SOCIOECONOMIC IMPACTS OF ROAD DEVELOPMENT IN ETHIOPIA: CASE STUDIES OF GENDEWUHA - GELAGO, MILE – WELDIYA AND GINCHI - KACHISI ROADS

by

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DECLARATION

I, BELEW DAGNEW BOGALE, hereby declare that the dissertation, which I hereby submit for the degree of PhD in GEOGRAPHY at the University of South Africa, is my own work and has not previously been submitted by me or any other person for a degree at this or any other institution.

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DEDICATION

I dedicate this dissertation to my wife Destaye Fekadu Tesfu, my children Estifanos, Addishiwot and Tizita as well as my mother W/o Guday Bezu Belay.

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ABSTRACT

Like many other economic and social activities that are infrastructure-intensive, the transport sector is an important component of the economy impacting on national, regional and local development as well as the welfare of citizens. An efficient transport infrastructure provides a multitude of socioeconomic opportunities and benefits with positive multiplier effects such as better accessibility to markets, employment, education and health. If it is well managed, transport infrastructure transforms the quality of life of residents through dynamic externalities it generates. But when infrastructure is deficient in terms of capacity, efficiency or reliability, it can have unwarranted economic costs due to reduced or missed opportunities. Despite its central role in rural development, little is known about the extent and impact of the various benefits that arise from the development of roads, particularly in developing countries. A large body of literature exists documenting the spatial patterns of socioeconomic development which can be induced by road infrastructure development processes and are in most cases dynamic and temporal. The impacts of a given road infrastructure development can also be analysed at the local, regional or national perspectives. The local impact is expected to be limited to the immediate neighbourhoods of the highway including tukuls, towns and villages to be found on both sides of the road within a distance of 5kms defining the influence zone. Based on this, the main objective of this research is to assess socioeconomic impacts of road infrastructure development of three newly developed highways on their respective surrounding communities 5-10 years after the interventions. Two of the highways are gravel surfaced and one is paved type. The respective study names are: Gendewuha – Gelago road (Corridor 1), Mile – Weldiya road (Corridor 2) and Ginchi – Kachisi road (Corridor 3). Their respective lengths are 165; 125; and 105 kilometres, while the study refers 10 kilometres on both sides of the roads. The study had focused on primary data on selected variables that describe socioeconomic conditions both before and after the intervention by using mixed methods of data collection considering quasi experimental design (QED). The main methods of analysis employed are descriptive and inferential statistics. Models such as: Random model approach and double-difference regression were used. The research had utilized two types of impact analyses (temporal and spatial) for comparison and also tested by using paired sample t tests: First: for each of the three corridors, comparisons between current conditions and the situation before the road intervention and, second: comparing conditions in the zone of influence (ZOI) situated within 5kms with control zone (COZ) situated beyond 5kms which are considered not to benefit much from road improvements during the period covered by the study. The research is based on data collected from 392 household heads, 77 key informants, 69 FGD participants from seven different localities, traffic counts from seven points, physical observations, outputs of GIS analysis utilizing satellite imageries and vast secondary data. The findings show that there are more positive and less negative temporal and spatial socioeconomic impacts generated by the three corridors notwithstanding disparities among the different locations. Accordingly, the paved highway is found to have more powerful positive impacts than the gravel roads, which are of low standards and functioning poorly. The status of truck and bus terminals which should have been integrated in the highway development projects are still underdeveloped with obvious effects on the sustainability of their socioeconomic impacts in the study areas. Furthermore, certain natural and more importantly manmade factors are found to have pre-empted the realization of certain positive socioeconomic impacts to be obtained from road interventions. In a nutshell, the dissertation had proofed the importance of conducting impact evaluation in the study areas by answering the questions of 'what works and what doesn't? and what is the extent of the impact?; measuring the impacts and relating the changes in the dependent variables to developmental policies; investigating the positive and negative effects of road development interventions and their sustainability; producing information that is relevant from transparency and accountability perspective; and finally contributing to individual and organizational level learning that can be inspired by conducting impact evaluations from the perspectives of change theory, programme theory and central place theory. These also offer possibilities of informing decision makers as to whether to expand, or improve road development related interventions by way of programmes, projects and policies. Therefore, from the perspective of Transport Geography, it is the primary interest of the researcher to contribute towards filling the aforementioned gaps in the existing body of the knowledge in Ethiopia and elsewhere.

Key words: *access, accessibility, change, corridor, COZ, highway, impacts, intervention, road development, socioeconomic, spatial, temporal, transport, ZOI,*

ACRONYMS

AADT	Annual Average Daily Traffic
ADB	African Development Bank
ADF	African Development Fund
BADEA	Bank of Arab for Economic Development in Africa
BoFED	Bureau of Finance and Development
CBD	Commodity Business District
COMESA	Common Market for Eastern and Southern Africa
COZ	Control Zone
CSA	Central Statistical Agency
DAC	Design Automation Conference
DD	Double-Difference
EEA	Ethiopian Economic Association
ERA	Ethiopian Road Authority
ETB	Ethiopian Birr
EU	European Union
FASID	Foundation for Advanced Studies on International Development
FTA	Federal Transport Authority
GDP	Gross Domestic Product
GIS	Geographical Information System
GOE	Government of Ethiopia
GPS	Global Positioning System
GTP	Growth and Transformation Plan
HH	Households
HYV	High Yield Value
IDA	International Development Association
EMA	Ethiopian Mapping Agency
FGD	Focus Group Discussion
IFPRI	International Food Policy Research Institute
INSA	Institute of Network Security Agency

IRF	International Road Federation
IRI	International Roughness Index
JICA	Japanese International Corporation Agency
Km/h	Kilometre per hour
MoFED	Ministry of Finance and Development
NDF	Nordic Development Fund
NMT	None Motorized Transport
NONIE	Network of Networks for Impact Evaluation
NW	North West
NE	North East
NUPI	National Urban Planning Institute
ODA	Official Development Agencies
OECD	Organization for Economic Cooperation and Development
OED	Operation Evaluation Department
OFID	OPEC Fund for International Development
OLS	Ordinary Least Square
PFM	Public Financial Management
QED	Quasi Experimental Design
RSDP	Road Sector Development Programme
RAI	Rural Access Index
RSDP	Road Sector Development Programme
RTA	Road Traffic Accident
SNNPR	Southern Nations Nationalities Peoples Regional State
SFD	Saudi Fund for Development
SSATP	Sub Sahara Africa Transport Policy
TOC	Theory of Change
TRL	Transport Research Laboratory
UNISA	University of South Africa
URRAP	Universal Rural Road Access Programme
USAID	United States Agency for International Development

USD	United States Dollar
VKM	Vehicle Kilometre
WHO	World Health Organization
ZOI	Zone of Influence

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CHAPTER ONE: INTRODUCTION

1.1 Background

Like many other economic and social activities that are intensive in infrastructure, the transport sector is an important component of the economy impacting on development and the welfare of the people (Rodrigue *et al*, 2011). When transport infrastructure is efficient, it provides various economic and social opportunities and benefits that result in positive multiplier effects such as better accessibility to markets, employment, education, health and additional investments (Oosterhaven and Knaap 2000).

Roads are viewed as a means of socioeconomic development because they link regions, places, people and economic activities. The expansion and improvement of a given road network would contribute to increases in accessibility and mobility, while reducing the distance to destinations, travel costs and travel time. Despite these social and economic benefits, road networks are also perceived as cultural artefacts that lead to negative ecological effects (Patarasuk 2013). Particularly rural roads are somewhat typical in terms of their capacity to literally pave the way for various investments in social infrastructure sectors such as schools, health services, and security services. Roads also facilitate access to new technologies as well as the marketing of surplus produce that contribute to increases in agricultural productivity. In case of the agriculture sector, better roads can significantly reduce the cost of inputs such as fertilizers, seeds, and extension services (Dercon *et al* 2008). On the output side, better roads increase the scope of profitable trade, which in turn encourages on-farm investments to raising agricultural production (Binswanger *et al* 1993). This in turn raises rural incomes, lowers food prices (and hence raises disposable income in urban areas), reduces spatial inequality in food prices, and reduces dependence on food imports.

If road infrastructure is well managed, it transforms the quality of life of citizens through dynamic externalities that its development often generates (Sengupta *et al* 2007:3). But when the system is deficient in terms of capacity or reliability, it can have an economic cost such as reduced or missed opportunities.

1.1.1 Historical Development of Roads

The first roads in various parts of the world were those that developed following trails and paths made by animals that helped people for hunting and gathering activities. Early roads were built in the Near East soon after the invention of wheels about 3000 B.C. The Romans were known for their ingenuity in road construction.

Roads in different countries have different historical backgrounds. According to Kadyali and Lal (2004), the origin of road infrastructures dates back to the period before the advent of recorded history. They point out that the ancient men who were living on by hunting began to form pathways to satisfy their desires. Rodrigue *et al* (2011) also stated that the pre-historic method of transportation mostly consisted of walking and swimming, then the use of animals to carry man himself as well as his possessions. The use of animals led ancient man to the invention of the wheel and this had contributed for changing the whole concept of transportation. Historical development of transportation and the socioeconomic role it played is well documented by Papi *et al* 2007:4 as quoted below.

> *Throughout history it is important discoveries and technological developments which have allowed mankind to leap forward, ameliorating its status and improving its standards of living. Reaching back thousands of years, the invention of the wheel generated a revolution comparable only to the invention of the steam engine which sparked the industrial revolution. In a similar fashion, it was the engineering feats of the Roman Empire, which allowed them to reach the furthest corners of Europe. Their roads, originally built for the fast deployment of legions, allowed citizens from all over Western Europe to have a better access to economic centres, thus enlarging the potential market for goods and services. It is significant to note, in light of the examples mentioned above, that road infrastructure has always played a key role in the progress and economic growth of a nation, both through the direct effects of a higher mobility for citizens and goods and also via the indirect benefits derived from the process of building infrastructure*.

However, the most improved type of road construction was started in 1810, when two Scottish, engineers, Thomas Telford and John Macdam demonstrated that a sheet of broken stones two or three centimetres in thickness became consolidated with the passing of traffic in to a hard water proof mass (Cain 1975 as cited by Shiferaw 2008). Many writers have also documented that the highway transportation has been expanded rapidly since the end of World War II.

1.1.1.1Historical Development of Roads in Ethiopia

The construction of modern highways and transport service in Ethiopia was started during the reign of Emperor Menilik, the founder of modern Ethiopia.. In 1902, he undertook the construction of the roads from Addis Ababa to Addis Alem and from the palace (presently located in the area known as Arat Kilo) to the British Embassy and to many different directions in the city (Meron 2007). The construction of these roads was soon followed by the import of the first automobile to the country in 1908. The vehicle was brought from Britain by a foreigner caller Mr. Bentley. During his importing, Bentley was convinced that, he needs a very strong kind of vehicle that can withstand the long trip and unfavourable road conditions since there was no paved road in the country that time (Eskinder 2007:9). In 1912 Emperor Menilik received a present from the king of Austria, a roller (stone crushers) for paving roads, which operates with steam energy. Then the road pavement was undertaken from the palace to 'Entoto Genet' and Addis Alem into modern standards. The rest roads were doomed to be dry and wet season types (Meron 2007). In 1915 other motor vehicles were imported to Ethiopia from Germany and Britain (Eskinder 2007: 10). However, up to the end of his reign in 1920, road pavement was not successful as expected and the transportation within the country was limited to the use of mules, donkeys and horses as well as camels in low land regions with most of the roads being nothing more than trails. Furthermore, it was during the reign of next successor, Emperor Hailesellasie I that road construction began to be undertaken in a modern and extensive manner.

Regarding the road network expansion in Ethiopia, time serious data of Ethiopian Roads Authority (ERA) had been summarised and computed since 1950s. Accordingly, when the Imperial Highway Authority established in 1951(renamed Ethiopian Road Authority in 1974), the total road stock was 6,400 kms (0.30 per 1000 people), which reached 48,793 kms in 2010 (0.59 km per 1000 people). The mean distance of the network had decreased from 95.31 kms in 1951 to 70.93 km in 1970 (in the Imperial period); and to 32.20 kms in 1990 (in the Derg period); and finally to 11.27 kms in 2010 (in the EPRDF period). The proportion of areas more than 5 km from all weather roads in 1951was 95 percent, in 1970, 93 percent; in 1997, 79 percent and in 2010, 64 percent showing significant improvements in terms of road accessibility.

These illustrate that the stock of road network in Ethiopia has been growing at encouraging higher pace. The budget allocated by FDRE for the construction of roads has exhibited a tenfold increase relative to the situation a decade ago. A recent government report on the implementation of the five year (2010-2015) Growth and Transformation Programme (GTP) indicates that, out of the total expenditure of the Government in 2010 and in 2011 the share of roads was 19.3 and 20.2 percent respectively. And out of the total expenditure in those sectors identified as pro-poor such as education, health, agriculture, water, and road, the share of roads was 29.24 and 30.33 percent (MoFED 2012). A recent report by W.T Consult PLC (2014) indicates that improvements in the road sector has helped to increase the accessibility of rural areas and their integration with the mainstream economy, as well as improve their access to health, education and other basic services (ERA 2014b).

Having quality road infrastructures is not a mere choice but a must for them to be competent enough in facilitating trade and investment in this era of globalization. Investors wish to deploy their capital where these facilities are available in good quality as the investors' main interest is to get good returns on their investment.

1.1.2 Overview of Impacts and their Evaluation Methods

Many factors can influence the livelihoods of household members as well as the performance of local areas and institutions. Policy makers should know these factors in advance and take measures to seek socioeconomic development. The measures to be undertaken can be highway construction, highway rehabilitation or highway pavement. In line with this, various questions should be raised to monitor and evaluate the outcomes of the implementation of suggested interventions. The central question, among others, may be 'To what extent can changes in outcomes of interest be attributed to a particular intervention?' It is in this line that impact evaluation strategies should be developed and executed.

Impact evaluation has over the last decades become more and more important for policy makers. Evidence-based (i.e., 'evidence-informed') policies are high on the (political) agenda and some even refer to the 'Evidence Movement' (Rieper *et al*, 2009 in Leeuw and Vaessen 2009:5).

Therefore, since the role of impact evaluation in development has received considerable and increasing attention from time to time, it is believed that governments, development agencies and researchers can benefit from such impact studies.

The starting point for an evaluation is a good consideration of the factual (what happened in terms of the outputs/outcomes targeted by the intervention?). A good account of the factuality requires articulating theories as this study considers programme theory and change theory which tries to connect the different causal assumptions from intervention outputs to outcomes and impacts.

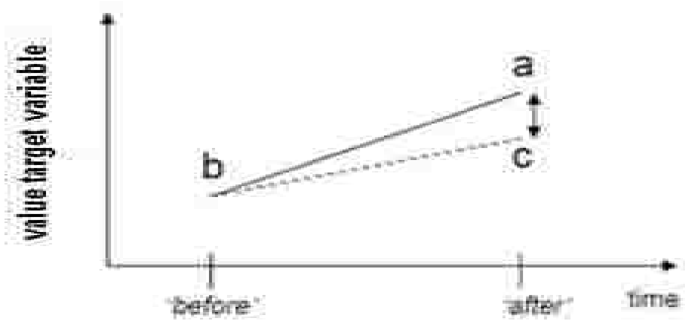

Figure 1. 1: Graphical Display of the Net Impact of an Intervention

Source:Leeuw and Vaessen 2009

Therefore, what we call the impact here is the net impact which is the difference between the target variable's value after the intervention and the value the variable would have had in case the intervention would not have taken place (a-c) (Leeuw and Vaessen 2009).

To achieve efficient type of impact evaluation, consideration of baseline and follow-up data (after intervention) gives facts about the development over the time and describe the factuality for the treatment group but changes observed by comparing pre-post data are rarely caused by the intervention alone since other interventions and processes influence developments, both temporally and spatially. To solve this problem the 'with' and 'without' intervention (counterfactual) should be considered in the impact evaluation. The application of quasi-experimental design which is commonly used in counterfactual analysis is that the situation of influenced group is compared with the situation of comparison group that is not affected by the intervention (also called the control group). Such design is nothing but impersonating an experimental situation. As illustrated in Figure 1.1, the net impact is the main issue here that point *a* after an intervention should not be regarded as the intervention's impact, nor is it simply the difference between the before and after situation (*a-b)*.

1.1.3 An Overview of Socioeconomic Impacts of Road Infrastructure Development

In the transport literature, the word 'mode' is used for all types of fixed facilities and moving entities providing services on the land and above the land surfaces. In other words, many transport types are providing services on the land surface (such as road, rail and pipelines), on/in the water body and in the air. Therefore, According to Lowe 2002 and Rodrigue *et al* 2014, 'mode' in transport context is classification based on the type of transport used and is named as: road, rail, water, air, pipelines, telecommunications, etc. or multi-modal (minimum of two basic modes providing the same type of services).

Among five modes: road, rail, water, air, and pipelines (also known as basic modes), road transport largely contributes to socioeconomic development of both developing and developed countries. A large body of literature reveals that the spatial patterns of socioeconomic development which can be induced by this infrastructure development process are in most cases said to be dynamic and tend to change over time. Major changes in the spatial structure of national, regional and local systems usually coincide with changes in the phase of social and economic developments.

Long term development benefits are among others likely to result from road investment interventions and in the long run vice versa. This means transport development presupposes economic development and economic development gains further presupposes road infrastructure development in terms of quality, technology and expansion. The quality and efficiency of road development impacts on quality of the social system, and the continuity of economic activity which assist multidirectional growth by reducing transport costs and improve the environment by removing unsuitable roads (Wimpy 2005). However, road is not always useful in and of itself, but the benefit comes when it allows users better and better which impacts through accessibility to various opportunities.

As pointed above, impacts of a road infrastructure development can be seen in terms of the local impacts as well as in wider regional and national perspectives. The local impact is expected to be limited to the immediate neighbourhoods of the highway. That is, to the towns and villages lying on both sides of the highway within an average distance of commonly 5 to 7 or 10 kms defining the influence zone (Vogel and Stephenson 2012:26; Sengupta *et al* 2007:10). The entire regional or national economic space beyond these neighbourhoods should also benefit from the development through progressive spread effect. Such effect may be called the regional or national level impacts. Further, the impact may be direct or indirect in nature. It may be mentioned in this context that the indirect effects on income, output, employment, land rent and land price and poverty are realized not only in the local economies in the proximity of the highway, but are also spread throughout the regional and the national economy by way of various linkage effects (Sengupta *et al* 2007:10). In line with this, this research focuses to assess the impacts of three Corridors in Ethiopia approximately 5 kms astride each road. Beyond 5kms, it is assumed to be control zones.

1.2 Research Problem

The Federal Democratic Republic of Ethiopia (FDRE) is the second most populous country in Africa (86 million people in 2013) (CSA 2013) but with low per capita income (USD 392, in 2010/11)(MoFED 2012:3), which is a very low amount as compared to LDCs such as African status which was USD 550 in 2013 (UN-Habitat, 2008:7). Structurally, Ethiopia's economy is based on agriculture.

Centuries of conflict, corruption and economic mismanagement have severely weakened the socioeconomic base of the country. Between 1960 and 2001, the economic development had experienced very low change (at an average 3% per annum), and the vast agricultural sector - which employs 86 per cent of the population – had been suffering badly particularly during the last two political regimes (before 1973 and 1973-1992). The country was and is importing more than twofold of its export). In short, the FDRE had been under severely depressed economy and governance and these chronic problems are still influencing the overall socioeconomic development in which the vast majority of the population survives in a subsistence agricultural economy.

Despite Ethiopia has diversified agro-ecological zones and immense human labor and said 'the water tower of East Africa', the question of how to reverse centuries/decades of economic stagnation in the Country is one that the research community has scarcely touched upon

One of the major causes of poverty which is dominant in developing countries like in Ethiopia is limited access and isolation attributable to poor road network distribution. Low emphasis given during the regimes to the road development has been impacted upon the Country not to enjoy the benefits of development that could be as a result of improvements in the transport sector. One of the bottlenecks is that policy makers do not have sufficient knowledge about the importance the impact assessment whatever the project or project they formulate. In a basically agrarian economy, achieving fast (now ambitious) agricultural and industrial growth requires a range of further investment particularly in road transportation accompanied by impact assessment. A recent study by Wei-Bin (2007) and Musekene (2010) indicated that rural people in developing countries have limitless problems and rural transport interventions are meant to alleviate the following challenges:

- Poor communities are isolated due to lack of reliable road access.
- Most journeys are short, numerous and time consuming. They typically occur for production or subsistence needs, such as collecting water and fuel, crop production, harvesting and processing.
- Longer journeys are infrequent, though they may well be essential to livelihood strategies. Such journeys include visits to hospitals and clinics, marketing of produce, or searching for jobs.
- Poor people do not own motorized vehicles and can rarely secure access to them. NMT, like carts and walking prevail in the rural areas.
- The transport burden for many domestic tasks tends to fall inexplicably on women, and social rules and customs often limit their access to available means of transport.

Therefore, based on the above mentioned issues of rural locations, improving the access for the isolated poor paves the way for access to better markets, better services, and better economic opportunities such as better living standards. Thus, investing on improved and standardized rural roads increases net returns to other worthy investments in both the farm and non-farm sectors. And such projects should be supported by scientific impact assessment studies to monitor and evaluate where they would achieve the expected outcomes.

Although promising investments and positive out puts are registered in Ethiopia, what is striking is that how do these infrastructure investment development efforts impact spatially and temporally upon society? How is the state of quality of the roads constructed? What are the quantifiable socioeconomic changes that road development brought to bear on households in the study area? The cases of such large projects, i.e. road Corridors, have not yet been analyzed from a scientific point of view on the perspective of socioeconomic growth relation in the country. Although rural roads play a central role in rural development, little is known about the size and especially the distribution of benefits that arise from it. This study considers some long-standing issues in transport geography and transportation research.

Based on appropriate measurement indicators, this particular study aims to discuss these and other issues scientifically by taking sample highway Corridors in three locations of Ethiopia (See the map in Annex 2). Assuming that there is a strong positive correlation between the development of road network and socioeconomic transformations, the findings will assist policy makers and stakeholders to conceptualize and widen the knowledge on how investing in road transport impacts on the socioeconomic development of households and communities and take appropriate measures to enhance the positive impacts and mitigating the negative impacts.

1.3. Objective of the Study

Based on the problem statement, the general objective of the study is to assess socioeconomic impacts of road infrastructure development on the surrounding communities of the study areas and investigate their relationships, with specific reference to Gendewuha – Gelago, Mile - Weldiya, and Ginchi-Kachise Roads. Based on this, the specific objectives of the study are to:

1) assess temporal development, status and quality of roads in Ethiopia;

2) examine the direct and indirect socioeconomic impacts (changes from pre to post implementation periods of road development interventions using quasi-experimental design) in the study areas:

   1.1) analyze the relationship of road proximity/accessibility with economic impact indicators such as: type of occupation of the household head, agricultural yield, income of individual household members, household asset, and expansion of trade activities;

   1.2) analyze and compare spatiotemporal impacts of road development based on pre and post road intervention periods in the study areas such as population and settlement expansion;

   1.3) analyze the relationship between road proximity/accessibility and social impact indicators such as poverty, education, health and gender;

   1.4) identify challenges related to road infrastructure development that might affect the achievement of positive impacts in the study area.

1.4 Motivation and Significance of the Research

What is the importance of impact evaluation at national regional and local levels? Leeuw and Vaessen 2009:5 in their study had summarized the following:

- Impact evaluation provides evidence on ‘what works and what doesn’t’ and how the extent of the impact. As OED (2005) cited in Leeuw and Vaessen (2009:5), measuring outcomes and impacts of the development and distinguishing these from the influence of other, external factors is one of the rationales behind impact evaluation;
- Measuring impacts and relating the changes with dependent variables and developmental policies and projects is not something that can be done ‘from an armchair’. Impact evaluation is a tool for these tasks;
- Impact evaluation can gather evidence on the sustainability of effects of interventions;
- Impact evaluation produces information that is relevant from an accountability perspective. In other words, it reveals knowledge about the societal effects of programmes which can be linked to the financial resources used to reach these effects;

- Individual and organizational learning can be inspired by doing impact evaluations. This is true for governmental, nongovernmental and donor organizations in developing countries. Informing decision makers on whether to expand, modify or eliminate projects, programmes and policies is linked to this point for further alternative interventions.

Nowadays, the issue of impact evaluation is coming to be a crucial tool to check whether or not transport policies formulated are being properly implemented and generate short and long term impacts at community, regional and national levels. Among the basic transport modes, road infrastructure has a major place globally, where as it is deficient in developing countries like in Ethiopia impacting on their development. Road transport, which is sharing about 95% of the total motorized modes in the country, has been given major emphasis in Ethiopia in view of its key role in national development in general and rural development in particular. Accordingly, its rural population, which accounts for 86% of the total, is enjoying direct and indirect benefits from road transport.

Although the Ethiopian government has made rapid progress in expanding its road infrastructure particularly since 1998, the affluence of researches exploring the direct and indirect socioeconomic impacts of road infrastructure development has been quite scanty. Although not sufficiently from transport geography point of view, Bhatta (2004) has an empirical study in Tigrai region of Ethiopia from economic point of view. His thesis discusses the relationship between road accessibility and socioeconomic development based on spatial (regional) patterns in Tigray region, Ethiopia. He had analyzed the socioeconomic transformation associated with road development. However, temporal analysis was not considered by the author, whereas transformation or development cannot be measured without considering temporal data. Apart from Bhatta's study, though not in the Ethiopian context, there are hand books of socioeconomic studies, such as Baker (2000) and Islam, *et al* (2008) as well as r some World Bank studies that analyzed the issue taking into account both spatial and temporal (baseline) variables though their general focus is on poverty issues.

The discussion about the relationship between road infrastructure and socioeconomic patterns particularly in developing countries like Ethiopia arises when one considers the exact impact for socioeconomic development. But there are no studies which address these issues in Ethiopia:

- No scientific impact studies have been so far conducted on newly extended roads in Ethiopia within the discipline of transport geography. There are few consultancy-based studies (such as those by Selam Development Consultants that cover four Federal Corridors conducted in 2007, 2008 and 2009). Even then, one cannot conclude that these studies are scientifically tested but rather they aim to fulfil limited objectives, for instance poverty alleviation. There is also a knowledge gap regarding possible negative impacts of road expansion.
- This study seeks to close the gap of baseline data for the study area. The socioeconomic baseline which will be established is expected to contribute to future studies and can also serve as a model for other corridors in the country.
- There is also a knowledge gap on how investment on roads can result in multidirectional benefits to the society through direct and indirect impacts. In most cases, road projects give priority to solving immediate problems than objective oriented policies. For instance, construction of narrow low capacity highways which cannot handle huge axle loads, lack of meeting standards and durability of roads, lack of emphasis given to quality of road expansion particularly related to road pavement, all of which cannot confirm to generate powerful long-term socioeconomic impacts which are very important in socioeconomic changes. In line with this, the present study aims to generate relevant policy orientated ideas. Based on this, a spatio-temporal impact analysis of road development may assist in the identification of areas or regions with specific problems, poverty, and further lead to a better sustained utilization of resources and consider spatially balanced development in the country.
- Appreciating the linkage between road investment and socioeconomic development offers direct help in identifying cost-effective projects, justifying the value of the same, and could also help point the way to alternative sources of funding. To this context, failure to link road infrastructure investments to various components of the regional economy makes it difficult to incorporate impact assessments into investment planning,

programming and budgeting procedures, and may lead to errors in the estimation of impacts (Huddleston and Pangotra 1990 cited in Gkritza 2006: 3).

Therefore, from the perspective of Transport Geography, there is little previous research undertaken on the issues mentioned above and it is the primary interest of the researcher to contribute and fill in the aforementioned gaps in body of the knowledge so far built up in Ethiopia.

1.5 Scope and Limitation of the study

This study is limited for appraising the socioeconomic impacts of road intervention at national and mainly at local levels. Study at national level covers data of 49 years for temporal analysis. Whereas, at local level, it includes three corridors in three regions ranging from 105 to 165 kms length each of which have 10kms in both sides as illustrated in section 3.1. Data through surveys, interviews, FGD, observation and traffic counts had been collected and analysed. ,

Socioeconomic impact assessment is complex and laborious process, and thus not a favoured type of research as some writers also suggest. The researcher had encountered challenges in obtaining accurate information on the income of individuals and households, as it is a highly sensitive issue in all of the communities covered by the study. As such, few figures were generated from the expenditure related data provided by the respondents, which were assessed and analyzed with utmost care.

Moreover, the research topic is broad and complex as making impact assessment by its nature requires employing several indicators, and the study areas were remotely located with limited inter and intra transport service, harsh climate and security-related concerns. In addition, getting satellite imageries for the base line was tiresome, while time and budget related constraints created some obstacles during the conduct of the research. However, the researcher has managed the various difficulties with his own efforts and various kinds of support he solicited from his dissertation supervisor, UNISA, Ethiopian Civil Service University, INSA, EMA, Regional and *wereda* offices, and professionals.

1.6 Explanation of Important Terms

The definitions of concepts and terms shown below are intended to allow common understanding among readers and researchers about their use in the study.

1.6.1 Different Concepts on the Classification of Roads

Different writers have classified vehicle roads differently: in terms of *seasonality in their use* (all weather and fair weather roads), in terms *carriage way* (paved and unpaved), based on their *service provision* as inter- urban and intra-urban linkages: named as arterial (primary), sub arterial (secondary) and local roads (tertiary) (Hursakar 1997). The latter classification is expanded up to six with more elaboration by Einstein [nd].

Einstein College of Engineering [nd] expands the latter classification based on speed and accessibility put as the most generic one. As illustrated in Figure 1.2, the roads are classified in the order of increased accessibility and reduced speeds:

(i)Freeways: Freeways are access-controlled divided highways, commonly four lanes (two lanes on each direction), but many freeways widen to incorporate more lanes as they enter urban areas. Access is controlled through the use of interchanges, and the type of interchange depends upon the kind of intersecting road way (rural roads, another freeway etc.).

(ii)Expressways: They are high standard type of highways and are designed for high speeds (120 km/hr is common), high traffic volume and safety. They are generally provided with grade separations at intersections. Parking, loading and unloading of goods and pedestrian traffic is unacceptable on expressways.

(iii) Highways: They stand for the superior type of roads next to express ways and freeways. They are of two types - rural highways (highways passing through rural areas (villages) and urban highways (those passing through large cities and towns). Highways of the latter type are the main focus of this dissertation.

