transport both people and goods. According to the experts, tractors and tractors with trailers are farm vehicles that are also used to transport people and goods. They further explained that tip trucks, which are vehicles used for transporting sand, gravel and quarry stones for road and building construction activities in rural areas, are sometimes used to transport people and goods. One of the experts expressed his opinion on the usage of vehicles below:

> the vehicles used to carry passengers are mostly ‘homes-used’[used vehicles imported and not new] 207 and 206 Benz buses and Nissan vans. Vehicles such as Benz cargo and flatbed trucks are used to load goods from the farms. Motorcycles and tricycles are used to convey goods and passengers as well. (EEL)

The experts were of the view that very few rural people own vehicles that they use for their private transport needs. Apart from tractors and motorcycles owned by a few farmers and individuals in rural communities, the experts said that motorised vehicles are mostly owned by groups and rich individuals who are often not residents in the rural communities.

8.1.2.2 Suitable vehicles used as transport on feeder roads

A number of motorised and non-motorised vehicles were mentioned by the experts in Section 8.1.2.1 as vehicles used to transport people and goods on feeder roads. Since vehicles are designed for specific usage and purposes, the views of the experts were further explored to determine which vehicles are suitable for transporting goods, people and children, as well as for travelling, emergency services, journeys of less than 5 km and journeys of more than 5 km.

1) Vehicles suitable for transporting people and goods

The experts expressed the opinion that the type of vehicle used and its suitability are dependent on the nature of the roads, the type of load and the design of the vehicle. As some of the experts observed:

> I think for safety reasons, there are certain vehicles that would be more suitable for certain purposes. For instance, a tractor with trailer would be more suitable in transporting goods than human beings but though at times you may see the tractor carrying people when it is transporting goods to the market. (EEO)

> For goods, the flatbed trucks are more suitable. Even if the road is not good, they manage to manoeuvre their way through. Then for transport of people, the Urvan is preferable. In the very remote areas, the tricycle is suitable; this is because the rider can even carry it over a gully and pregnant women can be transported to nearby towns and then sent to the hospital from there. We realised that, though in the city, it's a bit repulsive but in the villages is very effective. (EEF)

> Most of feeder roads lead to farms and motorcycles cannot transport heavy loads. Therefore, it will be preferable to have vehicles on feeder roads. However, tricycles can also help as they can be used to carry goods from the farm. (EEE)

The vehicles that the experts identified as suitable for transporting goods are listed in Table 8.4.

8.4: Vehicles suitable for transporting goods

A number of motorised vehicles such as motorcycles, motorised tricycles, tricycles and bicycles have been attached to trailers to make them suitable for transporting goods, as indicated in Table 8.4. The experts explained that non-motorised vehicles are suitable for transporting goods on short distances, whereas motorised vehicles are suitable for transporting goods on longer distances.

Table 8.4: Vehicles suitable to transport goods

Vehicles suitable to transport goods		
	Type of vehicles	
	Motorised vehicles	Non-motorised vehicles
Vehicles suitable to transport goods	Motor tricycles with carriers	Wheelbarrows
	Tractors with trailers	Two-wheel hand carts
	Tip trucks	Bicycles with trailers
	Flatbed trucks	Donkey carts with trailers
	Motorcycles with trailers	Four-wheel platform push carts
		Tricycles with trailers

Source: Author

Photos of some of the types of vehicles/IMTs used to transport goods are presented below.

Figure 8.1: Flatbed (long) and cargo car unloading; Source: Author

Figure 8.2: Flatbed (small size) full of goods; Source: Author

Figure 8.3: Pickup and motorcycle with load; Source: Author

Figure 8.4: Nissan van and saloon car overloaded; Source: Author

Figure 8.5: Tip trucks with goods; Source: Author

Figure 8.6: Motor tricycle with trailer and bicycle full of load; Source: Author

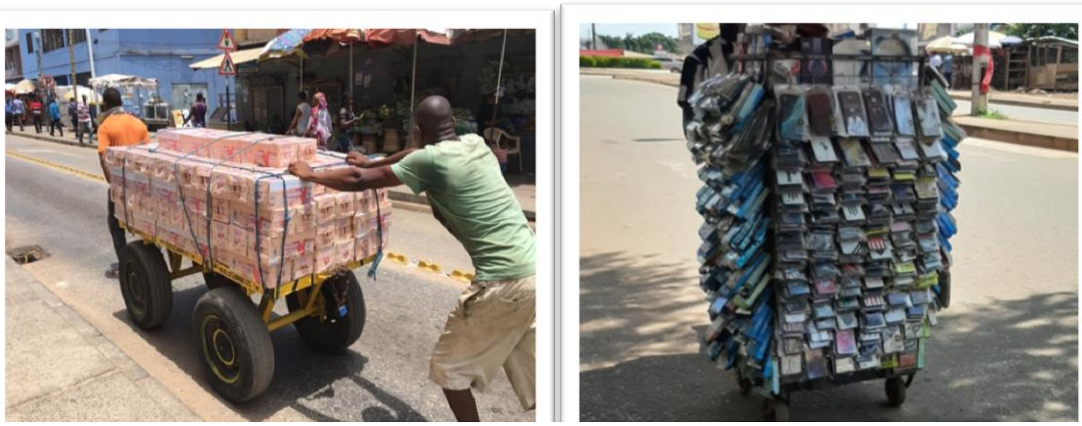

Figure 8.7: Four-wheel platform push cart and hand cart with goods; Source: Author

Figure 8.8: Two-wheel hand cart and wheelbarrow with goods; Source: Author

The vehicles used to transport various categories of people, particularly children, are listed in Table 8.5. According to the experts, bicycles and tricycles are easy to ride because they require less skill and normally do not require a licence, so they are easy for children to use as a means of transport to get to school or to run errands. The experts also commented that motorcycles and bicycles are not suitable to be used during rainy reasons, especially by children, because the slippery roads caused by rains expose riders to higher accident risks.

Table 8.5: Vehicles suitable to transport people and children

Vehicles suitable to transport people and children		
	Type of vehicles	
	Motorised vehicles	Non-motorised vehicles
Vehicles suitable to transport people	Minibuses/vans Taxis Motorcycles Motor tricycles Cars Heavy buses	Bicycles Tricycles

Source: Author

2) Vehicles suitable for travel and emergency services

Since health centres in rural areas in Ghana are often located some distance away from communities and sometimes in other rural communities, the choice of vehicles used for emergency transport is essential in facilitating the provision of healthcare. While the absence of vehicles for transport may be life-threatening in emergency situations, the type of vehicles used in emergency situations can either complicate or facilitate access to healthcare.

The opinions of the experts were collected on the suitable vehicles for emergency services on feeder roads. According to the experts, the choice of vehicle for emergency transport depends on what is available. In view of this, various types of motorised and non-motorised vehicles are used, most of which are not particularly suitable for this purpose. One of the experts elaborated on the types of vehicles used in emergency situations:

> when we talk about emergency, whatever is available; if you have different types of transport available then you have a choice to go in for the one that will take you fast to your destination. In the north, for instance, the only means of transport is a donkey or a bicycle. That's what is available and it is to serve the purpose. (EER)

The experts agreed that ambulances are the only suitable form of transport for emergency services; however, they explained that some health centres, even in urban communities but more often in rural communities, do not have access to ambulances. The non-motorised vehicles, according to the experts, are used where access to motorised vehicles transport is a challenge; consequently, other motorised vehicles are used as ambulances.

According to the experts, it is more suitable to use motorised vehicles for emergency transport services than non-motorised vehicles because the former are faster and much safer on irregular (bad) roads and in adverse weather conditions (such as rainy days) in rural communities. Nevertheless, out of the list of motorised vehicles in Table 8.3, the experts stated that taxis, cars and minibuses/vans are the most suitable in emergency situations.

Travel for leisure, like emergency situations, is dependent on the type of vehicles used. According to the experts, all vehicles listed in Table 7.5 are suitable for such travel.

However, for journeys of more than 5 km, motorised vehicles are more suitable because they are durable, safer and faster.

The next section focuses on the findings on IMTs used as transport and their suitability.

8.1.2.3 IMTs used as transport and their suitability

As indicated in the literature review presented in Chapter 4, IMTs represent an alternative means of transport to existing conventional means of transport, and their usage often fills gaps in the availability of conventional vehicles for transport services. To determine the various types of IMTs used as transport and their suitability, the experts were questioned about the use of IMTs to transport goods and people (including school children). The answers derived revealed that various IMTs are used as alternative means of transporting both goods and people.

According to some of the experts, in places where conventional transport services are lacking or inadequate, IMTs are alternatives that can be introduced, accepted and used. They explained that IMTs can be used for private and commercial/public transport services to meet transport needs, especially for travel for leisure and emergency transport services. This was captured in the statements made by experts provided below:

> In areas where the population is thriving, IMTs like motorbikes, taxis, donkeys, horses [which are not quite common in the country even in the north], and bicycles could be used for transport. (EEF)
>
> IMTs could assist in facilitating transportation; however, it is predominantly used in the north as the weather conditions are not favourable for walking. In the south, IMTs are virtually non-existent. It is these tricycles that are now coming to fill that gap. (EEM)

> I am of the view that the use of IMTs in carrying farm products from the farms to the market centres helps relieve the hardship that the rural folks face in transporting farm products. It also improves their health as they would have carried the products in the absence of IMTs. It also reduces travel time. (EEA)

The experts explained that in northern Ghana, IMTs have been introduced, accepted and are used for private and commercial transport services in most rural communities. Certain vehicles, particularly bicycles, tricycles, motorcycles and motorised tricycles, are used as IMTs for various transport services such as transporting children to school and transporting other passengers and goods. The IMTs used to transport people (including children to school) and goods are listed in Table 8.6.

Table 8.6: IMTs used to transport people and goods

IMTs used to transport people and goods	
Type of IMTs and usage	
Transporting people	**Transporting goods**
Bicycles	Motor tricycles with carriers
Tricycles	Tractors with trailers
Motorcycles	Tip trucks
Motor tricycles with designed passenger seats	Flatbed trucks
	Motorcycles with trailers

Source: Author

Although the experts admitted that the use of IMTs has been significant in northern Ghana, they also expressed the view that they are not being used safely or appropriately. They explained that the drivers of these motorcycles, motor tricycles, tricycles and bicycles often do not wear helmets and reflective wear. Because alternative vehicles are inadequate for travel in some areas, seats that are designed for use by two or three passengers are being used to transport more people, which is contrary to the designed intent. Moreover, motorcycles and motor tricycles designed to transport passengers and goods are often overloaded, with both passengers and goods sometimes inconveniently transported together. Lastly, operators of these vehicles speed, do not obey traffic regulations and are generally reckless in driving. Below are some photos of the IMTs used to transport people in Ghana.

Figure 8.9: Motor tricycle (taxi) and motorcycles loaded with passengers; Source: Author

Figure 8.10: Tractor with trailer overloaded with people; Source: Author

Figure 8.11: Tractor and tricycle loaded; Source: Author

According to the experts, unlike rural communities in northern Ghana, in the rural communities in the forest and coastal regions, IMTs are less prevalent and less accepted. They explained that in these forest and coastal regions, vehicles such as bicycles, tricycles, motorcycles and motor tricycles are used, but by only a very few persons and for their own personal travel needs.

It was also found that urban communities in the forest and coastal regions are rapidly beginning to accept the use of IMTs for private and commercial transport services; motorcycles are used as taxis, and motor tricycles designed in diverse forms are used to transport loads (people and goods). According to the experts, such rapid acceptance of IMTs in the Northern Region and in the urban communities in the forest and coastal regions has made it appropriate for the Ghana Health Service to adopt and repurpose some of these motor tricycles as ambulances to meet emergency transport service needs.

The cost of purchasing IMTs compared to conventional means of transport is much lower and IMTs consume less fuel. In view of this, when IMTs are used for commercial transport services, the transport fares charged by their operators are less than the fares charged by conventional vehicle operators for the same load and distance covered.

The next section presents the findings on the recommended IMTs and the conditions for their usage on feeder roads.

8.1.2.4 Recommended IMTs and conditions for their usage on feeder roads

Given that IMTs serve as alternative and supplementary means of transport to conventional means of transport and that this was welcomed by some of the experts, further questions were asked as to which IMTs the experts recommended and the conditions for their use. The questions commenced with a focus on the experts' recommendations for which IMTs should be used on feeder roads, and their views on how the factors of quality, speed, distance and cost affect IMTs usage. The discussion also covered the use of motorcycles and their suitability for transporting people and goods, and for emergency situations.

In Table 8.6, the various IMTs that are used to transport people and goods are listed. The experts were of the opinion that, for the purpose of transporting people on feeder roads, appropriately designed motorised tricycles are the best type of IMT, and that they are also suitable for emergency transport services.

The experts explained that motorised tricycles can be used as commercial and public transport and for both long and short journeys because they are convenient, durable and fast on feeder roads. However, they also commented that motorised tricycles cause a lot of road accidents and so there is a need for caution and education around the use of these vehicles, as indicated in the following statement by one of the experts:

> Yes, they can be used for commercial purposes especially in the south. However, people need to be educated very well because you often hear a lot of accidents caused by these motorised tricycles. This is because in the night, they appear like motorbikes because the whole body is not portrayed for oncoming vehicles or any pedestrian to know that what is coming is not just a motor bicycle but a tricycle. Most often, before you realise it is approaching, it would have hit you. There has to be more education and may be the need to put some light at the edges, so that it can indicate or show the sides of the tricycle coming. (EED)

The experts explained that bicycles and motorcycles are not ideal to be used as public transport but may be suitable for private transport use on feeder roads, to transport children to school and for other travel needs.

The experts observed that bicycles and tricycles are economical but not fast or convenient for long-distance travel. In contrast, motorcycles are faster and ideal for long-distance travel, yet pose a high accident risk, including accidents involving fatalities, if much care is not taken when used on feeder roads.

According to the experts, for the purposes of transporting goods, all the IMTs listed in Table 8.6 used for transporting goods are recommended. They further stated that tip trucks and flatbed trucks, while not economical, are ideal for transporting large volumes of goods (as they have higher goods loading capacity). These vehicles are faster and more convenient to use on good roads but are less convenient on rough and muddy roads. In contrast, motorised tricycles, tractors and motorcycles with trailers are economical but have a low loading capacity. Furthermore, tractors and motorcycles with trailers are only suitable for short-distance travel because the speed at which these IMTs can travel is often hindered by their loads.

The findings on the challenges associated with feeder road accessibility and mobility are presented in the next section.

8.1.3 Feeder road accessibility and mobility challenges

As explained in section 8.1.2.4, the experts recommended various IMTs for use on feeder roads. In section 8.1.2.3, the findings revealed the various IMTs that are used in Ghana, especially in rural communities in the north and in urban communities. As already outlined above, the experts recommended the use of certain IMTs, especially where there are no conventional vehicles. However, their usage as public transport, in the opinion of the experts, should be limited to rural communities.

The experts explained that accessibility and mobility are facing challenges in urban communities due to the high volume of vehicular traffic on roads, and that this traffic problem is being compounded by the use of IMTs, which are competing with conventional vehicles for passengers on already congested urban roads. In contrast, the experts commented that the challenges impacting accessibility and mobility in rural communities are due to the inadequacy or lack of conventional vehicles. In view of this, the acceptance and usage of IMTs as public transport are essential to address rural transport problems.

The findings on the feeder road accessibility and mobility challenges answer the third research question of the study, which is: *What are some of the challenges associated with accessibility and mobility along feeder roads facing rural communities in Ghana?* There are a number of issues confronting the promotion, acceptance and adoption of IMTs in Ghana, especially in rural communities. Therefore, the opinions of the experts regarding the adoption and acceptance of IMTs on feeder roads were sought. Specifically, the discussion was focused on the limitations impacting the adoption of IMTs, policy around and promotion of IMT usage, the drawbacks of such policy and promotion, the acceptance of IMTs in the absence of conventional vehicles, and IMT usage as public transport on feeder roads.

1) The limitations of IMT adoption

The adoption of IMTs to address rural transport challenges is not without its limitations. Some of the limitations outlined by the experts were legislative instruments inhibiting their adoption, a lack of commitment by transport operating bodies, challenges around the provision of vehicles, the poor condition of rural roads, issues related to acceptance and usage by rural people, lack of vehicle repair and maintenance service providers in rural communities, and a lack of spare parts in rural communities. These limitations are listed as accessibility and mobility challenges in Table 8.7.

Table 8.7: Accessibility and mobility challenges

Accessibility and mobility challenges
Limitation
Legislative instrument inhibiting adoption
Lack of commitment from transport operating bodies
Vehicular provision challenges
Poor condition of rural roads
Issues of acceptance and usage by rural people
lack of vehicle repair and maintenance service providers in rural communities
Lack of spare parts in rural communities

Source: Author

2) Policy around and promotion of IMTs on feeder roads

The experts stated that there is a law in Ghana that bans the use of motorcycles as commercial/public transport. Hence, the adoption of motorcycles as commercial/public transport will require supporting legislation. The experts clarified that there is a need for a regulatory body to sanitise the operations of IMTs by overseeing activities such as fixing and controlling transport fare charges, regulating transport routes and passenger boarding, and loading at various terminals. Moreover, they emphasised the difficulties associated with the provision of IMTs, which they suggested should be a shared responsibility of government, individuals and private institutions/organisations, as highlighted earlier. Further, the experts admitted that the adoption of IMTs will require the construction of roads and the rehabilitation and maintenance of existing roads to make it easier for vehicles to ply these roads. They stressed the need to support and facilitate the operations of maintenance service providers and vehicular spare parts dealers on rural roads. The experts were of the opinion that the operations of maintenance service providers and vehicular spare parts dealers on rural roads will develop over time following the adoption of IMTs as transport on feeder roads. Finally, the experts stressed that the acceptance and use of IMTs by rural people will need government support through policy interventions.

A few of the experts interviewed raised concern that people living in rural communities will not accept the use of IMTs as commercial/public transport due to lack of proper regulations and management in the operations of IMTs. Most of the experts interviewed, however, were optimistic about the acceptance and use of IMTs as commercial/public transport. According to the optimists, where accessibility and mobility are challenges, people will accept IMTs once they are made available and they can address their transport needs. This position is well captured in the following comment by one of the experts:

> You know these IMTs are more of psychological social issues. Depending on availability, the people will make their own choice; assuming where they are, they have no other choice than to walk. When there are no proper vehicles and they have to cope with IMTs, they will go with it. For instance, if you take the three northern regions of Ghana and largely the northern part of the Brong-Ahafo Region, where in certain communities availability of vehicles are difficult, they would welcome anything which will facilitate their movements. If you say bicycle or a motor with trailer once you feel that it will go faster than walking … Just by the way, you know I was involved with the introduction of bicycle with trailer in Tamale and I was the one who implemented the bicycle roads and the manufacturing of bicycles with trailer. So I was sitting with the company that was doing it … we did it, but when we constructed the roads and provided the bikes with trailer, we even assisted them to buy and then we did the road 3 metres wide and the taxis realised that they can go so they started going. Within the timeframe of two years they have changed the nature from the bikes with trailers to taxis. It is the availability and benefits that determine the behaviour of the people. When the thing is not there, they would make do with what they have. (EEK)

Thus, the experts believed that acceptance will create the required market. In other words, IMTs will be used not only by rural people but also by various people from urban communities who need to travel to rural communities for business or other activities.

The next section presents the findings on feeder road accessibility and mobility appraisal.

8.1.4 Feeder road accessibility and mobility appraisal

The findings on feeder road accessibility and mobility appraisal answer the fourth (last) research question of the study: *How are feeder road investments appraised to meet the accessibility and transport needs of people in rural communities in Ghana?* During the data analysis, two sub-themes were developed, which are feeder road transport investment, and feeder road appraisal models and recommendations. The two sub-themes are the focus in presenting the findings on accessibility and mobility appraisal.