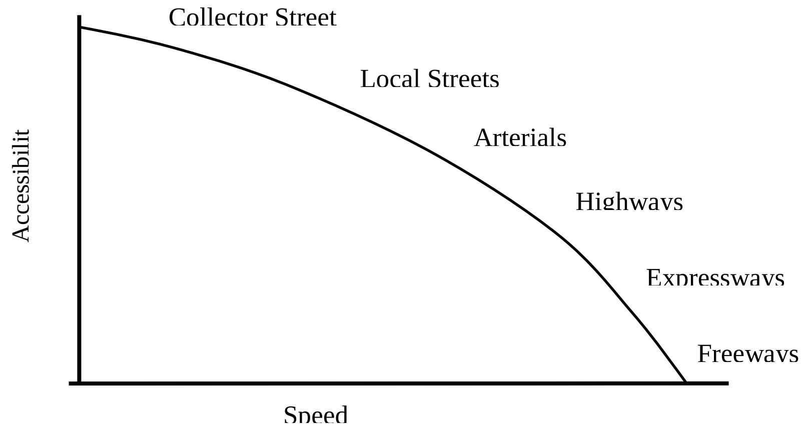

Figure 1. 2: Road Classification Based on Speed and Accessibility
Source: Einstein College of engineering [nd]

(iv)Arterials: It is a general term denoting a street primarily destined for thorough traffic usually on a continuous route. They are generally divided highways with fully or partially controlled access. Parking, loading and unloading activities are usually restricted and regulated. Pedestrians are allowed to cross only at intersections/designated pedestrian crossings. The width of these type roads is 25-30 metres

(v) Local streets: Are primarily intended for access to residence, business or abutting property. It does not normally carry large volume of traffic and also allows unrestricted parking and pedestrian movements.

(vi)Collector streets: These are streets intended for collecting and distributing traffic to and from local streets and also for providing access to arterial streets. Normally full access is provided on these streets. There are few parking restrictions except during peak hours.

Road components: Road is composed of different elements along its right of way. The main components are: carriage way, side walkway, parking, plantations, median strip/centre divider strip/, and street lights.

Long distance terminals standards: Terminal is depot/location where journeys begin and end and/or change of mode (e.g. from road to rail or vice versa) takes place (Lowe 2002). Long distance bus terminals must be designed to cater for the maximum predicted number of vehicle arrivals and departures, taking into account considerations of safety for passengers and other personnel using the station. For long distance bus terminals of about 30,000 square metres, 15 departure stands keeping parking angles should be prepared (Ils 2005). Accordingly the following facilities are used as the standard (Kadiyali 2006 and Ils 2005):

- It should be located outside a congested area;
- Offices for the operators and security purposes;
- Necessary infrastructure like fence, sufficient light, water and telephone facilities;
- Cafeteria, book-stalls, toilets etc should be made;
- The plate forms where pedestrians wait should be raised with shelter;
- Parking facilities for cars, taxis, cycles, scooters, etc should be liberally provided; and
- The terminals should be planned for the anticipated future traffic in the design period.

1.6.2 Concepts of Mobility, Accessibility and Road Condition

Mobility is the ability of people to transport themselves and their goods, and to reach economic and social services. Mobility is made possible by the transport means available—both motorized and non-motorised (NMT). Individuals and private entities typically own and operate these means of transport **(**FAO and World Bank 2009 in Banji *et al* 2012:37).

Road accessibility: It refers to the opportunity to use or to reach some destination. It is measured as the percentage of population having access to all weather roads. The accepted theory, according to ERA's (2008b) study, is that accessibility has three elements: 1) the location of the individual; 2) the location of the supply, service, or facility to which the individual needs access; 3) the link to bring the two together. The same study has used the random model approach among others to identify the country's network demand. This demand was estimated as such that all rural population could have access to all weather roads within a 5 km distance (Ibrahim 2010).

Rural accessibility is the degree of ease or difficulty rural people or communities encounter in accessing locations for satisfying their basic social and economic needs such as food production, water collection, firewood collection, education, primary health care, trading, and transport **(**FAO and World Bank 2009 in Banji *et al* 2012:37).

Road condition: Road conditions are defined as in the World Bank policy research working paper series by Queiroz and Gautam (1992:3) as *good*, *fair* and *poor*: (a) Good: includes paved roads substantially free of defects and requiring only routine maintenance, or unpaved roads needing only routine upgrading and spot repairs; (b) Fair: includes paved roads having significant defects and requiring resurfacing or strengthening, or unpaved roads needing reshaping or resurfacing and spot repair of drainage; and (c) Poor: are paved roads with extensive defects and requiring immediate rehabilitation or reconstruction, or unpaved roads needing reconstruction and major drainage works.

1.6.3 Concepts of Standards to Measure the Quality of Roads

To evaluate the status and quality of classified roads (those roads that are included in the roads legislation as public roads), the standards are broadly classified into three as illustrated in Table 1.1: good, fair and poor. The document of Sub Sahara Africa Transport Policy (SSATP) by Banji *et al* (2012:119**)** indicates that 'Good' classification includes 'Very Good' and 'Poor' classification includes 'Very Poor'. The guide is based on the International Roughness Index (IRI) which is most commonly used in the world. IRI can be obtained from measured longitudinal road profiles expressed in m/km or mm/m. For instance, of paved roads the roughness per km ranging between 1and 3.5 metres of its longitudinal surface is said to be 'good' and of 'earth' road ranging between 15.5 and 25 metres is said to be 'poor'.

Table 1. 1: Guidance on Conditions of Roads

Surface Type	Condition Category	Roughness(IRI m/km)	
		Minimum	Maximum
Asphalt	Good	1.0	3.5
	Fair	3.5	5.5
	Poor	5.5	16.0
Gravel	Good	1.0	9.0
	Fair	9.0	13.5
	Poor	13.5	25.0
Earth	Good	1.0	11.0
	Fair	11.0	15.5
	Poor	15.5	25.0

Source: Banji et al 2012

This indicator measures the percentage of the total classified road network in the project area depending on the road surface and the level of roughness. IRI, since its introduction in 1986, it has become the most popular globally for evaluating and managing road systems whether paved or un paved.

It is also used to evaluate new pavement construction, to determine penalties or bonus payments based on smoothness.

1.6.4 Concept of Impacts

According to OECD-DAC (2002) cited in Leeuw and Vaessen (2009:5), impact is defined as "*the positive and negative, primary and secondary long-term effects produced by a development intervention, directly or indirectly, intended or unintended. These effects can be economic, socio-cultural, institutional, environmental, technological or of other types*". From the definition, impact can be identified from the value of the results derived from an intervention. This is not only an empirical question but essentially a question about values – which impacts are judged as significant (whether positive or negative), what types of processes are valued in themselves (either positive or negative), and what and whose values are used to judge the distribution of costs and benefits of interventions.

Intended versus unintended effects: In most cases, in development programmes and projects, intended effects are often translated into measurable indicators as early as the design phase. Impact evaluation should go ahead of assessing the expected effects given an intervention's logical framework and objectives. Furthermore, effects are mostly context-specific, where different contexts trigger particular processes of change.

Classic impact evaluations assume that there are no impacts for non-participants, but this is not likely to be true for most development interventions. For example, spill over effects or replicatory effects can stem from market responses (given that participants and non-participants trade in the same markets). In other words, the ***influence zone (treatment group)*** of an intervention intends to generate results unlike the area outside the influence zone*(control group)* which is an unintended due to the counterfactual factors (*different type of intervention* rather than *no intervention)* (Leeuw and Vaessen 2009:29). The *treatment group* can be compared with the *control group* in order to determine whether change differences between both groups may be due to the intervention. By principle, the *control group* should resemble the *programme (treatment) group*, so that logical differences between the two groups may be attributed to the effects of the intervention (Musekene 2010; Islam *et al* 2008; Khandker *et al* 2010).

Short- term versus long-term effects: in some types of interventions, impacts materialize quickly. In others they may take much longer, and change occurs eventually. The timing of the evaluation is therefore essential. With the exception of the influence of humanitarian disaster, emergency situations, and other global and local external factors, development interventions are usually assumed to contribute to long-term developments. However, focusing on short-term or intermediate outcomes often offers for more useful and immediate information for policy- and decision-making issues. Intermediate outcomes according to Leeuw and Vaessen 2009, are perhaps misleading (what Vogel and Stephenson, 2012:20 also call *missing middle* in the logical frame work of impact pathway), often differing noticeably from those achieved in the longer term. Many of the impacts of interest from development interventions will only be manifested in the longer-term process, such as environmental changes, or changes in social impacts on successive generations.

The sustainability of effects: Impact evaluations therefore need to identify short-term impacts and, where possible, indicate whether longer-term impacts are likely to occur. To ensure sustainability, early warning indicators are important in order to detect negative impacts in the long term. A well-articulated intervention theory, that also meets the time horizons over which different types of outcomes and impacts could rationally be expected to take place, can help to identify impacts which can and should be explored in an evaluation. The sustainability of positive impacts is also likely to be only apparent in the longer term. Impact assessors therefore can focus on other impacts that will be observable in the short term, such as the institutionalization of practices and the development of organizational capacity, that are likely to contribute to the sustainability of impacts for the communities in the longer term(Leeuw and Vaessen 2009:19).

Types of impacts in development impact assessment

Development impact assessment should be an integral part of the planning process as it provides extensive documentation of the anticipated socioeconomic changes on a community. Types of common impacts which address the extent of any development on the community according to Edward (2000:3-5) are broadly categorized into four: *fiscal, traffic(transportation), socio-economic, and environmental impacts*. These are summarized below:

Fiscal impacts: Fiscal analysis involves assessing the public service costs and revenues associated with the development. Since fiscal feasibility plays an important role in indicating whether or not to proceed with a proposed development, fiscal impact analysis is a critical component of any development impact assessment.

Traffic (transportation) impacts: Motorized and non motorized traffic mobility on fixed and non fixed lines can be a normal end result of many development projects. In considering further development scheme, it is imperative to evaluate potential transportation-related impacts including additional infrastructure requirements (e.g., more roads, traffic lights), increased traffic congestion, traffic accident and environmental issues.

Socio-economic impacts: Socioeconomic impact assessment centres on evaluating the positive and negative impact development on community's social and economic well-being. ***Evaluation*** here refers to an independent quantitative and qualitative assessment of the processes of implementing a programme and its impacts. An evaluation is also about assessment of how successful or otherwise the programme has been, and/or what lessons can be learnt for the future (Musekene 2010:28; Edward 2000). Whereas, ***Impact evaluation*** is a systematic identification of whether positive or negative, changes, effects, outcomes on individuals, households, institutions, and the environment caused by a given development activity such as a road programme (Musekene 2010:28).

Development impacts are generally assessed in terms of changes in community demographics, housing, employment and income, market effects, public services, and aesthetic qualities of the community. *Socioeconomic impact analysis in this study* focuses specifically on measurable changes starting from transportation policy implementation trends, and impact analysis on how a programme affects the socioeconomic aspects of a given area and community. The economic impact area may be as small as a neighbourhood or as large as a region, and nation. At a neighbourhood or corridor level, socioeconomic impacts can be measured in terms of the change in household property values, increased investment along the corridors or increased density of development and change of residence or business. At a regional or national level, the measures of economic impacts are in terms of changes in output or gross domestic product, and the associated changes in jobs and in wage income. Evaluating proposed developments in a socioeconomic framework will help policy makers, community leaders, academicians and residents identify potential social equity issues, evaluate the adequacy of social services and decide whether the project may unfavourably affect overall social well-being.

Environmental impacts: In most cases development leads to positive or negative environmental impacts. Negative impacts can be loss of open space, impacts on groundwater and surface water quantity and quality, changes in air quality, increases in impervious cover (e.g., paved roads, parking lots), alteration of wildlife habitat and changes in landscape aesthetics. To the extent that a proposed development affects natural resources in a community, an environmental impact assessment is designed to identify the level of impact and assist the policy makers and the community in ensuring that development plans mitigate associated environmental impacts.

1.6.5 Direct and indirect impacts of road infrastructure

Road infrastructure is a fixed entity where the road transport operation takes place. Its physical elements are road networks which include tracks, nodes, terminals and bridges. Road infrastructure is playing a key role in the progress and socioeconomic growth of a nation, both through the direct effects of mobility for the society and goods and also via the indirect benefits derived from the process of constructing infrastructure (Papí *et al* 2007:4; Ochieng 2002:3-6; Islam *et al* 2008 Part 2 :13). The **direct impacts** apply in the form of (a) an enhancement of the level of spatial connectivity (and the consequent increase of passenger and freight traffic carrying capacity) which may be initially low (b) a reduction of the cost of provision as well as the cost of use of road infrastructure, and (c)the increase in turnover of the users.

The **indirect** impact of a road development, on the other hand, would work through the dynamic developmental synergies generated through the forward and the backward linkages. The change in agricultural land use pattern can be an example. This can be induced by changes in the patterns of settlement, agricultural land use, trading and other services and non-farm unorganized sector activities. All these would be reflected in the changes in the pattern of socioeconomic activities, income generation, price evolution, employment conditions and land rent prevailing in the concerned local region.

A new land use pattern may in turn create a greater attraction zone and accessibility to jobs, markets, health and educational facilities and attract investment for the development of feeder roads, power distribution networks, telecommunication facilities and other modes of connectivity leading to a greater access. All these should have a bearing on the level of well-being of the households (Sengupta *et al* 2007: 8-9; Islam *et al* 2008 part 2: 13). As stated by Ochieng (2002:6), generally it is not meaningful to study indirect effects without any knowledge of direct effects.

1.6.6 Socioeconomic Development Related Concepts and Theories

Growth and *development* are related but different concepts. **Growth** entails a quantitative dimension on a given area or on the community or on the performance which involves an increase in the size, input and outputs etc. It is generally measured in demographic, economic and spatial terms, such as population increase, increase in economic activities and associated outputs and the physical expansion in rural or in urban such as land use (Dagnew *et al* 2012:5).

Development as noted by many scholars has multi-dimensional concepts and those numerous meanings and definitions have been ascribed to it. *Development* is qualitative in nature and specifically based on the measure of human welfare. It entails a change that directly or indirectly generates an improvement in the well being of the generality or majority of change of landscape or society or residents: particularly the low income or other disadvantaged groups. Its determination is based on measures such as income, access to housing, safe and adequate supply of services, and other human development indictors (Dagnew *et al* 2012:5). Cypher and Diethz (1997) describe it as the process of addressing improvement of socioeconomic and political dimensions of society that leads to increased income and improved standard of living conditions.

Coetzee *et al*. (2001:120) cited in (Musekene 2010:39) in their book *Development Theory, Policy and Practice* noted that development is "*a form of social change that will lead to progress, the* *process of enlarging people's choices, acquiring knowledge and having access to resources for a decent standard of living, and a condition of moving from worse to better"*. This argument infers that development in development theory contends about socioeconomic change which is similarly addressed in change theory. Therefore, change theory is accommodated in the broad theory, development theory. Impact analysis is more specifically about change theory and more generally about development theory. Therefore, this research has given more emphasis to discuss the importance of change theory among others.

According to Goulet 1995 cited in Musekene 2010:23), any adequate definition of development should include various aspects, such as:

- an *economic component* dealing with the creation of wealth and improved conditions of material life, equitably distributed;
- a *social ingredient* measured as well-being in health, education, housing and employment;
- a *political dimension* embracing such values as human rights, political freedom, legal enfranchisement of persons, and some form of democracy;
- a *cultural element* in recognition of the fact that cultures confer identity and self-worth to people;
- *ecological soundness; and*
- *full-life paradigm*, which refers to meaning systems, symbols and beliefs concerning the ultimate meaning of life and history.

This entails that if people are living in poverty, then their community or society can be regarded as 'underdeveloped'. So it is sound to say that development should focus on the elimination of absolute poverty. Development in general has numerous fundamental elements: a) it is a *process* that involves *change* resulting in improvements. b) the focus of any change or advancement should involve the *reduction of absolute poverty*. c) the nature of the change will differ, depending on the *context* of the development process. Specifically, the values and priorities of the community, region or country undergoing change should determine the nature of change (UNDP 1997: 15 cited in Musekene 2010:23).

Socioeconomic development in this study refers to a process of improving the quality of life and level of well-being or prosperity of a local community. Increased employment opportunities, increased household income, promoting access to services and emerging socioeconomic activities, improved local infrastructures such as roads, health, education and housing, are all facets of socioeconomic development (Edward 2000:3-5).

1.6.7 Transport Geography: Concepts, and Development

Transport geography is a sub-discipline of geography which is concerned about the movement of people, freight and information. It seeks to link spatial constraints and attributes with the origin, the destination, the extent, the nature and the purpose of movements (Rodrigue *et al* 2006). This definition underlines a strong connection between geography and transportation.

"There would be no transportation without geography and there would be no geography without transportation" (Rodrigue *et al* 2006:1). He asserts that transportation concerns geographers for two major reasons. a) Transport infrastructures (such as networks and terminals), and equipment occupy a vital place in space and form the basis of a complex spatial system. b) Since geography inquires about to explain spatial relationships, networks are of specific interest because they are the main support of these interactions. Transport through its evolved components (infrastructure, modes and users) forms spatial imprints on the space.

As discussed by Rodrigue *et al* (2014), transport geography, as a discipline, came into view from the field of economic geography in the second half of the twentieth century. Harmse (2004) emphasized that economic geography had been in existence for more than a century as a hidden sub-discipline within the broad field of human geography. A historical view of transport geography is also provided by Black (2003). He highlighted that transport geography has made the paradigm shift from the use of basic spatial interactions models to the use of more sophisticated network approaches, and the venturing into the sphere of social-behavioural research. Keeling (2007) also added that the spatiality of human interaction by transport geography might help to influence public policy and shed light on new ways of understanding the role of transport at local, national, and global scale.

Conventionally, transportation has been an important factor over the economic representations of geographic space, namely in terms of the location of economic activities and the monetary costs of distance. The growing mobility substantiated the emergence of transport geography as a specialized field of investigation. In the 1960s, transport costs were documented as key factors in location theories. However, due to the influence of globalization, transportation became under-represented in economic geography in the 1970s and 1980s. Then after, since the 1990s, it revived with renewed thought, especially because the issues of mobility, production and distribution are interrelated in a complex geographical setting. It is now recognized that transportation is a system that considers the complex relationships between its core elements: networks, nodes and demand. Demand for all kinds of traffic mobility is a derived function of a variety of socio-economic activities. Nodes are the spots where movements are originating, ending and being conveyed. Networks are composed of a set of linkages drawn from transport infrastructures. As described by Rodrigue *et al*, the three core relationships and the impedance (friction) they are subject to are:

- **Locations**. Locations contend level of spatial accumulation of socio-economic activities together defines demand and where this demand is taking place. Impedance is by and large a function of the accessibility of nodes to the demand they service.
- **Flows**. Flows indicate the amount of traffic over the network, which is jointly a function of the demand and the capacity of the linkages to support them. Flows are mainly subject to the friction of space with distance being the most significant impedance factor.
- **Terminals**. Terminals are facilities conferring access to the network. They are jointly characterized by their nodality and the linkages that are radiated from them. The capability of transport terminals to handle flows is the main impedance factor.

Without a doubt, like geography, transport geography is at the meeting point of several concepts/disciplines and methods originally developed outside the discipline that have been adapted to its particular interests and concerns.

The analysis of these concepts depends on methodologies often developed by other fields, such as economics, mathematics, planning and demography. For instance, the spatial structure of transportation networks can be analyzed with graph theory, which was originally developed for mathematics. Nowadays, graph theory is a special concern of transport geography in network analysis (Rodrigue *et al* 2006).

1.7 Structure of the Dissertation

This dissertation is structured into eight chapters. Following this introductory chapter,

Chapter Two provides the reviews made on available literature on broad theoretical frameworks and empirical works on the impacts of road development on social and economic aspects of the community. The review documents the nature of methodologies employed in similar previous research, and key findings. An overview is also provided on the impact/change theories and the changing nature of the relationships between road infrastructure and socioeconomic development.

Chapter Three outlines the research methodology and the setting of the study within the framework of the available methodological constructs and theories. Specific focus is placed on explaining how the data collection instruments were developed, the list of respondents, the procedures followed to obtain ethical and administrative clearance and support to gather different types of data, and how the data was collected and analyzed.

Chapter Four analyzes the temporal development of roads in Ethiopia. It mainly focuses with the transport policy implementation in Ethiopia. The temporal analysis is focusing on the performance of road expansion and financing by classifying the growth process in three political regimes: the mixed economy, the command economy and the free market economy. The spatial analysis also includes the development of the distribution of the road network at the national and regional level and compares the baseline before the start of the RSDP (1998) with the present situation.

Chapter Five presents the analysis made on the findings on economic impacts of road development and the relationship of road proximity with impact indicators such as changes in occupational categories, agricultural yields, income, saving, assets, trade, market and traffic mobility.

Chapter Six is about the analysis made on the findings on social impacts of road development and the relationship of road proximity with impact indicators such as population changes, settlement patterns, status and changes on poverty indicators, education, and health and gender issues. .

Chapter Seven discusses internal and external factors that are found to have influenced the short-, medium- and long-term socioeconomic positive impacts of road development in the study areas.

Chapter Eight provides the main conclusions and recommendations. Here the conclusions of the findings, recommended implementation strategies and suggestions for future research are included.

CHAPTER TWO: REVIEW OF LITERATURE

This Chapter provides an overview of theoretical and empirical literature underlying the relationships between road infrastructure provision and socioeconomic impact variables. The Literature review is classified under three themes: the first is about theories relevant to this study; the second focuses on methodological approaches in socioeconomic impact evaluation; whilst the last one is about relevant empirical literatures.

2.1 Basic Theories in Impact Evaluation

The research process is not divorced from theory. According to Kitchin (2000:1), theory, methodology and practice are tightly bound. As ORS (2004:1) notes, *‘’There is nothing as practical as good theory’’*. Kitchin (2000:33) suggested that theory is a set of explanatory concepts that is useful for explaining a particular phenomenon, situation or activity. The identification of a valid theory in road development impact evaluation can tell us not only what should be done, but also what can be done and the process by which it can be achieved. This study employs theory of evaluation under which programme theory and change theory are used as tools for checking the road development impacts in the study areas. Programme theory is the issue of intervention by actors such as the government, private companies etc for the project formulation and implementation, whereas, change theory is about the impact created due to the interventions. The discussion of these relevant theories is provided below. Under the theory of change, the most important objective is to check temporal and spatial changes (impacts). Spatial change can also be analyzed using concepts from the Central Place theory and Graph Theory, which are dominant theories in transport geography.

Evaluation theory is defined differently by different writers. Mark (2005) puts evaluation theory as *evaluation model* and to the way the term *evaluation approach*. Evaluation theory by Mark is summarized from different scholars as the way of consolidating lessons learned (synthesizing prior experience), and to compare with the present situation; and to learn from the experience of others.

More acquaintance about evaluation theory according to Mark can especially at first make methodological choices harder because of many evaluation theories take quite different stances about what kind of uses evaluation should focus on, and about how evaluation should be done to achieve those uses. For example, he highlighted four views of evaluation theorists, Donald Campbell and Joseph Wholey, related to programme implementation, effects, outcomes and performance measurement systems: (a) the possibility of major choice points in the road, such as decisions about whether or not to implement some new programme; (b) the way decisions about such things often depend largely on the programme's potential effects; and (c) the benefits of either randomized experiments or the best-available quasi-experimental data for assessing programme effects; (d) evaluation can contribute through developing performance-measurement systems that programme administrators can use to improve their ongoing decision making. These performance measurement systems can help policy makers and managers identify problem areas and also provide them with sufficient feedback about the apparent consequences of decisions. Generally theories cannot exactly tell 'one size fits all' but centrally suggest that one size fits repair near all (Mark, 2005:3).

The difference in purpose and reasoning of the various performance measurements lead us to think about different drivers of contingent decision making. Furthermore, almost any method may be appropriate, if it is likely to help intended users make the intended use. Alternatively, evaluation theories related to purposes and methods for a new programme, according to Chen in Mark (2005), would typically be different from those for a mature programme to likely contribution to social betterment. Therefore, evaluation theories are tools to thoughtful judgment/ choices about methods.

Although, various theories (such as development theory, economic theory, and social theory) are somewhat related to this broad study, socioeconomic impact assessment, the most appropriate, and relevant specific theories in impact assessment are: programme (intervention) theory, theory of change and graph theory.

2.1.1 Programme Theory

Programme theory is understood as the underlying assumptions and delivery mechanism of how a programme should work. It is related to the development of programme goals and objectives. It is also related to how the programme is implemented through the tasks of education, funding mechanisms, mentoring, rules and regulations, technical assistance, etc. The assumptions are related to how the programme's outcomes can be measured or assessed via programme determinants (Rogers, Petrosino, Huebner, & Hacsi 2000 in Hubbard 2010:27). Programme theory according to Leeuw and Vaessen (2009:11) is put as impact theory. Impact evaluation is useful for assessing the validity of the programme theory and for testing some of the critical assumptions and hypotheses on which it is based (Bamberger & Fujita 2008:5-6).

As cited in Theory-based Impact Evaluation of White (2009:3) elaborations of programme theory have long been used by some practitioners of experimental and quasi-experimental approaches as a way of explaining their findings. The underlying theory behind a programme's formulation often remains hidden typically in the minds of policy architects and their staff unless it is properly documented. Recently, it has received the attention of many scholars within the evaluation arena because of its flexibility and compatibility with other programme evaluation theories and techniques (Leeuw and Vaessen 2009:11; Hubbard 2010:27).

2.1.2 Theory of Change (TOC)

2.1.2.1 Concepts of Theory of Change

There is no single definition of what theory of change is and no set methodology. People work with theory of change flexibly, and according to their requirements.

Organizational Research Services (ORS) (2004:1) defines that "The label *theory of change* is often referred to by other terms, such as *pathway of change, engine of change, blueprint, logic model* and *theory of action*.

Anderson (2005:12) widely covers the concept of theory of change as:

> *A theory of change (TOC) is a tool for developing solutions to complex social problems. A basic TOC explains how a group of early and intermediate accomplishments sets the stage for producing long-range results. A more complete TOC articulates the assumptions about the process through which change will occur and specifies the ways in which all of the required early and intermediate outcomes related to achieving the desired long-term change will be brought about and documented as they occur*.

Vogel and Stephenson (2012:3) defines theory of change as "… an outcomes-based approach which applies critical thinking to the design, implementation and evaluation of initiatives and programmes intended to support change in their contexts"

Davies (2012) defines theory of change as "The description of a sequence of events that is expected to lead to a particular desired outcome".

The Comic Relief review in Vogel and Stephenson (2012:9) puts further a learning-based defined theory of change as: "…on-going process of reflection to explore change and how it happens - and what that means for the part we play in a particular context, sector and/or group of people". In this perspective, it locates a programme /project within a wider analysis of how change comes about, t draws on external learning about development, speaks distinctly our understanding of change by also challenging us to explore it further and acknowledges its complexity: the wider systems and actors that influence it.

These definitions share very common terms. They indicate that theory of change is a guide which shows a picture of important implementation processes from the origin up to the destination. This can be explained in other words that if someone doesn't know where he is going, any road will take him there. This is to indicate how it has a paramount importance not to wander aimlessly. The conceptual essences also explicitly illustrate: the feedback loops in project implementation, how project achievements build capacity for further progress, how projects impact family and community strength in the short-term, and through their contributions to capacity building, their impact in the long-term process.

2.1.2.2 The Importance of the Theory of Change

Community initiatives are sometimes planning their projects without an explicit understanding of the early and intermediate steps required for long-term changes to occur. Therefore, many assumptions about the change process need to be investigated for programme planning or evaluation planning to be most effective. A TOC creates a truthful picture of the steps needed to reach a goal. It provides an opportunity for bilateral and multi-lateral development agencies, governments, non governments, planners, researchers and others to assess what they can influence, what impact they can have, and whether it is realistic to expect to reach their goal with the time and resources they have available. TOC is best kept flexible. It is ongoing process and a product rather than a prescribed methodology. It is most effective when applied through pre-existing processes, to support critical thinking throughout the programme cycle. Working with theory of change needs appropriate performance management approaches to accommodate uncertainty and flexibility. To be applied well, theory of change demands an institutional willingness to be pragmatic and flexible in programming responses, both at the design stage and, more prominently, in implementation and performance management (Weiss 2005:12; and Stephenson 2012:3-5).

2.1.2.3 Drivers of Theory of Change

The wide acceptance of theory of change by policy makers, researchers and in the society in general has taken long time. According to Vogel and Stephenson (2012:9-10), the current evolution of theory of change draws on two streams of development and social programming practice: The first is the evaluation: which is an aspect of programme theory, a long-standing area of evaluation thought, developed from 1960s onwards. And the second is informed social action: Since the 1960s, informed action for social change and participatory approaches has advocated a conscious reflection on the theories of development, as a basis for social learning and action.

Three key drivers according to Vogel and Stephenson (2012:8) which contributed to the mainstreaming of theory of change thinking are summarized as follows:

a) **Results agenda:** This is driving the call for demonstrating impact, especially in difficult areas like governance, highways and other development strategies. Evaluation has come to the forefront as the demand for evidence of results and the ascription of effects to programmes' influence is sought, as a means to understand impact and how that might be achieved elsewhere.
b) **Complexity:** In tension with the drive for more assurance of results, there is a growing recognition of the complexities, and uncertainties of development work, involving complex political and social change in dynamic country contexts. Theory of change thinking is viewed as one approach to help people deal positively with the challenges.
c) **Country-owned development:** The emphasis on country possession in development cooperation is focusing attention on supporting national programmes, collaborating and innovating with local actors, institutions and local capacities, as well as responding to new configurations of development actors. Theory of change thinking is viewed as encouraging realistic and politically informed mappings of circumstances, actors and capacities for impact.

Over the last five years, theory of change approaches has moved into the mainstream in international and national development. James (2011) suggests that a recent review on the use of theory of change in international development by Comic Relief has been very helpful in sharing and consolidating experience that up to now has been locked within organizations and opening up the discussion to people working on programmes who are not evaluators.

2.1.3 Difference between a Theory of Change and a Logic Model

Originally, log-frames were intended to summarize an in-depth participatory discussion with project stakeholders about the goals the project would contribute to, with in the umbrella of 'theory of change thinking.' The intention was that it should be used to analyze external dependencies that would influence the programme's effectiveness.

Another issue is that the log-frame as it is currently used hides what we call a 'missing middle' – how the immediate results of a programme influence changes at other levels to influence outcomes and impact in the longer-term. Theory of change thinking can help to bridge the 'missing middle' that the log-frame hides.

In short, the TOC summarizes work at a strategic level, while a logic model would be used to illustrate the tactical, or programme level understanding of the change process (Andreson, 2005).

2.1.4 Description of the Project Impact Evaluation Framework and Testing the Theory

2.1.4.1Mapping Types of Changes

In the change theory the connections from the origin up to the destination can be built by using outcome maps (a logic model). A logic model is a tactical explanation of the process of producing a given outcome. At the completion of an outcome map, there should be assumptions about the change. Government initiatives normally include strategies, interventions and activities, which are clearly defined, staffed and funded – for example, road project which is based on the goal expecting that it will bring the desired positive changes upon communities. Some of these 'on the way' changes reflect actual changes in people's lives, either at the individual or population level and also changes upon verities of entities (ORS 2004).