8.1.4.1 Feeder road transport investment

As outlined in Chapter 7, the data collected from the experts and analysed on feeder roads transport investment was focused on three issues: the inclusion of transport vehicles in road investment, feeder road transport investment, and the significance and effects of a lack of transport services on feeder roads.

The experts observed that, in designing roads, engineers must take into consideration the various types of vehicles that will ply the road. The types of vehicles that will ply a road will determine the condition, type and size of the road, as stated by one of the experts:

> Feeder roads consist of access roads, connectors and inter-district roads. Access roads are the typical rural roads. With access roads, we consider vehicles like bicycles, tricycles and trucks. These roads lead to the farms. Also, not much traffic is generated on access roads and, as such, the width of the road is about 6 metres with a culvert of 7 metres length. With the connector, traffic is generated; we take into consideration a width of 7 metres with a culvert of 8 metres. The types of vehicles that ply the connectors are trucks which transport food stuff from the rural area to the urban centres. Then we have the inter-district, which is the same as the connectors. It links one district to another. All types of vehicles ply the inter-district and the width of the inter–district is 7 metres with a culvert of 8 metres and generates much traffic. (EEQ)

Knowledge of the type of vehicles that will use the road also helps to determine the life span of the road. Various types of feeder roads are constructed based on knowledge of the activities and purpose that the road is to serve as well as the types of vehicles that will use the road.

According to the experts, there are instances when roads in Ghana are designed for light vehicles but end up being used by heavy vehicles. There are also instances where the volume of vehicular traffic estimated in the design has been exceeded, thereby leading to pressure on the road resulting in early damage.

The experts further explained that although vehicular traffic is considered in the design of roads, the Department of Feeder Roads and the Ministry of Roads and Highways do not invest in rural transport services in rural areas by purchasing or providing vehicles for rural transport services. However, the provision of transport services is significant such that its absence has serious ramifications for people and the community at large.

The findings on how feeder roads are appraised in Ghana are presented in the next section.

8.1.4.2 Feeder road appraisal models used in Ghana and recommendations

The findings presented in this section are synchronised from the data analysed on the following three themes which are feeder road appraisal models in Ghana, problems with road appraisal models in Ghana, and recommendations on road appraisal models.

1) Feeder road appraisal models in Ghana

In view of the fact that the vehicles that will use a particular road are considered in the design of roads but that vehicles for transport services are not provided by the government, there is a need to interrogate the road appraisal models used in rural transport. It was found that various models are used by the Department of Feeder Roads to appraise feeder roads in Ghana, which assess the economic benefits to users, the scale of impact of the project, the geographical area under consideration, political considerations, the internal rate of returns of the project, and the social benefit of the project.

i. Economic benefits to users

The discussions held with the key expert feeder road engineers revealed that a number of considerations go into the planning and appraisal of new roads and transport projects in general. The discussion revealed that the economic benefits to users and the overall impact of the project on poverty-reduction efforts are of interest to policy-makers and other stakeholders.

The experts explained that rural areas in Ghana are predominantly engaged in agriculture and that they thus constitute the 'food basket' of the country. Given this, the appraisal of roads often takes into consideration whether such projects (new or existing ones) will aid in the transport of agricultural produce from rural areas to urban settlements or major market centres. The aim is that enhancing the mobility of farm produce contributes towards a reduction in post-harvest losses, and indirectly provides farmers with good returns on their efforts.

According to the experts, the benefits to users are not only measured by how easily agricultural produce is able to move from rural areas to urban centres, but also how a road will facilitate the movement of people to nearby settlements to engage in other economic activities. In view of this, planners and road engineers consider whether the road to be constructed will connect settlements, especially rural and urban communities, so that trade and economic exchange can take place. It is also via such roads that processed and manufactured goods can reach rural areas.

ii. The scale of impact of the project

Another important model assesses the scale of impact of a project. In essence, how many people is the road project going to impact? And is the road going to serve just a few communities or a number of communities? In this respect, the experts explained that engineers are interested in the returns on investment and the wider impact of the road. On the assessment of impact, one expert engineer interviewed opined that:

> We also look at the impact on the sector. For instance, is investment in a new road project going to increase output of cocoa production which is, inevitably, a major economic sector in the country? Furthermore, the government may want to increase productivity by introducing new species of maize, tomatoes and any other agricultural produce. As part of its strategic plan, the government may improve road infrastructure in rural areas. (EEO)

The expectation here is that the new road will have a positive impact on the targeted agricultural output. In this regard, critical considerations are the size of the population the road will serve and whether the road will help people to access schools and health centres. In addition, the condition of the road, and how much intervention will be needed to make the desired impact, is also taken into consideration.

iii. Internal rate of return

According to the experts, another method adopted in the appraisal of feeder roads looks at the internal rate of return. With this method, data are gathered on road prior to its construction or renovation. This information is then compared to data collected after the road construction or road works have been completed, to assess whether there have been changes in terms of volume of agricultural produce transported. When there appears to be an increase in agricultural output following the construction or renovation works, then conclusions can be drawn as to whether the investment made on the road has yielded positive returns compared to alternative investments in the financial sectors using the official Bank of Ghana interest rate. The use of the internal rate of return method was referenced by one of the experts, who stated that:

> I think we use the internal rate of return (IRR) because what we do is, if you look at before and after, what is the situation before the road was constructed then when the road was constructed; what is the effect? Has it increased the output of food crops from the rural areas? What is their lifestyle? Has it been improved? The commercial activities in the rural areas or their economic lifestyle – has there been an improvement? (EEG)

iv. Type of geographical area

The experts interviewed also indicated that in their appraisal of feeder roads and rural transport infrastructure, they consider the geography of the area. Geography here connotes both the social and physical geography of an area. For instance, one expert, commenting on the social geography aspect of an appraisal, stated that communities vary in their use of transport facilities and services. According to this expert, in the northern part of the country, for example, both motorised and non-motorised vehicles are used on the same feeder roads. In such circumstances, the feeder roads in those communities are designed to be smaller – about 3 metres wide – in order to reduce the speed of motorised vehicles on the road and thereby to prevent accidents between motorists and users of non-motorised transport. However, in the southern part of the country, where the use of non-motorised transport is minimal, roads are about 6 metres wide. One of the experts stated:

> You should have an idea of the geographical area you are dealing with. In the north, for instance, you look at the major or most of the transport vehicles they use. At feeder roads, there were times we constructed roads around 3 metres wide for certain communities because they were using motor bikes, bicycles and donkeys, among others. So the department thought it was more appropriate for them and very economical to have that. (EEQ)

The physical geographical aspect of the appraisal process entails consideration of the topography of the area. The nature of the landscape influences the design of a road, which in turn affects the overall cost of the road. Furthermore, the nature of the land and surface water drainage systems will determine whether bridges and culverts need to be constructed at some sections of the road.

v. Political considerations

While a number of the appraisal methods consider the economic impact and the cost-benefit analysis of a project, the experts also commented that the appraisal process is not entirely technical. Political factors also influence decision-making. Political considerations emanate from politicians and other stakeholders who wield significant influence when it comes to decision-making about physical infrastructure. The experts explained that roads may be constructed in a rural community not on the basis of rigorous and objective cost-benefit analysis but as a result of the need to assuage agitation in communities against the government for neglecting them. According to the experts, this is common when members of the community are ardent supporters of a ruling party. In this regard, roads may be constructed as a way of persuading community members to vote for the government in power. Political influence was described by one of the experts as follows:

> Ok, let me talk about the real professional concept a bit. When we started feeder road it was clear that communities were coming with their request and we were following up and developing them. In fact, we did that for a reasonable time of over 10 years. But since my assumption of duty, I have seen that the politics of today have an influence in this matter. In 1988, we were called 'cocoa engineers'. When we are about to do the cocoa roads, we went for the data on the tonnage of cocoa on each of the areas. (EEA)
>
> As of now, selection of roads is not even done by the technical men here. It is done by the politicians. They bring their list and they ask you to go

> and carry out your studies. The engineers have a bit of influence on the decision as to which road to construct but most often some of the lists come from the politicians. (EEL)

vi. Social benefits

According to the experts, the social benefits model is used to determine whether a road infrastructural project will enhance quality of life and access to social services such as schools and hospitals, and allow people to engage in other forms of social interaction. One of the experts spoke of this:

> I think we consider the importance of the road to the people. By importance, we consider the socioeconomic benefit the people will derive from the construction of the road. We consider if the road will lead people to market centres. We also consider the quantum of the population the road will serve as well as whether the road will help people in accessing schools and health centres and then we also look at the condition of the roads itself. (EEH)

The next section covers the findings on the problems with feeder road appraisal models.

2) Problems with and recommendations for feeder road appraisal models in Ghana

A number of issues emerged as challenges confronting the road transport appraisal models used in Ghana. Specifically, these problems are a lack of participation of local people, a lack of provision of affordable and easily accessible means of transport, and too much political influence.

i) Lack of participation of local people

It was revealed in the discussions that, in most cases, there is no input from the local people in the planning and implementation stages of road projects. However, the experts all agreed that community input could be critical in the design and implementation of projects. It was noted that engineers sometimes call on local people to supply information about the topography of an area since some information may not be available on the existing maps being used in the construction process.

It was recommended by the experts that local knowledge be sought from the community in regard to important economic activities undertaken in the area. This could then be taken into account in designing roads that respond effectively to the needs and aspirations of the specific localities, as indicated by the following response:

> I think the people in the community where the road is to be constructed should be part of the decision to construct a road. This is because they are the beneficiaries and they should be involved in the decision to construct a road. (EEI)

ii) Lack of provision of affordable and easily accessible means of transport

Another failure of current road appraisal models is the lack of provision of affordable and easily accessible means of transport by the government. According to the experts, this can be attributed to the current institutional structure for transport planning in the country. The experts explained that in Ghana, the Ministry of Roads and Highways is basically in charge of the policy framework that guides road planning, construction and maintenance, and that the main implementation bodies under this ministry are the Department of Feeder Roads, the Department of Urban Roads and the Ghana Highways Authority. The Ministry of Transport also carries out transport planning. According to the experts interviewed, the Ministry of Roads and Highways and its implementing bodies have a mandate that does not include the type of transport (motorised or non-motorised) that should ply the roads. Rather, they are only interested in providing the roads to improve economic activities in the relevant localities, as already indicated.

To resolve this problem, the experts recommended that transport services be considered within road infrastructure development appraisal models, as indicated in the following statement by one of the experts:

> I would recommend the means of transport to be factored into the appraisal models. The models do not include the provision of cheaper, accessible and alternative means of transport. For road construction to have an impact on the people and to reduce poverty, it is important that transport services are considered. (EER)

Furthermore, one of the experts recommended an integration of the Ministry of Roads and Highways and the Ministry of Transport which had been separated by the current government. In contrast, another expert recommended a restructure of the Ministry of Transport to make it more proactive and responsive, specifically in relation to providing transport services that meet the needs of people. The positions recommended by these two experts are outlined below:

> I wrote a letter and requested the transport sector could be broken into two ministries, where two modes could be in one ministry and two in the other. If you put the two together then they should deal with the mode and the means of transport and the regulation of service and everything under that ministry. For instance, I suggested that the road and air transport should be put under one ministry and when put under one ministry, they should have control over means of transport … So that one ministry will be in charge of providing infrastructure, regulating means of transport and transport service … How it's done in that particular transport system … So if you take one ministry to be rail and water transport then the train system plus both boat and ship another system will all be under one ministry. So he knows how to provide infrastructure and how to regulate its usage and everything. Because the objective of the transport system is to carry goods, services and people, it's not just mere infrastructure, the ultimate is that people, goods and services. So it's not that I've done infrastructure and finished. (EEJ)

> Yes, it is important because we hold the view that the mandate of the transport ministry and the Department of Feeder Roads should be in tandem. The two institutions should not be separated from each other. If that was so, then we should have been able to address that issue and even design roads for specific modes of transport. (EEK)

iii) Too much political influence

The experts shared the opinion that the politics of the day often influence decisions that should be based on economic and technical appraisal, the latter of which allows for a better return on investment. According to these participants, this situation reduces the returns on investment, and affects the productivity of the country's economy since areas that should have been prioritised for road investment are instead being sidelined. Too much political influence, according to the experts, leaves no room for engineers and experts in the various road agencies to take control of the planning process around road construction.

The next section presents the findings from group interview data analysis.

8.2 Group interview findings

The group interview findings are based on the data collected and analysed from Awosoase, Abokoase, Subriso, Tuobodom and Offuman rural communities. As indicated in Chapter 7, the findings from the group interviews are essential to support the findings from the expert interviews in addressing the research questions. Therefore, the themes were grouped similarly to those for the expert interviews.

This section commences with a discussion of the group interview findings on the contribution of feeder roads to development, followed by a discussion of the types and suitability of vehicles and IMTs on feeder roads, and then of the transport challenges associated with feeder roads.

8.2.1 Contribution of feeder roads to development

The findings on the contribution of feeder roads to development support the findings from the expert interviews in answering the first research question of the study. The group interview findings on the contribution of feeder roads to development are summarised in Table 8.8.

Table 8.8: Contribution of feeder roads to development

Contribution of feeder roads to development
Contribution of feeder roads
Reduce poverty.
Create jobs.
Increase or expand market.
Enable quick and easy movement of people and goods.
Reduce transport fare costs.
Improve community network across neighbouring towns.
Improve rural transport.

Source: Author

Generally, all the participants were of the view that feeder roads are important to the development of their communities. The participants from communities with good feeder road infrastructure mentioned the value of these roads in contributing towards poverty reduction, job creation, expansion of the market, quick and easy movement of people and goods, reduction in transport fares, opening up the community by connecting it to neighbouring towns, and improving rural transport. However, the participants from communities with bad feeder road infrastructure attributed the poor condition of their roads as a major factor depriving them of access to essential social services and economic opportunities.

At Abokoase rural community, one participant confirmed that the availability of good feeder roads had resulted in an increase in demand for her goods. And a trader who sells bush meat made the following revelation in a group discussion:

> Not long ago, I used to sell about four live 'grasscutters' only along this road at very cheap price [GHC10–15, where 1 Ghana cedi is equivalent to about US$3]. However, following the construction of the new feeder road, a lot more passengers travel on the road, as more vehicles ply on it. Most of the passengers buy meat whenever they get here. I now sell close to eight grasscutters every day, at not less than GHC20 [or roughly US$4] each. This has improved my livelihood a lot. (ABD)

Similarly, another participant at Abokoase shared his view that the availability of good feeder roads had resulted in improved transport services:

> Now, we have access to vehicles at any time of the day, which has helped in making movement easier. Hitherto, it was very difficult to get access to a vehicle; most drivers did not ply the road due to its bad state. So, I think more feeder roads should be constructed. (ABA)

Another participant remarked on how the feeder roads constructed in her area had resulted in an increase in the number of vehicles on the roads, and therefore that drivers had been able to make more profits from commercial driving. To this participant, the construction of feeder roads in Abokoase had helped her to transport her foodstuff and other products from the farm gate.

In the group discussions at Awosoaso, one participant made the following comment about the importance of feeder roads:

> Roads are important for development. People who are sick have to be transported to hospitals by road, and harvested commodities such as cocoa also have to be transported from the farms. However, we are not satisfied with the number of roads. Transport helps in getting access to basic needs like water. It also helps in the movement of produce from farms to markets and homes. The lack of roads impedes the accessibility of the area. When it rains, it becomes difficult for school children to go to school due to the nature of the road. (AWC)

It was also noted that the roads leading to Awosoaso are not engineered feeder roads. In the same group discussions at Awosoaso, another participant complained about the unsatisfactory nature of the available feeder roads:

> It is appalling whenever I use the roads in Awosoaso. There are no intermediate means of transport and the other available means of transport are also not enough. The roads are also in deplorable state and get flooded during the rainy season, making it difficult to travel over them. (AWB)

The flooding was partly due to a lack of side drains, culverts and bridges to allow the run-off water to flow easily. At Tuobodom, a farmer spoke of the importance of feeder roads to his community:

> We are not satisfied with the number of roads that have been constructed for us. We would like the government to construct more roads. We need roads that can accommodate the use of heavy vehicles such as cargo vehicles to carry produce from the farm to the market centres and the cities. The feeder roads are important because they will facilitate movement of individuals as well as movement of produce from farms. For instance, the already constructed feeder roads have helped in reducing the cost of transport. (TUE)

Another participant indicated that, due to the bad nature of available roads, there have been instances where roads connecting Tuobodom to other neighbouring communities have been overflooded and therefore unmotorable:

> There are other routes apart from the main Offuman-Tuobodom road that sometimes become inaccessible during rainy seasons. When this happens, the drivers usually charge higher prices on transport services and this increases the cost of transporting farm produce. Again, some of the farm produce cannot be transported to other towns and be sold; as a result, most often the produce perishes. Also, due to the nature of the road, some vehicles do not want to go to nearby communities. In most cases, we are made to walk at some point by the drivers whenever we board to such communities. (TUF)

Vehicles were said to be scarcer at Tuobodom than in other communities, as described by one participant:

> There are many instances where people do not get access to vehicles to transport them to places of need. For instance, there was a situation where a lady died due to our inability to access a vehicle to transport her to the hospital. (TUB)

This particular situation was the result of the lack of vehicles in the area. The discussions at Tuobodom also raised issues related to poverty and the cost of transport. One trader interviewed stated that due to the level of poverty in his community, many people there would still have difficulty paying for transport fares even if transport services were improved in the area:

> It is possible, given the availability of improved roads; yet residents will not have the money to pay for transport fares in this community, due to the high levels of poverty here. Nonetheless, I think those able to patronise the transport fares are more than those who cannot in this community. (TUA)

At Offuman, another issue raised was that, apart from the new road that had been constructed, the smaller feeder roads that connect the markets to the farms are still in bad condition, making it difficult for farm produce to be transported to the markets. This was expressed with some emotion by two of the participants:

> Offuman is a predominantly farming community, and due to too many bad roads, some of the farm produces decay at the farms before being transported to the main township. (OFC)

> A student in Offuman was involved in an accident on the way to Tuobodom to write final exams. The accident was as a result of bad nature of road as it had rained heavily. Sometimes, farm produce, like tomatoes, get spoilt due to inaccessibility of road. The harvests are packed into boxes for transport; however, sometimes the road gets blocked due to heavy rains, making it difficult for vehicles to ply the road. The produce, after some days, get spoilt. There are also other villages nearby which do not have health facilities. Sometimes, when women are in labour, they have to be transported to health facility here in Offuman. However, due to bad nature of road, it becomes very difficult to get them to health facilities. Sometimes, they are transported using bicycles, which are very dangerous. (OFJ)

The findings on the types and suitability of vehicles and IMTs used on feeder roads are covered in the next section.

8.2.2 Types and suitability of vehicles and IMTs used on feeder roads

The findings on the types and suitability of vehicles and IMTs on feeder roads were obtained from the data analysed according to 10 nodes grouped under two sub-themes, as listed in Tables 7.8 and 7.9 in Chapter 7. The two sub-themes are the nature of roads and types of vehicles available; and the activities and types of vehicles/IMTs used. The findings presented in this section provide support to the findings from the expert interviews in addressing the second research question of this study.

In the subsequent sections, the findings from the nodes analysed are presented under the sub-themes.

8.2.2.1 Nature of roads and types of vehicles available

The nature of roads and the types of vehicles available were explored in the interviews, with the initial questions aimed at identifying the vehicles available in the communities, which are influenced by the poor condition of roads. This was followed by a discussion of the suitable/useful vehicles required and their availability in the community. Information was then sought from the participants on the suitable/useful vehicles available in their community, and on whether people needed support to purchase vehicles, and for which types of vehicles they required such support. The findings are presented in Tables 8.9 to 8.13.

Table 8.9: Vehicles available due to nature of roads

Vehicles available due to nature of roads		
	Nature of roads and types of vehicles	
Vehicles available due to nature of road	Communities with good roads	Communities with bad roads
	Motorcycles	Wheelbarrows
	Motorised tricycles	Two-wheel hand carts
	Minibuses/vans	Bicycles
	Tractors	Bicycles with trailers
	Tractors with trailers	Donkey carts
	Tip trucks	Four-wheel platform push carts
	Taxis	Tricycles
	Cars	Motorcycles
	Bicycles	Tractors
	Wheelbarrows	Tractors with trailers
	Tricycles	
	Four-wheel platform push carts	

Source: Author

Various vehicles, comprising both motorised and non-motorised types, were found to be available and used in the communities. Certain types of motorised vehicles, such as buses/vans, taxis, cars, motorised tricycles and motorcycles, are more often available in communities with good feeder roads to transport people and goods over long and short distances. Other types of motorised vehicles, such as tractors, tractors with trailers and motorcycles, are more often used in communities with bad feeder roads to transport people and goods. Vehicles such as wheelbarrows, two-wheel hand carts, bicycles, donkey carts, and tricycles are also used to transport loads over long and short distances.

All the vehicles listed in Table 8.9 are identified as useful vehicles that are required by rural communities. According to the experts, all these vehicles are useful when used for the activities for which they were built and designed, such as transporting loads, farming and construction. For construction purposes, vehicles such as wheelbarrows, pickups and flatbed trucks are found to be acceptable. In addition, vehicles such as tractors and tractors with trailers are seen as useful for farming activities. Furthermore, vehicles such as buses/vans, motorcycles, motor tricycles, tricycles, bicycles, taxis and cars are useful for transporting people. Lastly, vehicles such as wheelbarrows, two-wheel hand carts, donkey carts, flatbed trucks, tip trucks, four-wheel platform push carts and bicycles with trailers are convenient for transporting loads. Table 8.10 provides a list of vehicles and the activities they are used for.

Table 8.10: Activities and types of vehicles required

Activities and types of vehicles required			
Transporting people	**Transporting loads**	**Farming activities**	**Construction activities**
Motorcycles	Wheelbarrows	Tractors	Tip trucks
Motor tricycles	Two-wheel hand carts	Tractors with trailers	Flatbed trucks
Minibuses/vans	Flatbed trucks		Wheelbarrows
Activities and types of vehicles required			
Transporting people	**Transporting loads**	**Farming activities**	**Construction activities**
Bicycles	Bicycles with trailers		Pickups
Tricycles	Donkey carts		
Taxis	Tip trucks		
Cars	Four-wheel platform push carts		

Source: Author

In all the rural communities, vehicles such as motorcycles, tractors, tractors with trailers, bicycles, wheelbarrows and tricycles are available. However, due to the bad nature of roads in some communities, motorised vehicles such as taxis, cars, motorised tricycles and buses/vans are not used. Table 8.11 provides a list of vehicles that are found in all rural communities discussed in this study.

Table 8.11: Vehicles found in all communities

Vehicles found in all communities	
Motorised vehicles	**Non-motorised vehicles**
Tractors	Bicycles
Tractors with trailers	Wheelbarrows
Motorcycles	Tricycles

Source: Author

Of the vehicles presented in Table 8.9, wheelbarrows, two-wheel hand carts, bicycles, bicycle with trailers, donkey carts, tricycles and four-wheel platform push carts are vehicles for which communities do not require support to purchase, as such vehicles are considered to be less expensive than others. Table 8.12 lists all of the vehicles for which communities do not require support to purchase.

Tractors and tractors with trailers were reported as being owned by a few farmers, individuals and groups in the community. Furthermore, motorcycles and tricycles were reported as being owned by some individuals in the community and used for transport. Likewise, the discussions revealed that vehicles such as bicycles and wheelbarrows are owned by most individuals and homes in the community.

Table 8.12: Vehicles for which communities do not require support to purchase

Vehicles for which communities do not require support to purchase	
Motorised vehicles	**Non-motorised vehicles**
	Wheelbarrows Two-wheel hand carts Bicycles Bicycles with trailers Donkey carts Four-wheel platform push carts Tricycles

Source: Author

According to the participants, motorised vehicles are very expensive to acquire, especially considering the meagre earnings of most rural people, such that a lifetime's worth of savings would be needed to purchase one. From the list of vehicles in Table 8.9, the participants identified the motorised vehicles for which communities require support to purchase. These vehicles, which are listed in Table 8.13, are mainly used for farming activities and the transportation of loads.

Table 8.13: Vehicles for which communities require support to purchase

Vehicles for which communities require support to purchase	
Motorised vehicles	Non-motorised vehicles
Motorcycles Motor tricycles Minibuses/vans Tractors Tractors with trailers Tip trucks Taxis Cars	

Source: Author

The next section presents the findings on the activities and types of IMTs and vehicles required. It provides further details on vehicles and IMTs required for transport services.

8.2.2.2 Activities and types of IMTs and vehicles used

All the vehicles listed in Table 8.9 are invariably used for transportation during emergency situations like transporting pregnant women in labour or people involved in accidents that require emergency healthcare attention. These vehicles are also used to transport people to schools, workplaces and market centres; and to transport goods (foods and materials) over long and short distances.

In most situations where a person is required to be transported to the health centre for emergency treatment, for example in the case of an accident, the vehicles used often depends on the type of vehicle that is available in the community and the type available at the time when a vehicle is needed. In view of this, vehicles are often used inappropriately – that is, in a way or for a purpose for which they were not designed. Such inappropriate uses of vehicles were also reported, especially in relation to the transportation of people, animals and goods. In these cases, vehicles are overloaded, causing inconvenience or discomfort to the vehicle occupants and other road users and exposing them to accident and danger. Other factors such as the size of loads, the cost of transportation, the condition of feeder roads, safety of use and efficiency of travel also impact the types of vehicles and IMTs used.

Tables 8.14 to 8.17 list several activities, and the types of vehicles and IMTs used for those activities, which is dependent on the condition of roads. The activities covered are emergency services, the transportation of people (including children and workers) and the transportation of loads to market centres.

Table 8.14: Vehicles and IMTs used for emergency services

Vehicles and IMTs used for emergency services	
Communities with good roads	**Communities with bad roads**
Ambulances	Bicycles
Cars	Wheelbarrows
Taxis	Tricycles
Motorcycles	Motorcycles
Vans	Tractors
	Tractors with trailers

Source: Author

Table 8.15: Vehicles and IMTs used to transport people (including workers and children)

Vehicles and IMTs used to transport people (including workers and children)	
Communities with good roads	**Communities with bad roads**
Motorcycles	Bicycles
Motor tricycles	Motorcycles
Minibuses/vans	Tricycles
Taxis	Bicycles with trailers
Cars	Tractors
Bicycles	Tractors with trailers

Source: Author

Table 8.16: Vehicles and IMTs used to transport loads for less than 5 km

Vehicles and IMTs used to transport loads for less than 5 km	
Communities with good roads	**Communities with bad roads**
Vans	Bicycles
Minibuses	Wheelbarrows
Motor tricycles	Tricycles
Taxis	Donkey carts
Cars	Four-wheel platform push carts
Four-wheel platform push carts	Tractors with trailers
Flatbed trucks	Motorcycles
Tractors with trailers	
Motorcycles	
Pickups	

Source: Author

Table 8.17: Vehicles and IMTs used to transport loads
for more than 5 km

Vehicles and IMTs used to transport loads for more than 5 km	
Communities with good roads	**Communities with bad roads**
Vans	Bicycles
Minibuses	Tractors with trailers
Motor tricycles	Tricycles
Taxis	Motorcycles
Cars	
Pickups	
Flatbed trucks	
Tip trucks	

Source: Author

The next section presents the findings from the data analysed on rural transport challenges.

8.2.3 Rural transport challenges

The group interview findings on rural transport challenges complement the expert interview findings to answer the third research question of this study. These findings were obtained from data collected on the reasons why vehicles that are useful are not being used in communities, on the unavailability of some vehicles, and on the effects of rural transport challenges.

Rural transport challenges, such as poor rural road infrastructure and people's inability to own vehicles due to their high cost, were identified as the reasons why vehicles that are useful are not being used in rural communities. Whereas the problem of affordability was found to exist in communities with both good and bad feeder roads, poor rural road infrastructure was (of course) only identified in communities with bad roads. Both of these problems lead to limited or no availability of vehicles and consequently to increased transport prices.

During the fieldwork, a number of the participants complained bitterly about the poor state of feeder roads in their communities. According to the participants, the poor state of roads is a result of inadequate investment in road infrastructure. The findings also revealed that adverse weather conditions have also contributed to the current poor state of feeder roads. Furthermore, the participants explained that the untarred nature of the roads leaves them in a deplorable state after heavy rains. Indeed, most of the rural inhabitants interviewed indicated that whenever it rains, most taxi drivers are unwilling to take them to their destinations. In such situations, one of the few means of transport available is the motorbike, which can carry a few people simultaneously. Some also rely on other means of transport such as trains, as observed by one of the participants:

> We walk to our destinations. Again, we used to have trains that pass by the village from other towns so we sometimes board the train. However, when you missed the train then you have to walk. (SUG)

The participants in the group interviews were of the view that owning a vehicle is difficult due to the high cost of vehicles, particularly motorised ones. Vehicles are owned by only a few persons and groups who can afford them, for private use or commercial transport services. The inability of people to own vehicles has resulted in the majority of rural people having to rely on commercial transport services, for which transport routes and fares are determined by the owners.

Poor roads and the unavailability of vehicles for transport services have a number of social and economic effects for rural people and their activities. One major impact resulting from these problems is increased transport charges. According to the participants, most drivers are unwilling to transport passengers because of their incessant complaints that the vehicle will break down if they travel on bad roads. To mitigate this risk, most drivers increase their fares, as one of the participants complained:

> There have been instances that such scenarios have happened. This causes several problems for us as we lose revenue due to the fact that we are unable to get our produce to the market in other areas [such as Accra] early enough. The drivers sometimes complain about the nature of the roads especially during rainy seasons and during the dry season. Some drivers even refuse to go even after offering them a higher amount of money. Others will also accept the money and make the journey. (AWA)

Increases in transport fares thus place an undue burden on most rural people. The participants explained that, as a result, their agricultural produce might get spoilt if they cannot transport it, or that high transport charges render their produce uncompetitive in the market. Furthermore, buyers who come to rural areas to buy farm produce on a large scale will only pay low prices and cite the high transport fares as their reason.

Most farmers among the participants complain that the bad nature of roads is the result of both adverse weather conditions and a lack of government attention and investment. This has led to a situation where they are unable to easily move their farm produce from their farms to intermediate and major urban centres. According to these farmers, this significantly erodes their earnings as a proportion of their produce goes to waste.

According to the participants, the poor state of feeder roads presents serious social risks. One such risk mentioned was the incidence of crime on the roads. The participants described how, when roads are bad, vehicle speed must be reduced which means that travellers become vulnerable to attacks by robbers who lay ambush along these routes, especially on market days.

Another key challenge associated with accessibility and mobility on feeder roads that was highlighted by most of the respondents was that bad roads constrain access to healthcare. The participants commented that pregnant women in labour face considerable difficulties in getting to a nearby health facility, and that delays sometimes result in the death of babies and mothers. Other rural inhabitants with serious medical challenges also find it difficult to travel to clinics and hospitals in good time and on a regular basis. Such impacts were discussed by three of the participants:

> There was a time when a pregnant woman in labour was being carried by some men to a health facility which is quite distant from the village they were coming from due to the bad nature of roads and unavailability of means of transport. (ABL)
>
> This is a very difficult situation. There was a scenario where a sick person was carried on the back of individuals to a health facility due to the fact that the road had been blocked. (SUD)
>
> Yes, people, especially pregnant women, sometimes die because they are unable to access health facilities due to the bad nature of the roads or [the unavailability of] a proper means of transport or vehicle. The use of IMTs like donkeys, motorcycles and tricycles exposes the people to the risk of accidents and it also takes a longer time for them to reach their destination. (TUB)

The next section provides a summary of the main issues raised in this chapter.

8.3 Summary of main findings covered in this chapter

This chapter has focused on the findings captured by the analysis of the views and perceptions from the expert interviews and the group interviews. This section presents a summary of these findings, for both the expert interviews and the group interviews.

8.3.1 Summary of relevant expert interview findings

The findings from the expert interviews are presented according to four themes: the contribution of feeder roads to development, the types and suitability of vehicles and IMTs on feeder roads, feeder road accessibility and mobility challenges, and feeder road appraisal models. The findings on the contribution of feeder roads to development answer the first research question: *To what extent do feeder roads contribute to the development of rural people and rural communities in Ghana?* The findings on the types and suitability of vehicles and IMTs on feeder roads respond to the second research question: what types of vehicles and IMTs may be used on feeder roads and how suitable are they to address the transportation needs of the people in rural communities in Ghana? The findings on feeder road appraisal models used address the third research question: *How are feeder road investments appraised to meet the accessibility and transport needs of people in rural communities in Ghana*? Finally, the findings on feeder road accessibility and mobility challenges answer the fourth research question: *What are some of the challenges associated with accessibility and mobility along feeder roads facing rural communities in Ghana?* A summary of the relevant expert interview findings is provided below, under the four themes that correspond to the research questions.

8.3.1.1 Contribution of feeder roads to development

1. In recent years, more feeder roads have been constructed in Ghana. However, more feeder roads need to be constructed and the existing feeder roads require maintenance.

2. The availability of good feeder roads creates employment opportunities, opens up rural communities for trade, improves accessibility and mobility through transport service availability, facilitates the movement of people and goods, reduces post-harvest losses, increases the revenue of farmers, and enhances rural infrastructure development.
3. The provision of transport services is a shared responsibility of government, organisations and individuals. However, the government only intervenes when it is necessary for safety and security reasons.

8.3.1.2 Types and suitability of vehicles and IMTs on feeder roads

1. Motorised vehicles such as pickups and station wagons like Toyota Land Cruisers, which are government-owned vehicles, are used by experts to conduct various feeder road inspections and for their own personal travel on feeder roads. In the absence of government-owned vehicles, taxis, minibuses/vans, cars and other commercial vehicles are sometimes used by experts on feeder roads.
2. Vehicles such as motor tricycles, motorcycles, buses/vans, tractors, taxis, cars, wheelbarrows, bicycles, donkey carts and four-wheel push carts are used by rural people for transportation.
3. In transporting people and goods, vehicles are misused, for example, by being overloading or otherwise inappropriately used.
4. The use of IMTs is accepted where the conventional vehicles available are inadequate or where no conventional vehicles are available. Furthermore, IMTs, particularly motor tricycles, are appropriate for use on feeder roads as

commercial/public transport but not in urban communities due to the growing volume of vehicular traffic on urban roads compared to feeder roads.

5. IMTs are widely accepted and used in northern Ghana, in contrast to southern Ghana where they are less common. This is because a conscious effort was made to introduce IMTs in the north as a remedy to the transport challenges.
6. IMTs are becoming more widely accepted and used in rural communities, especially in the middle and southern parts of Ghana. However, certain important issues, such as the need for parliamentary legislation and a regulatory body to regulate transport fares, transport routes and the boarding of passengers and loads at transport terminals, should be considered before IMTs are introduced in places where they do not yet exist.
7. The use of IMTs helps relieve the hardship that the rural folks face in transporting farm products, it also improves their health as they would have carried the products in the absence of IMTs, and reduces travel time spent on transportation.

8.3.1.3 Feeder road accessibility and mobility challenges

1. The rural transport challenges identified include legislative instruments inhibiting the adoption of IMTs, a lack of commitment from transport regulating bodies and organisations, the difficulties of providing vehicles/IMTs, the bad nature of rural roads, issues hindering the acceptance and usage of IMTs by rural people, inadequate IMT/vehicle maintenance service providers on rural roads and in rural communities, and a lack of vehicle spare parts in rural communities.

8.3.1.4 Feeder road appraisal models

1. Various road appraisal models are used in Ghana, which variously consider one or more of the following aspects of road construction: (1) the economic benefit to users, (2) the scale of impact of the project, (3) geographical considerations, (4) political influence, (5) the internal rate of return of projects, and (6) the social benefits of projects.
2. The rural appraisal models adopted by the Department of Feeder Roads only consider the number of vehicles on the road but do not include government provision of vehicles for transport services.
3. There is lack of input from the local people in the planning and implementation stages of road projects although community input is considered to be critical in the design and implementation of projects.
4. Political influence or the politics of the day often influence road construction decisions that should be based on economic and technical appraisal.

8.3.2 Summary of relevant group interview findings

The findings from the group interviews are presented under three themes, which are aligned to the research questions, as presented for the expert interview findings.

8.3.2.1 Contribution of feeder roads to development

1. Feeder road construction contributes to socioeconomic development and impacts positively on rural areas if backed by sound policies such as those focused on the creation of employment, the reduction of poverty, the expansion of the market,

the quick and easy movement of people and goods, the reduction of transport fares, the improvement of community networks, and the simultaneous improvement of transport services and the availability of vehicles.

2. The socioeconomic development of rural communities will progress if it is linked to the availability of good feeder road infrastructure and efficient transport services.

8.3.2.2 Types and suitability of vehicles and IMTs on feeder roads

1. Vehicles such as motorcycles, motorised tricycles, minibuses/vans, tractors, tractors with trailers, tip trucks, flatbed trucks, taxis, cars, bicycles, wheelbarrows, pickups, tricycles and four-wheel platform push carts are available and used in rural communities for transporting people and goods and for emergency services.
2. Vehicles such as tractors, tractors with trailers, bicycles, wheelbarrows, tricycles, motorcycles and four-wheel platform push carts are found in communities with good and bad feeder roads.
3. Motorcycles, motorised tricycles, minibuses/vans, tractors, tractors with trailers, tip trucks, flatbed trucks, taxis and cars are vehicles for which rural communities require support to purchase them.
4. Bicycles, wheelbarrows, tricycles and four-wheel platform push carts are vehicles that rural communities can afford to purchase without external support.

8.3.2.3 Rural transport challenges

1. Rural transport challenges include the bad nature of rural roads, persistent increases in rural transport fares, the unavailability of appropriate transport vehicles including IMTs, the high cost of motorised vehicles and the inability of rural people to own vehicles due to their high cost.
2. The effects of the rural transport challenges are increased transport fares, low prices for farm produce, post-harvest losses, the risk of robbery attacks and crimes on the road, the inability to access healthcare services (including in emergency situations) at all or in a timely manner.

The next chapter discusses the findings from both the face-face expert interviews and the group interviews.

CHAPTER 9:

DISCUSSION OF FINDINGS

9.0 Introduction

In Chapter 8, the findings from the expert and focus group interviews were presented according to four main themes: (1) the contribution of feeder roads to development, (2) the types and suitability of vehicles and IMTs on feeder roads, (3) feeder road accessibility and mobility challenges, and (4) feeder road appraisal models. These themes correlate to research questions 1, 2, 3 and 4, respectively.

In this chapter, the findings are discussed under the main themes in relation to how they address the research questions of this study (Erans, Gruba & Zobel, 2013). The discussions were carried out in observance of the theoretical constructs in the theoretical framework of the study (Figure 5.3), the literature reviewed and the researcher's observations (Bryant & Charmaz, 2007; Charmaz, 2005). The theoretical framework established the vertical and horizontal relationships between the following major theoretical constructs: the construction of roads and the provision of transport services, the ability to access essential services and facilities and socioeconomic development or self-actualisation.

Theories such as the Hierarchy of Needs Theory, Time Geography Theory, Socio-Technical Theory and Systems Theory are used in the theoretical framework to help explain the relationships between the constructs. To test each of the theories, a theoretical framework was conceptualised to inform the development of the research questions, the collection of the data and the analysis of the data. The extent to which the findings obtained from the data analysis are supportive of the theories provided is essential for the strength of the theoretical framework. The theoretical framework did not only serve as a guide to the data collection and analysis, it equally served as guide for the discussion of the findings. In view of this, in this chapter, the researcher discusses how the findings address the research questions by juxtaposing the findings with the vertical and horizontal relationships between the theoretical constructs and the chosen theories.