Changes in people's lives can include changes in knowledge, skills, behaviours, health or conditions for children, adults, families or communities. This change as ORS is called an **impact.** Impact for individuals is also the first things that occur as a result of the programmes, services, actions or planned strategies of a community initiative. As individual changes arrive at a greater scale, they may contribute to community or societal level changes. For example, if many people increase their income, poverty rates decrease. Therefore, the individual impacts are the building blocks of community change; if they do not happen, it is unlikely that a community will improve. However, these individual changes are not sufficient, by themselves, to ensure that positive impacts will last. The desired changes due to the programmes also happen in entities include changes in institutions service systems, community norms, partnerships, public will, policies, regulations, service practices, business practices and issue visibility – a concept which is defined as **influence**.

In most of the programmes/projects, the process of impact evaluation logical frameworks read similar components. Exceptions are some highly detailed and others very narrow depending on the type of the intervention. Therefore, the impact evaluation of logical framework shown in the Figure 2.1 has been developed from different sources such as Vogel and Stephenson (2012:20); Leeuw and Vaessen (2009:11,104); Bamberger & Fujita (2008:31); Hubbard (2010:8). From the log frame, it can be generally understood that, an intervention implementation process commonly consists of several complementary activities that together generate intermediate outcomes, and then lead to impacts which results in sustainable development. The process of these interventions, in a given environment, is determined by the contribution of a variety of actions at various levels, some of which are beyond the scope of the intervention (e.g. actions of external actors (such as material prices variations, foreign exchange, globalization and natural disasters) and internal factors such as change in political situations, regional conflicts and poor governance). Consequently, an intervention may have different levels of achievement, in its component parts, giving mixed results (positive or negative) towards its objectives. Therefore, the log frame is developed to show the four stages in the project cycle which can be considered in impact evaluation design and meets both change theory and programme (intervention) theory. With this end each stage is described in the following section.

2.1.4.2Description of the Project Impact Evaluation Framework

As illustrated in Figure 2.1 under each components (inputs, outputs, outcomes and impacts), the impact pathway is growing with the continuum of multiple change processes due to the intervention. The programme implementation model is farther described in the following section.

i. The input stage*:* This stage consists of three stages: preconditions like prefeasibility studies, and planning at the initial stage and followed by the fulfillments of manpower, organizational structures, financial and material resources which can contribute to the project implementation. Such stages can appear mainly at the middle of input process. Having fulfilled the mentioned preconditions the third stage of the input will be the stage of the implementation (activities) which leads to the output component of the impact process.

ii. ***Project outputs or products:*** Projects are intended to achieve a set of quantifiable outputs or products after/in continuum of the implementation stage; for instance, the kilometres of roads or footpaths constructed or maintained. There may also be outputs which are assessed qualitatively, such as the quality of leadership training or the strength of community groups created.

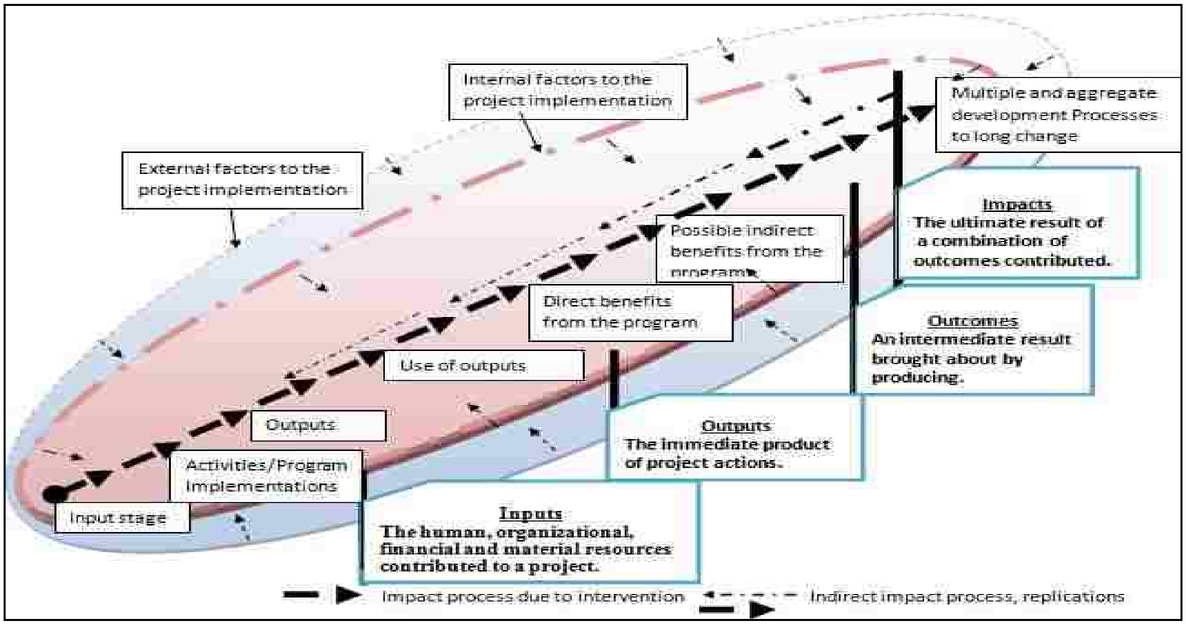

Figure 2. 1: Log-frame of Impact Evaluation Process

Source: Own development based on Vogel and Stephenson (2012:20); Leeuw and Vaessen (2009:11,104); Bamberger & Fujita (2008:31); Hubbard (2010:8).

iii. ***Outcomes or short-term impacts:*** These are the impacts which are achieved within a relatively short period of time, perhaps as Bamberger & Fujita (2008:18), 6 to 12 months after project completion. These writers also identified four types of impacts (more of direct) in poverty reduction programmes under this stage:

a) Opportunity: Access to economic resources and improved economic conditions
b) Capability: Access to public services (health, education etc.) and the effect on human development indicators such as anthropometric measures, years of schooling, frequency of use of public transport

c) Security: Economic, environmental and personal security
d) Empowerment and voice: Participation in decisions affecting the social, economic and political life at the household, community and local government levels. This may also include access to information and control of the means of communication.

iv. ***Medium and long-term impacts*****:** These are assessed on the same four dimensions as the short term impacts, but given the longer time frame, which also includes sustainability; broader assessments are possible. For example, access to education can also include access to labour markets after school completion. In terms of *Sustainability* stage, the overall objective of a project is not simply to produce impacts during the life of the project, but to ensure that the impacts are sustained over time. For example:

- Schools and clinics continue to function after donor funding has ended,
- Communities are able to maintain minor irrigation works, rural roads and bridges, and the bus company is able to maintain its fleet.

2.1.4.3 Articulating and Testing Intervention Theories on Impacts

Programme theory (intervention theory), according to Leeuw and Vaessen (2009:20), can be expressed in many ways – a graphic display of boxes and arrows, a table, a narrative description and so on. The intervention theory grants an overall framework for making sense of potential processes of change induced by an intervention (Figure 2.2). For example in terms of articulation an intervention's existing logical framework provides a useful starting point for mapping causal assumptions linked to objectives; other written documents produced within the framework of an intervention are also useful in this respect.

After articulating the assumptions on how an intervention is anticipated to have an effect on outcomes and impacts, the question arises to what level these assumptions are valid. In actual fact, evaluators and researchers have at their disposal a wide range of methods and techniques to test the intervention theory. These can be broadly distinguished between two wide approaches. First: theory by itself constitutes the basis for constructing a 'causal story' about how and to what extent the intervention has produced results. Second: to use the theory as an explicit benchmark for testing (some of) the assumptions in a formal manner based on the templates which constitutes selected indicators/variables (Leeuw and Vaessen 2009:25).

2.1.4.4 Relationship between Transport and Economic Development

Transportation plays a paramount role in distributing and optimizing the development particularly at locations where remote from access of the services. Figure 2.2 is more elaborative as compared to Figure 2.1. It illustrates that, transport impacts by lowering production costs, by increasing producers' prices, and by encouraging investment.

In terms of lowering production costs: for instance, due to the reliability of transport services in a given area, the importance of continuity of input supply increases rapidly as the degree of industrial sophistication increases. In addition, improved transport can broaden the labour pool to which a production facility has access.

In terms of increasing producers' prices: Irregular or infrequent transport services require purchasers to hold high levels of stock in order to ensure that they in turn can ensure continuous supply to their customers. The reliability of transport also solves the risk of spoilage of the production such as perishables like horticultural products.

In terms of encouraging investment: It is obvious that various investments reside towards the location of transport facilities (the fixed track and the service) such as road lines. As indicated by reverse arrows in the schematic representation of the impact processes provided in Figure 2.2, transport is an immediate remedy and catalyst to bring more virtuous circle effects.

The reduction in input costs and improved producer prices lead to improved profitability creating an incentive to increase output. With the same talking, greater access to investment funds permits the expansion of capacity required to enable producers to expand production in accordance with this incentive, and also assists in upgrading of the technology of production.

Economies of scale combined with improved productivity from capital deepening to further improve margins, and provide additional momentum for investments.

At the point where sustainability is to be achieved (which is reflected in both figures, (Figure 2.1 and 2.2), increases in levels of production bring with them further increased demand for transport services, improving profitability and encouraging further investment in transport itself. This in turn leads to enhanced service frequency and larger scale units of production, providing a basis for the next cycle of improvements

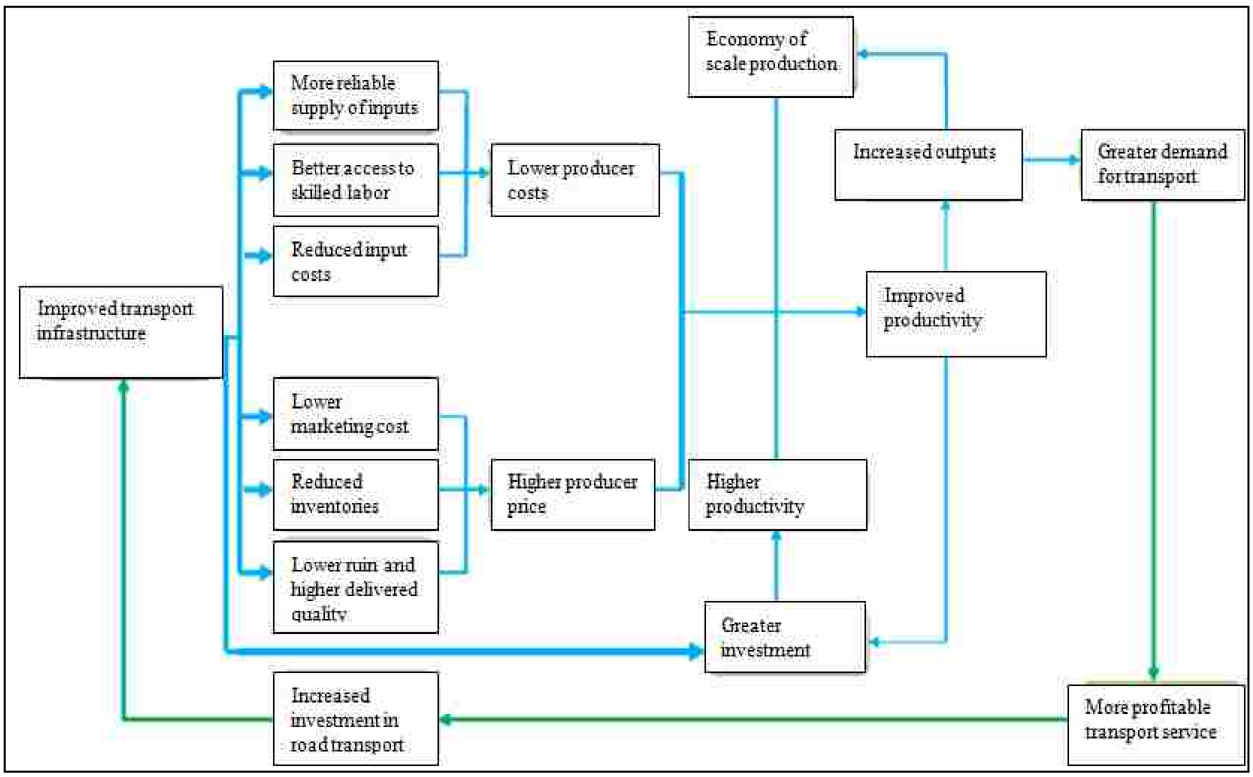

Figure 2. 2: Schematic Representation of Relationship between Transport and Economic Development
Source: Own development based on The Role of Transport [nd]

2.1.4.5 Direct and Indirect Impacts in the Project Evaluation Framework: in particular Reference to Road Infrastructure

Project impacts as shown in the frame work (Figure 2.1) consist of direct or first round effects, and indirect or second round effects. Direct effects are usually registered in the impact zone by reduced travel time to work, schools, hospitals, markets, etc. and savings in fuel and other direct transport costs (Ochieng, 2002). Road improvements may also reduce weather-related road closures. Although there is a tendency to perceive these direct effects as local, they may in fact be regional, national, or even international. For example, the benefits of a rural road infrastructure may accrue to local farmers, urban residents, domestic producers, or foreign tourists. The composition and distribution of the direct effects depends on the composition of users and the structure of the transport market. The indirect effects consist of increases in income and other dimensions of wellbeing (health, education, social interaction and political participation) brought about by the road infrastructure intervention. The roads may increase job opportunities and open up new sources of revenue, leading to a more diversified income structure, which can reduce household vulnerability to economic shocks.

What we call direct effects in the impact process are also those external to the market, such as noise, safety, emissions and environmental disturbances. Furthermore, the indirect effects also cause indirect external effects that need to be incorporated in the analysis when a fair valuation of investments in alternative transport systems is concerned.

From both social and economic effect/ impact contexts, an example can be given on how rural road development plays an important role from gender point of view as illustrated in the following paragraphs.

Time constraint is a key issue on the ability of women to build their assets and reduce their vulnerability. By reducing the burden of transport, development projects can raise women's productivity and income and also enhance their benefits. This situation would also give women more time to take rest, enjoy social life, and participate in community activities. Based on this, Bravo (2002) in her journal has undertaken the study to check whether rural roads programme in Peru brought about change on gender or not. Three Andean communities were chosen for the study, namely: Sócota (Cutervo Province, Cajamarca), Hampatura (Yanaoca Province, Cuzco), and Huallhua (Tayacaja Province, Huancavelica). The study revealed that improved rural roads have reduced the travelling time involved in accessing *health services*. But the exorbitant prices of medicine discourage women from using these services.

In terms of *education:* The gap between young men and women enrolment in secondary education especially in rural areas was reduced. Improved roads made it easier and faster to reach schools. In the highlands of the study areas, where economic status is scarce, only men have an opportunity to continue education.

In terms of access to *market*: Road improvement has led to an increasing number of women visiting markets, either to sell their produce or buy other products.

This journal has a good hint on the role of rural roads particularly on women. Nonetheless, since it is about the impact of road development it lacked to include the impact analysis procedures accepted internationally. Clear methodology with limitations is not considered. For instance it lacked to use control groups, base line and other counterfactual factors.

2.1.5 Some Common Approaches Used in Impact Evaluation

According to Khandker *et al* (2010) evaluation approaches for development programmes have evolved significantly over the past two decades aimed at helping policy makers decide whether the drawn projects are generating intended results; to promote responsibility and answerability in the allocation of resources across public programmes; and to fill the gaps in understanding what works or not, and how measured changes in the well-being of the community are attributable due to a particular project or policy intervention.

There are several ways of evaluating the implementation of the projects. Baker's (2000) approach includes four components: monitoring, process evaluation, cost-benefit evaluation, and impact evaluation. Each of these components is distinctly different: *monitoring* is used to assess whether a programme is being implemented as was planned and enables continuous feedback on the status of programme implementation, identifying specific problems as they arise. *Process evaluation* deals to check how the programme functions and it focuses on problems in the service delivery. *Cost-benefit* or cost-effectiveness evaluations assess costs of the programme whether monetary or nonmonetary including the benefits being produced by the programme. Finally, *impact evaluation* is aimed at determining more broadly whether the programme had the desired power to influence on individuals, households, and institutions and whether those effects are attributable to the programme intervention or not. It can also explore unintended consequences, whether positive or negative, on beneficiaries.

According to Baker (2000), some of the questions raised to address impact evaluation are: How did the project affect the beneficiaries? Were any progress as direct result of the project, or would they have improved anyway (indirect)? Were the costs reasonable? These questions may not however, be simply measured by the outcome of a project. This means, the outcome or change may be also due to other factors. Therefore, an impact evaluation must estimate the counterfactual issues. This is accomplished through the use of comparison or control groups (those non benefitting from the intervention and who are selected randomly from the same population) and then compare with the treatment groups (benefited ones).

However, Khandker *et al* (2010), summarizes Baker's evaluation classification into three: monitoring, operational evaluation and impact evaluation. *Monitoring* tracks key indicators of progress over the course of a programme as a basis on which to evaluate outcomes of the intervention. *Operational evaluation* examines how effectively programmes were implemented and whether there are gaps between planned and realized outcomes. *Impact evaluation* considers whether the changes in well-being are indeed due to the programme intervention and not to other factors.

Both writers including White (2009) have extensively discussed on impact assessment approaches. Although qualitative methods are significant in impact assessment they argue on the domination of quantitative methods. This approach is also strongly related to positivist theory. Khandker *et al* (2010) discusses the importance of comparison group in impact assessment. The two broad approaches that researchers resort to in order to mimic the counterfactual of a treated group he analyzed are: (a) creating a comparator group through a statistical design, or (b) modifying the targeting strategy of the programme itself to wipe out differences that would have existed between the treated and non treated (control) groups before comparing outcomes across the two groups.

A number of different methods are being used in impact assessment theory to address the fundamental question of the missing counterfactual conditions. As Baker (2000) and Khandker *et al* (2010) discussed, these methods vary by their fundamental assumptions regarding how to resolve selection bias in estimating the programme treatment effect. These are summarized below.

1) **Randomized (experimental) evaluation**: involves a randomly allocated initiative across a sample of subjects. The progress of treatment and control subjects exhibiting similar programme characteristics is then tracked over time. This experiment has the advantage of avoiding selection bias.
2) **Propensity score matching (PSM):** In the absence of randomization, PSM method compares treatment effects across participant and matches non participant units, with the matching conducted on a range of observed characteristics. This method assumes that selection bias is based only on observed characteristics.
3) **Double-difference (DD) method**: assume that unobserved selection is present and that it is time invariant—it considers the difference in outcomes across treatment and control units before and after the programme intervention. This method can be used in both experimental and non experimental settings.
4) **Instrumental variable (IV) method:** is used with cross-section or panel data and in the latter case allow for selection bias on unobserved characteristics to vary with time. In this approach, selection bias on unobserved characteristics is corrected by finding a variable that is correlated with participation but not correlated with unobserved characteristics affecting the outcome; this instrument is used to predict participation.
5) **Regression discontinuity (RD) design and pipeline method: it is extension of IV and** experimental method; it exploits exogenous programme rules to compare participants and non participants in a close neighbourhood around the eligibility cut-off.

6) **Others such as Distributional impacts, and Structural modelling approaches:** These approaches cover a mix of different quantitative methods as well as ex ante and ex post methods.

Evaluators Handbook of Foundation for Advanced Studies on International Development (FASID) by Bamberger & Fujita (2008) has also very relevant approach on impact assessment. This book designates that, in programme theory-based evaluations, often applied to ODA projects, observed changes in performance or output indicators are compared with the pre-project situation. This approach assumes that observed outcomes are due to the project intervention, "more or less". This is to indicate that this assumption unlikely happens because almost all projects operate in dynamic environments where many social, economic, political, environmental and demographic changes are occurring, any of which might have influenced the observed outcomes.

Therefore, conducting rigorous socioeconomic impact assessment experiments helped by identification of causalities according to (Bamberger & Fujita (2008:5-6) is difficult in many countries and researches due to the following constraints:

1) The evaluator may not consult until the project is already being implemented;
2) Limited baseline data: due to the start of the evaluation after the project implementation and due to weak organization of the existing data
3) No control or comparison group
4) Time Constraints
5) Budgetary constraints
6) Lack of defining the appropriate counterfactual: For instance what the situation would have been if the policy or programme had not been implemented
7) Non existence and inadequate secondary data.

To mitigate such problems, Bamberger & Fujita (2008) have developed impact evolution method based on what they call "shoestring evaluation approach" (now known as "real-world evaluation"). This approach is drawn from the experiences of Commerce Official Development Assistance (ODA) agencies, national governments and NGOs who have conducted evaluations in many Asian, African, and Latin American countries under budget, time, and data constraints. The approach has five steps for improving the quality of evaluations conducted with such limitations:

1) reduce data collection cost and time by reviewing and assessing different quasi-experimental designs applicable under these conditions;
2) reconstruct baseline data and control groups when information on conditions was unavailable before the project began;
3) compile a checklist of factors which can affect the validity of the evaluation's findings;
4) strengthen evaluation design and correct factors affecting validity; and
5) build evaluation data generation into the design of new programmes.

Furthermore, FASID also puts this kind of approach as a realistic method and useful way for impact evaluation.

2.1.6 True Experimental Design and Quasi-Experimental Design in Impact Evaluation

True experimental design in most cases is laboratory based design to evaluate impacts related to animals, plants, medicine, behaviour, educational researches etc. whereas Quasi-experimental (non-random) design is used to evaluate the impacts of development projects such as road, water supply, micro-credit, training, etc. According to Bamberger & Fujita (2008) and Baker (2000), it is almost impossible to approximate the true experimental design level of experimental control. For example, it is hardly ever possible to randomly assign subjects to treatment groups and control groups, and treatments cannot be applied in such an accurate way. The main benefit of quasi-experimental designs (QEDs) according to these authors is that they can draw on existing data sources and are thus often quicker and cheaper to implement, and they can be performed after a programme has been implemented, given sufficient existing data.

Therefore, a series of (QEDs) have been developed to estimate as closely as possible the true experimental design, for the following purposes:

1) To make the best possible estimate of the extent to which a project, programme or policy has produced its intended impact; and
2) To identify the factors which positively or negatively influence the magnitude and direction of the impacts.

Under the situations where there is no baseline data, some of the possible tools which could be employed to estimate the baseline conditions are as follows:

1) Using focus groups;
2) a rapid sample survey in which families are asked to recall situations before the project began; and
3) key informants such as community leaders, local health authorities, school teachers etc. could also be asked to assess the impact of the project.

Using the mentioned techniques, the treatment and comparison groups are usually selected *after* the intervention using non-random methods. Therefore, statistical controls must be employed to address differences between the treatment and comparison groups and/or sophisticated matching techniques must be used to construct a comparison group that is as similar as possible to the treatment group(Baker 2000:4).

2.1.7 Some Guidelines for Analyzing Specific Development Impacts

In most cases, particularly in developing countries, development decisions are too often made without sufficient understanding of the consequences of those decisions on the overall community well-being. Dantas and Ribeiro (2006) in their study titled 'Impacts of Transport Infrastructure Policies' stated that, most impact studies of transport policies formulated are analyzed, and observed and expected changes are compared in order to evaluate their efficiencies and effectiveness after implementation. According to the writers, this approach is based on the assumption that the impacts of transport infrastructure policies are exclusively the results of immediate changes in the transport and activity systems. In spite of the widespread adoption of this approach, there has been growing criticism regarding the lack of inclusive databases and evaluation methods that help planners in identifying the true dimension of the impacts.

Edwards (2000: 3-6), argues that since changes induced by growth in a community are not always positive, careful development planning is a mandatory for ensuring growth which is consistent for long-range goals of the community. This argument is also supported by Oosterhaven and Knaap (2000:7); Baker (2000:1) and Bamberger & Fujita (2008).

Most importantly, specific developments are assessed by impact analysis. Baker (2000: 16-39) and Khandker *et al* (2010: 28) have explained details of guidelines of impact research. Only the major ones are outlined as indicated below by Edwards (2000:6):

1) Focus on significant impacts, not on the nominal effects of development;
2) Consider direct impacts as well as cumulative (indirect) impacts of the development;
3) Give high priority to community values and long-term goals of the community when assessing impacts;
4) Evaluate both positive and negative impacts of the proposed development for each of the impact areas; and
5) Involve the community in evaluating impacts, especially during the socioeconomic impact assessment process.

Edwards also noted that development impact assessment is designed to assess the impacts taking place at one point in time and space. In other words, he pointed out that it would have to be adapted to understand the impacts of many increments of development over time (temporally) or across an extensive area (spatially).

2.2. Empirical Studies on Socioeconomic Benefits and Impacts by Road Development

Some of the empirical studies reviewed here under are adopted from Ochieng (2002) to see the results of the impact studied from the highway (transformed from gravel to asphalt) in Morocco (Africa); feeder roads in Bahia (Brazil); and regional road between Njombe and Makete in Tanzania (Africa). These studies have used different approaches in studies undertaken with regard to different type and quality of roads.

The impact study made in 1996 for the *Fourth Highway Project* in rural roads of Morocco found out that road intervention had a significant impact on socioeconomic changes. The road improvements consisted primarily of installing an asphalt surface to replace original gravel or un-engineered tracks. The most direct impact that had happened was the elimination of frequent road closures during rainy periods. The paved surface meant that the cost of operating vehicles dropped, leading to lower prices for freight and passenger services. Ownership of motorized vehicles and traffic volumes also increased, whereas in the past, the only service was a rural bus often running only once a day. Access time to markets and social services fell drastically by about 50%. Furthermore, higher transformation of the agricultural output mix appeared, and increased use of modern inputs, especially fertilizers. There was also a marked growth in off farm employment opportunities. On the social side, the biggest impact was on girls' enrolment in primary schools which tripled over the period. Quality of education also improved as it became easier to recruit teachers, and absenteeism rates of both teachers and students dropped. The population around the roads nearly doubled its use of health care facilities. In addition to the increase in enrolment of girls in primary schools, the roads also increased the availability and affordability of butane, which reduced the time women needed to devote to the collection of fuel wood for cooking and heating. However, the increased traffic on the roads led to increased road accidents.

From a methodological point of view, the Morocco road impact evaluation study attempted to calculate DD by comparing the follow up groups with those before the road improvement groups and by comparing conditions surrounding the project roads relative to control roads over the study period. But, for one of the four roads, the control road was selected judgmentally at the end of the project, and thus may affect the uniformity of the evaluation since the study didn't use triangulation or embedded method.

The document of Ochieng (2002:40-41) describes that between 1976 and 1982, the World Bank supported three rural feeder roads projects in the state of Bahia in Brazil. An impact assessment was conducted on the second and third feeder roads without the use of baseline data prior to the intervention and without identified control roads. The measure undertaken was that, much of the pre-project information had to be collected retroactively, and the study focused its analysis on comparisons before and after the project, rather than comparing situations with and without zonal comparison groups along the roads. Thus, the result could be less conclusive, but, as a minimum, the changes coincided with the improvements of the roads. For example, traffic on most roads in the late 1970s was about 20 to 40 vehicles per day, but in 1996 this traffic volume surpassed 100 vehicles per day in 12 of the 20 roads in the study area. The roads helped farmers expand production of several crops, to market their products more easily, and bring in modern inputs and machinery at a time when traditional production techniques were being upgraded. However, apart from changes in these crops, the study found that there were relatively few changes in the level of other economic activities and the roads also induced little migration. The study also indicated that school enrolment increased, as did availability of hospital beds. The main social change observed, however, was the change in land tenure patterns, especially an increase in the proportion of smallholders. What can we understand from this study is that if triangulation or embedded method was used from qualitative data, the result would have been better.

Another study also pertains to a regional road between Njombe and Makete in the Iringa region of Tanzania in 1995. The evaluation report indicates that baseline data and post-project data were collected but gave no indication on the use of control zones. The impact study found a 70% increase in daily vehicle traffic. Vehicle operating costs had shown a decline by almost 50% and fares by 40%. The study also pointed that there was an increased participation of vendors at local markets and an increased variety of available consumer goods and agricultural products. The geographic coverage of markets for agricultural products increased significantly. On the social side, the study noted an increased attendance at hospitals and family planning and preventive health care facilities. The study also observed that there was an increased participation of women in local government affairs due to the increased feasibility of one-day roundtrip travel to meeting.

Therefore, what can be observed from the above paragraphs is that, though some approaches employed in the impact assessment are different, the studies reveal that there are somewhat significant changes to some extent due to the road intervention.

In Botswana, the study made on road construction and maintenance revealed that it had generated a great number of employment opportunities but at a lower wage rate to the poor people. During the construction, the gender gap was almost disappearing as the programmes gave privileges and employed all available women, believed to be poorer, before opening the door to men (Grootaert 2002 as cited in Matebie 2009).

Sengupta *et al* (2007: 19-21) conducted and analyzed the research based on household survey of pre-project baseline on the NH2 road in India during September-November 2002. The survey design was two-stage stratified probability sampling with the village and the household as the first and second stage units, respectively. Out of 1697 villages located in the neighbourhoods of the two sides of 14km of the road line in the rural segments of the 900kms distance between Agra and Dhanbad, the sample covered 200 villages. The numbers of influence zone and control zone households were 2,112 and 1,088, respectively. The authors defined 30 impact variables and grouped them into seven dimensions: (a) poverty status, (b) mobility, (c) income, employment and occupation, (d) housing condition and asset ownership, (e) access to health, education and other infrastructural facilities, (f) attitudinal variables due to the widening of NH2, and finally (g) composite indices of household well-being that combine relevant outcome variables. The result showed that out of 30 outcome variables only 15 met the basic hypothesis that proximity of NH2 gave better socioeconomic well-being.

Accordingly, most of the regression curves have shown a change in gradient indicating change in the structural pattern of relationship more between distances of 4 to 5 km from NH2 line. However, they noted that the distance from NH2 may not be the only explanatory variable influencing the set of outcome variables (Sengupta *et al* 2007: 22-23).

Sengupta *et al* 2007) and other researchers such as: Pankaj (2000), Islam *et al* (2008), Ochieng (2002) and Bhatta (2004) dealt on road impacts without separating social and economic aspects. The road impact assessment has also viewed by other writers separately for both social and economic aspects. Majority of writers' debates support the strong correlation of road development in the socioeconomic aspects at local and national level. However, except Ochieng (2002) and Bhatta (2004), their analysis does not clearly show whether the data is statistically tested or not. Hulten (2005) also concluded that infrastructure investment is associated with convergence in regional growth in both built-up and infrastructure-poor networks, though to claim that the infrastructure causes convergence would be to over-interpret the evidence

With regard to spatiotemporal impact of road development, Von Thunen (1966) contends that the non-productive lands are the ones father with higher transport costs. These leads to negative exponential decline of population density with road distance. With the same token, considering the road track as the attraction zone, household's socioeconomic status is related to his income, occupation and education status and transport costs are proportional to distance (Burgess and Christsller in Brandford and Kent 1987). In other saying the main driving force of urbanization is transportation expansion and the evolving population growth (Rui 2013).

Patarasuk(2013) used fifty-six intensive study areas in Thailand to investigate the relationships between the development of the road network in Lop Buri province and land-cover dynamics between 1989 and 2006. He used network analysis and graph theory-based network indices to determine road connectivity. And he also used Kendall's Tau (T) Test and Wilcoxon matched pair test (for non-control group). The findings confirm that though the total length of roads in the study area increases, the connectivity was not as expected. This is because roads developed may or may not link the existing roads, or developed as dead-ends. The most evident relationships are between road connectivity and built-up areas and forest cover. For instance, the observation that the percentage of built-up area is associated with the connectivity indices imply that humans prefer to reside near a road network for better accessibility, as the built-up areas in Lop Buri province are almost exclusively human settlements and industrial estates. This study is more of spatial and temporal helped by scientific research in transport geography and meets change theory. However, the methodology adopted did not consider the opinions from the community to make the study more informed.

Inoni and Omotor (2009) studied the impact of rural roads through questionnaires from 288 agricultural households and through interviews in Delta State, Nigeria. He specified models in order to estimate factors that determine output and income among rural households. The OLS technique was used to estimate the relevant parameters. The findings indicate that rural roads have a significant positive effect on agricultural output, reduce transportation cost, stimulate demand for rural labour, improve rural income and promote inter-sectoral linkages between the agricultural and non-farm sector that enhances income diversification strategies among rural households. Road quality has also brought about a strong positive response on output and income as a 10% improvement in road quality caused a 12% and 2.2% increase in agricultural output and total household income respectively. However, the methodology he used does not indicate the study influence zones from both side of the road line, the use of the base line, temporal considerations, the counterfactual factors for the comparison purposes are not clearly considered to keep the study holistic and more scientific.

Papí *et al* (2007:10-14), in the Valencia Region (Spain) also demonstrated the positive direct effects from the intervention of the road named as A7 stretching through the region. According to this study, the A7 motorway contributed as much as 1.5% to the overall regional GDP growth in the year 2000. Finally, the study concluded that this motorway had tremendous impacts on Valencian society through an increase in citizen's wealth, higher property values and the accelerated expansion of the industrial base.

As indicated in the above empirical study paragraphs, various writers have asserted their witness towards positive roles of road development. On the other hand, a study conducted by Jacoby's (1998) is a little bit different from the positive role of road infrastructure. Particularly from poverty point of view, he argues that rural road construction is certainly not the magic bullet for poverty alleviation. Finally he concludes that separating out distinct benefits of rural roads is left as a topic for future research. Following his work, many empirical studies have been conducted. For instance: Pedersen (2007: 6-9) declares that improved transport to peripheral regions might have negative consequences for development because it opens up for increased imports which often threatens local industries and trade and lead to emigration of the most qualified labour, increasing environmental problems and demands for additional infrastructure.

2.3 Summary

Theory is a set of explanatory concepts that is useful for explaining a particular phenomenon, situation or activity. Since the research process is not divorced from theory, this study has employed theory of evaluation among others under which programme theory and change theory are used as tools for checking the road development impacts in the study areas. Programme theory is the issue of intervention by actors such as the government, private companies etc for the project formulation and implementation, whereas, change theory is about the impact created due to the interventions. Therefore, using theory as the research base has a paramount importance not to wander aimlessly.

The four stages (inputs, outputs, outcomes and impacts) in the project cycle are about both change theory and programme (intervention) theories. Under each component, the impact pathway is growing with the continuum of multiple change processes due to the intervention.

According to Khandker *et al* (2010) evaluation approaches for development programme had evolved significantly over the past two decades aimed at helping policy makers decide whether the drawn projects are generating intended results; to promote responsibility and answerability in the allocation of resources across public programmes; and to fill the gaps in understanding what works or not, and how measured changes in the well-being of the community are attributable due to a particular project or policy intervention.

Given the availability of sufficient data, QED can be performed after a programme has been implemented. Based on this, Edwards (2000) had outlined the guides in impact evaluation and noted that development impact assessment is designed to assess the impacts taking place at one point in time and space. In other words he pointed that it would have to be adapted to understand the impacts of many increments of development over time (temporally) or across an extensive area (spatially).

In conclusion, as many literatures depicted, it can be generally understood that, in theory, roads facilitate rural development; new roads will improve transport; improved transport will solve access problems; improved access enhances living conditions and income earning opportunities. Improved living conditions and income saving opportunities foster further development. In the next chapter, the research design is formulated to check the impact theories discussed.

CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY

The research design is the general plan/strategy adopted for solving a research problem. It contains all the parts and phases of a research project together. Under this section, the philosophy, spatial demarcation methods of the study area, design framework and planning, survey design, data gathering, and data analysis are discussed.

3.1 Description of the Study Areas

This study focuses on three geographical areas situated in three regional states, namely Amhara, Afar and Oromia. The name of the study highways are Gendewuha-Gelago(Corridor 1), Mile-Weldiya (Corridor 2) and Genchi – Kachisi (Corridor 3)(Figure 3.1 and Table 3.1). These corridors are purposively selected because of these highways are newly penetrated (corridor 1 and 3) and newly intervened (Corridor 2). Each of the highways are described in the following sections

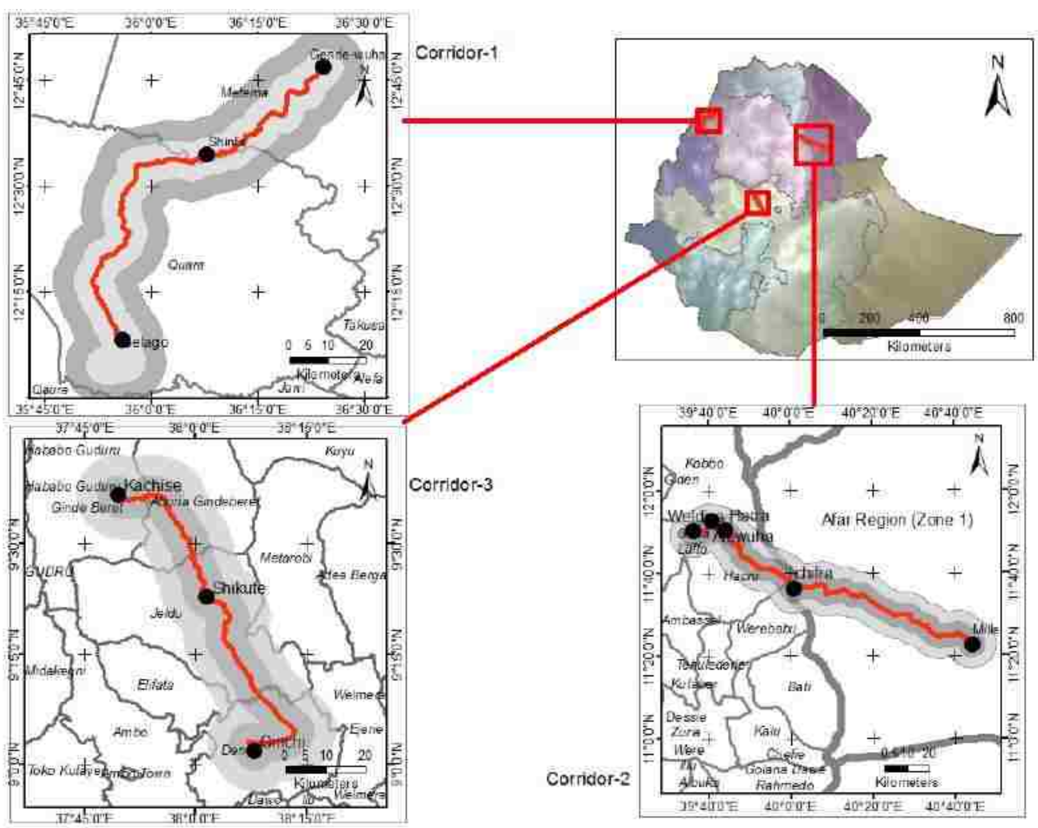

Figure 3. 1: Study Areas
Source: Own adoption ,2015

Table 3. 1: Backgrounds of the Study Areas

S/N	Study Corridors (Highways)	Name given for the study purpose	Road type	Length (km)	Intervention commenced	End of last intervention	Average altitude (m)	Region where the road situated
1.	Gendewuha-Gelago	Corridor 1	Gravel	125	2002	2007	644	Amhara
2.	Mile- Weldiya	Corridor 2	Paved	165	2007	2010	1247	Amhara and Afar
3.	Genchi – Kachisi	Corridor 3	Gravel	105	1998	2003	2402	Oromia

Source: Author's Development, 2015

3.1.1. Description of Corridor 1

Corridor 1 is situated in Amhara Regional State in the north western part of Ethiopia. The road corridor takes off from a T-junction at Gendewuha town, which is located at about 900 kms away from Addis Ababa, from the early paved Azezo-Metema Highway and traverses towards south-westerly direction up to Shinfa town and continues to south direction to reach Gelago town (Figure 3.2.... The astronomical coordinates of the origin-destination are 12˚46'N; 36˚24'E for Gendewuha town and 12˚12'N; 35˚55'E for Gelago Town. The highway has two study centres; namely Shinfa Town (12˚08'N; 35˚56'E) and Gelago town. The former centre is located in Metema *Wereda*, whereas the later is located in Quara *Wereda*. Both centres are selected purposively since they are far from other influencing highways.

This area has semi arid climate of Tropical Zone with average annual rainfall of 510mms (ANRS 2011) and the maximum temperature ranges between 36^0c – 45^0c (Metema *Wereda* Report, 2013). As taken from GPS points it has average altitude of 644masl.

The study area is composed of Amhara Ethnic group (88.7%) and others like Agew, Gumuz, Kimant and Tigrie in Sum 11.3 percent.

According to the results of interviews conducted with officials of the *Kebele* Administration of Shinfa, the upgrading of the road into gravel surface was started in 2002 from Gendewuha and completed in 2007 after reaching Gelago town. The road was constructed by the Amhara Regional State Road Authority. The status of the study road as observed during the survey conducted by the researcher in 2013 was 10 percent in good condition, 40 percent in fair condition and 50 percent in bad condition. The sum of good and fair, which is only 50 percent, is 36 percent lower than that of the national average performance in 2013 (GTP 2014:48). It is full of very narrow and old bridges (Figure 3.3). Vehicles should wait until others pass the bridge. Furthermore, there are no drainage ditches that exacerbate the wear and tear of the roads.

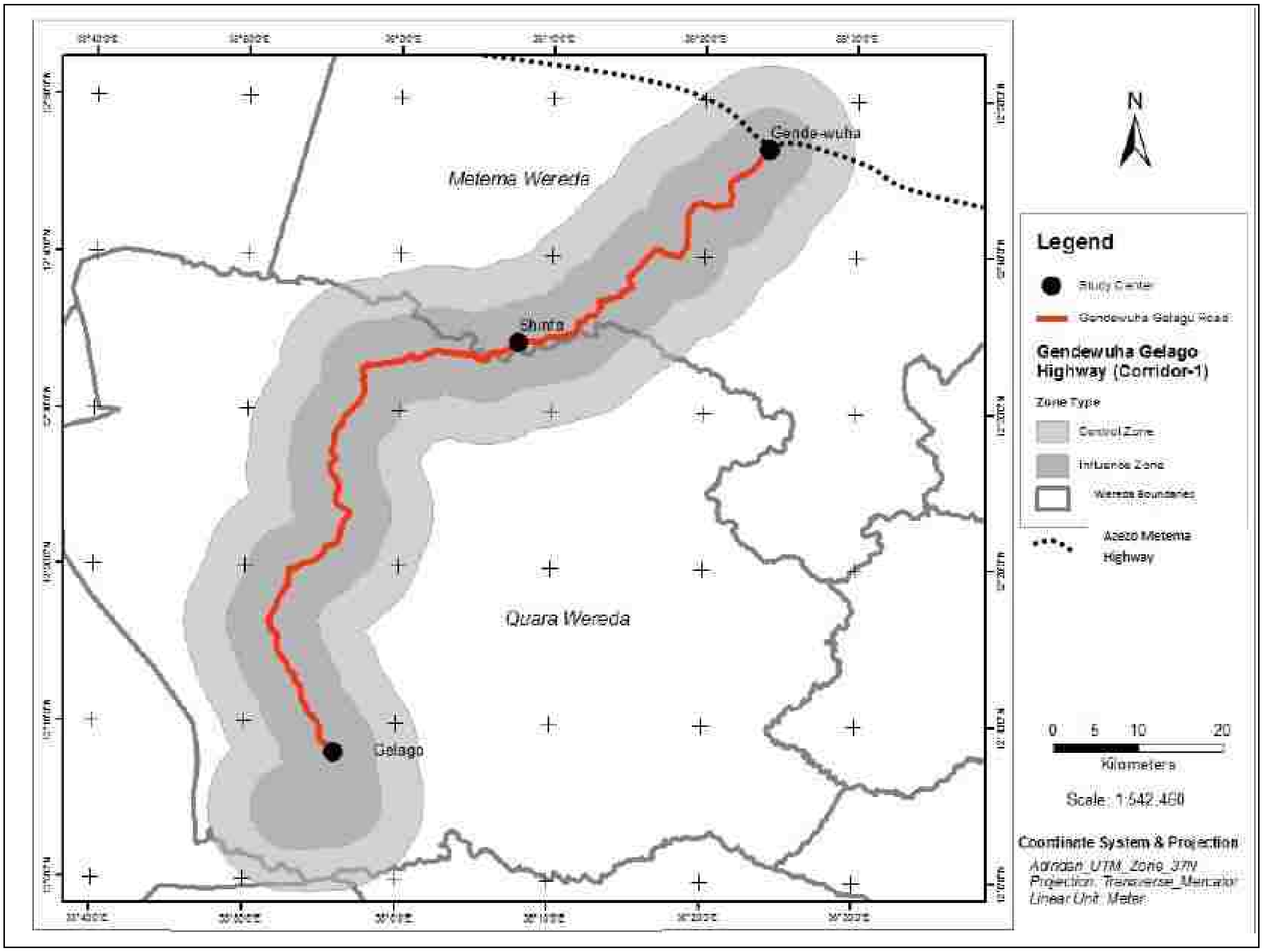

Figure 3. 2: Gendewuha – Shinfa – Gelago Highway (Corridor 1)
Source: Own adoption ,2015

At the origin and destination of this corridor, parking facilities exist only for passenger vehicles. In case of Shinfa town, however, there is no terminal facility at present (2014) and even there are no current plans to establish one.

The vehicle terminal at Gendawuha has also been operational since the last six years. It is about $25,000m^2$, the grounds of which is poorly covered with gravel and is poorly fenced. It has temporary office constructed with corrugated iron, toilets, bath room, sheltered waiting area with tea room for passengers. It has four guardians, two cashiers, one terminal transport operator. But other employees like cleaners are not yet hired. And it has no electric power. On average, it serves for about 100 passenger vehicles per day. Vehicle types are one maxi bus per day at an average, and the remaining are midi and minibuses. They collect terminal fees of three to 12 ETB per vehicle and the amount per month is estimated to be 22,500 ETB

The vehicle terminal at Gelago (9000m^2) has been providing service for about three years. Its ground is poorly covered with gravel, while it is just an open ground that is not fenced and there are no any shelter and other facilities (Figure 3.4). It is guarded by two persons in 24 hours (one person per shift). On average, it serves about 13 passenger vehicles per day and up to 65 passenger vehicles during market days. There is no payment for terminal service in the day time except five to eight ETB per night and they collect about 3,600ETB per month. The vehicles types commuting are one maxi bus per day at an average as well as several midi and minibuses.

Generally, as explained above, the terminals in Corridor 1 do not meet the acceptable standard and are immature. According to interview findings, there is the plan to upgrade these terminals in the near future.

Figure 3. 3: Status of Road Bridge along Corridor 1

Figure 3. 4: Passenger Terminal at Gelago Town (Corridor 1)

Source: Photo by the Author, *2013*

3.1.2. Description of Corridor 2

The Mile-Chifra-Weldiya road (Corridor 2) is 165 km in length and located in the north eastern part of Ethiopia (Table 3.1). About 102 km of this road is located in Afar Regional State, while the remaining 63 km is in the Amhara Regional State.

The road corridor takes off from a T-junction at a distance of 4.5 kms to the south of lower Mile town on Addis Ababa-Mile trunk road and traverses towards north-westerly direction before it reaches Chifra (Figure 3.5) The corridor ends at a locality known as Alewuha on the Weldiya - Mekele road at a distance of about 13 km from Weldiya Town (ERA 2002).

The astronomical coordinates of the origin-destination are: 11˚23'N; and 40˚44'E for Mile and 11˚52'N; 39˚41'E for Aleweuha Junction. The highway has two study centres: Namely, Chifra (11˚36'N; 40˚01'E) and Hara (11˚50'N; 39˚44'E).

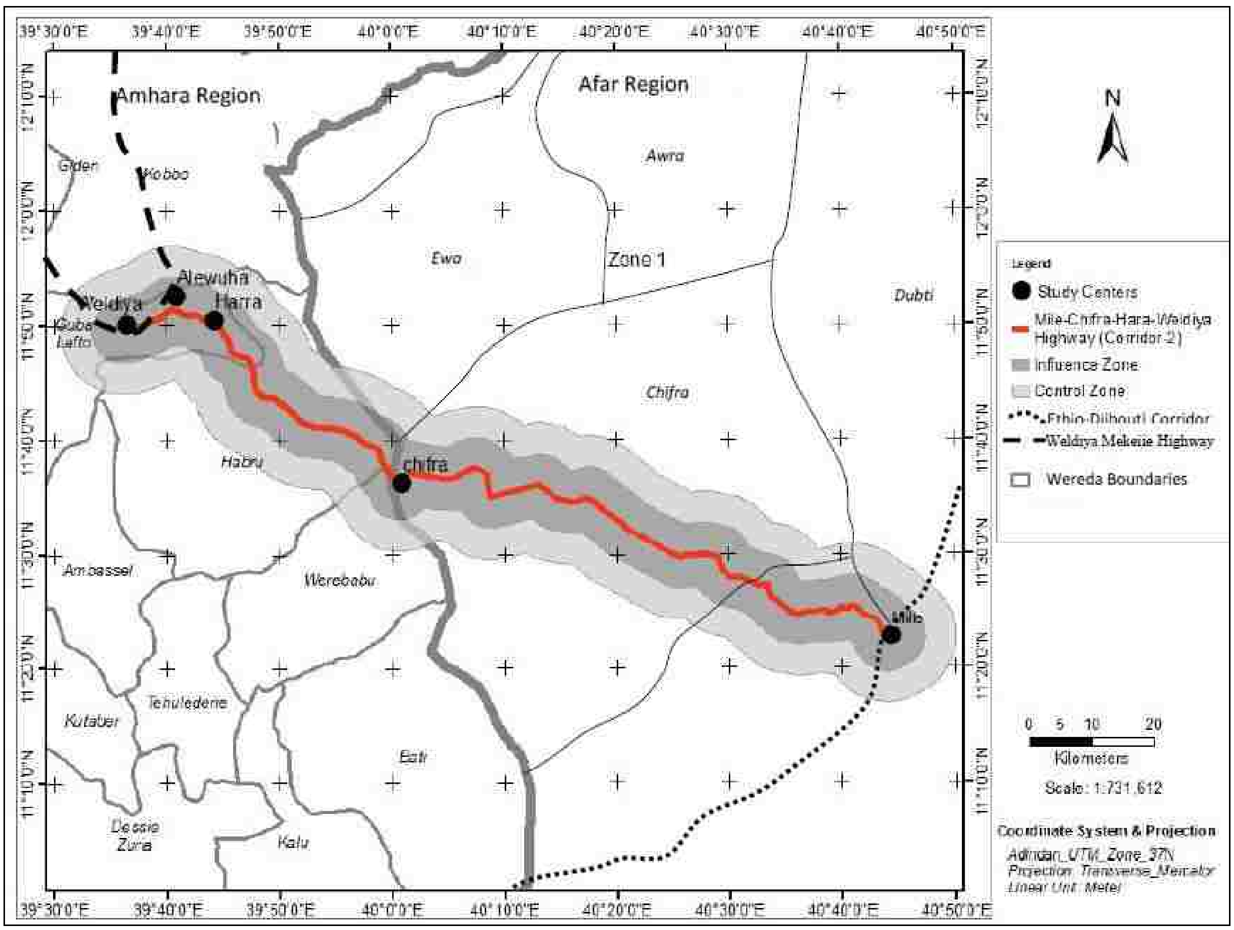

Figure 3. 5: Mile – Chifra – Weldiya Highway (Corridor 2)
Source: Own adoption ,2015

The former centre is located in Afar Regional State, whereas the latter is located in Amhara Regional State. Both end points of this highway meets (branches out from) other highways that were constructed long ago. The study centres along the highway are selected purposively since they are further away from the long standing highways within a view to identifying typical impacts of the study corridor. The road paving work started in 2007 at Mile direction and the project could be completed in 2010 at Alewuha. The road construction was undertaken by Sur Construction Company under the supervision of ERA. The status of the road during the survey period was all in good condition

This area has Arid and Semi Arid climate with varying monthly average temperature of 25^0c during rainy seasons to 44^0c during dry seasons. The average annual rainfall is less than 500mm (Afar National Regional State, 2010). As recorded using GPS it has an average altitude of 1,247 masl. According to the household survey, the population of the area is composed of Amhara (63 %), Afar (36.1%) and Tigre (0.8 %) ethnic groups.

There is a spacious terminal (9,010 m^2) in Hara town, whereas there is no passenger vehicles terminal facility at Mile. The terminal at Hara has been operational for about nine years and its grounds were recently (2014) covered with gravel by the local community. It is poorly fenced and the gate is yet to be prepared, while it has an improvised guard house. It is guarded by two persons (one person per shift). It serves for about 50 passenger vehicles per day on average and up to 250 passenger vehicles on market days. Vehicles have to pay service fees and more than ETB 6,000 is being collected per month (three Birr per passenger vehicle). The most dominant vehicles are mini buses. The terminal is managed by two facilitators that include a cashier who work in the open as there is no any structure they can use as an office. The most common types of vehicles providing transport service are midi and minibuses. The Hara transport terminal serves as a hub in both sides (to Weldiya and Chifra-Mile routes).

Generally the Hara terminal does not have any shelter, toilet and cafeteria facilities. There is, however, a plan to upgrade the terminal in the near future. During the survey time, passenger service at Chifra and Mile was being provided without any dedicated roadside or off the-road parking facility.

3.1.3. Description of Corridor 3

Genchi-Shikute-Kachisi Road is located in the central part of Ethiopia in West Showa Zone of the Oromia National Regional State. The road is 105 kms and traverses four *Weredas* (Dendi, Jeledu, Abune Gendeberete and Gendebrete).

According to interviews with the local community, the road was constructed during the reign of Emperor Haileselasie as a low grade gravel road category, while there was frequent interruption of transport services along this road due to damages caused by unmanaged flood and absence of regular maintenance. As per the interview from *kebele* administration, the road was upgraded to a gravel road by the Oromia Rural Roads Authority between 1998 (starting from Ginchi) and 2003 (reaching Kachisi Town). Genchi town (09˚02'N and38˚06'E) is found 73kms from Addis Ababa. The road extends in the NW direction ascending the West Showa Highlands and ends at the outskirts of Kachisi town located at geographical location of 09˚02'N and 37˚49'E.

Before arriving at Kachisi, there is a short gravel road departing 8kms from main Shikute – Kachisi route to Beki Kelete, the administrative centre of a newly established *wereda*, Abune Gendeberete.

Two study centres are purposefully selected for the Ginchi-Kachisi corridor, namely Shikute (09˚22'N and38˚01'E) and Kachisi both of which are not located at cross roads.

This area has a subtropical climate with an average annual rainfall of 1,530mm and average temperature of 22^0C. As measured by GPS, it has an average altitude of 2,402 masl. The composition of the ethnic group along the route is predominantly Oromo.

The status of the study road at the time of the survey was five percent in good condition, 35 percent in fair condition and 60 percent in bad condition. During the rainy season, vehicular access becomes very difficult because of limited maintenance. There are no drainage canals along the whole route, which results in unmanaged floods that contribute to wear and tear (Figure 3.7).

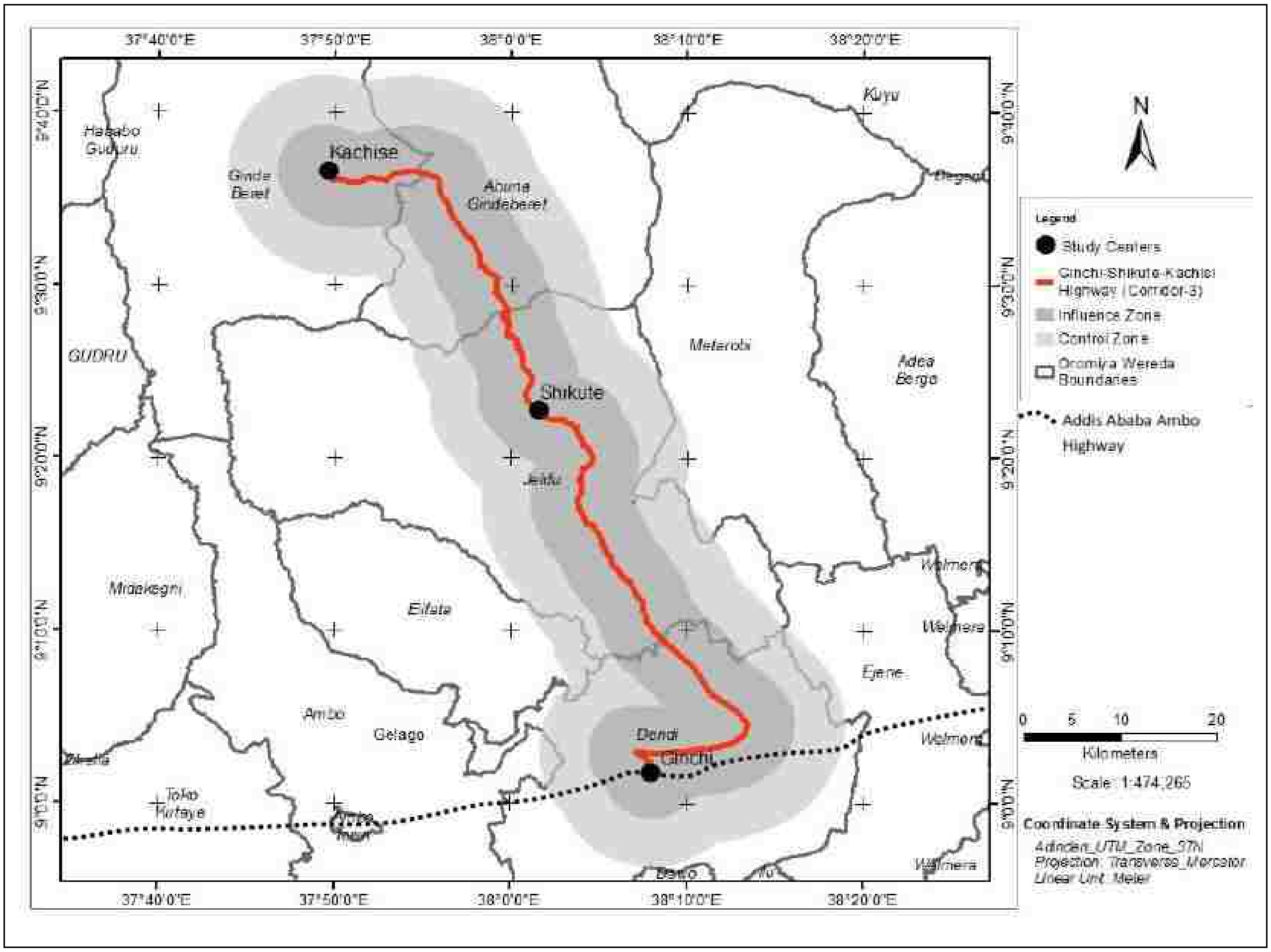

Figure 3. 6: Ginchi – Shikute – Cachisi Highway (Corridor 3)

Source: Own adoption ,2015

There are passenger vehicle parking terminals at Ginchi and Kachisi sites, whilst it is under construction in case of Shikute (Figure 3.9).

The vehicle terminal at Ginchi is about 2,500 m^2 and is found to be congested even for the existing level of activity. It is fenced and gravel surfaced, while it is guarded by two persons (one person per shift). There are facilities like toilet, bath room, waiting shelter for passengers and electricity in the compound. It serves for more than300 passenger vehicles per day. Terminal fee of about 150,000 ETB is collected per month. This terminal is the hub for three directions: to Gojo-Shikute-Kachisi, to Ambo and to Addis Ababa.


Figure 3. 7: The Status of Road along Corridor 3

Figure 3. 8: Passenger Terminal, Kachisi (Corridor 3)

Figure 3.9: Passenger Terminal Under Construction, Shikute(Corridor 3)

Source: Photo by the Author, 2014

The terminal at Kachisi is very small (about 1,500 m^2) and is covered by macadam and not in a good situation (Figure 3.9). It is fenced partially by corrugated iron and the back wall of residential houses as well as Kachisi *Kebele* hall used as protective fences. It is guarded by three persons (one person per shift). Except poorly handled office and electricity in the compound, there are no facilities like toilet, bath room, waiting shelter for passengers. It serves for about 15 midi bus passenger vehicles per day. Terminal fees from these vehicles is about 4,500 ETB collected per month.

In conclusion, the terminals mentioned above do not have basic facilities such as well handled shelter, cafeteria and toilets, although there is a plan to upgrade them in the near future.

3.2 The Research Approach

Transportation as part of geography is a highly researchable field and it invites the researchers to various options. To assess the truth for true knowledge in geography, the main three realistic options are: the formal concept of truth, a hermeneutic concept of truth, and a dialectical concept of truth (UNISA 2011e). The study in transport geography highly supports the view of formal concept of truth which assumes the reality as an objective (UNISA 2011c).

The nature of transportation as a whole, at any particular time and throughout its history, is altogether determined by its inter-relations with physical and social forces and conditions (Cooley 2007). Movement from place to place cannot be conceived as taking place without the application of force. Therefore, the existence of natural and social laws will be accredited and it is presumed that there is order and regularity in natural and social occasions.

Geographers cannot trust to understand transportation without at the same time considering the geographical facts that condition it. And as these geographical facts are permanent, relatively at least to the social facts which the study of transportation must also embrace, a theory of their influence forms the ground-work of the theory of transportation. Based on this, the facts permit the researcher to confirm a theory or improve on a theory or to formulate a new theory. Theory also lets for the classification and conceptualization of facts.