The discussion of the findings below is structured according to the four themes included in the theoretical framework.

9.1 Contribution of feeder roads to development

The views gathered from the expert and group interviews reveal a number of findings related to the theme of the contribution of feeder roads to development. From the expert interviews, it was observed that, even though feeder roads are constructed periodically, there is still a need to construct more and to maintain existing ones. It was found that the availability of good feeder roads creates employment opportunities, opens up rural communities for trade, improves accessibility and mobility through transport service availability, and facilitates the movement of people and goods. In addition, the availability of good feeder roads reduces post-harvest losses, increases the revenue of farmers and signifies rural infrastructure development. The findings reveal high levels of socioeconomic development in communities that have good roads compared to communities that have bad roads. Finally, it was identified that the provision of transport services is seen as a shared responsibility of government, private organisations and individuals.

The findings from the expert interviews were corroborated by those of the group interviews. In particular, the findings of the latter indicate that feeder roads contribute to socioeconomic development in the form of employment creation, poverty reduction, market expansion, quick and easy mobility, transport fare reduction, community network improvement and availability of transport services due to the good condition of roads. Moreover, the group interview findings demonstrate that the needs of communities with bad feeder roads and inadequate transport services were not fulfilled due to a number of factors that impacted negatively on their ability to transport goods and to move from one place to another.

The findings on the contribution of feeder roads to development answer the research question: *To what extent do feeder roads contribute to the improvement of life of people in rural communities in Ghana?* Assessment of the extent to which feeder roads contribute to development needs to incorporate the theoretical constructs developed for the study. The theoretical framework indicated that the satisfaction of basic needs such as road and transport services leads to self-actualisation or self-fulfilment. Self-actualisation is attained when people in rural communities with good feeder roads and transport services are able to access good healthcare, meet their other travel needs and engage in various socioeconomic activities. The attainment of desired goals and needs, terms of socioeconomic wellbeing, health and poverty alleviation is attributed to the fulfilment of basic needs such as the availability of good roads and transport services. Good feeder roads and the availability of transport services, to this end, are essential basic needs that enable the self-fulfilment and the improvement of the socioeconomic wellbeing of rural dwellers.

9.1.1. Access to good feeder roads and transport services as a basic need

According to the findings, the theoretical constructs of the construction of roads, the provision of transport services and access to essential services and facilities and economic opportunities are connected and interdependent. From the findings, it was observed that the construction of roads is necessary to ensuring the availability of good feeder roads. Consequently, the availability of good roads influences the provision of transport services and subsequently both the latter and former promote access to essential services and facilities and economic opportunities. This finding reveals the availability of good feeder roads to be a basic need. Indeed, the entire socioeconomic wellbeing of rural communities depends on roads, and not just any roads but good quality roads.

Access to good roads as a basic need enhances the quality of life of people in Ghanaian rural communities in diverse ways. The availability of good roads attracts good vehicles for transport services. Conversely, where the roads are bad, transport services are difficult to come by because the owners of vehicles opt for good roads to ply. Furthermore, good roads and transport services are, to a large extent, interconnected, and the latter is highly dependent on the former. As explained in the theoretical framework, the availability of good feeder roads and transport services enables people to trade time for space, and vice versa.

In order to ensure access to essential services and facilities and economic opportunities, good roads alone are not enough; there must be vehicles to facilitate the movement of rural people from one geographical area to another. However, the significance of transport services as a factor driving movement of people from one geographic area to another is somewhat hidden in the literature review.

The findings on the contribution of roads to the development of communities make clear that access to good roads is a basic need. In rural communities with bad roads, the available vehicles for transport services were unsuitable and/or few in number to the extent that the movement of people and goods from one geographical area to another was limited compared to communities with good feeder roads. The Time Geography Theory supports this finding, specifically with reference to the space-time concept, which is supportive of the importance of transport services for facilitating the movement of people and goods within specific times. Furthermore, Maslow's human needs theory confirms that good roads and transport services are basic needs.

Both the expert and group interview findings on the contribution of feeder roads to development highlight the availability of feeder roads as an essential basic need. Comparatively, the findings from the expert interviews emphasise the need to construct more roads and maintain existing roads, whereas the findings from the group interviews, whether from people with access to good or bad roads, establish a link between the condition of roads and their ability or inability to facilitate the movement of people or goods from one community to another. The triangulation of the expert and group interview findings supports the fact that good roads are essential basic needs for rural transport development, and that they help to improve the quality of life of rural people.

The evidence from the literature reviewed also affirms that good feeder roads are essential basic needs. The literature reviewed in Chapters 2 and 3 highlights the relevance of good roads to the facilitation of access to markets, healthcare, education and employment (Afukaar et al., 2019; Berg & Ihlstrom, 2019; Afukaar & Peters, 2017; Miller, 2015; Atuoye et al., 2015; Taiwo & Kumi, 2013; Arethun & Bhatta, 2012; Danso-

Wiredu, 2011; Bryceson et al., 2008; Mu & van de Walle, 2007; Cobbold, 2006; Bhatta, 2004; Porter, 2002a; 2000c). Thus, a lack of good roads will hinder this access.

Overall, by referring to the theoretical framework, the findings from this study affirm the relationship between the construction of roads and the provision of transport services, on the one hand, and access to essential services and facilities and economic opportunities, on the other hand. The finding that roads and transport services constitute basic needs that help engender socioeconomic development is affirmed by a study conducted by the DFID in Ghana, as reviewed in section 2.2.4 in Chapter 2. The DFID study and this current study both drew respondents from rural communities, and both collected data via group interviews with different categories of respondents who lived in rural communities. Where this study collected data from the Awosoaso, Abokoase, Subriso, Tuobodom and Offuman communities, the DFID collected data from the Adabra, Sampa, Lome, Abora and Aworabo communities. Supporting the findings of the present study, evidence from the DFID study suggests that rural people are unable to transport goods to markets due to the bad nature of their road networks and the inadequate transport services.

In the next section, another finding related to the contribution of roads to socioeconomic development is discussed.

9.1.2 Importance of road and transport services in facilitating self-actualisation

The theoretical framework posits that the attainment of self-actualisation is realised through poverty alleviation, good health, socioeconomic wellbeing, sustainable infrastructure development and industrialisation, and sustainable rural community development. Poverty alleviation is achieved where people can access social and economic opportunities that provide them with income and reduce their spending. Such economic opportunities include access to markets to enable people to trade and access to employment opportunities. Reduced spending is enabled by several factors such as a reduction in production costs, a reduction in the cost of transport, and a reduction in the cost of general goods and items. Likewise, good health is attained where people can access good healthcare services in hospitals, clinics and other community health centres. In addition, people need to travel from one place to another for various reasons and their ability to do so will improve their socioeconomic wellbeing. Road and transport development enables resilient infrastructure development, which in turn supports industrialisation, and consequently sustainable rural community development. Furthermore, the theoretical framework suggests that the satisfaction of needs such as access to road and transport services is fundamental to the attainment of self-actualisation. That is to say, poverty alleviation, good health, socioeconomic wellbeing, sustainable resilient infrastructure development for industrialisation, and building sustainable rural communities are all dependent on accessibility and mobility.

The findings on the contribution of roads to development reveal that the availability of good feeder roads creates employment opportunities, opens up rural communities for socioeconomic trade, improves accessibility and mobility through transport service availability, facilitates the movement of people and goods, reduces post-harvest losses, increases the revenue of farmers and signifies rural infrastructure development. For the purposes of the analysis, these findings are grouped into five categories (contribution of roads to poverty alleviation, contribution of roads to good health, contribution of roads to socioeconomic wellbeing, contribution of feeder roads to infrastructure development and industrialisation, and contribution of feeder roads to sustainable rural community development), as depicted in the theoretical framework.

9.1.2.1 Contribution of roads to poverty alleviation

Poverty alleviation is essential to the attainment of SDG 1 (No poverty). The literature reviewed in Chapter 2 of this study suggested that one of the main causes of poverty in rural communities is isolation, which is the consequence of a lack of accessibility and mobility in rural communities. In Chapter 3, the literature reviewed also indicated that a lack of accessibility and mobility implies poor feeder road infrastructure and non-existent transport services, which deprives rural communities of the necessary socioeconomic opportunities that are available to people in urban areas where such transport services abound.

In relation to socioeconomic implications, both the experts and rural people interviewed acknowledged the extent to which good feeder roads contribute to socioeconomic development and improves the quality of life of people. The significance of feeder roads was identified during both the expert interviews and the group interviews. The responses on this subject included mention of employment creation, a reduction in spending, the quick and easy movement of people and goods, and the improvement in rural community networks. According to the respondents, fundamental to the significance of improved accessibility and mobility is that it results in poverty alleviation, and consequently improvements in the quality of life of rural people.

Without good feeder roads, socioeconomic advantages such as employment and reduced spending are difficult to attain; yet these advantages are the norm in communities with good feeder roads. In addition to good feeder roads, the availability of and access to transport services is another important factor cited by the experts and respondents from rural communities. This finding affirms the interrelatedness of the concepts of accessibility and mobility in that, without good feeder roads, rural transportation is difficult. Thus, regardless of the condition of feeder roads, there is a need for an effective means of transportation to enable people access essential social services and economic opportunities.

Based on the findings, it can also be noted that the relationship between accessibility and mobility is linear. That is, the availability of and access to fast and convenient transport services (mobility) are reliant on the availability of good feeder roads (accessibility). In other words, the good condition of feeder roads fundamentally paves the way for various transport services to support the timely movement of people and goods from one place to another. This probably explains why communities with good feeder roads, compared to those with bad roads, had reliable vehicles that enabled them to carry out various socioeconomic activities.

Employment creation is associated with the emergence of and ability to engage in various forms of economic activities by rural people, such as buying and selling along rural roads. The findings indicate that drivers and commuters promote employment at various transport terminals and small market centres along feeder road corridors, revealing that motorable feeder roads contribute to the creation of employment. Both commercialised and private vehicles use motorable feeder roads to transport people and goods. In the event of slow-moving traffic, rural people take advantage of the situation to generate some form of income by engaging in various forms of trade that target drivers and passengers, as reported in the findings. In contrast, in communities with poor roads, economic activities like buying and selling along the roads were lacking. This may be due to the bad condition of the roads, which serves as a disincentive to commercial drivers and vehicle owners plying such roads. This impedes engagement in socioeconomic activities in such communities, thereby contributing to poverty.

In Ghana, people who reside in rural communities generally have lower incomes than urban dwellers due to the nature and type of economic opportunities available in rural areas. Given their lower income levels, rural people are more impacted by additional expenses or the high cost of services. In this regard, respondents from communities with bad roads reported that, where feeder roads are in poor condition, affecting transport service availability, rural dwellers are forced to pay high transport fares that they can ill afford, further reducing their disposable incomes. On the reverse, communities with motorable roads attract transport services, making the supply of such services (transport service availability) exceed the demand. This discourages transport service operators from charging exorbitant fares. The resultant lower transport fares, and the concomitant greater stability in transport fare charges, thus reduce the extra spending required of rural people. Importantly, this reduced spending on transport fares means that such monies can be used to cover other essential activities to improve the lives of rural people.

In situations where poverty is reduced or eradicated, people can have a good quality of life, and ultimately achieve self-actualisation; the converse is the case when poverty has occurred due to isolation. Isolation can be described as a social canker as it marginalises and deprives rural people of important external socioeconomic opportunities, eventually leading to abject poverty.

The findings of this study on the links between roads and poverty alleviation are strengthened by empirical findings identified in the literature reviewed in Chapter 3, under section 3.3.1. Two studies on rural roads and poverty alleviation, one carried out in China by Fan and Chan and the other conducted in India by Mohapatra and Chandrasekhar, affirm the availability of road and transport services as important factors contributing to the alleviation of poverty (Mohapatra & Chandrasekhar, 2007; Fan & Chan, 2004).

In Ghana, similar findings on the significance of roads for poverty alleviation were found by Adom-Asamoah (2016), as discussed in section 3.3.1. Both the current study and Adom-Asamoah's research found that the availability of good roads increases the likelihood of attracting a range of transport services and reducing the cost of transportation. Both studies collected data from the Brong Ahafo Region of Ghana and focused on feeder roads. However, compared to the present study, Adom-Asamoah's work assessed the impact of road investments on poverty reduction and the achievement of the MDGs on education and health (Goals 2 and 5), which correlate to SDG 3 (Good health and wellbeing) and SDG 4 (Quality education). On the other hand, this research assesses the impact of road and transport infrastructure development in relation to SDG 1 (No poverty), SDG 3 (Good health and wellbeing), SDG 4 (Quality education), SDG 9 (Industry, innovation, and infrastructure), SDG 11 (Sustainable cities and communities) and SDG 13 (Climate action).

9.1.2.2 Contribution of feeder roads to good healthcare

Good healthcare is among the main indices of development and is captured as an SDG, specifically Goal 3 (Good health and wellbeing). In Ghanaian rural communities, most healthcare centres and hospitals are situated at some distance from rural communities, which makes accessibility and mobility crucial to enabling the good health and wellbeing of rural people. In this context, accessibility and mobility entail the ability of people to not only get to health centres and access their services, but also to access reliable and efficient means of transport to travel the shortest possible time to these health centres. Hence, what is most important is access to a good road and a reliable and an efficient means of transport.

The findings on the contribution of feeder roads, especially those from communities with bad feeder roads, highlight the ordeals that people must endure in order to access good healthcare. Bad feeder roads limit the possibility of attracting reliable and convenient transport services. The numerous potholes on poor roads are a hindrance to mobility, and make driving on such deplorable roads an unpleasant experience. For instance, vehicles plying these roads are forced to slow down considerably or meander, sometimes hitting a pothole. Consequently, transporting people on such roads engenders stress, physical discomfort and other health challenges. The situation is aggravated when people with emergency health-related issues, like pregnant women in labour, must be transported on such roads to health centres or hospitals. In some instances, road accidents and adverse health impacts occur in the process, as stated in the findings.

In contrast, access to healthcare services seems to be better in communities with good feeder roads and transport services. The availability of good feeder roads attracts various transport services, thereby supporting access to healthcare services. Specifically, good feeder roads enable fast and smooth vehicular travel and cause few health complications for people travelling on them. Considering the significance of feeder roads and transport services to access to good healthcare, it is safe to claim that the availability of motorable roads and appropriate vehicles to meet the various transport needs of road users is a vital factor in the provision of access to rural healthcare services.

Evidence from the literature reviewed in Chapter 2, section 2.2.2, supports the finding of this study on the relevance of road and transport services (accessibility and mobility) in promoting good healthcare. As revealed in the literature, a lack of accessibility and mobility has impeded good healthcare in rural communities in countries such as Tanzania, Egypt and Morocco (Ellis, 1997; Airey, 1992; Howe & Roberts, 1984). Similarly, the findings of this research from communities with bad roads and bad transport facilities clearly highlight the prevalence of certain issues impacting access to healthcare, such as delays and difficulties related to travel.

The findings of the present study provide support to the relationship between the theoretical constructs indicated in the theoretical framework. The attainment of good health and the ability to access healthcare centres are mutually dependent, just as ability to access healthcare centres is dependent on the availability of good roads and transport services. The availability of good roads and transport services is an essential basic need (Maslow's Hierarchy of Needs Theory) that enables people to travel from one place to another, such as to and from home to a healthcare centre (as explained by the Time Geography Theory).

9.1.2.3 Contribution of feeder roads to socioeconomic wellbeing

Socioeconomic wellbeing is discussed in relation to feeder roads and their role in promoting the easy and convenient movement of people and goods to and from social and economic centres such as schools. Access to socioeconomic centres is necessary for rural development, as socioeconomic development is a problem in rural communities, especially in Sub-Saharan African countries. In view of this, people move to and from one community to another in order to engage in social and economic. Depending on the nature of roads and the availability of transport services, such quests may either be hassle-free and convenient or difficult and problematic.

The significance of access to roads and appropriate vehicles for transport in the promotion of socioeconomic wellbeing has been well noted in this study. In Offuman, Tuobodom, Awosoaso, Subriso and Abokoase, people travelled within and from communities to engage in socioeconomic activities, such as to attend school, access healthcare, transport farm produce and transport people to work. A finding on the contribution of feeder roads to development is that most feeder roads in the rural communities studied are in a deplorable state and lack appropriate and suitable transport services.

The fact that communities with bad roads lack appropriate means of transport confirms the relationship between the availability of good roads and access to transport services.

As explained by the Hierarchy of Needs Theory and Time Geography Theory, the availability of roads and access to transport services are essential needs for people to be able to move from one geographical location to another (trade time for space) within a specific time period. It is, however, not surprising to find that people complain about their inability to travel and transport goods in communities that have bad roads.

The relationship between theoretical constructs such as roads and transport services, access to socioeconomic centres and socioeconomic wellbeing indicated by the findings of this study are further supported by the literature reviewed in Chapter 2, section 2.2 and in Chapter 3, section 3.3. The literature demonstrates that access to socioeconomic centres and attainment of socioeconomic wellbeing are as a result of the availability of roads and transport services (Afukaar et al., 2019; Berg & Ihlstrom, 2019; Afukaar & Peters, 2017; Miller, 2015; Atuoye et al., 2015; Taiwo & Kumi, 2013; Arethun & Bhatta, 2012; Danso-Wiredu, 2011; Bryceson et al., 2008; Cobbold, 2006; Bhatta, 2004; Porter, 2002).

The availability of roads and transport services not only improves access to education but also allows people in rural communities to access quality schools, quality teaching and quality learning materials (SDG 4: Quality education). As reviewed in Chapter 2, section 2.2.1, this improved access to quality education support the development of human and social capital in the form of skills, talent and knowledge (Miller, 2015; Chigbu, 2013; Agyemang, 2009; Haines, 2009; Cobbold, 2006).

9.1.2.4 Contribution of feeder roads to infrastructure development and industrialisation

The theoretical framework explains that the availability of quality roads has a direct impact on transport service development, and this is well supported by the findings of this study. Likewise, the availability of a good road network and transport services promotes infrastructure development. In accordance with the United Nations sustainable development agenda for the year 2030, sustainable infrastructure development of roads and transport services is necessary for building resilient infrastructure, promoting sustainable industrialisation and fostering innovation, which are pivotal to the attainment of SDG 9 (Industry, innovation and infrastructure).

Road and transport infrastructure development is also essential to enabling national integration through the stimulation of rural and urban trade. Agricultural produce, industrial goods and human resources can be easily traded between rural communities and between rural and urban communities where there is access to good roads and transportation. Conversely, as indicated in the findings, the trade activities of communities with bad roads are restricted. Road and transport infrastructure development is significant in achieving SDG 9 (Industry, innovation and infrastructure); therefore, in a country such as Ghana, where road transportation accounts for more than 60% of its internal freight, the importance of such infrastructure development in road and transport services cannot be overemphasised.

Road and transport infrastructure development is also required to support sustainable industrialisation. The availability of essential infrastructure such as roads, transport and energy is a determinant of a community's or country's attractiveness to local and foreign direct investment. Road and transport infrastructure development increases cost efficiency, ensures the easy transport of industrial material, and improves access to markets for productive resource and industrial output.

Most countries in Africa, including Ghana, are focused on bridging the wide deficit gap between agriculture (the production of raw material) and industry (the processing of raw material into finished products). In Ghana, efforts in this area to date, such as reducing taxation and promoting easy business registrations, challenges such as a lack of adequate road and transport infrastructure and energy persist. These problems are the result of inadequate funding for infrastructure development, a lack of research that drives innovation and government's inability to implement methods that build resilient infrastructure.