This dissertation was undertaken with the intention of contributing to the body of knowledge in the discipline of Transport Geography (which has emerged from Economic Geography). The main role of Transport Geography is in making understand the spatial relations that are formed by transportation systems. This gives rise to several relations between accessibility, distance and time. Transportation here is a system that considers the complex relationships between its core elements: i.e., fixed facilities (networks and nodes) and demand. The extent of the service provided for the moving entities along available (supplied) fixed facility results in socioeconomic impacts.

Therefore, to address socioeconomic impact assessment, a kind of research methodology to be adopted is suggested by many realists. They advocated for the use of mixed methods, and discuss the complementary nature of intensive and extensive methods. According to Sayer (1992), an *intensive* research design is employed when the centre of the study is to obtain in-depth knowledge of specific phenomena and mainly applies qualitative methods and analysis. An *extensive* research design on the other hand is being used given that the focus of the study is to explore the common properties and general patterns regarding the impact of the study area on both participants and nonparticipants of road intervention at a broader geographical scale.

In this regard the logical positivist paradigm also concentrates exclusively on those attributes that are observable and measurable. This will be achieved more through the use of quantitative methods. These methods are very important because truth is assessed by how well the internal validity of the study is managed as well as the reliability and validity of instruments as a measure of the phenomena being investigated (UNISA 2011c).

Lawson and Staeheli (1990:18) also state that researchers must combine methodologies as different rounds of a study raise different questions, some of which require qualitative as well as quantitative techniques. A methodological approach in impact evaluation, according to Bryman (2001); Baker (2000); Edward (2000); Bamberger & Fujita (2008) and Denzin (1970:313), is to use more than one method to investigate the same research problem, and is therefore believed appropriate to meet the study's data and information needs. This can be used in a study with a view to double (or triple) check results (O'Donoghue and Punch 2003:78).

Generally, this dissertation aims to explore and evaluate the impact of highways (as defined by Einstein College of Engineering [nd], in section 1.2.1iii, Chapter One) in Ethiopia in particular reference to Gendewuha – Gelago, Mile - Weldiya, and Ginchi-Kachise Roads. By using the approaches mentioned in the above paragraph (mixed method considering concurrent embedded design), this study quantifies the impacts of road development related interventions on the affected communities and areas by employing a range of outcome indicators. Qualitative methods in this study can add context and depth to quantitative survey findings and help to explore impact pathways, even though they have limited efficacy for rigorous evaluation of such impacts. However, this study is also required to assess perceptions of the key respondents towards the design and implementation of the project for which qualitative methods are entirely appropriate. This part shares the paradigm of critical realism. In this regard, the critical realism includes the promotion of progressive social change and the development of a broad range of critical theories and their application in geographical research and political practice.

The other relevant theories employed in this study refer to the basic theories of impact evaluation, while some use is also made of the Central Place Theory and Graph Theory. Basic theory of impact evaluation under which programme theory and change theory accommodated are discussed by many authors. Programme theory is dominantly discussed by White (2009) and by Khandker *et al* (2010), whereas change theory by Anderson (2005) and Vogel and Stephenson (2012). All of these writers have generally described the theory of change due to interventions. Central place theory is also well discussed by Von Thunen (1966) and later developed by many writers. Furthermore, graph theory is more discussed by Rodrigue *et al* (2012). Therefore; knowledge and truth are taken as relative to the evidence, the methods and theories employed. So the qualitative component of the study will simultaneously strengthen the quantitative component and generate additional findings. Therefore the research under study is based on different theories and approaches.

In line with this, the first objective of this dissertation which is covered in Chapter Four is about *the assessment of temporal changes, status and quality of roads in Ethiopia.* Analysis of this objective requires large amount of the historical and more recent secondary data and limited amount of primary data. Under this chapter, the secondary data are the transport policy and strategies, financial documents (budgets and disbursements), transport master plan as well as road network maps and annual reports. These data are mainly collected from ERA, MoFED, EEA, EMA and various libraries, while some of them were also obtained from the internet.

The second objective is about *the assessment of the direct and indirect impacts of road infrastructure from pre to post road intervention periods in the study areas*. This objective is covered in three consecutive chapters: Five, Six and Seven. This objective is classified into four sub objectives. The **first** sub objective which is covered in Chapter Five deals with road impacts of households' economy (like occupation, agricultural productivity, income, asset, market access, trade and traffic mobility), This objective is answered more by primary (quantitative and qualitative) data collection from the households (treatment and the control groups) and key informants. The outcomes are assessed to determine whether the project (before and after intervention) had the desired impacts on individual participants, households, and the community and determining whether the effects are attributable to the project's intervention or to other causes.

The second and the third sub objectives are covered in Chapter Six and their concern is about social impacts of road development. The **second** sub objective focuses on *spatiotemporal analysis and comparison of population and settlement changes in the study areas*. The sources of data are satellite images from EMA and INSA, secondary data from MoFED, BoFED, CSA, from *weredas*. The **third** sub objective is about *relationship of road proximity/accessibility with social impact indicators such as: poverty, education, health, gender*. The **fourth** sub objective is about *the factors which are influencing the positive impacts of road development in the study areas*, and is covered in Chapter Seven. The source of data for the third and fourth sub objectives is the same as the first sub objective with some additions of secondary data and data generated from the analysis, interviews, and FGDs.

3.3 Realistic Approaches and Useful Ways for Impact Evaluation

Despite the challenges described in the review of literature, the increasing interest in rapid and low cost impact evaluation has led to a number of promising approaches, on which "shoestring evaluation approach" best fits this study. Therefore, technical tasks which are executed in this study are:

a. ***refinement to quasi-experimental designs*****.** Recognition of the need to adapt QEDs to the real-life conditions under which evaluations carried out have yielded many ways to simplify and rationalize evaluation designs.

b. ***Participatory methods*****.** A wide range of participatory methods have been developed to obtain the perspectives of project beneficiaries and other affected groups. Many of these methods could be used to reduce the time and financial cost of data collection such as by FGD.

c. ***Statistical methods to improve the use of cross-sectional studies*****.** Different methods of analysis have been used to statistically test the differences between project and control groups; hence improving the utility of cross-sectional studies is a tool for impact assessment. Statistical methods are used primarily to improve the analytical strength of sample survey designs, but these methods can also be used to improve the way in which participants in qualitative studies are selected and the results of the studies are analyzed.

3.4 Spatial Demarcation

3.4.1 Approaches and Methods of Selecting the Study Areas

As explained by Ochieng (2002:4), since road transport investment accommodates a wider range of infrastructure (from large cross- national highways to local roads and paths), one and the same methodology cannot be developed for assessing all types of roads. The main reasons are that the ratio of direct to indirect benefits differs widely, as does the geographical size of the impact region. For example, national highways generate much of their socioeconomic impact benefits through indirect processes. With local or regional roads, the direct benefits are expected to be larger and spread out outside the project zone may be less important.

This study focuses on two newly penetrated gravel rural roads and one newly intervened rural road for pavement that are purposively selected. They are located in the North Western, North Eastern and Central regions of the country. Their appropriate locations are expected to represent a variety of topographic, climatic, agro-ecological, demographic and socioeconomic conditions. The selection is targeted on one (paved) from federal roads, and two from regional roads keeping their completion before five to seven years. But, after 2013, the latter two roads became under the federal government, which is expected to bring more positive impact through better upkeep.

3.4.2 Method of Demarcating the Zones of Influence (ZOI) for the Study Area

As elaborated by Ochieng (2002:4), the zone of influence or the buffer zone of a rural road can be defined in different ways, depending on the local situation of how new roads are connected to the existing network. The zoning has no standard methodology. It needs very complex combination of many factors relating to the characteristics of the road itself and the characteristics of the population around it (e.g. spatial dispersion of the population, type of economic activity, etc.). According to Ochieng, deciding the influence zone in both sides is too expensive as registering all households is too complicated. But a more practical approach is to define the zone of influence as coinciding with districts, counties, or other administrative entities through which the road runs. The present study partially adopts this approach, with more focus on *kebeles* and employing local maps, satellite imageries and the use of GPS to keep 10 kms on both sides of the study corridor.

3.5 Research Flowchart

The socioeconomic impact study is designed to analyze the different relationships depicted in the Figure 3.1 below. As explained by Bhatta (2004), Rodrigue *et al* (2012) and Islam *et al* (2008), road improvement directly affects the transport sector; and directly or indirectly the trade, institutional, agricultural, and household sectors.

Transportation service is the very contiguous sector on which the immediate impact of road improvement is likely to be reflected in terms of an increase in the volume of traffic, a decrease in travel time, cost savings, and increased mobility. It has also immediate impacts on the **trade sector** through location spread and size of markets as well as changes in the composition of goods and services traded. Road improvement and the consequent changes in the transport sector also facilitate improvements in the **institutional service sector**. The major components of this sector are social institutions like healthcare, educational and financial institutions, and extension services. Roads by providing easier access to inputs and to market for output have positive impacts on various **production and service sectors**. The possible impacts on **agricultural production** include: (a) intensive use of improved inputs and technology, (b) increased volume of output, (c) changes in output mix, and (d) rise in the level of productivity. It is likely that better infrastructure will also have an impact on **non-farm activities** such as: (a) increased diversity in products and services available locally, (b) new employment opportunities, and (c) higher non-agricultural wages (Islam *et al* 2008:13).

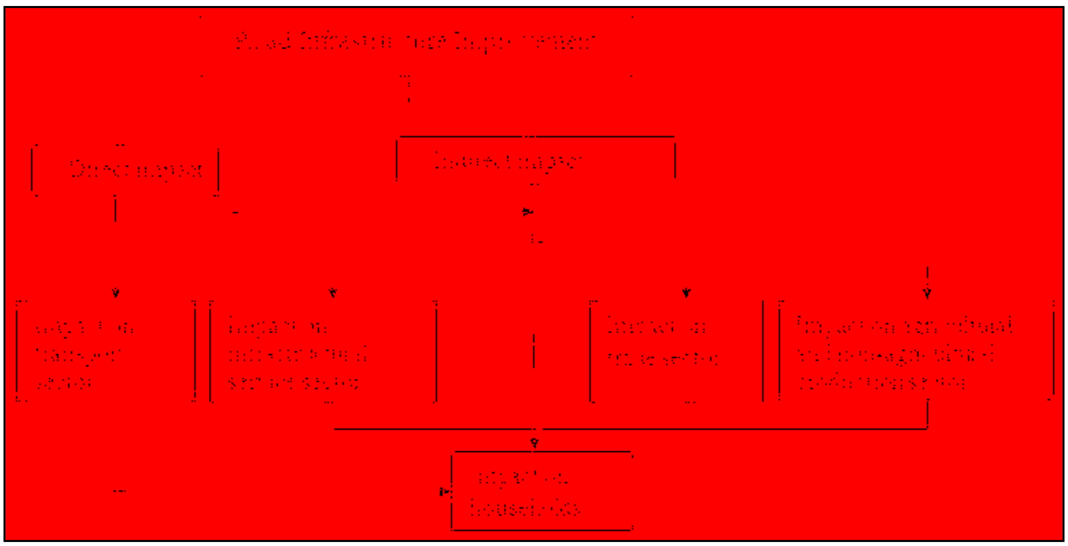

Figure 3. 10: Research Design Flow Chart

NB — — → *Partly direct impact*

Source: Adapted from Islam et al (2008:16), ERA (2010: 99-100)

As illustrated in Figure 3.10, the direct effect of improvement in road transportation and trade and their indirect effects through production and services sectors and institutional service further lead to change in the **household sector.** The possible impacts at the household level are transformations in both economic and social attributes of the household, including: (a) the level and characteristics of the employment of the household members due to changes in both demand and supply of labor, (b) the level and sources of wage and non-wage income and, by improving poverty situation, (c) consumption and marketed surplus, (d) use of transport itself, (e) demand for institutional services such as healthcare and education, (f) savings and investment, (g) ownership of assets, and (h) demographic features (Edwards 2000:37- 51; Islam *et al* 2008:13)

3.6 Survey Design, Sample Population, Data Gathering, and Data Analysis

3.6.1 Survey Design

The alternative approach employed to find out socioeconomic impact for the study areas is that: two categories of villages be selected: (a) villages from within the *Zone of influence (*ZOI) and (b) villages outside the ZOI of the selected road (called *control zone*, COZ). The ZOI here is an area within 5 kilometres on either side of the three corridors selected for the study, namely Gendewuha - Gelago, Mile - Weldiya , and Ginchi - Kachise.

For further in-depth analysis, villages within the ZOI are categorized into (a) *progressive* and (b) *traditional* villages. This classification is mainly used to apply the double deference model in the analysis by using multiple regression and see the significance of the difference between the base line and the follow-up periods. This will make the control villages more comparable with the *traditional* villages in terms of socioeconomic characteristics, as the control villages must possess the same relevant characteristics as the villages of the ZOI receiving the intervention. However, the most dominantly used geographical classification in the analysis in this study is two (comparing ZOI and COZs) by using paired sample t test.

In terms the selection of *progressive*, *traditional* and *control* villages, the researcher has applied three distinct criterions (Islam *et al* 2008): (a) adoption of modern agricultural technology, since the economic base of the study areas is in the main agriculture-based, (b) existence of a market, which is the centre of non-agricultural economic activities, (c) existence of a road, which is the project intervention mechanism.

Modern agricultural technologies that have been adopted by Ethiopian farmers in the study area are identified to be: (a) power tiller/tractor, (b) high yielding varieties (HYV) seeds, (c) chemical fertilizers, (d) pesticides/ herbicides, (e) threshing machines and (f) irrigation technology. The technological utilization by farmers is categorized into six and the seventh is for none users as shown in the Table 3.2.

Table 3. 2: Classification of Level of Agricultural Technologies.

Level	Criteria
1	When a farmer uses all the six technologies stated below
2	When farmers use any five out of six technologies
3	When farmers use any four out of six technologies
4	When farmers use any three out of six technologies
5	When farmers use any two out of six technologies
6	When farmers use any one out of six technologies
7	When farmers use any non of six technologies

Source: Adapted from Islam et al (2008:17),

As illustrated in Table 3.3, the existence of road infrastructure is common in both *progressive* and *traditional* villages. The only difference between them is the existence of market infrastructure in the progressive villages. In a generalized context, what differentiates *traditional* and *control* villages is also the existence of a road in the traditional villages. Thus, a comparison between and among the mentioned villages is expected to show the impact of the road intervention.

Table 3. 3: Selection Criteria of Progressive, Traditional and Control Villages.

ZOI-Village		**Control Village**
Progressive Village(in ≤ 2.5kms)	***Traditional Village (in 2.5 – 4.9kms)***	***Control Village(≥5kms)***
Road	Road	No road
Market	No market	No market
Agricultural technology level either 1 or 2	Any level of agricultural technology	Any level of agricultural technology

Source: Adapted from Islam et al (2008:17),

3.6.2 Data Sources, Sample Population and Data Gathering Techniques

Data for the study are collected from secondary and primary sources. The collection of the primary data is based on ethnographic strategy which is generally applied in economic geography and transport geography as a methodology. Ethnography attempts to understand social and economic phenomena from the viewpoint of participants in the social setting under the study (Schensul *et al*. 1999 cited in Musekene 2010:124). In this regard, this study has included ethnic groups from remote areas of Ethiopia such as in those in the north western parts: Quara and Metema *weredas* in Amhara region; in the north eastern parts: Zone 1 in Afar (Chifra and Mile *weredas*), Gubalafto *wereda* in Amhara region; and Gindeberet and Jeldu *weredas* in Oromia region). The remaining *weredas,* Dendi in Oromia and Weldiya in Amhara, are the places where only interviews had been undertaken as there was no need to collect quantitative data since the study areas in these *weredas* are penetrated by other highways which had been constructed long time before the construction of the study roads and not to duplicate the data (See Figure 3.1 and Table 3.5).

In terms of corridor sectioning**,** the classification for the three segments had been specified to draw a representative sample in the Country. Accordingly, each corridor has a number of sections as shown below:

Table 3. 4: Study Highways and Data Collection Centres

	The study highway and location	**Sections**	**Data collection centres which are far from any highway joining them**
1	Gelago-Gendewuha (125 km) at the NW Ethiopia	3 Sections	Shinfa and Gelago
2	Weldiya-Mile (165km) at the NE Ethiopia	4 Sections	Chifra and Hara
3	Ginchi-Kachise (105 km) central Ethiopia	3 Sections	Shikute and Kachisi

Source: own development, 2014

The scoping survey (bordering of the sampled study areas) was also carried out with coordination of *kebele* leaders.

Regarding the collection of primary data through **household survey**, 400 questionnaires were distributed in the six study centres as illustrated in Table 3.5. The sample size is determined based on Gay & Airasian (2000) who put that for a population of 5000 and beyond sample size of 400 is adequate. Before data collection, some preconditions had to be by the respondents, namely they should be those who lived for more than ten years in the study area and have knowledge about the situation before the road intervention. Therefore, this makes the selection method judgmental.

Table 3. 5: Research Instruments and their Purpose in Road Impact Assessment

S/N	Survey Instruments	Purpose	Gendewuha-Gelago(1)			Mile – Weldiya(2)				Ginchi –Kachisi(3)			Executed sample from planned	Selection method
			Gendewuha	**Shinfa**	**Gelago**	**Weldiya**	**Hara**	**Chifra**	**Mile**	**Ginchi**	**Shikute**	**Kachisi**		
1	Questionnaires for HH heads **(Household Survey)**	To identify the status of change associated with the road improvements and its impact on the households and individuals	*	59	56	*	61	58	*	*	77	81	**392/400 (98%)**	Judgmental Then random
2	**Interview** for transport users and key informants	To know and record the patterns of transport use; to collect primary data on key indicators of impact.	9	8	9	6	3	9	8	8	8	9	**77/81 (95%)**	Judgmental Then random
3	**Focus Group Discussion**	To identify villagers' perceptions of expected and actual socioeconomic impacts, and record significant events and changes identified by villagers.	10	10	9	*	12	10	*	*	9	9	69/ 70 (98%)	Judgmental
4	**Observation**	To check quality of the route, terminals, and the status of transport users at the origins and destinations	√	√	√	√	√	√	√	√	√	√	General observation of the whole line	Judgmental
5	**Traffic count** surveys	To record change in traffic volumes, traffic composition, etc due to road development.	Before Gendewuha.	*	Before Gelago	*	Before Hara	Before Chifra	Before Mile	Before Ginchi	*	Before Kachisi	**Seven** points along the line	Judgmental
6	**Secondary data** performance (raw data, satellite images etc)	To identify and document indicators that are spatially relevant to village life, *weredas* and at macroeconomic level	√	√	√	√	√	√	√	√	√	√	From micro to macro level	
		Total sample	**19**	**77**	**74**	**6**	**76**	**77**	**8**	**8**	**94**	**99**	**538/551 (98%)**	

**Taking primary data from the indicated centres is purposefully omitted. The most important reason is that it can create duplications because of there are roads constructed long time before the road under study.*

Source: Field Survey, 2014

Out of the total 400 households identified, eight outliers have been omitted considering among others the reported size of household members and income and the remaining 392 households (98%) were considered for analysis (See Table 3.6). A unique GPS point had been also recorded for the residence of each household to allow further spatial analysis.

Regarding the **interview**, face-to-face communication through structured and semi structured questions has been executed in 10 centres (Table 3.5 and Annex B2) by the Writer himself. Each centre has nine interviewees (Weldiya and Hara centres sharing six and three interviewees respectively being considered as one because of they are in the same werda, Gubalafto). The interviewees are higher at Weldiya because of key resource persons with better knowledge are working in this town that is serving as the administrative centre of Gubalafto *Wereda*. Out of 81planned interviewees (from education sector, health sector, *wereda* administration, businessmen, agricultural sector, road transport infrastructure, drivers, passengers and traffic police), 77(95%) had actually participated. From each of purposively selected sectors one interviewee had been selected randomly (for instance, one from top management members, from drivers, from passengers, and so on per each station). Furthermore, out of these 77 interviewees, nine were drivers (one driver per centre) and the remaining were key informants distributed in the study centres. Drivers who had been interviewed were those who served for more than five years along the road under study. Similarly, key informants had knowledge of the study areas around the roads under study well before the road intervention.

In addition to the interviews, **focus group discussions** (FGDs) were undertaken by the Writer himself in the study highways as shown in Table 3.5 and Annex B3. The planned participants were 10 per each seven centres (a total of 70). Accordingly, 9 to 12 persons had participated, which corresponds to a participation rate of about 98%.

Traffic mobility **status (traffic count**) is also very important in the impact study and, to get tangible primary data, manual count was undertaken by hiring data collectors in seven strategic locations as shown in the Table 3.5. In addition, the GPS locations had been recorded for each of the traffic count locations for further spatial analysis. Moreover, qualitative data was also supported by **observation**, and photographs of the track and the terminals where vehicles park.

Table 3. 6: Summary of Household Respondents in ZOI and COZ

	ZOI						COZ		Total	
	Progressive (≤2.5 kms)		Traditional (2.5-4.9 kms)		ZOI (<5kms)		COZ (≥5kms)		Total	
Period	N	Percent	N	Percent	N	Percent	N	Percent	N	Percent
Before	173	44.1	85	21.7	258	65.8	134	34.2	392	100
Now	180	45.9	85	21.7	265	67.6	127	32.4	392	100

Source: Field Survey, 2014

3.6.3 Impact Variables and Method of Data Analysis

3.6.3.1 Socioeconomic Impact Indicators (Variables) and Measurement Models

The thesis reports the findings on major selected socioeconomic variables such as: household income, agricultural yield, employment, household asset, trade, education, health, gender, population and nature of housing and poverty.

The collected data had been computed using the following statistical tests: (a) Assuming that data for two-sample problems consist of two dependent random samples (data before and after road project implementation, within two dependent variables say Z_1, Z_2, Z_3…., Z_n and X_1, X_2, X_3…., X_n); assuming both Zs and Xs are normally distributed; the null hypothesis, Ho: $\mu_z = \mu_x$. Then the statistical significance of means had been checked by using **paired sample t-test**. (b) For independent group samples, for instance, to check the statistical significance between progressive and traditional village samples, the **independent sample t-test** had been employed. (c) For more complex group comparisons (for more than two independent samples), data had been tested using **ANOVA (analysis of variance)** and this had been used in the double difference model.

3.6.3.2 Method of Data Analysis

Having the above models as well as based on the results from SPSS version 21 and GIS, the researcher had utilized two types of impact analyses for comparison: a) for each of the roads considered, comparisons are made between current conditions with those before the intervention and, b) there are comparing conditions in the project road relative to a control zones which are not benefiting from improvements over the period of the study. The method of analysis in this study has used descriptive and inferential statistics. Descriptive statistics (the use of graphs, tables, pie charts etc) has been employed where appropriate. Related to inferential statistics, the results from paired sample t tests had been dominantly employed. Baker (2000), Ravallion (2001), Ochieng (2002), and Islam *et al* (2008) had provided a theoretical framework for application of double-difference method to estimate net project impacts by using multiple regression, and they raised several issues relevant in bringing tasks to a good end. Accordingly, the model has been used as described in the following paragraphs.

A regression-based estimate of the double difference (DD) can be obtained from estimating the following regression model:

$$Y_{ijt} = \beta_0 + \beta_1 D_{ij}^{TC} + \beta_2 D_{it}^{AD} + \beta_3 D_{ij}^{TC} D_{it}^{AD} + \varepsilon_{ijt}$$

where Y_{ij} is the value of an indicator for ith household in jth village at time t, ε_{ijt} are error terms which are assumed to be uncorrelated across villages but not necessarily within villages, D_{ij}^{TC} and D_{it}^{AD} are dummy variables defined as:

$$D_{ij}^{TC} = \begin{cases} 1, & \text{if } j^{th} \text{ household resides in a treated village} \\ 0, & \text{if } j^{th} \text{ household resides in a control village} \end{cases}$$

$$D_{it}^{AD} = \begin{cases} 1, & \text{if } i^{th} \text{ observation is from the follow-up survey} \\ 0, & \text{if } i^{th} \text{ observation is from the baseline survey} \end{cases}$$

In the above setting, a significant β_2 is an indication of a significant difference in the average (expected) value of the characteristic of interest between the baseline and follow-up periods for the control group. Similarly, a significant β_1 portrays a significant difference in the average value of the characteristic of interest between the treated and control groups (villages) in the baseline period. The parameter of much interest is the double-difference estimator, β_3. A significant β_3 is an indication of a significant impact of the programme (treatment) on the average value of the characteristic under consideration (Y). Note that the double-difference estimator controls for any differences between households (or individuals) in treated and control groups at the baseline period.

3.7. Ethical Considerations

Questionnaires are designed following two options to include some amount of protection of the subjects: **anonymity or confidentiality**. **Confidential** research participation implies that the data from the research subject(s) can potentially be identified or linked to a particular individual. Thus, any data collected face-to-face (survey, focus groups, etc.) is automatically considered in the category of being **confidential.** This is true even when the researcher assigns a coding number to the subject-and this number cannot be traced back to the subject—because the researcher himself knows who provided the data. Thus, the second option is the researcher's option, because, mostly impact analysis by its nature requires respondents identified by their names. It is about the changes due to the interventions. To be identified by their names and the location point of their residence is very important to ease for the future impact study through the permission of the respondents. The student researcher had also been helped by GPS and local names to guarantee farther study.

Thus, where a study involves confidential participation by the subject(s), extra measures were taken for their protection. These would include at minimum:

- Securing the collected data (e.g., samples and information) in a locked file cabinet or similar environment, to which only the researcher and/or other trained assistants have access.
- If assigning subjects a key or code that connects them to the data, storing the key in a locked file cabinet separate from the data.
- Informing the research subjects of these measures to ensure confidentiality.
- Focussing on collecting only those data that are necessary to fulfil the research objectives.

While the research is being undertaken, the following three key ethical principles (Connolly 2003:6) among others were adhered to the researcher:

1) Conducting the professional work with integrity and in such a way so as not to jeopardize future research, the public standing of researchers or the ability of others to publish and promote the findings of their research.
2) Respect the rights and dignity of all those who are involved in or affected by their research.
3) Ensure as far as possible the physical, social and psychological well-being of all those who take part in their research or are subsequently affected by it.

3.8 Summary

Studies in transport geography highly support the view of formal concept of truth which assumes the reality as an objective. With this end, the main role of Transport Geography is in making understand the spatial relations that are formed by transportation systems.

A methodological approach, in transportation impact evaluation according to Staeheli (1990); Baker (2000); Edward (2000); Bryman (2001); Bamberger & Fujita (2008) and Creswell (2009:214) is to use of more than one method(such as mixed method with the application of concurrent embedded design). The increasing interest in rapid and low cost impact evaluation has produced a number of promising approaches, on which "shoestring evaluation approach" best fits this study.

In terms of the survey design of the study, two categories of villages had been selected: (a) villages from within the *Zone of influence (*ZOI) and (b) villages outside the ZOI of the selected road (called *control zone* (COZ). The ZOI here is an area within five kilometres on either side of the roads, where as COZ is the zone beyond five kilometres.

The study employs both primary and secondary data. The tools used to collect primary data are: household survey, interview, FGD, observation and traffic count. On the other hand, secondary data are collected from ERA, CSA, MoFED, regions and *wereda* administrations. Accordingly, out of the 400 questionnaires distributed for households, eight were skipped due to incomplete answers and outliers. This give a response rate of 98 percent which is equivalent to the rate of all quantitative and qualitative types of questions used in the study areas.

The variables considered in the study are: occupation of the household head, agricultural productivity indicators (such as input use, volume of output, and changes in output mix), income, assets, market access, trade, traffic mobility, population, settlement, poverty indicators, education and health access, and gender.

In keeping with the methodology discussed above, the next chapter analyzes the collected data by using Excel word, SPSS and GIS software and testes by paired sample t test, independent sample t test, and ANOVA for DD. From the variables mentioned above, income is set to be dependent variable; the others are selectively used as independent variables.

CHAPTER FOUR: TEMPORAL ANALYSIS OF ROAD DEVELOPMENT, ITS FINANCING AND IMPACTS IN ETHIOPIA

This Chapter describes the impact of road development at national and regional (state) level. At national level, the performances from 1951 to1991 are compared with those of the present Government from 1992 to 2014. It contributes to have broad knowledge on road development in Ethiopia and its generalized impacts, which shall serve as a bridge to the next chapters that focus on the analysis made on the spatiotemporal changes due to road development programme interventions in the study areas.

Using time series data, the analysis in this Chapter focuses on the expansion of road infrastructure since 1951 and the financing of road construction since 1965 using a periodization that takes into account the three consecutive political regimes: the Imperial period (mixed economy, until 1974), the Derg period (command economy, until 1991) and the EPRDF period (free market economy after 1991). The spatial analysis also covers the development regarding the distribution of the road network both at national and regional (state) levels and compares the baselines before the start of the RSDP in 1998 with the current situation.

4.1 Road Infrastructure Planning and Development in the Imperial and the Derg Periods

The Ethiopian experience in road transport development planning and expansion performance can be discussed under the different regimes and is about to be mentioned.

4.1.1 Imperial Period

The road network in this Era was characterized by radial network centring the capital city, Addis Ababa to different resource areas, and administratively important towns and historical sites. It is following these radial roads that the major towns in Ethiopia emerged. The 40-towns master plan project in the mid 1960s that was undertaken by Italian consultant firms was an important opportunity in the consideration of road network. But these town masters plans did not deal adequately with transport facilities like bus and truck terminals, parking, junctions, and traffic control points as an integral part of the transport infrastructure. Moreover, they paid little attention to integrate urban transport with regional transport system (NUPI 2006).

In 1951 when the Imperial Highway Authority (now Ethiopian Road Authority) was established, the total road network was 6, 400km most of which was built during the Italian invasion (1931-1936). At the end of Imperial political power (in the early 1970s), the road stock reached to 9,160 km. The average annual growth rate of road network expansion was 4.6 percent. The road length per 1000 people and per 1000km^2 was also 0.30 and 5.2km in 1951, respectively. The respective figures were 0.29 (this decline is caused by low rate of road growth may be due to political instabilities during the transition period than population growth rate) and 7.7 km in 1973 (at the end of Imperial period) (Table 4.1).