As indicated in the findings, the development of road infrastructure is funded by the Government of Ghana. Yet such funding is often limited and sourced through the mobilisation of tax revenue, and may be supported by loans and grants provided by donor partners like the World Bank and the IMF. Such limited funds are usually allocated to the road sector to finance the construction of new roads and the periodic maintenance of road networks. Given the limited funding provided, some of the roads constructed, particularly bitumen sealed and gravel roads, turn out to be non-resilient and unsustainable to the impacts of climate change, such as extreme heat and torrential rainfalls. This suggests that such funds should be channelled towards improvements in the quality and resilience of road infrastructure for climate change adaptation. Preventing the effect of climate change on road infrastructure development is needed for the attainment of SDG 13 (Climate action).

The design and construction of roads that are resistant to climate change is required in Ghana to save money and reduce the additional financial burden of road reconstruction and maintenance activities, as indicated in the literature reviewed in Chapter 3 (UN ECOSOC, 2017; Twerefou et al., 2015; World Bank, 1996). Again, design and construction of roads that are resistant to climate change is very crucial as literature has warned of annual temperature increases in all regions of Ghana; specifically, an increase of 0.8^0c by the close of 2020 and an increase of 5.4^0c by the end of 2080 (World Bank, 1996; Environmental Protection Agency (EPA) et al., 2000).

As found in this study and supported by the Hierarchy of Needs Theory and Time Geography Theory, the relationships between road and transport service development and infrastructure development and between infrastructure development and stimulating industrialisation are direct and causal. The Hierarchy of Needs Theory posits road and transport service development as an essential need that is fundamental for promoting and measuring sustainable infrastructure development. Likewise, the Time Geography Theory helps explain the critical role of transportation services in facilitating sustainable industrialisation.

The relationship between road and transport service development and the promotion of infrastructure development, as found in this study, is affirmed by the literature reviewed in Chapter 2, section 2.2, and the literature reviewed in Chapter 3, section 3.3. In Chapter 2, for example, a study conducted by the UN ECOSOC (2017) established a positive link between road and transport service development and sustainable infrastructure development. In addition, various studies reviewed established a connection between transportation development and economic growth (Cigu et al., 2018; Dang & Sui Pheng, 2015; Pradhan & Bagchi, 2013; Sahoo & Dash, 2012; Stephan, 2001). These studies identify the significance of road transportation in terms of the promotion of trade, the reduction of the cost of doing business and the facilitation of access to markets, all of which have direct and indirect impacts on industrialisation.

9.1.2.5 Contribution of feeder roads to sustainable rural community development

Sustainable rural community development is an essential component of SDG11 (Sustainable cities and communities). Developing sustainable cities and communities entails efforts and initiatives on many fronts, including creating career and business opportunities, keeping cities and communities alive through opportunities that promote migration, and opening up cities and communities through infrastructure development.

The theoretical framework posits a causal relationship between road and transport service development and the development of sustainable rural communities. This relationship is also well supported by the Hierarchy of Needs Theory and Time Geography Theory, specifically in terms of the need to develop transportation infrastructure. Significantly, the availability of roads and transport services creates employment, promotes access to education and markets, stimulates migration from one community to another and opens rural communities to urban communities. The significance of road and transport services was identified in both the expert and group interview findings. Both sets of findings triangulate each other, particularly on the significance of roads to the creation of employment and business opportunities and for migration.

The literature corroborates the findings of this research on the contribution of feeder roads to sustainable rural community development. Studies conducted by Berg and Ihlstrom (2019), Afukaar (2017), Beans (2015) and Smith et al. (2001), outline the significance of road and transport services development in terms of creating employment and business opportunities and enhancing migration in rural communities.

The findings on the types and suitability of vehicles and IMTs on feeder roads are discussed in the next section.

9.2 Types and suitability of vehicles and IMTs on feeder roads

The discussion of the findings on the types and suitability of vehicles and IMTs on feeder roads is geared towards answering the research question: *What types of vehicles and IMTs may be used by people in rural communities in Ghana and how suitable are they to address the transportation needs of these communities?* As outlined in the theoretical framework, improved rural transportation rests on the availability of good roads and vehicles for transport services. In relation to vehicles, the emphasis is not merely on access to any vehicle, but access to efficient and suitable vehicles and IMTs. The type of vehicle and IMT used is important in view of the fact that the type of vehicle used influences the nature of the travel (movement of people and goods) and the ability to access socioeconomic centres within a specific timeframe. Ultimately, the ability of people to access socioeconomic centres affects their socioeconomic development (self-actualisation).

The findings from the expert and group interviews on the types and suitability of vehicles and IMTs on feeder roads revealed that various types of vehicles are used to meet people’s transport needs on feeder roads in Ghana. As raised earlier, it was discovered that the availability and use of vehicles are dependent on the nature of feeder roads. Moreover, it was found that the communities with good feeder roads had access to various motorised conventional vehicles and IMTs, whereas communities with bad roads mainly had access to non-motorised vehicles and IMTs. It was also found that in communities where vehicle availability was a problem, there was inappropriate usage or misuse of vehicles for transportation. Additionally, it was found that the use of IMTs helped relieve the hardship that the rural folks face in transporting farm products, it also improved their health as they would have carried the products in the absence of IMTs, and reduced travel time spent on transportation. Finally, the experts recommended the promotion and use of motorised tricycles as IMTs in communities where transport services were lacking.

This section discusses the various types of motorised and non-motorised vehicles and IMTs found in Ghana, and considers their suitability and effectiveness in addressing the transportation needs of rural people. The discussion also looks at how the availability of vehicles (as a construct) is influenced by other constructs or affects other constructs in the theoretical framework. The discussion is organised under headings reflecting the various constructs, to enable the researcher to address the research question by outlining the relationship between the constructs.

9.2.1 The nature of roads and its impact on the availability of motorised vehicles and IMTs

The theoretical framework explains that the construction and maintenance of roads and the provision of transport services are essential basic needs in the promotion of and access to socioeconomic centres. The construction and maintenance of roads are necessary in ensuring the availability of good roads, whereas the provision of transport services ensures the availability of efficient and suitable vehicles, particularly motorised vehicles and motorised IMTs. Earlier discussions (section 9.1.1) stressed the importance of and relationship between the good nature of roads and the availability of transport services. In turn, an effective and reliable transport service is influenced by the availability of suitable and efficient vehicles or IMTs. In this section, the discussion focuses on the relationship between the nature of roads and the availability of efficient and suitable vehicles for rural transport services.

The findings from both the expert interviews and group interviews provided corroborative insights into the types of vehicles and IMTs used based on the nature of feeder roads in the communities. Indeed, it was clear that the nature of feeder roads plays an influential role in determining the types of vehicles and IMTs available in the community. It was noted that in communities with good feeder roads, the people had access to various motorised vehicles for both private and commercial transport; whereas in communities where the roads were in poor condition, non-motorised vehicles were more often owned by individuals and used for transport purposes.

Considering the types of vehicles and IMTs found in communities with good feeder roads and the types of vehicles and IMTs found in communities with bad roads, it can be assumed that the surest way to provide vehicles for rural transport is to ensure that feeder roads are in good condition. That notwithstanding, it would also not be entirely wrong to suggest that constructing new roads and maintaining them will not guarantee access to the vehicles required to meet the transport needs of a community. This is because providing adequate transport services to a community depends not only on the nature of feeder roads but also on other factors such as the cost of vehicles, ownership, constraints to the operation of commercial vehicles and transport service regulation challenges, as observed in the literature reviewed in Chapter 3.

Ideally, a road must have the best of vehicles to ply on, to maximise the convenience and efficiency of transportation and to facilitate access to socioeconomic centres. However, more suitable and efficient vehicles like cars, vans and buses are only available in communities where the roads are good. It is therefore not surprising that people living in communities with poor roads lament over their inability to live fulfilling lives. The relationship between the constructs of good roads, the availability of suitable and efficient vehicles, the ability to access socioeconomic centres, and socioeconomic development or improved quality of life is causative and interrelated.

The relationship between the nature of roads and the availability of vehicles found in this study is affirmed by other empirical reviews. From the literature, a study conducted by Danso-Wiredu in the West-Akim District of the Eastern Region of Ghana identified a relationship between the nature of roads and the availability of vehicles for transport services. Similarly, Naazie et al. (2018) confirmed that poor roads affect the availability of vehicles and the suitability of transport services in the Gushegu District of the Northern Region of Ghana. Moreover, Adom-Asamoah (2016) initially established a relationship between the nature of roads and the availability of vehicles for transport services and then discovered a relationship between the availability of transport services and access to socioeconomic centres, and finally between access to socioeconomic centres and socioeconomic wellbeing. Thus, as established in this study and in the literature, all of these constructs are interrelated (Afukaar et al., 2019; Afukaar & Peters, 2017).

In the next section, the next finding on the types and suitability of vehicles and IMTs on feeder roads is discussed.

9.2.2 *Importance of motorised vehicles and IMTs in supporting socioeconomic development*

There are various types of vehicles and IMTs such as motorised tricycles, motorcycles, buses/vans, tractors, taxis, cars, wheelbarrows, bicycles, donkey carts and four-wheel push carts found in communities with good feeder roads and communities with bad feeder roads. These motorised and non-motorised vehicles and IMTs are used for numerous private and commercial transport activities with little consideration of their suitability and effectiveness, probably because of factors such as availability, cost and affordability of vehicle services. As evidenced in the findings, in making use of what was available, people often used a range of vehicles that were unsuitable to transport people and goods or to undertake farming and construction activities. Where appropriate vehicles are available, users can choose a suitable vehicle that meets their transportation needs. When the right vehicle is used for the right activity, efficiency is assured, in contrast using vehicles that are unsuitable and inappropriate.

As listed in Table 8.10 in Chapter 8, the types of vehicles used in the communities are categorised according to the activities for which they are suitable. Thus, the vehicles are grouped under the following activities: (1) the transportation of people, (2) the transportation of goods, (3) farming and (4) construction. However, this categorisation of vehicles had some limitations. Vehicles such as motorised tricycles, motorcycles, buses/vans, taxis, cars and bicycles were considered by the respondents for transporting people without consideration for certain factors such as distance of travel, speed of vehicle or category of user. Similarly, vehicles such as wheelbarrows, donkey carts, tip trucks, flatbed trucks and four-wheel platform push carts were identified by the respondents as suitable for transporting goods, without taking into account the loading capacity of vehicles, the distance to transport goods, the size and volume of goods, or the speed and durability of the vehicle when loaded.

The types of vehicles available and their suitability influence the movement of people from one place to another. The availability of motorised vehicles and IMTs facilitates movement and travel, such that a person can undertake a number of trips within a given timeframe. In contrast, when non-motorised vehicles are the only form of transport available, travel activities are slowed, reducing the number of trips a person can take within a given timeframe. The use of motorised vehicles also saves the time spent on travel, freeing up time for people to spend on engaging in other socioeconomic activities. Furthermore, where comfort is reduced and stress is increased as a result of the type of vehicle used – more likely in the case of non-motorised vehicles – people's desire to travel to engage in various forms of socioeconomic activities is diminished.

The type of vehicle used influences access to socioeconomic centres and consequently the attainment of self-actualisation. For instance, a farmer has more need for a cargo car than a bicycle or motorised tricycle. A farmer's ability to transport their farm produce to the market means that they will be able to sell the produce and make some income, which will enhance their quality of life. In contrast, in situations where farmers are unable to transport their produce to the market because they lack a suitable vehicle, they will likely suffer a loss of income, which will in turn affect their quality of life.

Motorised vehicles and motorised IMTs are useful for transport services in rural communities as indicated in the theoretical framework. The motorised and non-motorised

IMTs are suitable for various transportation purposes and users. Motorised vehicles or IMTs are convenient, less stressful to use, have high resistance on bad roads, have high loading capacity, can reach higher speeds and are suitable for both long and short distance travel, as indicated in the literature reviewed in Chapter 4, under section 4.4.5. One further consideration is that motorised vehicles are more expensive to use than motorised IMTs.

Motorised IMTs are very popular in Ghana, especially in the north of the country. Motorised IMTs are preferred because they are affordable to purchase and have good fuel economy compared to other vehicles. The lower purchasing cost and lower fuel consumption of IMTs reduces the fares charged for commercial transport via this means. Similarly, previous research, as identified from the literature review, confirms that IMTs are economical to use.

Although the present research did not aim to cover vehicle ownership and its impact on rural transport specifically, it was evident from both the expert and group interview findings that ownership plays a significant role in determining which vehicles are available in communities. An important reason for this is that there are some vehicles that communities or people can afford to purchase without external support, especially from government. Most of the vehicles for which people required assistance to purchase are the motorised. In such situations, it is prudent, if not a necessity, for both government and the private sector to intervene by providing financial assistance for the purchase of vehicles. Government intervention may also come in the form of subsidies to assist individuals and groups to own needed motorised vehicles and IMTs. This is necessary to bridge the gap between private ownership and public ownership of vehicles as well as between private commercial transport operation and public commercial transport use in rural communities.

Government provision of vehicles for rural transport services is necessary as evidence from this study shows that the reliance on the private sector to provide transport services to deprived and remote communities has often not proved successful. Poor and deprived communities are often isolated, with little or no access to motorised and non-motorised forms of transport (Witkiss et al., 2001). The government could intervene by promoting the use of and providing IMTs to such communities. Government intervention coupled with private sector support would augment rural transport services, and ensure access to a range of transport services for people to choose from.

Government intervention may also take the form of transport policy. In Africa, rural transport policy and strategy documents have been prepared in countries such as Tanzania (Ministry of Transport and Communication, United Republic of Tanzania, National Transport Policy, 2002), South Africa (Republic of South Africa, Department of Transport, 2007), Nigeria (Nigeria Federal Ministry of Agriculture and Rural Development, 2013) and Uganda (Republic of Uganda, Ministry of Works and Transport, 2013). Government intervention through policy development can focus on the need to build other transport infrastructure and services such as railway and water transportation. In this regard, the railways network and transport service in Ghana is inefficient, outdated, limited to a very few areas and consists mostly of single lines. Likewise, most of the water bodies have been raided by vegetation and the few that are reliable are traversed by canoes providing transport services. The development of world-class railway and water transport infrastructure and services requires a great deal of funding, which is not an attractive proposition to the government. Although such initiatives would be very expensive, effective policy could mitigate the situation by attracting the necessary funds from the private sector. Such policy must also provide a legal framework and business regulations that are transparent, simple, stable and can support profitable investment. In investments where huge capital is required, the government may find it more appropriate to source funding and provide such infrastructure through public–private partnerships. Policy interventions could also focus on how the country's vast energy resources like hydro and solar can be utilised to provide transport services that are sustainable and affordable. Furthermore, rural transport could be improved through the use of electric IMTs that use solar energy to recharge, which would require the development of necessary infrastructure like electric and solar filling stations. The government could also consider how development in the telecommunications industry might be utilised to provide sustainable and efficient rural transport services.

When the (essential) need for readily available vehicles is satisfied, access to socioeconomic centres will also be enabled, as indicated in the theoretical framework. In this regard, a good transport service requires a range of vehicles that are efficient and suitable for multiple purposes such as farming, transporting farm produce, transporting people, and emergency transport, and for both short- and long-distance travel.

In the next section, the findings on feeder road appraisal models are discussed.

9.3 Discussion of findings on feeder road appraisal models

According to the findings, the appraisal models adopted by the Department of Feeder Roads in Ghana consider the construction and maintenance of roads and the growth of vehicles, but do not make provision for vehicles for transport services. The appraisal models used assess a road construction project in terms of: (1) the economic benefit to users, (2) the scale of impact, (3) geographical area considerations, (4) political considerations, (5) the internal rate of return, and (6) the social benefits.

The findings on feeder road appraisal models answer the fourth research question: *How are feeder road investments appraised to meet the accessibility and transport needs of people in rural communities in Ghana?* To answer this research question, the theoretical framework established the role of various stakeholders and actors who are expected to perform actions and activities to ensure the availability of good roads and transport services. The actions and activities are performed with a view to fulfilling the social and economic needs of rural people and, ultimately, enabling people to achieve self-fulfilment and socioeconomic wellbeing. These stakeholders and actors include the Government of Ghana, the Ministry of Roads and Transport, the Department of Feeder Roads, private transport service unions and rural people, all of whom must collaborate to ensure the availability of roads and transport services. The activities to be performed by these stakeholders and actors are financing, planning, construction, maintenance, the provision of vehicles for transport, and the regulation of transport services.

Assessment of the economic benefits of roads to users is one of the models used to appraise feeder roads in Ghana. This model, according to the findings, gives priority to agricultural production, and therefore assesses the extent to which a road's construction, rehabilitation and maintenance promote economic development in food production areas. This type of appraisal model is one of the oldest used in Ghana and is best described as the Consumer Surplus Approach and Producer Surplus Approach, as explained in the literature reviewed in Chapter 3, section 3.5.5.2. This appraisal model is based on the concept that high transport costs impact production costs and production yield. The economic benefit of road to user has some elements of the CBA discussed in literature reviewed in section 3.5.1, insofar as the economic benefit is derived from a road that is constructed at a cost. However, its point of deviation from the CBA has to do with its focus on the direct benefits of the road to the community, by identifying, converting into monetary terms, and calculating the conceivable gains and losses of a proposed road construction and comparing it to the community benefits that will be derived from the construction of the road, in order to decide whether the proposed road is necessary. This appraisal model also embraces aspects of the RED appraisal model, specifically, by carrying out economic evaluation of low-volume roads and capturing the economic benefits of roads.

The economic benefit to user model as described in Ghana is biased towards those rural communities that are not located in agriculture production areas. Moreover, compared to the Integrated Rural Accessibility Planning Model reviewed in Chapter 3, this model focuses solely on road infrastructure without giving equal priority to vehicular availability to harness transport services. The economic benefit to user model is based on the premise that transport services will emerge once a road is constructed. Empirically, there is evidence to support the assertion that transport services will develop as roads are constructed. However, there is also empirical evidence that most conventional transport services face several challenges that render them unreliable; hence, there is a need for appraisal models that capture all of the factors shaping rural transport.

It is the responsibility of the Government of Ghana, acting through the DFR, to construct, maintain and rehabilitate feeder roads. The findings of this study reveal that more feeder roads have been constructed in recent years but that a lot more need to be constructed. In addition, the findings demonstrate that some rural roads in Ghana are in good motorable condition, while others are in poor condition. The government, acting through the Department of Feeder Roads as well as other international actors, is required to ensure that good roads and transport services are available to promote accessibility and mobility. In some areas, roads are bad and transport services are unavailable and inadequate because there is a lack of interaction among key actors and stakeholders in rural road transport planning.

This finding indicates that whereas the rural people are not consulted about their road and transport needs, the Ministry of Transport and the Department of Feeder Roads do not interact with each other at any level regarding road infrastructure and transport service development for rural people. Because this vital collaboration (a major feature of the Socio-Technical Theory) is lacking, room is created for rural transport challenges to emerge – in the form of bad roads and inadequate vehicles for effective rural transport services. It is therefore not surprising that most of the experts interviewed in this research recommended a merger between the Ministry of Transport and the Department of Feeder Roads. Such a merger might better enable the design of social and technical systems to work in tandem in rural transport planning. This would also ensure that feeder road appraisal models are designed to achieve optimisation in rural transport planning, which would pave the way for possible collaboration with a broader range of stakeholders such as the World Bank, the Ghana Private Road Transport Union and the vehicle owners associations in the road and transport sector around rural transport planning. Such collaborations are needed to comprehensively discuss rural road and transport issues and the planning of rural transportation.

In other words, effective interaction and coordination will pave the way for a more holistic appraisal that focuses on structures and methodologies for promoting rural transport. This will ensure that roads that respond to the socioeconomic needs of people will be constructed and regularly maintained and that the required transport services will be provided to enable people to travel and transport goods from one geographical area to another.