Table 4 1:Road Length (km), Road Density and Population Growth in Ethiopia(1951-2013)

Regime	Year	Asphalt	Gravel	*Wereda* Road	Rural	Total	Average Annual Growth Rate of Road[1]	Population (000,000)	Road Density /1000 people[2]	Road Density /1000 km2
Imperial Period	1951	3400	3000			6400	4.60%	21.5	0.30	5.2
	1973	3360	5800			9160		31.3	0.29	7.7
Derg Period	1974	3360	5900			9260	4.20%	32.1	0.29	7.6
	1991	4109	9298		5610	19017		53.0	0.36	15.6
EPRDF	1992	3542	8966		5573	18081	7.40%	53.3	0.34	14.8
	2013	11301	14455	32582	27628	85966		86.0	1.00	78.2

Source: Computed by the author base on Data of ERA, Annex 4.1 and 4.2

4.1.2 Derg Period

A major breakthrough in urban transport planning was observed in 1986 by Addis Ababa Master Plan (AAMP). It had considered the regional metropolitan transport system; the road network; public transport services and basic infrastructures; future urban mobility scenarios; integration of

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[1] *The mathematical model of average annual growth rate of road is* $\mathbf{AAGR = [\sum[(X_2-X_1)/X_1]*100]/T}$; *Where AAGR is Average Annual Growth Rate of Road;* X_2 *is the next or the end value of road performance;* X_1 *is the beginning value of road performance; and T is defined here as number of years.*

[2] *Area of Ethiopia before 1992 was 1.22million* km^2; *after the separation of Eritrea the density is computed by 1.11million* km^2

road infrastructure with public utilities; mass transit consisting of metropolitan railway system; a trolley bus service and the main bus system. AAMP also considered priorities and implementation programmes for key projects though it failed to provide detail action plans for its implementation. Following the AAMP, many urban plans were prepared by the National Urban Planning Institute (NUPI) after 1987 and Regional Works and Urban Development Bureaus since the early 2000s, although the attention they gave for road and transport planning was in the main focussing on the city level road networks and not supra-urban level.

In terms of the network expansion status (Table 4.1), when the Derg assumed power (at the end of 1974), the road network had grown to 9,260 km, of which 3,360 km(36.7%) was paved. By 1991, the network had increased to 19,017 km of which 4,109(21.6%) was paved. The increase over these years was mainly due to the expansion of the rural network most of which was unpaved. Average annual road growth rate was 4.2% which was lower than both Imperial and, as we shall see later, with the EPRDF period. At the end of its political power (after17 years), the road density per 1000 people and per 1000km2 reached to 0.36 and 15.6kms respectively.

4.1.3 EPRDF Period

In the 1990s, the Government of Ethiopia had given more emphasis to expand road network to meet its development goals. These goals are: (a) upgrade and expand essential infrastructure; (b) advance the private sector; and (c) conserve the environment. To implement these strategies, the Government formulated the 10-year Road Sector Development Programme (RSDP 1997–2007), a two-phased integrated package of investments, reforms, and institutional reorganization. The programme was later extended to include a third phase up to the end of June 2010. Currently, (2014) ERA is implementing the 4^{th} RSDP which will end in 2015.

In the design of the RSDP, project planners first looked at the country’s overall road sector issues. They defined policy and institutional reforms, as well as the levels of interventions that would help to achieve their objectives. The programme was then designed to achieve the following:

- Improve trunk and regional/rural road access to meet the agricultural and other economic development needs;
- Build institutional capacity in both the public and private sectors for sustainable road development and maintenance;
- Provide economic opportunity for the rural poor both through increased employment in rural road works and affordable transport and services.

4.2 Road Network Expansion and Pavement in Ethiopia

After the ousting of the Derg by EPRDF, due to the formation of Eritrea as a new state in 1992, the road network in the remaining part of Ethiopia was 18,081 km, of which 3,542 km (19.9%) was paved (Annex 4.3). By 2002, the road network had reached 33,297 km of which 4, 053 km (12 .2%) was paved and the remaining 29, 244 km (87.8 %) was gravel. As a result of huge investments under RSDP I, II, III, and IV, the current road stock (in 2013) has reached 85,966km, of which 11, 301km (13.15%) is paved. As shown in the trend line of 62 years data (Table 4.1), both total road, and rural road growth were generally increasing upward almost keeping parallel pace until 2011. But after 2011, a new campaign at *wereda* level contributed to significant increases in the amount and average annual growth rate that reached 7.4%.

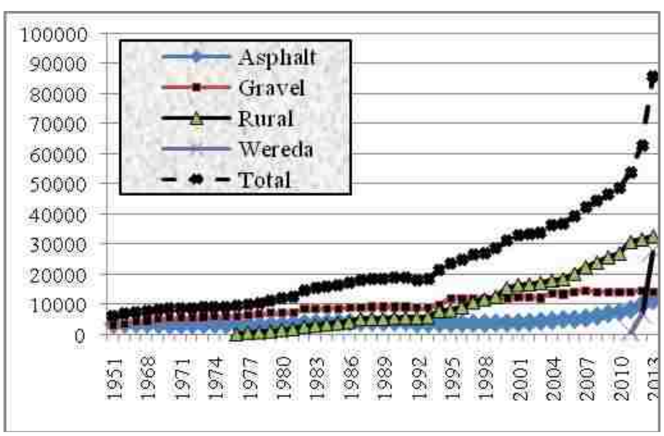


Figure 4. 1: Trend of Road Network Growth in Ethiopia(1951–2013)(km)

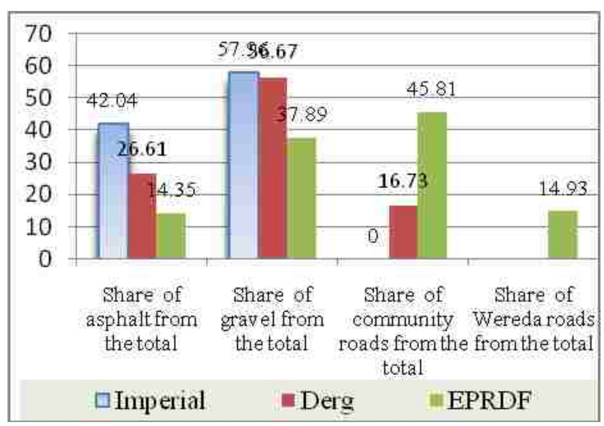


Figure 4. 2: Share of Road Pavement in Ethiopia (1951–2013) (%)

Source: Computed by the Author based on the raw data of ERA, 2014, Annex 4.1 and 4.3

The average growth rate of paved roads almost remained flat up to 2009 (Figure 4.1). Figure 4.2 also depicts that the rate of pavement is 42, 27 and 14% in Imperial, Derg and EPRDF periods, respectively. According to a World Bank study (2014), the density of paved roads per 1,000kms in Ethiopia (8 kms) is below the average of low income countries. The selected low-income and less populated countries with the share of paved road in this study are Nigeria (31kms), Cameroon (9kms), Vietnam (423kms), Madagascar (10kms), Kenya (19kms), Cambodia (13kms), and Algeria (36kms)(World Bank, 2014).

4.3 Comparing Road Density Status of Ethiopia with Low and Middle Income Countries

In spite of recent increases in the density, the road network of Ethiopia is one of the least developed in Africa. For instance, in 1997 Ethiopia had 0.5km per 1000 people as opposed to Sudan (0.8), Kenya (2.3), Tanzania (2.0), Angola (6.0), DR.Congo (2.8), and South Africa (12.6) (ERA, 2007a). By 2010, the figure for Ethiopia had increased to 0.59 km per 1,000 people and 44.4 km per 1000 km^2 (the change which is lower than the Africa region average of over 54 km per 1000 sq. Km) (ERA, 2011).

On the other hand, Ethiopia's road development status can also be compared with low and middle income countries using comparable data for 2012. Accordingly, the average road density for the low-income [3] countries is 39.5km per 1000 km^2, whereas Ethiopia's road density at 49km per 1000 km^2 is greater than the average of low income countries (Annex 4.7). The average road density for the middle-income countries is 104.7km per 1,000 km^2, which is twice higher than that of Ethiopia. The average density in high-income countries is 167.6km per 1,000 sq km, which is about 3.4 times higher than that of Ethiopia. However, the road density in very high-income countries (315.8km per 1000 km^2) is about 6 times higher than that of Ethiopia. Finally, the ERA, 2014a document suggests that Ethiopia should reach a road density of about 120km per 1000km^2 to arrive at middle per capita income countries by the year 2025.

[3] According to ERA (2014a) low income countries are those with per-capita income of less than USD 1,000, middle income countries are those with per capita income of USD 1001-5000, high income countries are those with per capita income of USD 5001-10,000, while very high income countries are those with per capta income of above USD 10,000.

4.4 Road Infrastructure Growth Index

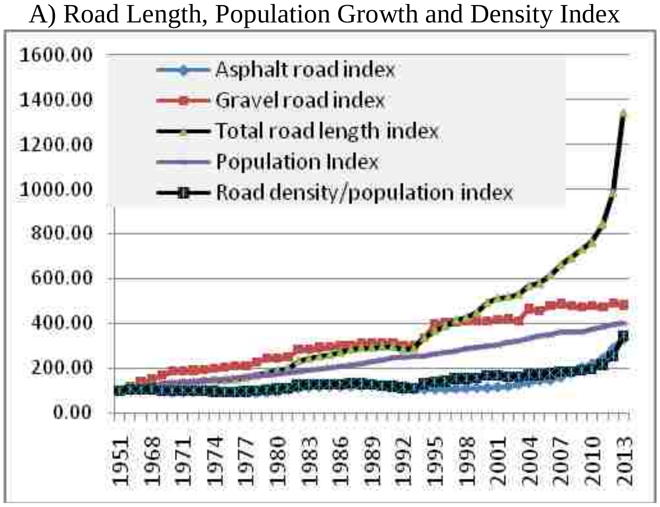
Road growth index is commonly used to evaluate and compare the changes by taking into consideration the base line in the given time. The model developed in this study is indicated as follows:

$$\boldsymbol{Rgi = (k/x_1)^* \, x_2, x_3, x_4, \ldots x_n} \quad \text{.......(1)}$$

$$\boldsymbol{ARgi = \sum[(k/x_1)^* \, x_2, x_3, x_4, \ldots x_n] / T} \quad \text{.......(2)}$$

- *Where Rgi is the value of road growth index*
- *K is the constant and here is 100*
- $\boldsymbol{x_1, x_2 \ldots x_n}$ *are the consecutive figures according to the given time* $\boldsymbol{x_1}$ *considered as base line*
- *ARgi is the value of average road growth index*
- *T is time*

A) Road Length, Population Growth and Density Index



B) Road Length Growth Index by Regime

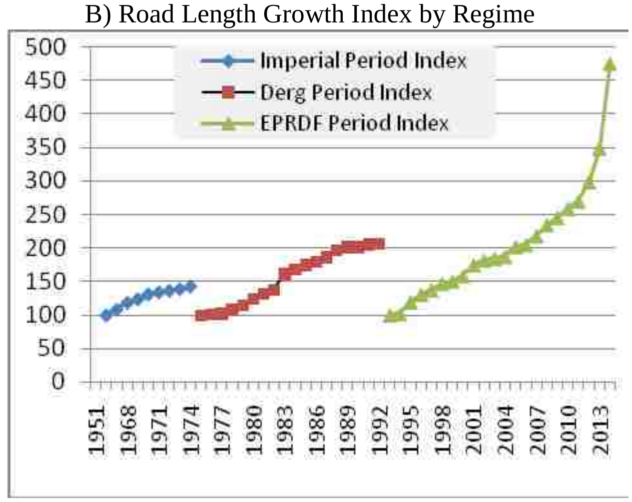


Figure 4. 3: Road Length, Population Growth and Density Index in Ethiopia (1951-2013)
Source: Computed by the Author based on ERA Data, 2014; Annex 4.1and 4.4

As illustrated in Figure 4.3A, by taking 1951 as the base line *(index = 100)*, growth of total road, paved road, Ethiopian population and road density indexes per population could reach to 1343.22, 332.38, 400.00, and 345.66 in 2013 respectively. The growth rate of the road network is very fast particularly after 1992 (Figure 4.3B), whilst the change of total road related to the population is 3.4 times greater (Figure 4.3A). However, the figure illustrates that pavement and the impact on density is not rapid, though improvements have been observed particularly since 2011 under GTP-1 implementation.

4.5 Regional Comparisons of Road Growth and Induced Density Changes

Data on changes in road density depicted in Figure 4.4 shows significant differences across the various regions. The comparison is made baring urban centred regions like Addis Ababa, Dire Dawa and Harari National Regional states. As illustrated in the Figure, Amhara Region is found to have very low road density as compared to other regions during the last seven years. It performed the road density of 0.15, 0.2 and 0.38 in 2007, 2010 and 2013 respectively. Whereas sparsely populated regions like Gambella and Afar have high road density. In terms of total road length, Oromia with 8354 km is the first (31.33% of the total road stock in the country) followed by SNNP region that has 7482 km (28.06%) in 2013. Oromia has performed 2.3 times greater than Amhara, which is expected to have its own implications in terms of socioeconomic impacts in the respective regions.

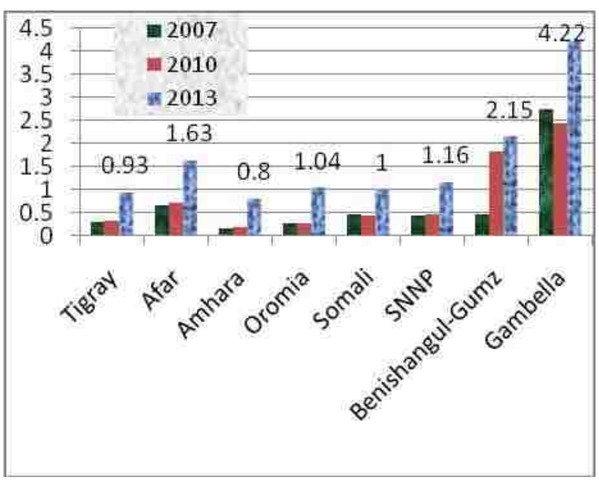


Figure 4. 4: Road Density Changes in Ethiopian Regions in Selected Years 2007 -2013) (km per 1000 inhabitants)

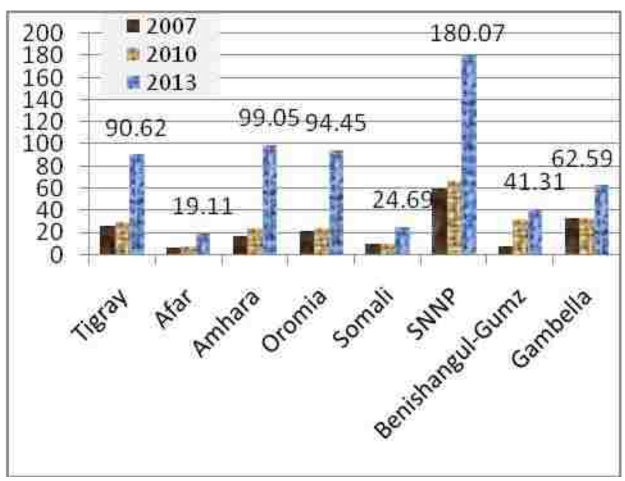


Figure 4. 5 : Road Density Changes in Ethiopian Regions in Selected Years 2007 -2013) (km per 1000 km^2)

Source; Computed by the Author based on data of ERA

A spatial comparison of the road length shows that (Figure 4.5), Afar Region is the least performer during the last seven years followed by Somali Region. The ratio is very high for SNNP (180.07km), which is higher than two folds of the national average.

4.6 Comparing Road Network Growth with Motorized Vehicle Growth in Ethiopia

The low level of road provision in Ethiopia is accompanied by a very low level of motorization. The total vehicle fleet has been growing at an annual average rate of 6.7% as it increased from 96,502 vehicles in 1996/97 to 190,367 in 2006/07 of which, 69% are passenger vehicles, 28% are cargo cars, while the remaining refer to other types of transport equipment such as motor cycles. Furthermore, in 2013, the total number could reach to 474,143 vehicles which is 5.5per 1,000 people in the country. When we compute and compare the density of low and middle income countries with the available data for 2012 that is obtained from ERA, Ethiopia has 3.3 vehicles per 1000 people which is 2.8 and 19 times lower, respectively (Annex 4.7)

With regard to Ethiopian regions, excluding urban areas (outliers like Addis Ababa, Dire Dawa and Harari), average vehicle ownership is 1.59 per 1,000 people. The figure for Tigray (4.82 per 1000 people) is 5.54 times higher than that of Amhara (0.87 per 1000 people) (Annex 4.8).

4.7 Road Infrastructure Financing Trends in Ethiopia

Ethiopia has seen three different economic systems: Imperial, Derg and EPRDF. The road sector financing trend shows irregular picture in these different regimes. Under the following subtitles, the Government national road budget and expenditure, road sector financing trend (in EPRDF period) and overview of road financing comparisons with cross countries are explained.

4.7.1 Road Sector Budget and Expenditure in Three Regimes in Ethiopia (1965-2013)

The analysis under this subtitle will be based on 49 years data on the Ethiopian Government budget and Expenditure, which is collected from ERA and MoFED. In line with this, the extent of the emphasis given to road infrastructure financing is analyzed for the different regimes.

The data available for the Imperial period are confined to nine years (1965-1973). As illustrated in the figures below, the capital budget allocated to the road sector by the central government in 1965 was 9.6 million USD (36.53%) of the total national capital budget. This was a maximum share which was never registered in 33 years (until almost the first commencement of RSDP, 1999). The proportion of capital budget allocated to roads after 1965 gradually declined to 24.6 percent, and to 4.1 percent in 1968 and 1969, respectively. Generally the proportion stayed at lower levels until 1973. The proportion of the disbursement was also showing irregular trend reflecting the trend in the allocation of capital budgets for the road sector. Particularly, during the period between 1969 and1973 that experienced major internal political conflicts, the amount of budget and expenditure on roads were oscillating between the range of 10.6 and 28.8 million USD (from 4.1% to 9.7%) and between 0.55 and 15.57USD (from 2.5% to 6.2%) of the total capital and expenditure of the country respectively. Soon after the takeover of power by the Derg in 1974, the proportion revived to be 31.3 percent of the total capital budget in 1974. But again the share declined from 8.8 percent to 4.4 percent between 1985 and 1989 and had shown slight growth to 23.85 percent in 1995. The years between 1985 and 1991 were also times of heightened fighting between the Derg and the EPRDF. Then after, except slight fluctuations due escalation of foreign exchange, it could show better share because of a change in policy and the formulation of the road sector development programme (RSDP) under EPRDF.

(a) (b)Budget and Expenditure

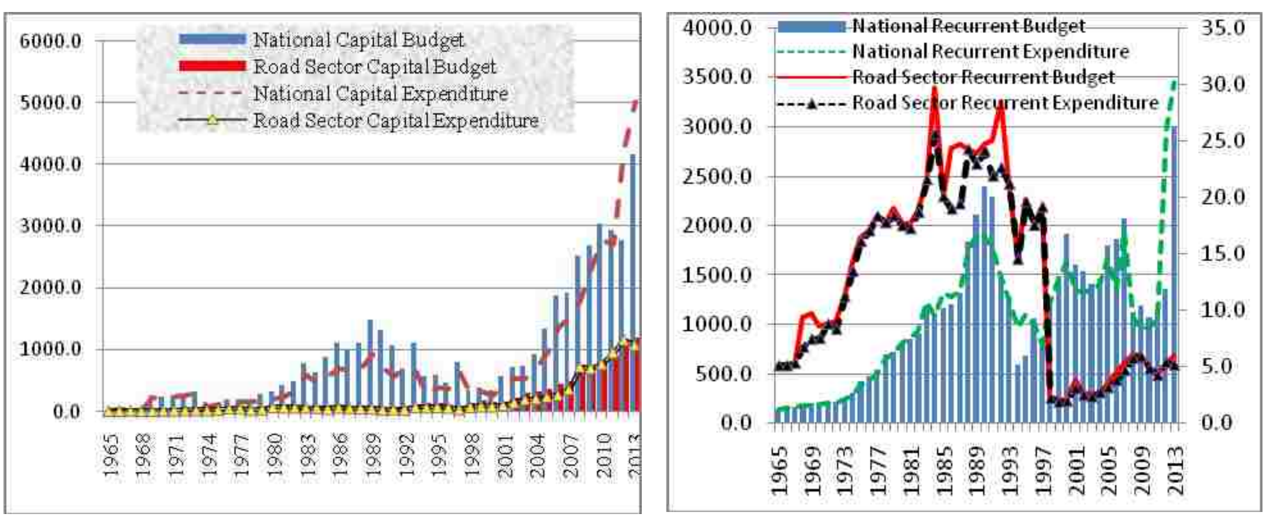


Figure 4. 6: National Capital/Recurrent Budget and Expenditure as Compared to Road Capital/Recurrent Budget and Expenditure (Million USD) (1965-2013)

Source; Computed by the Author based on the Data from ERA,2014

Generally, the average annual capital budgets and capital expenditures on roads in USD were 15.96 and 11.71 million during the Imperial (1965-1973); 67.37 and 45.34 million under the Derg (1974-1991); and 410.21 and 339.68 million during EPRDF (1992-2013) periods. This shows that there is a significant increase in the amount budget allocated and actually disbursed. But the disbursement could not match with the annual budget allocated. In other words, out of the average annual road budgets allocated, the undisbursed finance accounted for about 27, 33 and 17 percent under the Imperial, Derg and EPRDF periods, respectively. The average annual allocation of the capital budget for road transport was also very low in the Derg period as compared to other regimes (17.04%, 15.94% and 26.70% of the total national capital budget of the country in Imperial, the Derg and EPRDF, respectively). This may be because of more budget diverted for the military purposes in the Dreg regime (See the wide gap between 1983-1994 from Figure 4.6 and where the budget proportion to the road sector was highly depressed between1969-1973 and between1981-1997 from Figure 4.7). Following the change of government in 1991, the flow of official development assistance (ODA) exhibited significant increase that provided opportunities for better infrastructure financing under EPDRF.

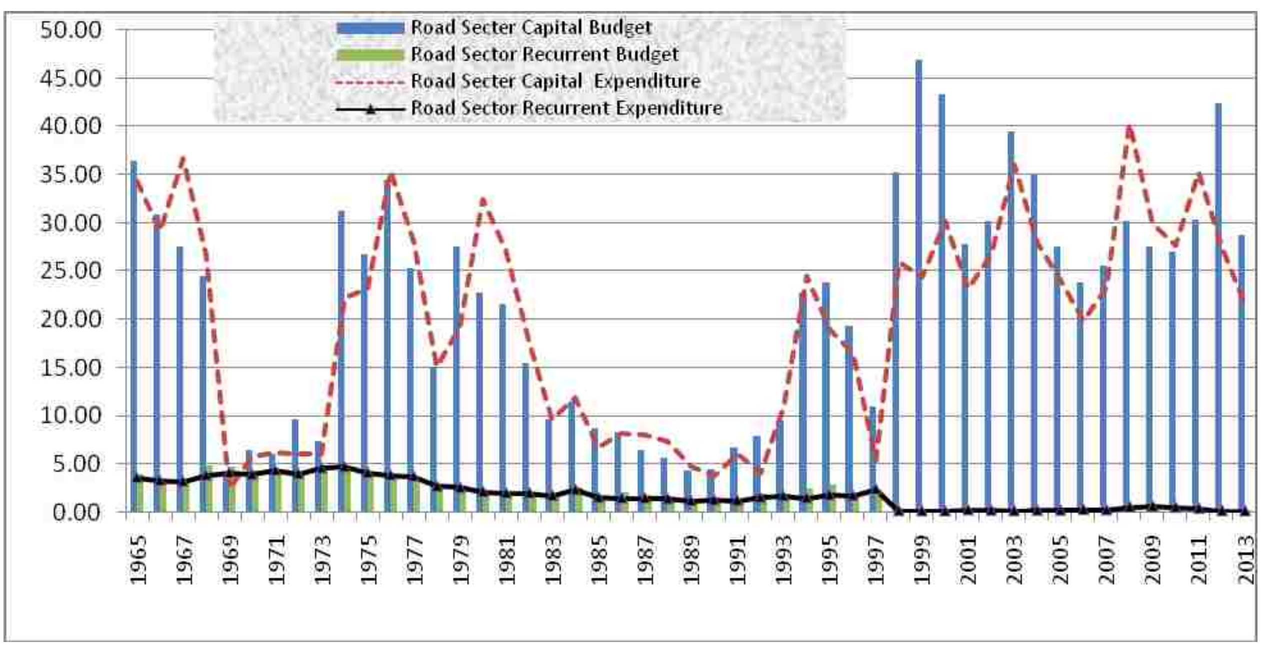


Figure 4. 7: Proportion of Ethiopia's Road Capital/Recurrent Budget and Expenditure from Total National Capital /Recurrent Budget and Expenditure (%)(1965-2013)
Source; Computed by the Author based on the Data from ERA,2014

When we see recurrent budget allocation for the road sector, which mainly goes to the maintenance of existing stock, a very significant emphasis was given during the Derg period. The annual average recurrent budget and recurrent expenditure were 8.06 and 7.30 million USD in Imperial (1965-1973); 20.89 and 19.62million USD in the Derg (1974-1991); and 7.94 and 8.41million USD in EPRDF (1992-2013) periods, respectively. Within the last 49 years, the highest recurrent budget was allocated in 1984 (29.71million USD) in the Derg period followed by 28.42 million USD in 1992 in the EPRDF period.

4.7.2 Financing Trends for the Implementation of RSDP (1998-2013)

Various donors including the World Bank, European Union, ADB, NDF, BADEA, OFID, Governments of Japan, Germany, UK, China, Ireland, the Road Fund and the Government of Ethiopia have been committed to the programme implementation through provision of the required funding.

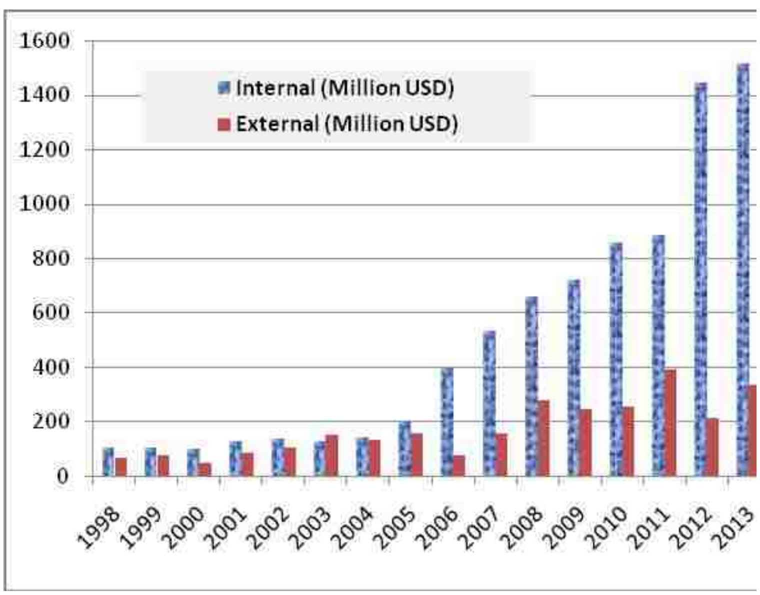


Figure 4. 8 : Share of Internal and External Financiers of Road Sector (1998-2013) (Millions USD)

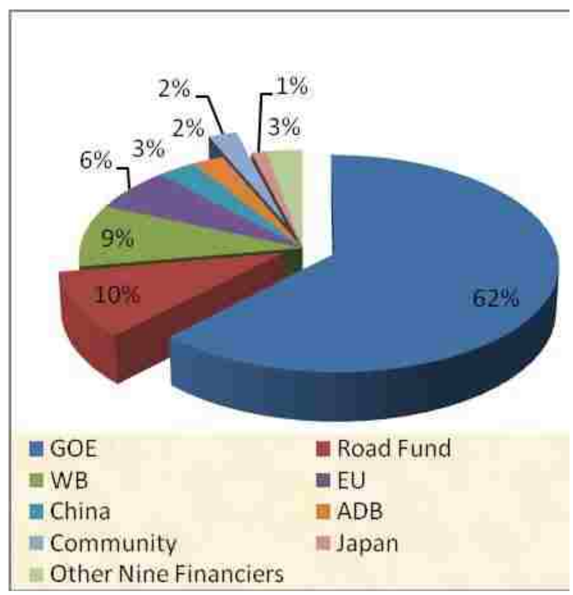


Figure 4. 9: Percentage Share of Road Sector Financiers(1998-2013)

Source; Computed by the Author, based on the data from ERA, 2014

In terms of the contribution of different categories of financiers during RSDP (1998-2013), on average 75% of the total finance was obtained from internal sources (the Government, the Road Fund) while the remaining substantial amount of funds (25%) has been pooled from the international development partners (See Figure 4.8). Specifically, the share of the Government of Ethiopia including the Road Fund is the highest (68.4%), followed by IDA (14.6%) and EU (5.7%) in 2009. But in 2013, the rank of the share is changed to 72, 9 and 6 percent to the GOE, World Bank and to EU respectively (See Figure 4.9).

4.8 Analysis of Impacts of Road Network Development on Accessibility by Using Random Model Approach (1951-2013)

In the preceding sections, explanations had been given how the implementation of road development strategies brought about gradual changes in the total stock of roads as well as in the overall densities per inhabitant and per area from. In particular, the empirical results that are based on time series data show disparities among the last three regimes. This can be attributed to the fact that different regimes accord different priorities to the road sector

In the following sections, it is also important to analyze the extent of impacts due to policy interventions on accessibility, road conditions and mobility.

The change of accessibility can be demonstrated by employing the commonly used parameter, *Random Model Approach*. The word *random* is to explain that if all pieces of road tracks are distributed equally in a given area, keeping many other barriers constant; in reality, it is impossible to distribute all road tracks equally in a given area because of natural and manmade factors. The random model approach therefore, is a model which measures road accessibility scientifically (ERA, 2008b). In this model, accessibility is measured in terms of the distance to the nearest location of the road network for any residence or business area. The random model assumes that the road track is straight and distributed randomly on a plane. The time series data available for the period 1951 to 2013 has been computed to check the impact of the road network expansion on accessibility during the various regimes.

For a given pattern of roads, the average distance to be travelled per person to a road link is inversely proportional to the area's road density. Assume that, for an area *'A'* with road length *'L'* the *mean distance* to the road network *'M'* is given by *0.5A/L*. i.e. the constant of proportionality is around half. Within the given area, the average distance to the nearest all weather road may take long hours before the construction of additional roads. But if the government or local communities interven and developed the road network length in the same mentioned area, time or distance of taken to arrive to the nearest all weather road obviously reduces since the road density per area is increased. For instance, the total area of Ethiopia in the Imperial and the Derg Periods is the same, 1.22 million km^2 whereas in the EPRDF period, it is 1.1million km$^{2.}$ The total road length in 1951 and 2013 is 6,400 and 85,966kms of randomly distributed network of the country, respectively. The mean distance to the network is calculated as:

In 1951(during Imperial period) = 0.5(1220 000km$^{2)}$/ 6400km) = 95.31km*
In 1970(during Imperial period) = 0.5(1220 000km$^{2)}$/ 8600km) = 70.93km*
*In 1990(during the Derg Period) = 0.5 * (1 220 000 km^2 / 18946km) = 32.20km*
In 2013(during EPRDF) = 0.5(1100 000 km^2) / 85966km = 6.4km*

The computed result shows that the mean distance of the network had decreased from 95.31kms in 1951 to 70.93km in 1970 during the Imperial period; and to 32.20kms in 1990 during the Derg period and finally to 6.4kms in 2013 under the EPRDF period. As illustrated in Figure 4.10 the result shows that the accessibility (proximity to the network) is increasing from year to year with decreasing in the average distance within each network.

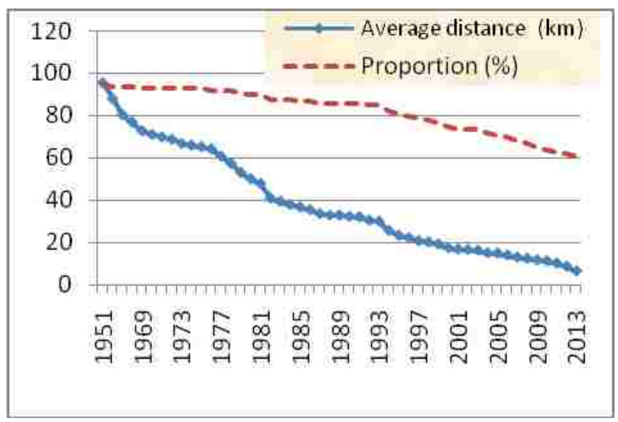


Figure 4. 10: Trend of Average Distance to all Weather Roads(km) and Proportion of Area More than 5km from all Weather Roads(%) in Ethiopia(1951-2013)
Source; Computed by the Author based on data of ERA; Annex 4.5

Based on this, the *proportion* of the area farther than a given distance, '*d*' to the network is given by the formula $P = e^{-d/m}$. The proportion of the area, for instance, more than 5 km from all weather road networks in 1951 in the country was 95 percent:

$P = e^{-5/95.31} = 95\ \%$; *where 'e' is transcendental number given as 2.718 282*

As computed, the change in 1970 was 93%; in1990, 86%; in 1997, 79% and in 2013, 61%. Figure 4.10 shows that the *proportion of areas beyond 5km of all weather roads* is declining. In other token, the proportion of the area within a distance of 5 kms from all weather roads had increased from 5 percent in 1951 to 39 percent in 2013 (Annex 4.6). The result confirms the existence of a gradual increase in network accessibility under all of the three regimes. Accordingly, one can say that such change contributes to socioeconomic development of the country at macro level in general and its citizens in particular.

4.9 Impacts of RSDP on Road Network Quality and Mobility

Since there are no complete data available for the previous two regimes, the researcher has used the last seventeen years data to analyze trends in quality and mobility.

4.9.1 Impacts on Road Network Quality in Ethiopia

The secondary data obtained from ERA is illustrated in Figure 4.11. The share of the road network categorized under good condition had increased from 22 percent in 1997 to 70 percent in 2013**.** In other words, during the first year of RSDP, 52 percent of the road network was found to be in poor condition and only 22 percent was in reasonably good condition. The proportion of roads in good condition has overtaken the proportion of roads in poor condition from 2004 onwards. Another observation is that the roads in fair and poor condition are consistently declining shifting to good condition since 2002. This change is mainly linked with the rapid expansion of roads with better standards as well as better attention given to road maintenance.

In general, interventions made to standardize and maintain roads had contributed for further improvements in the quality of roads. Yet, the World Bank study (2014) mentioned above pointed out that the density of paved road of Ethiopia still remains far below the standard of 260 middle-income countries in 2013.

When changes in road condition over time are viewed in terms of their classification, that is asphalt and gravel roads, it shows improvement in good condition from 17 to 74 percent and from 25 to 55 percent between 1997 and 2011 respectively (RSDP III- 2009, ERA, 2014).

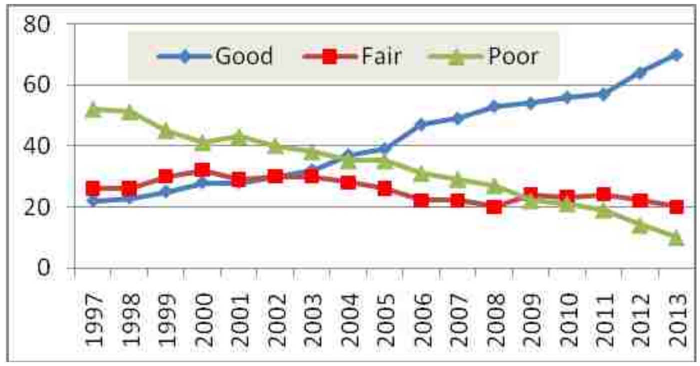


Figure 4. 11: Road Condition Improvements (1997-2013) (%)

Source; Computed by the Author based on data of ERA,2014

4.9.2 Impact on Mobility

Classified traffic counts have been undertaken on most of the road network in Ethiopia. An assessment of traffic on main roads reveals that there is a rapid and continuous change in the volume of motorized traffic mobility (3,771,565 VKM in 1997 to 14,683,918VKM in 2012).

The percentage increase is 289 percent which is about double the percentage increase in the total road network (138%) of 1997 and 2012. The rate of traffic growth is about 9.4 percent per annum on average. Figure 4.12 illustrates the traffic trend (VKM) on all roads under the counting stations of ERA.

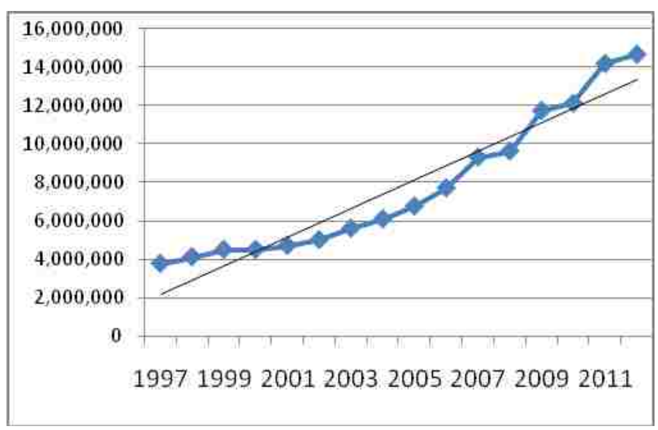


Figure 4. 12: Traffic Mobility Trend Over the Period of the RSDP (1997-2012)

Source; Computed by the Author based on data of ERA,2014

4.10 Overview of Negative Impacts of Road Development in Ethiopia

Road development has much positive socioeconomic impacts. However, one should not put this infrastructure development always as positive since it contributes to impacts of environmental degradation (particularly air, and noise pollution); and traffic accidents. The dominant problem happening in developing countries like Ethiopia is the latter outcome. In line with this, this section describes road traffic status in Ethiopia in general and the impact in Addis Ababa in particular.

4.10.1 Overview on Traffic Accidents and Impacts in Ethiopia

It is obvious that mobility on the road is accompanied by traffic accident related risks. Accidents caused by road traffic accidents account for 2.2 percent of all global deaths per annum. This makes it the ninth leading cause of global deaths and by 2030 it is projected to be the third leading burden on health worldwide (WHO, 2008 cited in Samson *et al*, 2012). Nowadays with the rapid expansion of roads for vehicular use, about 95 percent of traffic-related accidents occur on the road (Rodrigue *et al*, 2014).

Ethiopia has the lowest vehicle density in the world (5.5 per 1000 persons),yet it has the highest road traffic accidents. As of FTA, 2010, Ethiopia is losing about 0.8 percent of the total GDP annually due to road accident.

The number of traffic casualties in 2013 increased by 74 percent as compared to the baseline year (1996), with an average annual growth rate of 6 percent (Figure 4.13). During 2013, 3,362 people were killed along the road, which showed an increase by 72 percent and 7 percent from the baseline year and the preceding year 2012 respectively. In terms of fatalities in 2013, about 50, 34 and 15 percent were pedestrians, passengers, and drivers respectively (Annex 4.9).

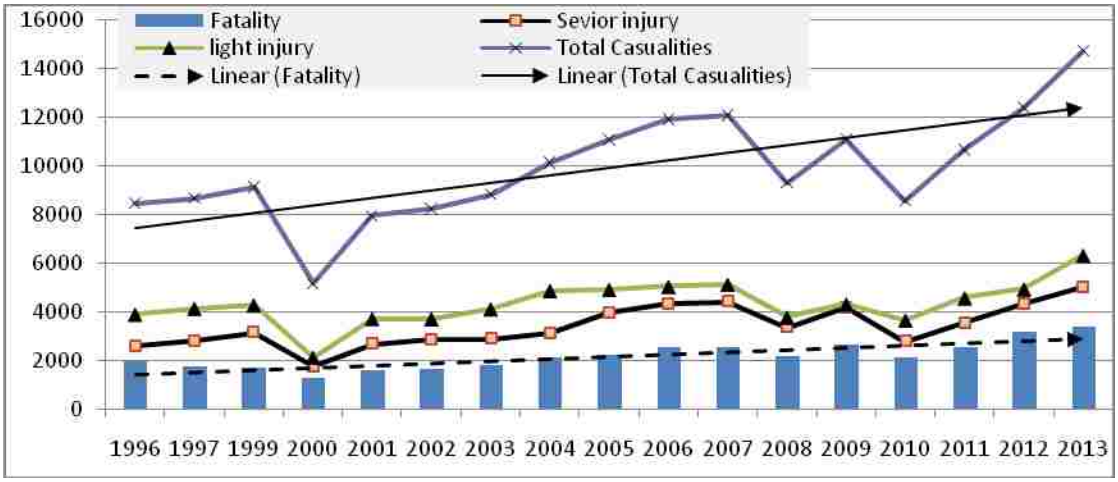


Figure 4. 13: Traffic Accident Trends in Ethiopia (1996-2013)
Source; Computed by the Author based on data of ERA

Therefore, it can be said that RTA in Addis Ababa is a major health scourge. Annex 4.10 shows distribution of causalities by region.

4.10.2 Impacts of Road Traffic Accidents (RTAs) on Quality of Life, the Case of Addis Ababa.

Once individuals come across RTA, their chances could be death, heavy injury, light injury or property damage. The victims and their families will suffer from low quality of life, which would result from health related impacts such as pain, or temporary or permanent disability. Because of data limitation, this section focuses on the impacts of both heavy and light injuries in Addis Ababa.

In analysing Quality of Life due to RTA, Addis Ababa has been selected because of the following conditions: It is a primate city, about 9.1 times greater than the average population size of each five secondary cities (Dire Dawa, Hawassa, Bahir Dar, Adama and Mekele) in Ethiopia. Secondly, it accounts for about 70 percent of the Country's total vehicle fleet. Thirdly, it accounts for the second highest share of total vehicle accidents of 23 percent after Oromia with 25 percent (Annex 4.10). Fourth, the availability of data for casual disabilities due to RTA in Ethiopian regions is limited.

Figure 4.14 illustrates the type and proportion of disabilities caused due to RTAs in Addis Ababa. It illustrates that RTAs contributes up to 29 percent of the total annual disability caused by all forms of accidents in Addis Ababa. It depicts that musculoskeletal injuries are ordinary in road users obviously for pedestrians. Moreover, severe limb strain, psychological disorders and depression are the long lasting wounds that road accident can bring about. People who are hurt can have physical and mental impacts and even they are people who are facing themselves with the problem of activities and capabilities which may be permanent upon them.

Furthermore, the victims or their households can be further forced into financial burden or selling of their own assets, or interruptions from schooling. If the injured is from poor households, the impacts can run much deeper since the poor segment of the society also happens to be an extremely vulnerable group.

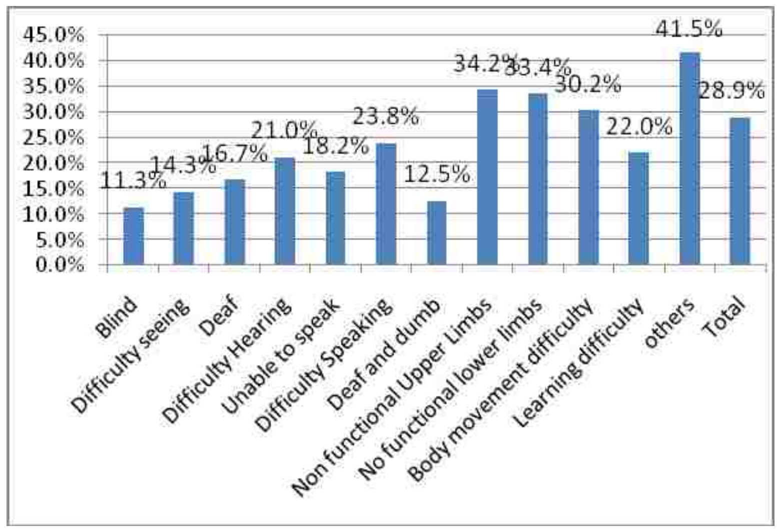


Figure 4. 14: Proportion of Persons with Disabilities in Addis Ababa for whom the Cause is RTA (2007)
Source, Computed by the Author based on Samson et al, 2012

The rapid expansion of roads in Ethiopia is expected to invite further increase in motor vehicle ownership. Therefore, proactive actions must be made by measuring the quality of life in terms of impacts and costs that RTA can be caused by the increased in fixed entities and motorized fleet. In this case Quality Adjusted Life Years (QALYs) model can be used which the researcher could not show the measurements due to non availability of complete data. QALYs is a health outcome measure that gives a value of one to a year of perfect health and zero to death (Gold *et al.*, 1996, cited in Samson *et al*, 2012). This model is widely used by transport planning and transport economics.

4.11. Conclusions

Using time series data, the analysis in this Chapter has analysed the performance of road expansion since 1951 and that of road financing since 1965 under three regimes. A spatial analysis on the trends in the distribution of the road network is made both at the national and regional level, which is also compared with the situation in other countries.

In this regard, explanations had been given how the implementation of road development strategies had brought about changes in the stock of roads, accessibility and mobility, notwithstanding their negative impacts due to road traffic accidents (RTAs). However, the empirical results obtained from the analysis made on time series data show the disparities that exist among the three regimes in terms of their road infrastructure related performance. In the next chapter, major focus is accorded to the actual analysis made on the economic impacts of road interventions in the three study road corridors.

CHAPTER FIVE: ECONOMIC IMPACTS OF ROAD INTERVENTION

This chapter presents the analysis and findings on the economic impacts of road development interventions in the three corridors that are purposefully selected for the study. As Change Theory confirms, impacts are generally classified into two broad categories: direct and indirect. Economic impacts in most cases are said to be the results of direct processes though difficult to identify each impact in the processes of transformation of inputs into outcomes. Under this chapter, the impacts of road intervention on economic indicators such as occupation, agricultural productivity, income, savings, assets, expansion of small scale trade, market access and traffic mobility are analyzed. In-depth analysis on these variables is made based on quantitative and qualitative data collected from primary and secondary sources. The measurement type used in undertaking temporal and spatial analyses are t tests (more of paired sample t test), percentage changes, multiple regression in the double difference model and comparisons between pre and post road intervention periods as well as between zone of influence (ZOI) and control zone(COZ).

5.1 Impacts of Road Development on Occupation

This section presents the study findings on the occupation of household heads and other members of households. The analysis made on household heads had focused on three main employment types, whereas about eight engagement types were examined in case of other household members.

5.1.1 Impacts of Road Development on the Occupation of Household Heads

Ethiopia is predominantly an agricultural country, and as such, the majority (72.4%) of the surveyed households in the three Corridors are engaged in farming as their primary engagement, while an additional 8.0 percent indicated it as their second important engagement.

Household heads were identified to be engaged in about 12 different types of occupations, of which farming takes the lion's share followed by animal husbandry and small scale trading which taken together account for more than 90% of the households. As the remaining nine occupational types account for a very small share, the discussion here under focuses on the three major occupational types.

Putting other factors constant, a diversification has occurred in the occupational mix of households in the ZOI and COZs due to road access. For instance, farming activity in Corridor 1 is 95.2 percent in the COZ as compared to 83.6 percent in the ZOI. This is due to the fact that there is limited opportunity to undertake other non-farm activities in COZ as opposed to the ZOI. Almost the same change is happening in Corridor 3 with some exceptions in Corridor 2. As shown in Figure 5.1, about 50 percent and 16.9 percent livelihood is dependent up on animal husbandry in COZ and ZOI of Corridor 2, respectively. The main reason is that most parts of the Afar region is lowland, desert area, which is sparsely inhabited by pastoralists and semi pastoralists.

In terms of small scale trade, mainly engagement in small kiosks accounts for the dominant proportion is in ZOI. Corridor 3 takes the first rank as 17.4 percent of the household heads indicated that it is their number one source of livelihood.

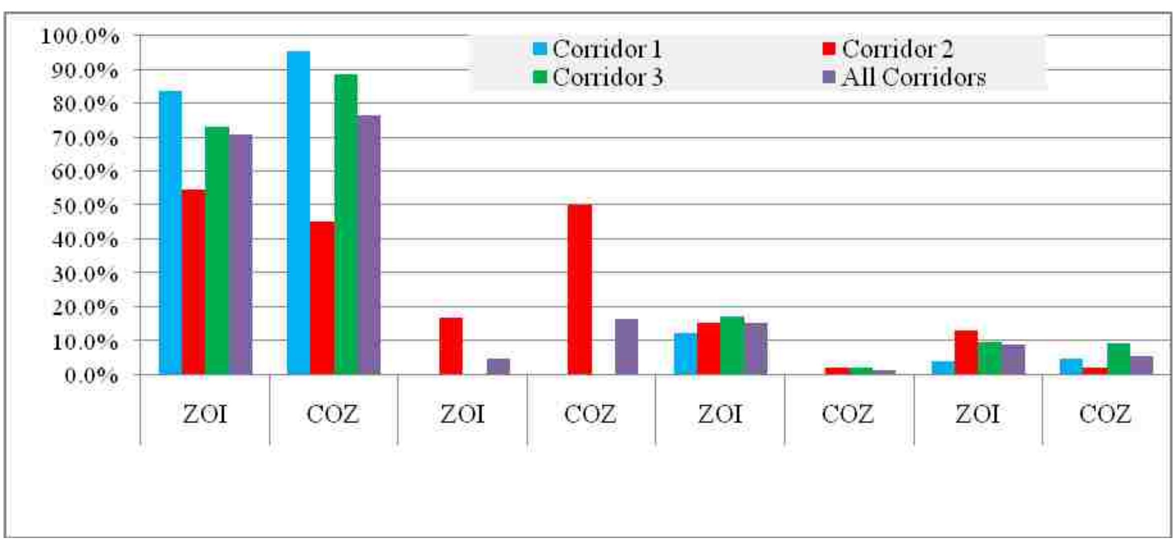


Figure 5. 1: Occupation Types of Households in the ZOI and COZs of Corridors (%)
Source: Computed by the Author based on field survey data, 2014

A spatial comparison shows that, the share of farming activity in the ZOI is lower than COZ (Figure 5.1) particularly for Corridors 1 and 3. The main reason for such result is that households in ZOI are engaged in additional activities because of their proximity to the road. The share of farming related activities in Corridor 2 exhibits a completely different pattern (i.e., more farmers in ZOI than in the COZs). The main reason might be related to the major focus of the local agricultural extension system, which is promoting sedentary agriculture and/or more market orientated livestock husbandry. Therefore, the nearer households are to the road, the higher is their chance to diversify their occupation type and vice versa (See Annex 5.1).

5.1.2 Road Impacts on Engagement or Occupational Types of Family Members

The above discussion was focusing on the impacts of the road intervention on the main occupation of household heads. What is discussed under this section is the occupation of other household members (i.e., excluding household heads). The main aim of the analysis is to identify the reasons for spatial disparities in engagement or occupational types of family members in ZOI and COZs. The family members in each household are assumed to be engaged in any of the eight types of occupations in both zones (Annex 5.2). Otherwise they are unemployed, housewives, kids, and elderly or engaged in other type of occupation.

a) Road Impacts on Family Members' Engagement in Studentship (Enrolments)

Out of engagement of all family members of the study corridors, the lions share goes to economically the non productive one, students' enrolment. The number of students in the family are about 50 percent among, while in case of Corridor 3 it accounts for more than 60%. As indicated in Figure 5.2, there is no huge disparity of student's distribution in the ZOI and COZs in Corridor 3. The main reason as per the FGD and secondary data collected from Jeldu and Gindeberet *Weredas* is the availability of primary schools. In case of Corridor 1, the share is 42.9 and 36.2 percent for ZOI and COZs, respectively, whereas for Corridor 2 the respective shares are 36.4 and 29.5 percent. The overall result shows that lower student enrolment rates are generally associated with longer distances from the study roads. The situation in Corridor 2 shows the challenges of expanding educational opportunities in pastoral regions, which are sparsely populated.

b) Road Impacts on Family Members' Engagement in Agricultural Activity

As discussed in Section 5.1, majority of the households are engaged in agricultural activity. But with regard to family members (excluding household heads) 9.2 percent of sum total are engaged in agriculture. This proportion looks low because of the members' composition shares with studentship, house ladies, kids and others (Annex 5.2).

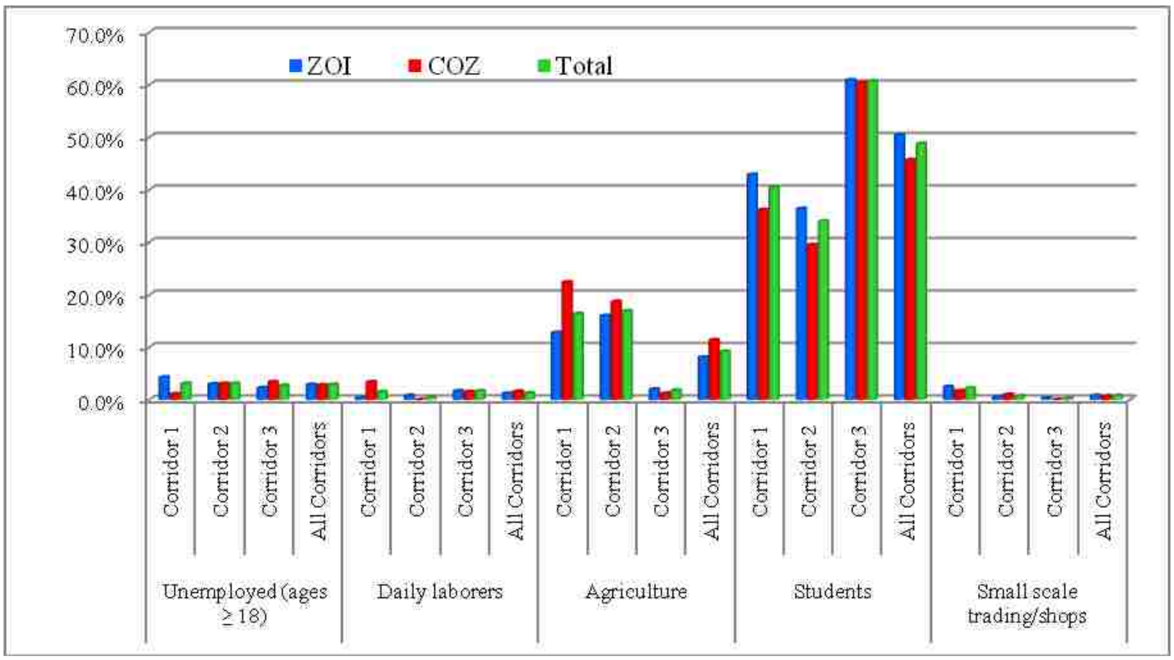


Figure 5. 2: Engagement Types of Family Members in the ZOI and COZs (%)
Source: Computed by the Author based on the field survey, 2014

When we see the distributions spatially, out of 1343 family members in ZOI, 108 (8.1%) are engaged in agriculture. Whereas out of 683 household members COZ, 79 (11.6%) are engaged in agriculture. Among three study corridors, Corridor 2 has many family members engaged in agriculture. In other words, out of 363 family members in its ZOI 58(16.0%) and out of 193 in its COZ, 36 (18.7%) are engaged in agriculture. From point view of Corridor 1, there are 282 family members in ZOI of which 36 (12.8%) and in its COZ, 174, family members of which 39 (22.4%) are engaged in agriculture. Surprisingly few members of Corridor 3 are engaged in this activity. This is because of majority of family members in Corridor 3 are students as explained above. As illustrated in Figure 5.2, the cumulative result shows that as one move to COZs agricultural engagement increases where as the diversification of activity decreases.

c) Road Impacts on Family Members' Engagement as Daily Labouring

The daily labouring is very high in Corridor 1 of COZ (3.4%). This is because of rural areas produce cash crops such as sesame and cotton which are labour intensive. Therefore, the finding shows an increase of daily labour activity towards COZ.

d) Road Impacts on Family Members' Participation in Small Scale Trading / Shops

The highest pick of this business is observed in Corridor 1 of ZOI (2.5%). In the same Corridor the COZ accounts only 1.7%. Therefore, the figure confirms that small scale trading decrease with distance from the road.

e) Road Impacts on Unemployment of Family Members

As illustrated in the figure the highest pick (4.3%) is registered in Corridor 1 of ZOI. The result confirms that unemployment decreases with an increase of distance for Corridor 1 which is opposite to Corridor 3.

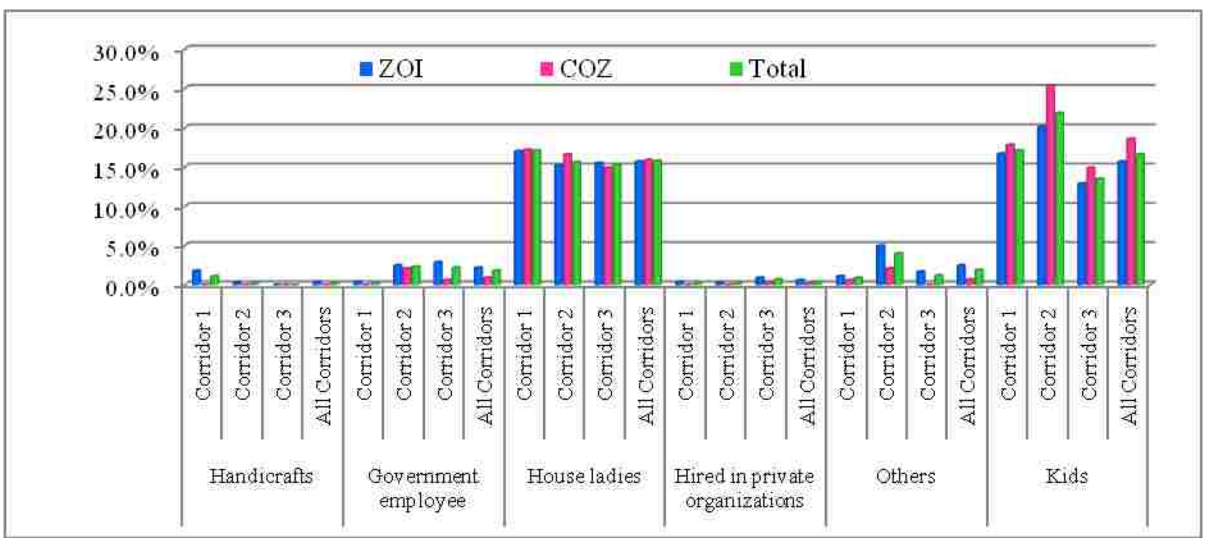


Figure 5. 3: Engagement Types of Households in the ZOI and COZs (%)

Source: Computed by the Author based on the field survey, 2014

f) **Road Impacts on Family Members' Engagement in Government Organizations**

Figure 5.3 illustrates that the share of Corridor 3 is very high where as Corridor 1 is very low engagements in the occupation of government organizations. Accordingly, out of 698 family members in ZOI of Corridor 3, 20 (2.9%) are engaged in the governmental organizations whereas, out of 314 members in COZ only 2 (0.6%) are engaged in the same. Generally the cumulative finding shows that as distance increases from the study road the members' engagement in governmental organization decreases. The obvious reason for such opportunity is the road access.

5.1.3 Impacts of Road Development on Family Dependency

The households of the study area are composed of 2417 family members. This accounts an average household size of 6.2 members. Larger amount of household size is registered along Corridor 3 (average of about 7.4 members per household). Accordingly, when we compute the dependency status and observe spatially, the large amount is registered in COZs of the same Corridor (85%). Figure 5.4 depicts an increased status of dependent family members with distance from the road. For instance out of 483 working force (age of 15 to 64), 330 (61%) are dependent family members in Corridor 2 in ZOI, But out of 193 working force, there are 165 (81%) dependant members in COZ of the same Corridor. This shows that there is an increase with the difference 20% from ZO1 to COZ in Corridor 2. With regard to Corridor 3 there is an increase by the difference of 17%.

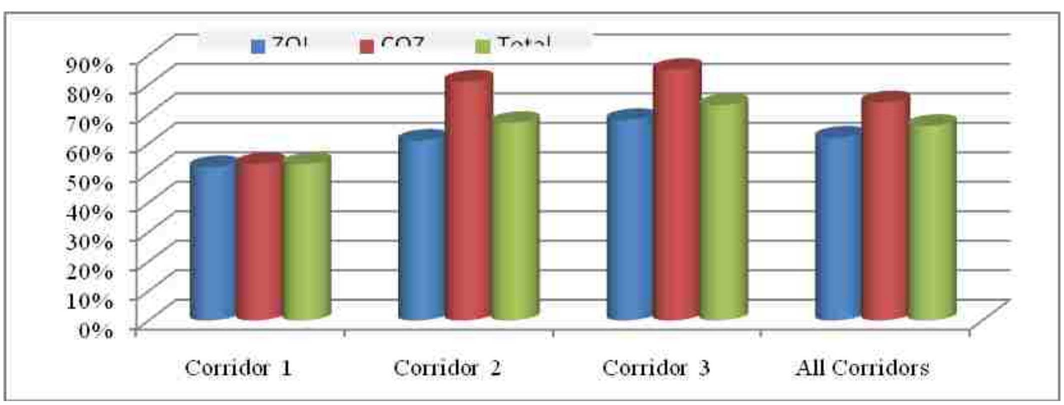


Figure 5. 4: Dependency Ratio (%)

Source: Computed by the Author based on the field survey, 2014

5.2 Impacts of Road Development on Agricultural Performance

The main focus of this section is on agricultural productivity, agricultural technology utilization, on the main agricultural marketable surpluses, on the means of transport used agricultural products and on the changes of farm and market distances from the road under study.

5.2.1 Impact of Road Development on Agricultural Productivity

The most common staple crops produced in the study areas are maize, sorghum and teff. Sesame and small amount of cotton as cash crops are produced particularly in the arid zones (Corridor 2). The focus of this sub-section is the temporal (between before and after road interventions) and spatial (between ZOI and COZs) impacts of road interventions on the productivity of the three staple crops.

a) Productivity of Maize

Table 5.1a illustrates that the average land productivity for maize exhibits some temporal and spatial differences. Accordingly, the average annual yield of maize in Corridor 3 takes standout as the highest as compared to the other two corridors. The average maize productivity in the ZOI and COZs is 33.17 and 22.21 Qt per hectare respectively after road intervention. However, keeping the respective zones, the yield was 21.29 and 10.07 Qt per hectare before the road intervention. The paired sample t test confirms that there is strong significant change at p value less than 0.001. Although insignificant difference, maize productivity in COZs of Corridor 1 and 2 showed some decrease after the road intervention. As revealed by FGDs the reason for the decline in productivity is attributed to the degradation of rural land and limited agricultural extension interventions. When we consider maize productivity in all of the corridors, road intervention is found to have strong significant impact in the ZOI than COZs (at P value less than 0.001 and 0.05 respectively).

b) Productivity of Sorghum

Similar to maize productivity, sorghum yields also show temporal and spatial variations (Table 5.1b). Temporally, Corridor 3 is found to have better road intervention impacts than other

Corridors. The average yield per quintal in the ZOI is 14.35 and 15.87 before and after intervention, respectively.