Unlike the economic benefits to user model, the scale of impact model analysis of roads is based on its socioeconomic impact on the rural population. That is, it addresses how the road aids the rural population to access healthcare, education and market centres. This model can be classified under the economic analysis and prioritisation of rural roads models (Chamorro-Gine, 2012) and shares some similarities with the Rural Access Index Model reviewed in Chapter 3, particularly in terms of socioeconomic analysis. The model prioritises rural isolation and focuses on the need for access and mobility to reduce poverty and facilitate access to healthcare and socioeconomic wellbeing in deprived communities (Roberts et al., 2006). The scale of impact model does not attach much significance to efforts that promote mobility, such as ensuring that reliable, suitable and efficient vehicles are available.

The internal rate of return (IRR) model, according to the findings, requires that data are gathered on activities on roads prior to their construction and renovation and later compared to data collected after such roads have been built and refurbished. This data comparison is used to assess whether there have been any change in socioeconomic activities on the road as a result of construction or renovation. However, in the assessment of any change in activities, transportation, which is a major determinant of such activities, is not considered under IRR. The model shares some aspects of CBA, since both conduct ‘ex-ante’ and ‘ex-post’ analysis (Boardman et al., 1994) and compare the results.

According to the findings, the appraisal of roads is sometimes influenced by political considerations. The appraisal of roads might be influenced by agitation from people seeking to have the concerns of their community addressed by government or shaped by the political agendas of incumbent political parties seeking to win votes. Whatever the motivating factor, roads have socioeconomic significance; so, where political agendas are a significant factor, bias is unavoidable since roads may not then be constructed, rehabilitated or maintained in communities without political affiliations. The roads influenced by political considerations, like the other models used in Ghana, does not consider all of the aspects of or factors shaping rural transport. In view of that, roads may be constructed, yet the required vehicles to ply them may be unavailable, making mobility a challenge in the corresponding communities. In addition, such roads may not be adequately maintained when political power changes hands. Of course, road appraisal models should be devoid of politics, and instead be geared towards finding an approach that is capable of addressing rural transport issues and promoting modernisation and development.

Very significant and common to all the appraisal models is their emphasis on roads as a basic need, required to ensure accessibility, which in turn supports socioeconomic development, as explained in the theoretical framework. The theoretical framework establishes a link between the availability of roads and accessibility, as captured in all the road appraisal models used in Ghana, which recognise that the availability of roads enables people and goods to be transported from one geographic location to another. Although the models do not provide for adequate transport services, ensuring access to good roads will always attract some transport services, which enable people to have access to socioeconomic centres and opportunities that are lacking in their communities. Consequently, the ability of people to access socioeconomic opportunities such as market, employment, healthcare and education will manifest in the achievement of self-actualisation and improve their quality of life – as evidenced in this study in the communities that have good roads. However, the existence of good roads does not ensure the provision of the required transport services and thereby the resultant socioeconomic benefits for the relevant communities. Thus, road appraisal models should always factor in the provision of transport services.

The findings on feeder road accessibility and mobility challenges are discussed in the next section.

9.4 Discussions on feeder road accessibility and mobility challenges

The findings on feeder road accessibility and mobility challenges answer the third research question: *What are some of the challenges associated with accessibility and mobility along feeder roads facing rural communities in Ghana?* In order to discuss the findings, they need to be finetuned according to the theoretical constructs indicated in the theoretical framework. As explained in the theoretical framework, the construction of good roads and the provision of motorised vehicles and IMTs for transport services are dependent on the actions (and inaction) of rural transport stakeholders such as the Government of Ghana (acting through the Department of Feeder Roads and the Ministry of Transport), private institutions, private organisations and individuals. The availability of good roads and access to motorised vehicles and IMTs is crucial in facilitating access to socioeconomic activity and essential services such as healthcare and market centres, and this leads to self-actualisation and improvement in the quality of life of rural people. The availability of good roads and access to motorised vehicles and IMTs for transport services together represent the most fundamental construct and also the focus of the discussion of the challenges associated with accessibility and mobility along feeder roads in rural communities in Ghana.

The evidence from the expert and group interviews revealed several independent but interrelated factors that can inform understanding of rural transport challenges. These factors are classifiable into either rural road challenges or transport service challenges. The rural road challenges relate to the bad nature of road infrastructure, whereas the rural transport challenges identified by the experts include legislative instruments inhibiting the adoption of IMTs, a lack of commitment from transport regulatory bodies and organisations, certain challenges linked to the provision of vehicles and IMTs, and issues impacting the acceptance and usage of IMTs by rural people. Others include inadequate vehicle and IMT maintenance service providers on rural roads and in rural communities and inadequate access to vehicle spare parts in rural communities.

Similarly, the rural transport service challenges raised by the group interview participants were persistent increases in rural transport fares, the unavailability of appropriate transport vehicles and IMTs, the high cost of motorised vehicles and the inability of rural people to own transport vehicles due to financial constraints. The major consequences of these road and transport challenges identified in the study include increased transport fare charges, the low prices offered on the sale of farm products, post-harvest losses, the risk of robbery attacks and crimes while on the road, and the unavailability and/or untimely access to healthcare services in emergency situations.

Such rural road and transport services challenges raise questions about human actions and the actors whose roles are significant in addressing these challenges. The existence of such challenges is an indication that actors – which in this context include government, private organisations (such as transport unions) and individual transport operating firms – have not fulfilled their responsibilities in relation to supporting rural transport. In order to promote rural transportation and create positive change in this space, these actors need to engage in or undertake certain initiatives or projects such as enacting laws that promote and support the adoption of IMTs on feeder roads, ensuring appropriate regulations and managing rural transport by providing vehicles, licensing, route planning, regulating loading and transport fares. When this is done, these actors will be effective, responsive and acting responsibly.

The bad nature of feeder road infrastructure in rural communities was identified as a major rural transport problem in both the expert and group interview findings. Without good roads, accessibility and mobility are hindered, negatively affecting engagement in socioeconomic activities; and it was clear from the findings that most people in rural communities in Ghana depend on roads to take part in various socioeconomic activities. Rural people also see the availability of good feeder roads as an opportunity to undertake sustainable socioeconomic activities through their travel, transportation of farm produce to market centres, and access to healthcare and other essential services, and trade. Moreover, rural people pride themselves on having roads running through their towns and villages – a fact that was highlighted by the group interview participants, who unequivocally argued for the construction and maintenance of roads in their communities.

The poor nature or condition of roads is the main factor underlying most transport challenges. To a large extent, the bad nature of feeder roads explains the lack of commitment from transport regulating bodies and private organisations to provide vehicles and operate transport services, which is often based in a fear of losing their investments and vehicles to bad roads.

Poor condition feeder roads cause delays in travel time and reduce the number of trips possible in a given timeframe because vehicles are forced to slow down, in particular to limit any damage to the vehicle resulting from the condition of the road. In contrast, where feeder roads are in good condition, such fears are minimised, as are delays in commuting time, while the number of possible trips is greater. On such roads, transport operators are more confident and willing to provide vehicles for transport services.

The findings from both the expert and group interviews highlighted the importance of IMTs in bridging the rural transportation gap. However, the use of IMTs is hindered by numerous challenges, such as legislative instruments on the adoption of IMTs, the acceptance and usage of IMTs by rural people, inadequate IMTs, and a lack of vehicle maintenance service providers on rural roads in rural communities. Other encumbrances are inadequate access to vehicle spare parts in rural communities and the legislation that specifically bans the use of motorcycles and tricycles for commercial transport purposes. As identified in the expert findings, the rationale for passing this legislation was to improve the safety of the road transport system and to prevent the high volume of vehicular traffic, road accidents and robberies associated with the promotion and use of motorcycles and motorised tricycles. The respondents in the group interviews identified road accidents and robberies in particular as limiting the acceptance and use of IMTs like motorcycles and motorised tricycles.

IMTs, such as motorcycles and motorised tricycles, are expensive and for some people would take a lifetime of savings, especially rural people seeking to privately own an IMT, because their income levels are low. In view of such difficulties, the suggestion made by the experts during the interviews to allow the commercial use of motorised tricycles should be considered, in addition to ensuring proper registration, licensing and other transport regulations. Such measures could contribute towards addressing some of the concerns and challenges related to IMTs, and build the confidence of users of IMTs.

In Chapter 3, under section 3.4, various rural transport challenges were identified from the literature reviewed. These transport challenges include, but are not limited to, a shortage of transport vehicles, difficulties limiting vehicle ownership, and bad roads, and these were also found in this study. This study also identified that bad feeder roads are the major factor determining rural road transport challenges. This notwithstanding, this research did not specifically assess the condition of feeder roads in the communities from which data were collected, as was undertaken by Okoko (2011) and detailed in section 3.4.3. A very significant finding of Okoko’s study, and of research conducted in Ghana by Adom-Asamoah and Naazie et al., as outlined in the literature review in Chapter 3, under section 3.4.3, is the emphasis placed on bad feeder roads in Ghana as the primary cause of rural transport challenges, such as a lack of transport services on feeder roads (Adom-Asamoah, 2016; Naazie et al., 2018).

The next section provides a summary of the main findings presented in this chapter.

9.5 Summary of main findings presented in this chapter

The findings from the expert and group interviews presented in Chapter 8 under the main themes of contribution of feeder roads to development, types and suitability of vehicles and IMTs on feeder roads, feeder road accessibility and mobility challenges and feeder road appraisal models were discussed in greater detail in this chapter. The discussion was focused on answering the research questions of the study in consideration of the theoretical constructs outlined in the theoretical framework of the study, the literature reviewed and the researcher’s personal observations. To aid the discussion, headings were developed in line with the main themes reflected in the research questions and the theoretical framework.

The discussions on the theme of the contribution of feeder roads to development were undertaken under two headings: 1) access to good feeder roads and transport services as a basic need, and 2) the importance of roads and transport services for self-actualisation. Similarly, the findings on the theme of types and suitability of vehicles and IMTs on feeder roads were discussed under two headings: 1) the nature of roads and its impact on the availability of motorised vehicles/IMTs, and 2) the importance of motorised vehicles and IMTs for socioeconomic development. The discussion on the two remaining themes – feeder road accessibility and mobility challenges and feeder road appraisal models – was also structured according to suitable headings. The major theoretical constructs of the study considered in this discussion are the construction of roads and provision of transport services, the ability to access socioeconomic centres, and socioeconomic development or self-actualisation.

The discussion on the theme of the contribution of feeder roads to development focused on how the vertical relationship between road construction and the availability of transport services and how the availability of roads and transport services as a fundamental construct and as a basic need influence the fulfilment of other needs (constructs) such as access to socioeconomic centres and, subsequently, to self-actualisation or socioeconomic development.

The discussion on the theme of the types and suitability of vehicles and IMTs on feeder roads focused on the vertical relationship between the availability of good roads and the availability of efficient and suitable vehicles for transportation, each as distinct constructs. The discussion also covered the horizontal relationship between access to good roads and motorised vehicles and IMTs, on the one hand, and access to socioeconomic centres and consequently to socioeconomic development, on the other.

The discussion on the theme of feeder road appraisal models focused on the relationships between key rural transport stakeholders and how their activities influence the theoretical constructs of the study.

The discussion on the feeder road accessibility and mobility challenges focused on both the vertical and horizontal barriers between the theoretical constructs and how they could be addressed in a practical sense looking at policy and technology deployment or implementation.

The empirical findings from the literature reviewed in Chapters 2, 3 and 4 were harnessed for the purposes of triangulation with the empirical findings presented in Chapters 5 to 8. The conclusions and the recommendations in relation to this research are presented in the next chapter.

CHAPTER 10:

CONCLUSIONS AND RECOMMENDATIONS

10.0 Introduction

The research problem leading to this study was derived from the over-reliance of people in Africa and Ghana on road infrastructure in seeking to promote socioeconomic development and to improve their lives. The problem encapsulates the emergence of road and transport service issues that affect personal and socioeconomic development, especially for rural communities and their inhabitants. In order to address these rural transport issues, the researcher, through a review of the available literature, established the research aim and four research objectives. From the research aim the main research question was developed. Likewise, the four subsequent research questions were developed in consideration of the research objectives.

To answer the research questions, a theoretical framework (Figure 5.3) was developed that served as a guide to the data collection, analyses and discussion. The theoretical framework outlined vertical and horizontal relationships between major theoretical constructs such as the construction of roads and provision of transport services, the ability to access socioeconomic centres, and socioeconomic development or self-actualisation.

To explain the relationships between the theoretical constructs, various theories were reviewed and used to develop the theoretical framework. The aim was to test the theories to identify those that best explain the phenomenon under study. The theories considered were Hagerstrand's Time Geography Theory, Maslow's Hierarchy of Needs

Theory, Trist et al.'s Socio-Technical Theory, Bertalanffy's General Systems Theory, Soja's Socio-Spatial Dialectic Theory, and Davis's Technology Acceptance Model.

To test the relationships between the theoretical constructs in this research, the study adopted an interpretivist paradigm with phenomenological qualitative research methods. Data were collected from individual expert and group interviews. The expert interview data were obtained from 18 selected feeder road expert engineers in Ghana drawn from Ghana's Ministry of Roads and Highways, the national head office of the Department of Feeder Roads, the Brong-Ahafo regional head office of the Department of Feeder Roads and the Ghana Institution of Engineering. The group interview data were obtained from five group discussions conducted in five communities selected from the Brong Ahafo and Eastern regions of Ghana. In all, a total of 72 respondents were selected from Awosoaso, Abokoase, Subriso, Tuobodom, and Offuman communities using the voluntary sampling method. The two sets of data collected were analysed manually and with the help of NVivo, through which thematic nodes emerged and provided answer to the research questions.

The findings and discussions were organised under four main themes: (1) the contribution of feeder roads to development, (2) the types and suitability of vehicles and IMTs on feeder roads, (3) feeder road accessibility and mobility challenges, and (4) feeder road appraisal models. These themes correspond to research questions 1, 2, 3 and 4, respectively. The discussions were focused on how the findings answered the research questions vis-a-vis the theoretical constructs outlined in the theoretical framework.

In this chapter, conclusions are drawn based on the findings of the study, which are then used to inform the insights and recommendations for policy implementation and further research subsequently presented.

10.1 Research conclusions

To bridge the gap in empirical studies and contribute to theory and knowledge on transport studies in Ghana, the following aim was established for this research:

> To explore the accessibility and transport needs of rural communities in Ghana and to investigate their effects on the access to socioeconomic wellbeing and essential services and the quality of life of rural people living along feeder roads in Ghana.

This research aim, together with the research objectives, has been successfully achieved in view of the findings discussed in Chapter 9. The conclusions are presented below under the following research themes: the contribution of feeder roads to development, the types and suitability of vehicles and IMTs on feeder roads, feeder road accessibility and mobility challenges and feeder road appraisal models. Under each theme, the key responses to the research objectives are provided. In addition, a conclusion is made in consideration of the theoretical framework and appropriate theories used in this study.

10.1.1 Contribution of feeder roads to development

In relation to the contribution of feeder roads to development, various findings emerged from this research. These included that more feeder roads have been constructed in recent times, but also that there is a need for more feeder roads to be constructed and for existing ones to be maintained. The findings also indicated the perception that the availability of good feeder roads creates employment opportunities, enables rural communities to engage in trade, improves accessibility and mobility through transport service availability, facilitates the movement of people and goods, reduces post-harvest losses, increases the revenue of farmers and enhances rural infrastructure development. Moreover, the findings suggest that the provision of transport services is a shared responsibility of government, organisations and individuals, but that the government only intervenes when it becomes necessary due to safety or security reasons.

The findings were discussed under two headings, in consideration of the theoretical framework of the study: (1) access to good feeder roads and transport services as a basic need, and (2) the importance of road and transport services in facilitating self-actualisation. The discussions covered a number of sub-themes including the relevance of roads to poverty alleviation, the promotion of access to healthcare and socioeconomic wellbeing, infrastructure development and industrialisation, and rural community development. Interestingly, these sub-themes are linked to and promote the attainment of Sustainable Development Goals 1 (No poverty), 3 (Good health and wellbeing), 4 (Quality education), 9 (Industry, innovation, and infrastructure), and 11 (Sustainable cities and communities). In the discussions, the relationship between the findings and the theoretical constructs were considered.

Three key responses that emerged from the data are particularly noteworthy. The first key response was that access to good feeder roads is a basic need and attracts efficient and suitable transport services, since the construction and maintenance of feeder roads ensures the availability of all-season good feeder roads, as explained in the theoretical framework. Indeed, the availability of good feeder roads is an essential factor considered by transport service providers because vehicles that circulate in good roads are not prone to damage, and therefore incur lower maintenance costs.

The second key response was that good feeder roads promote access to socioeconomic centres and socioeconomic opportunities such as employment opportunities and improve accessibility and mobility through transport service availability. Other benefits are that they open up rural communities for trade, facilitate the movement of people and goods, reduce post-harvest losses and increase the revenue of farmers.

The third key response was that access to good feeder roads is necessary in ensuring the attainment of Sustainable Development Goals 1 (No poverty), 3 (Good health and well-being), 4 (Quality education), 9 (Industry, innovation, and infrastructure), and 11 (Sustainable cities and communities). Road and transport infrastructure development creates employment opportunities, facilitates access to essential social services, promotes trade and access to markets for industrial output, and facilitates the movement of people. These benefits of road and transport development are thus integral to the attainment of the above SDGs.

10.1.2 Types and suitability of vehicles and IMTs used on feeder roads

The findings also revealed perceptions on the types and suitability of vehicles and IMTs used on feeder roads by people in rural communities in Ghana. First, the study found that motorised vehicles such as pickups, station wagons (like Toyota Land Cruisers), taxis, minibuses/vans and cars were used by feeder roads engineers as transport on feeder roads, and were either government-owned or privately owned. Second, it was found that vehicles such as motor tricycles, motorcycles, buses/vans, tractors, taxis, cars, wheelbarrows, bicycles, donkey carts and four-wheel push carts were used by rural people for transportation. Third, the findings revealed that, in rural transportation, vehicles are frequently misused through overloading, speeding or other forms of inappropriate use which raises safety concerns. Fourth, it was found that IMTs were used to supplement conventional vehicles to bolster rural transport services. Fifth, it was found that motor tricycles are more appropriate for use on feeder roads as commercial/public transport. Sixth, it was found that IMTs are widely accepted and used in northern Ghana, but not so in southern Ghana. Seventh, it was found that the rural people were unable to own the motorised vehicles/IMTs for transportation and farm purposes because the cost of the vehicles/IMTs was expensive. Moreover, it was found that commercial use of IMTs such as motor tricycles and motorcycles have been banned in Ghana therefore served as disincentive to their use.

The findings were discussed with a focus on how the availability of vehicles is determined and affected by the factors (theoretical constructs) outlined in the theoretical framework. Guided by the theoretical framework, the findings were considered under the following headings: (1) the nature of roads and its impact on the availability of motorised vehicles and IMTs, and (2) the importance of motorised vehicle and IMTs in promoting socioeconomic development.

Three key findings were identified and discussed. First, the types and suitability of vehicles and IMTs available in the communities are influenced by the nature of roads. Communities that have good roads have numerous types of motorised and non-motorised vehicles and IMTs that they use to transport people and goods, whereas communities with bad feeder roads have few available vehicles or IMTs. Second, overall, there is a lack of motorised vehicles and IMTs in rural communities, and motorised vehicles and IMTs are misused or inappropriately used for transport services in rural communities. This is due to the inability of most people within rural communities to own vehicles and IMTs and to the lack of interest among transport service providers in providing rural transport services. This situation results in the misuse of vehicles in various ways, such as: overloading, high transport fares, and speeding. Finally, the availability and suitable use of motorised vehicles and IMTs influence access to socioeconomic centres and subsequently enable rural people to advance their socioeconomic development, as indicated in the theoretical framework.

10.1.3 Feeder road accessibility and mobility challenges

Various rural transport challenges emerged from the findings. These included legislative instruments inhibiting the adoption of IMTs, a lack of commitment on the part of transport regulating bodies and organisations, the challenges around providing vehicles and IMTs, the bad nature of rural roads, and issues of acceptance and usage of IMTs by rural people. Others included inadequate IMT and vehicle maintenance service providers on rural roads and in rural communities, and a lack of vehicle spare parts in rural communities. The discussions focused on how the challenges identified affected accessibility and mobility, and thereby the socioeconomic development of communities located along feeder roads in Ghana.

In relation to feeder road accessibility and mobility, four significant issues were raised during the interviews. First, there is a lack of road infrastructure development in rural communities in Ghana. Accessibility and mobility are impeded in rural communities because there are few access roads, and most of these access roads are in a deplorable state due to poor maintenance. Second, there exist numerous rural transport service challenges that hinder accessibility and mobility along feeder roads in Ghana. These challenges are legislative instruments inhibiting the adoption of IMTs, a lack of commitment from transport regulatory bodies and organisations, and difficulties in terms of providing vehicles and IMTs for transport services. Third, there is a lack of coordination and interaction among the various rural transport stakeholders and actors, such as the Government of Ghana, the Ministry of Roads and Transport, the Department of Feeder Roads, private transport service unions and rural dwellers. The construction of good roads and the provision of motorised vehicles and IMTs for transport services are dependent on the effective and ongoing engagement between rural transport stakeholders. The lack of a common platform to enable these actors to interrelate affects accessibility and mobility in Ghana's rural communities. Fourth, the failure to address rural transport challenges will continue to negatively affect the socioeconomic development of the rural communities located along feeder roads in Ghana.

10.1.4 Feeder road appraisal models

In seeking to determine how feeder road investments are appraised to meet the accessibility and transport needs of people in rural communities in Ghana, various findings were established. The first revealed the main appraisal models that are used in Ghana focus on: (1) the economic benefit to users, (2) the scale of impact of projects, (3) geographical area considerations, (4) political considerations, (5) the internal rate of returns on projects, and (6) the social benefits of projects. Second, it was identified that rural people are not consulted about road construction decisions. Third, it was found that there is a lack of interaction between the Department of Feeder Roads and the Ministry of Transport (the main government agencies in charge of road construction and transport services development, respectively). Fourth, there is a low level of engagement between the Ministry of Transport and the other private commercial transport operators.

The findings were discussed in consideration of how the models are used in Ghana and how the interactions between the various rural transport stakeholders could influence the following theoretical constructs: the availability of road and transport services, access to socioeconomic centres, and self-actualisation or improved quality of life of rural people.

From the discussions, four key responses were noted. The first key response was that feeder roads are appraised based on their socioeconomic relevance. In doing so, the models considered one or both of the following factors: the need to transport cash and food crops from agricultural production areas, and the need to promote accessibility and mobility to enable people to travel from one community to another to access healthcare, education, market centres, or other essential or recreational services. The second key response on feeder road appraisal models was that the vehicle traffic expected on the road over a period of time is considered in the design of feeder roads. This consideration of vehicular traffic is included to achieve two things: (1) ensure the durability and life span of the road, and (2) establish the types of vehicles expected on the road to transport goods and people. The third key response was that feeder roads are appraised based on the cost of construction. The total budget of a road construction project is considered in relation to a number of factors such as the social, economic and political relevance of the roads to stakeholders. The fourth key response was that the type of road appraisal model used is of significance in ensuring the availability of good roads and transport services, access to socioeconomic centres and opportunities, and the self-actualisation of rural people.

10.1.5 Theoretical framework

To explain the relationship between the theoretical constructs provided in the conceptual framework of this study, various theories were reviewed and tested using a number of selection criteria, as outlined in Table 10.1.

Table 10.1: Selected theory for the study

Criteria and assessment for theory selection							
	Selection criteria						
Theories	Is it significant to the phenomenon under study?	Does it satisfy the theoretical/ conceptual variables?	Is it related to trans-port study?	Does it meet the objectives set for the study?	Does it support the conclusions and recommendations?	Does it conform to the research methodology and analysis?	Aggregate score
Time Geography	4	4	3	4	2	4	21
Hierarchy of Needs	4	4	2	3	2	3	18
Socio-Technical	3	3	2	2	2	2	14
Systems Theory	3	3	2	2	1	2	13
Socio-Spatial Dialectic	3	2	2	2	1	2	12
TAM	1	1	2	2	4	2	12

Scale*:* 4 (highest), 3 (high), 2 (low), 1 (lowest); Source: Author

As shown in Table 10.1, Hagerstrand's Time Geography Theory is ranked highest, with a score of 21, and all the other theories ranged from 12–18. In ranking order, Hagerstrand's Time Geography Theory is followed by Maslow's Hierarchy of Needs Theory, Trist et al.'s Socio-Technical Theory, Bertalanffy's General Systems Theory, Soja's Socio-Spatial Dialectic Theory, and lastly Davis's TAM.

To draw on the strengths of multiple theories, the study made use of Hagerstrand's Time Geography Theory and Maslow's Hierarchy of Needs Theory. That is, Maslow's Hierarchy of Needs Theory and Hagerstrand's Time Geography Theory were deemed the appropriate theories for this research.

Having dealt with the theoretical underpinnings, insights and recommendations in relation to policy implementation are provided in the next section.

10.2 Insights and recommendations related to policy implementation

> It is relatively rare for a government to prepare a separate rural transport policy or strategy document. The topic is usually covered within national transport policy and strategy documents. (Hine, 2014, p 6)

Government policy that promotes accessibility and mobility through the construction of good feeder roads and the provision of vehicles for transport services often has the end benefits in mind. Impactful policy can provide direct and significant social and economic benefits and generate other spill-over effects such as promoting employment, aiding access to healthcare and facilitating the easy movement of people and goods. Government policy can have both positive and negative outcomes that affect stakeholders, depending on how well considerations of cost, time and quality of the project are managed. Whereas a positive outcome brings rewards for and approval of the implementers, a negative result has the tendency to diminish the popularity of implementers. In consideration to the findings, specific recommendations are provided for policy consideration, which implemented will produce only positive outcomes for both the implementers and the benefactors, in this case, the politician and rural people.

10.2.1 Road infrastructure development policy recommendations

Roads that are resistant to climate change must be constructed. Road engineers need to apply innovation in the design of roads to ensure they can withstand extreme heat, given the anticipated global temperature increase of 5.4^{0}c by the close of 2080. Furthermore, the design of feeder roads must prioritise bitumen surface roads that have appropriate drainage systems. Such roads and drainage systems must be regularly maintained and repaired. A concerted effort is required to finance technical skills training for road engineers, particularly in the design and construction of roads that are resistant to climate change.

In order to ensure that roads are periodically maintained to guarantee that they are in good shape, the Department of Feeder Roads, in consultation with the Ministry of Transport, must ensure that road maintenance works are carried out at the district level. The contracting of routine maintenance works must be reviewed so that roads are allocated to eligible contractors to maintain over a period of not less than 10 years. The activities of the contractors must be supervised and the contractors must be paid periodically based on the work done.

Innovative ways of generating funds need to be identified to ensure sustainable funding for the construction of roads, maintenance and repair works. Apart from relying more on grants from donor funding agencies and institutions like the World Bank and the IMF, the following sources of funding ought to be considered. First, the government could encourage private investment in road construction, in particular public–private partnership. In order to encourage investment and support, there should be a transparent policy framework that enables private investors to develop trust and confidence and to guide investment decisions. In addition, road infrastructure projects that have high investment returns can be used to attract private sector investment. Second, funds to support the construction and maintenance of roads could be sourced by government from non-traditional investments such as pensions and private equity funds. Third, funds could be sourced through the proper collection and management of domestic revenue. This could be achieved by widening the tax net, preventing tax evasion, reforming and modernising tax systems, and emphasising value for money on all road infrastructure investments.

The construction and maintenance of roads in Ghana must be devoid of political influence and control because it undermines road construction and maintenance decisions that should be based on economic and technical appraisal. A national road construction and maintenance programme should be developed, which every government that comes to power must ensure to implement. The development of the national road construction and maintenance programme must have inputs from various stakeholders such as road agencies, transport unions, community people and political parties. The programme must be detailed and provide information such as feasibility report, evaluation report, and implementation plan. In addition, it must provide detailed information on maintenance after road construction, and plans on expected transport vehicles to use the roads.

10.2.2 Transport infrastructure development policy recommendations

The Ministry of Transport is mandated to perform a number of core functions that include transport sector policy formulation and coordination. These are often carried out at the national level, with much emphasis on urban transportation and little focus on rural transportation, resulting in high urban traffic in cities like Accra and Kumasi. For the purpose of ensuring effective rural transport planning and efficiency in the provision of rural transport services, the Government of Ghana must establish a Department of Rural Transport. To enable the (proposed) Department of Rural Transport to liaise effectively with the Department of Feeder Roads to ensure the availability of roads and transport services, the former must have an established structure like that of the Department of Feeder Roads. The Department of Rural Transport would need to be well structured and equipped to support its operations at the national, regional and district levels. This would necessitate the establishment of national, regional and district offices, with the national office serving as the head office to supervise all activities at the regional level, and the regional level offices supervising the district-level operations.

The *Road Traffic Regulation 2012* (Legislative Instrument (LI) 2180), which prohibits the use of motorcycles and motor tricycles for commercial transport, must be reviewed to allow the use of motorised tricycles for commercial transport purposes in rural areas. For commercial transport purposes, motorised tricycles have been found to be more durable, safer and more convenient than motorcycles, which have a high accident rate and are unsafe on dusty roads and inappropriate for use in warm and rainy weather conditions – conditions that are prevalent throughout Ghana. The commercial use of motorised tricycles must then be properly regulated by the Department of Rural Transport and the DVLA in the areas of their road worthiness, the qualifications of individuals who ride them and the haulage of goods.

The proposed Department of Rural Transport must endeavour to create an effective and competitive rural transport system that will harness individual commercial transport service operators and unions. A rural community transport system that makes use of mobile software applications could be adopted to bridge the gap between transport service needs and the availability of vehicles for such services. For instance, the prototype of Uber and Grab transport services that is already operating in cities in Ghana like Accra, Tema and Kumasi could be embraced and innovatively designed to facilitate rural transport service delivery. The system operates in the form of an external entity (system controller) linking transport services providers and users through the use of a designed software application (apps). The apps has transport service providers registered, and it has features that allows persons in need of transport services to determine vehicles that are available, accessible, cost of transport service per the destination, and monitor the transport routes. For rural transport purposes (transporting people and goods), the devices required are designed apps, smart phone, and internet service. The use of mobile phones is very popular in rural communities, so it represents an opportunity for entrepreneurs to create apps that link users with smart phones.

The Government of Ghana must support rural transport services, especially where the transport market is small and therefore a disincentive to private commercial transport operators. The support should be in the form of providing subsides on vehicle/IMTs, especially for farmers to own vehicles such as tractors, tractor with trailers, flatbeds, and motor tricycles. Such vehicles/IMTs if owned by the farmers will enhance farming activities and better the lives of farmers. Furthermore, electric-motorised IMTs could be introduced by the government to transport people and goods. Battery recharge and changing stations that are solar powered could be installed at various points along feeder roads to facilitate the smooth running of this initiative.

Recommendations for future research are presented in the next section.

10.3 Recommendations for further research

These recommendations for further research are made in consideration of the limitations, research methods, theoretical constructs, findings and conclusions of this study.

This study adopted an interpretivist paradigm with phenomenological qualitative research methods. Various findings were established, including that there are significant challenges hindering the ownership of motorised and non-motorised vehicles and IMTs in rural Ghana. A statistically based quantitative study could be conducted to ascertain the levels of ownership of non-motorised and motorised vehicles and IMTs in rural communities in Ghana. Significantly, such a study would provide a broader picture of the number of rural people who own a vehicle or IMT in Ghana. It could also establish the impact of the availability of such vehicles on the socioeconomic wellbeing and quality of life of individuals inhabiting the rural areas where feeder roads are mostly used. This would add to the existing empirical literature and knowledge on rural transport.

The findings in this study on the challenges facing rural transport in Ghana were based on data collected from expert engineers and rural people. Similar research could be conducted to specifically collect data from transport operators who provide transport services in rural communities. Such research could offer different insights into the challenges that affect accessibility and mobility along feeder roads in Ghana, based on the perspective of transport operators.

In line with the recommendation to promote the use of electric vehicles that are powered by solar energy, an explorative study could be conducted to understand electric vehicle infrastructure development, including its challenges and potential remedies for such challenges. This would serve as a guide for policy and planning in this area.

Furthermore, in order to statistically test the relationships between the theoretical constructs in this study, a quantitative study could be undertaken to provide another perspective on these relationships.

This study was conducted in the Brong-Ahafo and Eastern regions of Ghana. It collected data in the form of group discussions from five rural communities in the selected regions. Using the same research method, another study could be conducted in other communities and regions of Ghana, which would add to the literature and provide additional empirical support to the findings of this research.

This study recommended the use of mobile software applications to enhance and facilitate transport service delivery in rural communities in Ghana. Further research could be conducted to explore the infrastructure and implementation modalities required for the use of mobile software applications in this space. Such a study would serve as reference material for private investors and the government.

10.4 Limitations of the study

The first limitation relates to the generalisation of findings based on the data collected. The data reflect the subjective or personal experiences of feeder road expert engineers from the Ministry of Roads and Transport, the national office of the Department of Feeder Roads, the regional offices of the Department of Feeder Roads, and the Ghana Institution of Engineering. Likewise, data from the group discussions reflect the subjective view of participants selected from rural communities with regard to the transport needs of their communities. It must be noted that while their views are subjective, these experts and participants were chosen for their experience and/or knowledge of feeder roads in Ghana.

Time and resources also represent a limitation of this study. It would have been appropriate if one-on-one, instead of group, interviews had been used to collect further in-depth data from respondents from the rural communities, which would have improved the richness of data. However, the choice of expert interviews and group discussions and the rigorous ethical procedures followed ensure the richness of the data collected.

10.5 Replicability of the research

This research has sufficiently demonstrated that it is replicable. A detailed research methodology has been provided, in addition to a clear account of research procedures that others may easily follow. The context of the research is also clearly described, and the data collection processes followed ethical procedures approved by the RMIT University Human Research Ethics Committee.

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APPENDIX A: EXPERT INTERVIEW SCHEDULE

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SEMI – STRUCTURED EXPERT INTERVIEW SCHEDULE FOR THE PROJECT

I. **Opening**

A. (**Establish Rapport**) [shake hands]. My name is ***Charles K. Asafo-Adjei, I am conducting research at RMIT University, Australia***. And based on your experience with feeder roads management you have been referred by Mr/Ms…….. to enable me seek your opinion on 'transport and accessibility challenges facing the rural people living along feeder roads in Ghana'. You view will contribute to the general position the Experts on f feeder roads have about rural transport and accessibility challenges.

B. (**Purpose**) I would like to ask you some questions about the type and mode of transport vehicles you consider will be accessible for travel by the communities that use feeder roads for their mobility needs.

C. (**Motivation**) I hope to use this information as a guide in outlining the issues to include in interviews to seek the experiences of the feeder road users to identify the challenges they go through in meeting their mobility needs.

D. (**Time Line)** the interview should take about 45 minutes. Are you available to respond to some questions at this time?

(**Transition:** Let me begin by asking you some questions about how long you have been involved in the management or issues with feeder roads)

II **Body**

A. (Topic) GENERAL FEEDER ROADS CONSTRUCTION AND MAINTENANCE

1. In your opinion, do you think there is the need for feeder road construction and maintenance?

a. Has Ghana constructed enough feeder roads?
b. Should more feeder roads be constructed?
c. Do road investments include transport vehicles?
d. Do you think it is important that transport vehicles are included in road investment?
e. Whose responsibility is to ensure that the rural people are provided road transport?
f. Who decides whether rural transport is included in the rural road investment?

(**Transition to the next topic);**

B. (TOPIC) TYPES OF VEHICLE ON RURAL ROAD

1. What type of vehicles do you normally use on feeder roads?

a. What type of vehicles are normally used on feeder road by the rural communities
b. Do you think there are types of vehicles that are more suitable for the movement of (i)goods (ii) people (iii) to use for children to school (v) to travel to work and (v) for emergency services like going to the hospital on feeder roads?
c. What type of vehicle(s) will you recommend for journeys less than 5km on feeder roads
d. What type of vehicle(s) will you recommend for journeys greater than 5km on feeder roads

(**Transition to the next topic);**

C (TOPIC) INTERMEDIATE MEANS OF TRANSPORT

a. What is your view about intermediate means of transport (IMT)?
b. Do you see them as a good transport vehicle on rural roads to carry people?
c. Do you see them as a good transport vehicle to carry goods?
d. Do you see them as a good transport vehicle to carry school children?
e. Do you see them as a good transport vehicle for emergency services?
f. Is there any particular type of IMT you will recommend on feeder roads?
g. At what condition(s) will you recommend the usage of IMT on feeder roads with respect to (i) quality (ii) cost (iii) distance (iv) road condition and (v) Speed
h. Do you think IMTS, can be used for public transport on feeder roads
i. Do you see any limitations of IMT adoption on feeder roads
j. Will you consider the promotion of IMT on a rural roads as a good policy
k. What will you consider as the possible side effects or draw backs of such policy if it is adopted

l. In the absence of conventional vehicles like buses, and taxis can IMTs be used as the main vehicles on rural roads

(**Transition to the next topic):**

D TOPIC (MOTOR CYCLE TRANSPORT)

a. Is there any sign of motor cycles being used on feeder roads?
b. What is your view of motor cycles being used on feeder roads?
c. Do you see them as a good transport on rural roads to carry people?
d. Do you see them as a good transport to carry goods?
e. Do you see them as a good transport to carry school children?
f. Do you see them as a good transport for emergency services?
g. Is there any particular type you will recommend on feeder roads?
h. Under what condition(s) will you recommend the usage of motor cycles on feeder roads with respect to (i) quality (ii) cost (iii) distance (iv) road condition and (v) Speed?
i. Do you think they could be used as taxis on feeder roads?
j. Do you see any limitations of Motor cycles on Feeder roads?
k. Will you consider the promotion of motor cycles on rural roads as good policy?
l. What will consider as the possible side effect or draw backs of such policy if it is adopted.
m. In the absence of conventional vehicles like buses, and taxis can motor cycles be used as the main vehicles on rural roads

(**Transition to the next topic):**

E. (Topic) TRANSPORT APPRAISAL MODELS

1. Are you familiar with the road/transport Appraisal Models? What type of appraisal models do Department of Feeder Roads general used?

a. Have you used any of the appraisal models?
b. Does it cover all rural road transport investment?
c. Is there any issue you will like it to be included in road appraisals.

(**Transition:** Well, it has been a pleasure finding out more about you. Let me briefly summarize the information that I have recorded during our interview.)

F. (Topic) ACCESSIBILITY AND MOBILITY CHALENGES

Do you have a personal experience where you or a close friends or relatives have encountered difficulties in accessing opportunities due to lack of transport on a feeder road.

Can you share the experience? (I will like to record this on audio recorder; do I have your permission to do so?)

III **Closing**

A. (Summarize) You are very involved in the management of feeder roads for …… years. You recommend the following type of vehicles on feeder roads. You hold the view that, IMTs ……..
B. Type of IMT(s) suitable or not suitable on feeder roads
C. Motor cycles are………….on feeder road
D. Motor taxis should be ……………..on feeder road
E. Road appraisal models should include……….

.

B (Maintain Rapport) I appreciate the time you took for this interview. Is there anything else you think would be helpful for me to know so that I can successfully undertake the survey in Ghana?

C. (Action to be taken) I should have all the information I need. However, would it be alright to call on you again if I have any more questions? Thanks again.

APPENDIX B: GROUP INTERVIEW SCHEDULE

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Time	**What to say**	**What to do**
5-10 minutes	Welcome to the … group. Thanks for volunteering to help in the discussions of the causes and effects of rural transport accessibility which is a study is being conducted as part of Mr Charles Kwarteng Asafo-Adjei's doctoral research at RMIT University, Australia. Explain to them what we want them to do: Most transport services in Ghana do not reach rural communities adequately to meet their mobility needs. This project investigates the challenges facing rural communities in Ghana in accessing opportunities. How the participants can help us to achieve our goal(s) by sharing with us for travelling experience and how they make essential trips to improve their health and livelihoods Why the participants are suitable for the task	GREETINGS/WELCOME *Welcome and thank everyone for volunteering for this focus group. Tell them where the bathrooms are.*
5-10 minutes	Introductions We will record the discussion in print for post-analysis. All recorded information is confidential and anonymous, and will be used only for the purpose of the research.	INTRODUCTIONS *Introduce implementation Team. Give names and affiliations Ask participan*

		ts to introduce themselves with their name *Explain the means to record the session*
3-5 minutes	Participants role today Tell them: 1) Please, speak from your own experience and knowledge. 2) You are not expected to act like experts. 3) Feel free to give your opinions. There are no Wrong answers. 4) At times we may go around the table asking for your inputs. 5) One person will speak at a time. If you are waiting for your turn to speak or want to note some thoughts, please use the paper and pen provided to take notes. I will be the interviewer/facilitator. I will be asking the questions. I will assist with the discussion by summarizing key points on the flip chart. I will be taking notes and keeping track of time. As back-up, the conversation will be tape recorded. No names will be used in the final report. Does anyone have any objections? This focus group will last about 2 hours.	
3-5 minutes	Icebreaker If you have all the funds (money) what type of vehicle will you buy for this community	*Set Participants at Ease*
15-20 minutes	QUESTION 1 (ABOUT THE ACCESS ROAD) What has been the importance of the road to the	*Make sure participan*

	community: It contributions to community. To your own life (Welfare and livelihood) community? Anything do you think will help make the road more useful to you and the community	*ts Understand this question and the subsequent ones.*
15-20 minutes	Question 2 (INACESSIBILITY: THE IMPACT IF THE COMMUNITY IS NOT ACCESSIBLE) What do you do when the road is not through or blocked? Where do you normally go or not go because the road is blocked? Can you recall any situation where the road is not blocked but there are no vehicles to move people to their desired destinations? What will happen if there is no access road to the community?	
15-20 minutes	Question 3 (MOBILITY AND ACCESSIBILITY: WHAT ARE THE VALUE ADDITION THROUGH THE AVAILABILITY OF TRANSPORT) Take a minute to think before we start Can you recount situations in the community through your personal experience where because of the availability of transport, opportunities were opened to you or you have lost opportunity due to the absence of transport vehicle? Can you also recount the same situation when emergency or health situation were saved or lost? Let us hear your views in general about your experience with the types of transport vehicles you find more useful in this community. Which of the recounted experience do we find it more common here and which one do you think we can solve without external help? Which of them do we need support?	
15-20 Minutes	Question 4: SUSTAINABLE TRANSPORT Looking at the situation and the state of the road, what type of vehicle and mode of transport are more affordable to your household and to the community in a sustainable way Which of them can also be used as emergency vehicles? To go to work? To facilitate the movement of your children to school? To go to the market. Why are they not being used	

	in the community?	
5-10 minutes	CONCLUSION Please, make sure you fill in the personal information completely. Following this session, I will summarize your comments into a report. In the report, you will not be quoted by name and your name will not appear in any printed materials If you are interested in receiving a report, please mark the appropriate box on the information form. Thank you for taking time out of your day to participate in this focus group.	*Pass out information form*

APPENDIX C: PARTICIPANT INFORMATION CONSENT FORM

RMIT UNIVERSITY

Date: 24 November, 2014

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INVITATION TO PARTICIPATE IN A RESEARCH PROJECT

Project Title:
TRANSPORT AND ACCESSIBILITY CHALLENGES FACING THE RURAL PEOPLE LIVING ALONG FEEDER ROADS IN GHANA

Investigators:

Name	Qualification	Email	Phone contact
A/Prof Usha Iyer-Raniga	B. Arch, MASA, PhD	xxxxxxxxx	xxxxxxxx
A/Prof Guillermo Aranda-Mena	PhD	xxxxxxxxx	xxxxxxxx
Mr. Charles K. Asafo-Adjei	BSc, MBA, MSc	xxxxxxxxx	xxxxxxxx

Dear Sir/Madam

You are invited to participate in a research project being conducted by RMIT University. Please read this sheet carefully and be confident that you understand its contents before deciding whether to participate. If you have any questions about the project, please ask one of the investigators.

Who is involved in this research project? Why is it being conducted?

This research is being conducted as part of Mr Charles Kwarteng Asafo-Adjei's doctoral research at RMIT University, Australia and it has been approved by the RMIT Human Research Ethics Committee. We wish to inform you that you have been selected to offer your opinion on the above research project based on your experience in rural travels and transport on feeder roads**.**

What is the project about? What are the questions being addressed?

The study seeks to investigate the challenges facing rural communities in Ghana in accessing opportunities due to the lack of appropriate transport vehicles for travelling and making essential trips. The study focuses on the difficulties rural people go through in making essential trips including emergencies. The questions to be asked are related to the struggle one goes through in accessing health, education and economic opportunities. Some of the interview questions will relate to your experiences with the various types of vehicles plying on the feeder roads and preferences. It is planned that about 60 people will participate in this project.

If I agree to participate, what will I be required to do?

It will take about 1 to 2 hours to go through the interview. Some examples of the questions to be asked are shown below. There is no risk associated with this study other than inconvenience to you.

What will happen to the information I provide?

The information you provide will be put together with response from others to be part of a doctoral thesis. This thesis will be in the RMIT Repository and will be publicly accessible online as part of research papers. The information may be published in academic journals and student reports, and where references have to be made; your identification will not be disclosed. The data recorded from you will be stored safely for five years and will be strictly confidential. After five years, it will be destroyed.

What are my rights as a participant?

As a participant of this research, you have the right among other rights to:

- Withdraw from the interview or group discussion at any time

- Demand that your interview should not be recorded
- Have any unprocessed data withdrawn and destroyed
- The right to be de-identified in any photographs intended for publication, before the point of publication; and before the taking of any photographs or video recordings you have the following conditions holding for you:
    1. You understand that images may be recorded
    2. You give permission to have your images captured , and the following options are available:
        i. any identifying feature must be disguised, or
        ii. your personal images may be published or presented without any attempt made to disguise the identity
    3. The image may not be altered (re 2i above) or used for any other purpose without your approval
    4. Not all images that are recorded may be used
    5. The images will be published in a thesis/publication. Such a report may include a digital copy of the thesis/publication which may be accessible via the internet
    6. The images will be used for the specified purpose only (that is, only for the current research project)
    7. You are free to withdraw from the project and to withdraw any images of themselves, *prior to the publication of the project report or thesis*
    8. All images, used and unused, will be securely stored at RMIT University
    9. Requirements for retention and destruction of images retained five (5) years after publication of the thesis/project [specify as appropriate], other than those which are published as part of a final work published as an ADR.
    10. If images are uploaded onto the Internet that the research you understand the permanency of this decision - that their image will remain available on the Internet

- The right to have any questions answered at any time

Whom should I contact if I have any questions?

If you have any questions, please contact:

- Associate Professor Usha Iyer-Raniga on [redacted].
- Associate Professor Guillermo Aranda-Mena on xxxxxxxxxxxx or School of Property, Construction and Project Management on xxxxxxxxxxxx

Yours sincerely

[redacted]

A/Prof Usha Iyer-Raniga

(B. Arch, M.A.S.A., PhD)

[redacted]

A/Prof Guillermo Aranda-Mena

(PhD)

[redacted]

Mr. Charles K. Asafo-Adjei

(BSc, MBA, MSc)

If you have any concerns about your participation in this project, which you do not wish to discuss with the researchers, then you can contact the Ethics Officer, Research Integrity, Governance and Systems, RMIT University, GPO Box 2476V VIC 3001. Tel: (03) 9925 2251 or email human.ethics@rmit.edu.au

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1. I have had the project explained to me, and I have read the information sheet
2. I agree to participate in the research project as described
3. I agree **to be interviewed and/or complete a questionnaire.**
4. I acknowledge that:

   (a) I understand that my participation is voluntary and that I am free to withdraw from the project at any time and to withdraw any unprocessed data previously supplied (unless follow-up is needed for safety).

(b) The project is for the purpose of research. It may not be of direct benefit to me.

(c) The privacy of the personal information I provide will be safeguarded and only disclosed where I have consented to the disclosure or as required by law.

(d) The security of the research data will be protected during and after completion of the study. The data collected during the study may be published, and a report of the project outcomes will be provided to RMIT University. Any information which will identify me will not be used.

Participant's Consent

Participant: ______________________________ Date: ________________
(Signature)

Participants should be given a photocopy of this PICF after it has been signed.

APPENDIX D: DFR INVITATION LETTER FOR EXPERT ENGINEERS

RMIT UNIVERSITY

School of Property,
Construction & Project Management

Building 8 Level 8
360 Swanston Street
Melbourne 3001
Australia

GPO Box 2476V
Melbourne VIC 3001
Australia

Tel. xxxxxxxxxxxxxx
Fax xxxxxxxxxxxxxx
www.rmit.edu.au/property construction

Date: 17th August 2015

The Director
Department of Feeder Roads
PMB
Ministries, Accra

Dear Sir/Madam

SUBJECT: TRANSPORT AND ACCESSIBILITY CHALLENGES FACING THE RURAL PEOPLE LIVING ALONG FEEDER ROADS IN GHANA.

It is our pleasure to invite you to participate in a research project entitled: **Transport and accessibility challenges facing the rural people living along feeder roads in Ghana.** The research is being conducted by RMIT University as part of Doctoral research undertaken by Charles K. Asafo-Adjei.

The study seeks to find the most suitable transport vehicle for rural people in Ghana. It will more specifically focus on the experiences rural people who use feeder roads go through in accessing opportunities.

We will much appreciate it if you could use your good office to extend invitation to your esteemed technical staff to participate in an interview pertaining to feeder roads transportation. Preferably, we will require as a start at least ten (10) experienced engineers from your Department to partake in this interview.

The information they provide will be collated with responses from others to be part of a doctoral thesis to be completed by 2017. This thesis will be in the RMIT Repository and will be publicly accessible online as part of research papers. The information may be published in academic journals and student reports. Any references to your identification will not be disclosed in any publication. The data recorded from you will be stored safely for five years and will be strictly confidential. After five years, it will be destroyed.
If you have any questions, please contact:

- Associate Professor Usha Iyer-Raniga on xxxxxxxxxxxxxxxxxxx.
- Associate Professor Guillermo Aranda-Mena on xxxxxxxxxxxxxxx
- School of Property, Construction and Project Management on xxxxxxxxxxxxxx.

You can also contact any of the above names relating to your availability or non-availability to participate in the research.

Thank you in advance for your interest in participating in this research.

Yours Sincerely

[redacted] [redacted] [redacted]

A/Prof Usha Iyer-Raniga A/Prof Guillermo Aranda-Mena Mr. Charles K. Asafo-Adjei

APPENDIX E: RESPONDENT INVITATION LETTER

School of Property, Construction & Project Management

Building 8 Level 8
360 Swanston Street
Melbourne 3001
Australia

Date

GPO Box 2476V
Melbourne VIC 3001
Australia

Tel. +61 3 9925 2230
Fax +61 3 9925 1939
www.rmit.edu.au/property construction

Dear Sir/Madam

SUBJECT: TRANSPORT AND ACCESSIBILITY CHALLENGES FACING THE RURAL PEOPLE LIVING ALONG FEEDER ROADS IN GHANA.

It is my pleasure to invite you to participate in a research project entitled: **Transport and accessibility challenges facing the rural people living along feeder roads in Ghana.** The research is being conducted by RMIT University as part of Doctoral research undertaken by Charles K. Asafo-Adjei.

The study seeks to find the most suitable transport vehicle for rural people in Ghana. It will more specifically focus on the experiences rural people who use feeder roads go through in accessing opportunities.

You have been selected to participate in this study due to your technical expertise in the above study area and your previous involvement pertaining to transports and feeder roads activities in Ghana. It is in this context that your name was proposed by stakeholders of the road and transport industry in Ghana. The information you provide will be collated with responses from others to be part of a doctoral thesis to be completed by 2017. This thesis will be in the RMIT Repository and will be publicly accessible online as part of research papers. The information may be published in academic journals and student reports. Any references to your identification will not be disclosed in any publication. The data recorded from you will be stored safely for five years and will be strictly confidential. After five years, it will be destroyed.

If you have any questions, please contact:

- Associate Professor Usha Iyer-Raniga on xxxxxxxxxxx or xxxxxxxxxxxxxx
- Associate Professor Guillermo Aranda-Mena on xxxxxxxxxxxxxx or xxxxxxxxxxxxx
- School of Property, Construction and Project Management on xxxxxxxxxxxxxx.

You can also contact any of the above names relating to your availability or non-availability to participate in the research.

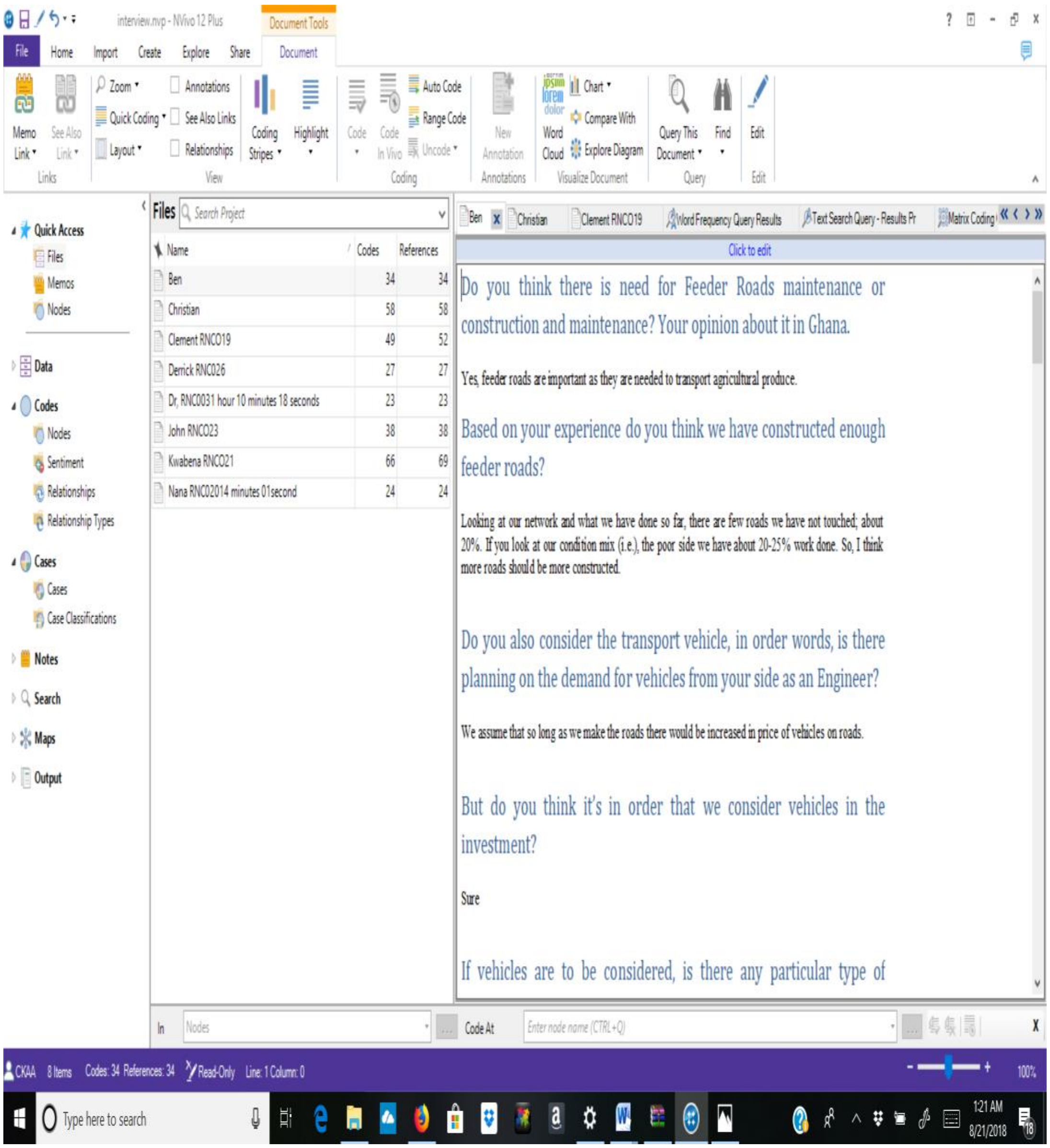
Thank you in advance for your interest in participating in this research.

Yours Sincerely

[redacted] [redacted] [redacted]

A/Prof Usha Iyer-Raniga A/Prof Guillermo Aranda-Mena Mr. Charles K. Asafo-Adjei

APPENDIX F: SCREENSHOT OF TRANSCRIPT IMPORTED INTO NVIVO



APPENDIX G: ETHICS APPROVAL LETTER

RMIT UNIVERSITY

Design and Social Context College Human Ethics Advisory Network (CHEAN)
Sub-committee of the RMIT Human Research Ethics Committee (HREC)

Notice of Approval

Date:	**2 May 2017**
Project number:	**CHEAN B 18524-03/14**
Project title:	**Transport and Accessibility Challenges Facing the Rural People Living along Feeder Roads in Ghana**
Risk classification:	**Low Risk**
Investigator:	**Associate Professor Guillermo Aranda-Mena, Charles K. Asafo-Adjei, Associate Professor Usha Iyer-Raniga**
Approved:	**From: 2 May 2017 To: 31 May 2018**

I am pleased to advise that your extension request has been granted ethics approval by the Design and Social Context College Human Ethics Advisory Network, as a sub-committee of the RMIT Human Research Ethics Committee (HREC). Ethics approval is extended until 31 May 2018.

Terms of approval:

1. **Responsibilities of investigator**
   It is the responsibility of the above investigator/s to ensure that all other investigators and staff on a project are aware of the terms of approval and to ensure that the project is conducted as approved by the CHEAN. Approval is only valid whilst the investigator/s holds a position at RMIT University.
2. **Amendments**
   Approval must be sought from the CHEAN to amend any aspect of a project including approved documents. To apply for an amendment please use the 'Request for Amendment Form' that is available on the RMIT website. Amendments must not be implemented without first gaining approval from CHEAN.
3. **Adverse events**
   You should notify HREC immediately of any serious or unexpected adverse effects on participants or unforeseen events affecting the ethical acceptability of the project.
4. **Participant Information and Consent Form (PICF)**
   The PICF and any other material used to recruit and inform participants of the project must include the RMIT university logo. The PICF must contain a complaints clause including the project number.
5. **Annual reports**
   Continued approval of this project is dependent on the submission of an annual report. This form can be located online on the human research ethics web page on the RMIT website.
6. **Final report**
   A final report must be provided at the conclusion of the project. CHEAN must be notified if the project is discontinued before the expected date of completion.
7. **Monitoring**
   Projects may be subject to an audit or any other form of monitoring by HREC at any time.
8. **Retention and storage of data**
   The investigator is responsible for the storage and retention of original data pertaining to a project for a minimum period of five years.

Please quote the project number and project title in any future correspondence.

On behalf of the DSC College Human Ethics Advisory Network, I wish you well in your research.

Dr David Blades
DSC CHEAN Secretary
RMIT University
E: dscethics@rmit.edu.au