Table 5. 1:Productivity of Cereals in the Study Corridors

(a) Productivity of Maize (Qt/ha)										
Corridors	**Period**	**Mean value**			**Std. Deviation**			**T value**		
		ZOI	**COZ**	**Both**	**ZOI**	**COZ**	**Both**	**ZOI**	**COZ**	**Both**
1	Before	10.02	9.06	9.7						
	After	11.12	8.88	10.65	10.98	-1.99	9.79	-0.92(NS)	-0.87(NS)	-1.19(NS)
2	Before	15.97	14.45	18.37						
	After	14.53	13.78	15.29	-9.02	-4.64	-16.77	0.65(NS)	0.84(NS)	0.85 (NS)
3	Before	21.29	10.07	19.79						
	After	33.17	22.21	29.84	55.80	120.56	50.78	-3.91*	-5.26*	-4.65*
All	Before	18.26	14.74	17.09						
	After	26.49	17.64	23.4	45.07	19.67	36.92	-3.77*	-2.13***	-4.22*
(b) Productivity of Sorghum (Qt/ha)										
1	Before	17.29	8.9	13.79						
	After	12.31	9.7	11.18	-28.80	8.99	-18.93	1.31(NS)	-0.92(NS)	1.16(NS)
2	Before	21.7	20.93	22.52						
	After	13.52	12.18	13.54	-37.70	-41.81	-39.88	4.46*	2.16***	4.62*
3	Before	14.35	17.84	15.37						
	After	15.87	19.79	17.2	10.59	10.93	11.91	-1.86****	-1.19(NS)	-2.37***
All	Before	17.63	14.31	16.57						
	After	13.71	13.4	13.6	-22.23	-6.36	-17.92	2.36***	0.68(NS)	2.55***
(c) Productivity of Teff (Qt/ha)										
2	Before	15.1	12.08	14.65						
	After	9.19	8.5	9.31	-39.14	-29.64	-36.45	4.43*	1.13(NS)	3.66**
3	Before	10.05	9.02	9.78						
	After	12.86	12.3	12.77	27.96	36.36	30.57	-3.56**	-3.65**	-4.88*
All	Before	11.68	10.18	11.25						
	After	11.71	11.65	11.73	0.26	14.44	4.27	-0.05(NS)	-1.12(NS)	-0.72(NS)
(d) Productivity of Cotton (Qt/ha)										
1	Before	17.90	6.83	14.58						
	After	14.04	7.83	12.18	-21.56	-14.64	-16.46	2.57 ***	-2(NS)	1.89****
(e) Productivity of Sesame (Qt/ha)										
1	Before	7.18	6.24	6.37						
	After	5.76	4.29	5.14	-19.78	-31.25	-19.31	3.33**	2.57 (NS)	4.11*

*NB: NS: Not significant, ****: significant at p < 0.1, ***: significant at p < 0.05, **: significant at p < 0.01,*
**: significant at p < 0.001,*
Source: computed by the Author based on the field survey, 2014

But in the respective intervention periods the average yield levels in COZ is 17.84 and 19.79 Qts per hectare, which is higher than the amount in ZOI. Therefore, the road intervention is found to have a negative spatial impact on sorghum productivity in Corridor 3 only. However, the impact is significant at p value less than 0.10 in the ZOI and at less than 0.05 for both zones in case of Corridor 3. In general, the significant differences in Corridor 2 and other corridors show road intervention have had negative impacts on sorghum yields.

c) Productivity of Teff

Teff is known as the main staple food crop in Ethiopia. However, the climatic condition in the study area of Corridor 1 is not suitable for the production of native type of teff. As shown in Table 5.1c, communities in Corridor 1 were not producing teff before road intervention. After the road intervention, however, six farmers (from the sample) have adopted improved varieties of teff and chemical fertilizer. Due to this new innovation, interviewees and FGD participants mentioned that the community in Corridor 1 has started to sow teff mainly for their own consumption.

A significant part of Corridor 2 is not also suitable for rain-fed agricultural production. The part in Afar region is not producing teff, but cultivated in the Hara study corridor which is found in Amhara region, though the utilization of modern agricultural inputs is still very limited. Because of this, the average productivity per hectare is reduced from 15.1Qt before intervention to 9.19 Qt after intervention in the ZOI and from 12.08Qt before intervention to 8.5 Qt after intervention in the COZ. But spatially, better yields are found in ZOI than COZs.

Corridor 3 has a strong significant p value at less than 0.001 due to road intervention. Various reasons can be mentioned among which the major one is the highest level of utilization of chemical fertilizers in the Corridor as compared to other corridors under study.

d) Productivity of Major Cash Crops

Cash crop production in the study areas is confined to Corridor 1 and the major types are cotton and sesame. All cash crops have higher yields in ZOI than COZs. The productivity is found to be lower for the period after intervention than before intervention (Table 5.1 d and e) showing the negative impact of road intervention. The main reason as interviews and FGD is land depletion and limited utilization of agricultural utilization. For instance, this Corridor does not use modern fertilizers as Corridor 3 does, except its application in teff production. The p values which are significant are due to the difference between the results of before and after intervention periods.

5.2.2 Changes in the Level of Agricultural Technology Use

To evaluate the level of agricultural technologies used by farmers, six variables had been selected. Namely: *use of power tiller for ploughing, improved seeds, chemical fertilizers, herbicides /pesticides, thresher machine and irrigation*. Accordingly, the rating of technology use in the study areas is as stated in Table 3.1 (the chapter on methodology), where by farmers using all the six technologies stated above will be rated as level 1, while those using none of the technologies will be rated as 7. Accordingly, if the mean value of this indicator is approaching 1, it is expected to show a better level of agricultural technology use, a mean value of around 3.75 will be taken as moderate, whilst a result near 7 depicts poor level of utilization . The results of the computations that are done considering these set of criteria are shown in Table 5.2.

The level of use of agricultural inputs in Corridor 1 is found to be better after the road intervention (5.73 and 6.62 in the ZOI and 5.68 and 6.78 in COZs, respectively). Although it shows a strongly significant change at P value of less than 0.001, the level of agricultural technology use is still at the infant stage. The information from the interview and FGD revealed that, many farmers do not use chemical fertilizer as they consider that *"…the land is naturally fertile"*, the chemical fertilizers may not be suitable for the local soil types and shortage of rainfall in those areas with harsh climate. Some of them also relate it with their limited affordability to acquire them from the market and uncertainty about getting the desired results. In addition, none of them use threshers and combine harvesters due to economic reasons, mainly scale economies small holdings offer and the absence of rental arrangements. The use of irrigation is also scantly due to the absence of irrigable water.

Corridor 2 exhibited the lowest level of technology use than the remaining corridors (P value of less than 0.10). The temporal changes observed are almost the same to Corridor 1. Generally the value calculated for the period after intervention is near to 7, which is explained by the continued use of traditional agricultural technology. Apart from the reasons mentioned for Corridor 1, the additional factor to be mentioned here is that, more than 50 percent of the area is in the arid zone and promotes pastoral and semi pastoral activities which still need more innovations to use agricultural technology.

In terms of Corridor 3, although the percentage increase is better than the other corridors, the mean value of the level of agricultural technology use is above half of the index value. This Corridor is ranked first in level of agricultural technology use. In other token, there is a strongly significant temporal change due to road intervention (P value less than 0.001), but the change in the COZ is better than ZOI. This may be due to the fact that minor roads that had been constructed under the recent Urban Rural Access Road Programme (URAP) have resulted in better changes related to road penetration in COZs.

Table 5. 2 : Level of Agricultural Technology Use in the Study Corridors

Corridors	**Period**	**Mean value**			**Percentage Change**			**T-value**		
		ZOI	**COZ**	**Both**	**ZOI**	**COZ**	**Both**	**ZOI**	**COZ**	**Both**
1	Before	6.62	6.78	6.69						
	After	5.73	5.68	5.72	-13.44	-16.22	-14.50	4.66*	6.07*	7.09*
2	Before	6.56	6.33	6.41						
	After	6.28	6.33	6.23	-4.27	0.00	-2.81	2.39***	0.00(NS)	2.11***
3	Before	5.74	5.66	5.73						
	After	4.65	4.45	4.59	-18.99	-21.38	-19.90	7.16*	5.75*	9.12*
All	Before	6.22	6.22	6.21						
	After	5.37	5.33	5.35	-13.67	-14.31	-13.85	8.60*	7.43*	11.24*

*NB: NS: Not significant, ***: significant at p < 0.05, *: significant at p < 0.001,*
Source: Computed by the Author based on field survey data, 2014.

5.2.3 Changes in Marketable Surplus

Marketable surplus in this study is to mean the surplus from annual crop production of major cereals and cash crops after the deduction of the sum of consumption for households, consumption for cattle and quantity left for seeding. Table 5.3 provides data on the temporal and spatial variations in terms of marketable agricultural surpluses. Temporally, it illustrates those households before the road intervention had marketable surplus better than after the intervention except in Corridor 3 in case of cereals. The mean value of surplus production per hectare has increased by 64.82, 70.62 and 66.48 percent for ZOI, COZ and for both zones of Corridor 3, respectively. In other words, keeping the respective zones, the P value is significant at less than 0.01 and 0.001. But spatially COZ is found to have more agricultural surplus than ZOI. As explained in section 5.1, the main reason here is that a considerable proportion of households in ZOI are engaged in other non agricultural activities. Temporal impacts in the corridors 2 and 1 are negative at P value less than 0.01 and with no significant impact respectively for cereals.

Table 5. 3: Marketable Surplus from Major Cereals and Cash Crops (Qt/ha)

Corridors	Period	Mean value			Percentage change			T-value		
		ZOI	COZ	Both	ZOI	COZ	Both	ZOI	COZ	Both
Marketable Surplus from Cereals										
1	Before	34.75	28.89	32.27	-7.86	-14.75	-10.6	0.83(NS)	1.79***	1.62(NS)
	After	32.02	24.63	28.85						
2	Before	14.65	16.96	14.32	-60.68	-65.21	-59.92	3.780**	3.21**	4.22*
	After	5.76	5.90	5.74						
3	Before	9.75	12.83	10.74	64.82	70.62	66.48	-5.346*	-3.41**	-6.05*
	After	16.07	21.89	17.88						
All	Before	18.69	19.63	19.08	2.35	1.58	2.36	-0.33(NS)	-0.17(NS)	-0.42(NS)
	After	19.13	19.94	19.53						
Marketable Surplus from Cash Crops										
1	Before	28.84	19.49	25.35	25.56	29.86	26.9	1.49(NS)	2.62***	2.18***
	After	21.47	13.67	18.53						

*NB: NS: Not significant, ****: significant at p < 0.1, ***: significant at p < 0.05, **: significant at p < 0.01, *: significant at p < 0.001,*

Source: Computed by the Author based on field survey data, 2014

There are no significant cash crops produced in Corridor 2 and 3, while Corridor 1 is the one producing sesame and cotton. In this regard, the p value for the later shows negative impact at less than 0.01. This shows that the road intervention has no positive impact. Despite the decrease in yields, as revealed by FGDs and interviews, the road intervention has created better market and paved opportunities for the construction of warehouses at centres like Gelago and Shinfa towns, which are undertaken by the government to collect mainly sesame from farmers who produce it for the market. They suggested that it was after the road intervention that traders started to buy much more sesame at better prices, which they transport to the central market. Due to this opportunity households in Corridor 1 have the highest annual income as compared to the other Corridors. Some farmers including those that have organized themselves under cooperatives are selling cash crops at Gendewuha where a relatively well organized market facility has been established. Various farmers speak about the crucial importance of the opening of the Gendewuha – Gelago road, which facilitates the transport of cash crops as well as seasonal daily labourers.

From Corridor 3, particularly in Jeldu *wereda* , improved potato varieties are recently introduced. The area is now becoming a model in Ethiopia in terms of producing potatoes for the market, which is facilitated by the road penetration and improvement as confirmed by FGDs and interviews.

5.2.4 Means of Transport Used to Move Agricultural Products to and from Market

The question posed to households was *"What means of transport do you use to transport your agricultural products to market?"* The mean value and the paired sample T-test results for Yes = 1 and No = 2 answers for the proposed types are explained in the sub topics from i to vi below. The proposed means of transport are non-motorized transport (NMT) such as human portage, use of draft animals and equine- drawn carts as well as motorized transport that include three wheelers (locally known as bajajs), freight trucks and passenger buses. The summary of the temporal and spatial analysis is presented in Table 5.4.

i. The Use Human Portage

The Table illustrates that if the mean value after intervention (Now) is greater than the situation before the intervention (Before), then we can say that the use of human portage is reduced that can be taken as the positive outcome of the improvements in road infrastructure and transport services. Accordingly, the result is significant at P value of less than 0.05 for ZOI and COZs, respectively, and at less than 0.01 for both zones. In the same token, Corridor 3 has experienced significant change as compared to the other corridors. The change of the mean value in the same Corridor is 2.04, 8.9 and 4.79 percent for ZOI, COZ and for both zones respectively (Table 5.4). This shows the fact that people in COZ of Corridor 3, which are far from the study road, mainly use animals than human portage to bring their goods to the market (see in the Table 5.4ii and explanation under the subtitle below).

ii. The Use of Equines as Draft Animals

It is obvious that as members of a community develop economically, the use of human portage will give way to the next higher level of affordable means of transport. Table 5.4ii compares the status of pack animal transportation both temporally and spatially as well as the "before" and "after" situation. If the mean value is equal to 1 (Yes = 1), then it means there is utilization of pack animals, but if it equals 2 (No =2), then pack animals are not utilized in transportation.

The result summarized in the Table reveals the lack of strong pattern. For instance, the use of pack animals in ZOI of all corridors exhibited a reduction of 2.59% as compared to the situation before the intervention, whereas it increased by 39.68% in the COZ. This shows typical temporal and spatial impact of road intervention on the use of pack animals. But the difference between the ZOI and COZ had an effect on the paired sample T- Test not to be significant at P values of 0.001, which is found to be an anomalous result of the paired sample test. However, a corridor level analysis shows that Corridor 3 and 2 have exhibited significant changes at P value of less than 0.05 and 0.10, respectively. Put differently, the extent of pack animals use is reduced for Corridor 2 by 4.8 percent. This may be due to the introduction of bajajs since the road under study is paved with asphalt in 2010. In Corridor 3, the utilization of pack animals increased to 5.41percent. As underlined during the FGDs and interviews, this change is associated with the needs to transport bulky and perishable outputs like potatoes (which is the recent product from improved seed).

Table 5. 4: Means of Transport Used by the Community to Transport Produce to the Market

Corridors	Period	Mean value			Percentage change			T-value		
		ZOI	COZ	Both	ZOI	COZ	Both	ZOI	COZ	Both
i)Use of human portage to transport goods										
1	Before	1.89	1.95	1.91	0.53	-1.03	0.00	-1(NS)	1.00(NS)	0.00(NS)
	After	1.9	1.93	1.91						
2	Before	1.15	1.42	1.23	0.00	5.63	3.25	-	-1.45(NS)	-1.43(NS)
	After	1.15	1.5	1.27						
3	Before	1.47	1.46	1.46	2.04	8.90	4.79	-1.75****	-2.61***	-3.1**
	After	1.5	1.59	1.53						
All	Before	1.55	1.62	1.58	0.65	4.32	2.53	-2.02***	-2.39***	-3.1**
	After	1.56	1.69	1.62						
ii)Use of equine as draft animals to transport goods										
1	Before	1.2	1.13	1.17	6.67	6.19	6.84	-0.93****	0.96(NS)	-2.36(NS)
	After	1.28	1.2	1.25						
2	Before	1.32	1.13	1.25	2.27	7.08	4.80	-1.00(NS)	-1.45(NS)	-1.77****
	After	1.35	1.21	1.31						
3	Before	1.08	1.18	1.11	-1.85	-11.02	-5.41	1.00(NS)	2.61***	2.58***
	After	1.06	1.05	1.05						
All	Before	1.16	1.89	1.42	2.59	-39.68	-17.61	-1.16(NS)	1.01(NS)	0.96(NS)
	After	1.19	1.14	1.17						
iii)Use of carts to transport goods										
1	Before	1.43	1.49	1.45	-6.29	-5.37	-5.52	1.93****	1.78****	2.60***
	After	1.34	1.41	1.37						
3	Before	1.94	1.96	1.95	-0.52	0.00	-0.51	1.00(NS)	-	1.00(NS)
	After	1.93	1.96	1.94						
All	Before	1.77	1.75	1.77	-1.69	-1.14	-2.26	2.14***	1.75****	2.75**
	After	1.74	1.73	1.73						
iv) Use of three wheelers (bajajs) to transport goods										
2	Before	1.63	1.58	1.64	-9.82	-10.13	-10.98	2.38***	2.15***	3.27**
	After	1.47	1.42	1.46						
v)Use of trucks to transport goods										
1	Before	1.83	1.72	1.78	-9.84	-5.81	-8.43	3.47**	2.08***	4.04*
	After	1.65	1.62	1.63						
3	Before	2	2.46	2.16	0.00	-18.70	-7.41	-	1.00(NS)	1.00(NS)
	After	2	2	2						
All	Before	1.94	2.09	2	-2.58	-11.48	-6.00	3.25**	1.2(NS)	1.68****
	After	1.89	1.85	1.88						

*NB: NS: Not significant, ****: significant at p < 0.1, ***: significant at p < 0.05, **: significant at p < 0.01, *: significant at p < 0.001,*

Source: Computed by the Author based on field survey data, 2014.

Types of Pack Animals Used

As explained above, those respondents who indicated that they use pack animals were asked to specify the type of pack animal they use. Accordingly, the majority of the households are using donkey, a very popular beast of burden extensively used throughout Ethiopia. The other types of beast of burden used are horses, mules and camels. Table 5.5 summarizes the temporal and spatial data on the means of transport used by households. Before the intervention, out of 392 respondents, 240 (61.2%) were using pack animals to transport their produce, while the remaining 152 (38.8%) were not (See also Annex 5.3). On the other hand, after intervention, out of the same respondents, 238 (60.7%) were using pack animals, while the remaining were not using this means of transport. Comparison across corridors shows certain disparities.

- **In Corridor 1:** 68.5, 81.4 and 73.0 percent of the respondents were using pack animals for transportation in ZOI, COZ and in both zones, respectively before intervention whereas the respective share after intervention declined to 60.3, 76.7 and 66.1 percent, respectively.
- **In Corridor 2:** 29.9, 42.6 and 32.8 percent of the respondents were using pack animals in ZOI, COZs and in both zones, respectively, before the intervention whereas the respective share became 28.6, 38.3 and 30.3 percent, respectively, after the intervention.
- **In Corridor 3:** the respective figures are 71.6, 80.0 and 74.1 percent before the intervention, which increased to 74.1, 93.3 and 79.7 percent, respectively, after road intervention.

It can therefore be concluded that in the first two corridors, the proportions of those using pack animals are decreasing, while those of non users are increasing. This can be attributed to increased use of improved types of transport equipment that was possible because of improvements in the conditions of the roads. Road maintenance frequency in Corridor 1 is found to be better than in Corridor 3, while regarding Corridor 2, road maintenance became more frequent after its pavement. In Corridor 3, the trend of using pack animals is increasing, and the major reason that can be mentioned here is the increase in agricultural production that has led to increased demand for bulk transportation of commodities such as potatoes and teff to the market.

Secondly, as illustrated in the previous sections, the topography and the poor state of repair of the study road, among others, have pushed the people in Corridor 3 to continue using pack animals.

In addition, the utilization of pack animals in COZs is higher than that in ZOI. This shows that the longer the distance from the study road, the more is the use of pack animals for transporting households' produce to the market.

Table 5. 5: Types of Animal Back Means of Transport Households are Using (%)

Period	Beast of burden	Corridor 1			Corridor 2			Corridor 3			All Corridors		
		ZOI	**COZ**	**Both**	**ZOI**	**COZ**	**Both**	**ZOI**	**COZ**	**Both**	**ZOI**	**COZ**	**Both**
	Donkey	61.6	79.1	67.8	16.9	21.3	16.8	57.8	57.8	58.2	47.2	52.3	48.5
	Horse	4.1		2.6				0.9		0.6	1.5		1.0
	Camel	1.4	2.3	1.7	6.5	14.9	10.1				2.3	6.3	3.6
	Other	1.4			6.5	6.4	5.9	12.9	22.2	15.2	7.6	8.6	8.2
	Total	68.5	81.4	73.0	29.9	42.6	32.8	71.6	80.0	74.1	58.5	67.2	61.2
	Not Using	31.5	18.6	27.0	70.1	57.4	67.2	28.4	20.0	25.9	41.5	32.8	38.8
Before	Total	100	100	100	100	100	100	100	100	100	100	100	100
	Donkey	53.4	76.7	61.7	19.5	19.1	18.5	60.3	77.8	65.8	46.8	58.6	50.3
	Horse	5.5		3.5				0.9		0.6	1.9		1.3
	Camel	1.4		0.9		8.5	3.4				0.4	3.1	1.3
	Other				9.1	10.6	8.4	12.9	15.6	13.3	7.9	7.0	7.9
	Total	60.3	76.7	66.1	28.6	38.3	30.3	74.1	93.3	79.7	57.0	68.8	60.7
	Not Using	39.7	23.3	33.9	71.4	61.7	69.7	25.9	6.7	20.3	43.0	31.3	39.3
After	Total	100	100	100	100	100	100	100	100	100	100	100	100

Source: Computed by the Author based on field survey data, 2014 (see also Annex 5.3).

iii. The Use of Animal Drawn Carts

The level of utilization of animal drawn carts is generally determined by the development status of the community, the availability of road infrastructure and topographic conditions. The topographic feature of an area would invite the use of animal drawn wheel carts if the available tracks are relatively gentle and supported by crossing bridges where necessary. With this regard, the utilization of animal drawn carts in the study areas is at infant stage except in Corridor 1 with suitable topography as compared to the remaining Corridors. As shown in Table 5.4iii, if the mean value is approaching 1 for *After* than *Before*, then there is an increase in the utilization of animal drawn carts. Accordingly, the utilization of such carts in Corridor 1 had increased by 6.29, 5.37 and 5.52 percent for ZOI, COZs and for both zones, respectively. This change is significant at P value of less than 0.10 for ZOI and COZs as well as at less than 0.05 for both zones.

Although there is ample utilization of animal drawn carts in Corridor 2 and 3, there is no significant change because they are dominantly using bajajs and pack animals. In addition, the use of carts in Corridor 2, particularly at Hara study centre, is made difficult due to the elevation of the paved road, which makes crossing impossible for carts as the wooden scaffolds and stairs made using quarry stones can only allow pedestrians to pass (See Figure 5.5).

The Chifra centre in Corridor 3 (in Afar region) is an arid and semi-arid area that is suitable for camel raising and particularly goat rearing for the market. As observed during the field survey, pastoralists, semi pastoralists/ and sedentary farmers in the study area mainly use bajajs followed by minibuses particularly during the market days to transport goats to the market. There is no as such any significant farming activity in this centre, although as pastoral-residents rear camels, cows and goats for their milk. It is difficult to use animal drawn carts in Corridor 3 because of the undulating topography of the area that is dominated by several streams which require the construction of bridges to join the surrounding areas with the main gravel-surfaced highway. Therefore, as explained above the use of pack animals and animal drawn carts is common in Corridor 3 (Section ii).

Figure 5. 5: Barriers to NMT Mobility: Status of Road Design at Hara Route(Corridor 2)
Source: Photo by the Author, 2014

Types of Animal Drawn Carts

Respondents who use animal drawn carts were asked to indicate the types of domestic animals they use. Accordingly, out of 392 households 69 (17.6%) were using animal drawn carts before the road intervention, whereas the proportion increased to 75 (19.1%) after the intervention. The dominant type of animal used to pull carts is donkey (Table 5.6). The others that include horses, mules and camels taken together accounted for a small share (16 and 11 %). Out of the total 69 and 75 animals drawn carts that were in use before and after road intervention, respectively, the share of donkeys was 84 and 89 percent, respectively.

Table 5. 6: Types of Animals Used to Pull Carts (%)

Period	Use of Animal Back	Corridor 1			Corridor 2			Corridor 3			All Corridors		
		ZOI	**COZ**	**Both**	**ZOI**	**COZ**	**Both**	**ZOI**	**COZ**	**Both**	**ZOI**	**COZ**	**Both**
	Donkey	42.5	48.8	45.2	1.3		0.8	3.4	2.2	3.2	13.6	17.2	14.8
	Horse	1.4		0.9		2.1	0.8	0.9	2.2	1.3	0.8	1.6	1.0
	Mule				2.6		1.7	1.7		1.3	1.5		1.0
	Donkey and camel	2.8		1.8		2.1	0.8				0.8	1.6	0.8
	Total	46.6	48.8	47.8	3.9	4.3	4.2	6.0	4.4	5.7	16.6	19.5	17.6
	Not using	53.4	51.2	52.2	96.1	95.7	95.8	94.0	95.6	94.3	83.4	80.5	82.4
Before	Total	100	100	100	100	100	100	100	100	100	100	100	100
	Donkey	52.1	55.8	53.9				3.4	2.2	3.2	15.8	19.5	17.1
	Horse				1.3	2.1	1.7	0.9	2.2	1.3	0.8	1.6	1.1
	Mule				2.6		1.7	0.9	4.4	.6	1.1		0.8
	Donkey and camel					2.1	0.8					0.8	0.3
	Total	52.1	55.8	53.9	3.9	4.3	4.2	5.2	4.4	5.1	17.7	21.9	19.1
	Not using	47.9	44.2	46.1	96.1	95.7	95.8	94.8	95.6	94.9	82.3	78.1	80.9
After	Total	100	100	100	100	100	100	100	100	100	100	100	100

Source: Computed by the Author based on field survey data, 2014(See also Annex 5.4)

When we consider the use of animal drawn carts per corridor, out of the total of 69 and 75 carts that were in use in all Corridors (Annex 5.4), Corridor 1 accounted for 55 (80% of the total) and 62 (83% of the total) before and after road intervention, respectively. In the same Corridor, the level of pack animal utilization was 46.6, 48.8 and 47.8 percent in ZOI, COZs and in both zones, respectively, before the road intervention. Whereas the change after road intervention is 52.1, 55.8 and 53.9 percent, respectively (Table 5.6). In Corridor 2, the share is very small and there is no significant temporal change. In Corridor 3, in contrast, the share is exhibiting a slight temporal decline. When we see the utilization in all corridors it shows an increasing temporal trend.

From a spatial perspective, COZs exhibit a high extent of utilization than ZOI except in Corridor 3 (due to the topography). Therefore, in consideration of the gentle topography of the area, the longer the distance from the study road, the higher is the level of cart utilization.

iv. The Use of Three Wheelers (Bajajs)

There is limited use of bajajs except in Corridor 2 (Table 6.4v). The utilization of bajajs in this Corridor is increased by 9.8, 10.1 and 11 percent for ZOI, COZ and for both zones, respectively. The result is significant at p value less than 0.5, 0.5 and 0.01 for the respective zones. We can say that the asphalt pavement has promoted the use of bajajs in this Corridor. The FGDs, interviews and observations confirm that bajajs provide door to door service. The routes between Hara and Chifra as well as between Chifra and Mile is served by bajajs, with these vehicles having their destination at intermediate locations that serve as points of inter-change. Women living in rural areas are the main users and beneficiaries of this means of transport to transport marketable goods as well as themselves since the road’s improvement. Corridors 1 and 2 could not promote three wheelers because they are gravel-surfaced. The only exceptions are their use at Gelago centre of Corridor 1 along roads that are covered with red ash and with gentle slopes.

v. The Use of Trucks

Truck utilization is very high in Corridor 1 where cash crop production is dominant (Table 5.4vi). The mean value shows percentage increase by 9.84, 6.81 and 8.43 percent for ZOI, COZs and for both zones, respectively. This result is significant at p value of less than 0.01, 0.05 and 0.001, respectively. Based on these results we can say that there is temporal and spatial difference in the use of trucks due to road intervention.

vi. The Use of Buses

Buses in this study refer to *mini*, *midi* and *maxi* buses that provide transport services along the study roads. Many households use buses to transport their agricultural products that they bring in small amounts to markets. As per the traffic count conducted as part of this study, the highest number of buses is observed during market days. However, the figures summarized from the responses provided by household respondents are not significant. This is due to the fact that the number of buses frequenting along the study roads particularly along the gravel-surfaced ones is very limited. But the evidence from interviews, FGDs and observations confirms that the mobility by the buses along the study roads is increasing from time to time.

a) **Along Corridor 1:** Before the road intervention, people had to walk for more than two days to arrive Gendewuha town. Then they used to hire tractor trailers which were frequenting along the area for agricultural purposes. Once the road under study had been gravelled, trucks and four wheel drive cars started to use the new road. Since the last three years, however, a maxi-bus could be allocated from Gelago to Gonder each day on a regular basis. At the time of the study (2014), about 15 midi and 8 mini buses per day operate along this line as confirmed by the traffic count. The numbers of mini- and midi-buses increase during market days. And because the buses could not satisfy the passengers' demand, trucks also serve in peak times. In principle, trucks should not be used to transport passengers, but as underscored during the interviews, owners of passenger buses are not interested to provide services along the line in consideration of frequent mechanical break downs and wear and tear of tyres due to the rough road condition. Therefore, as the FGDs and interviews highlighted, the transport offices of Quara and Metema *weredas* are passive about the mobility of passengers by trucks and are looking forward to the immediate pavement of the road by ERA. In case of Corridor 2 and 3, however, trucks are not used to transport passengers except on market days. Except the maxi buses, all midi and mini buses are non- scheduled and overloading is not well regulated.

b) **Along Corridor 2**: About 65 percent of the route under study is situated in Afar region where the climate is generally harsh, which coupled with the none upgrading of the route had made the area isolated for the periods before the intervention. The earthen road had been changed in to gravel between 2000 and 2002 and the asphalt pavement was finalized between 2007 and 2010. A regular maxi bus service was allocated only after the finalization of the road pavement that resulted in significant shift in traffic mobility (See section 5.8.2). About 268 buses (maxi, midi and mini) per day were moving along the line (in 2014) as compared to 78 mini and midi buses that were operating in 2005. Moreover, short distances (about 25 km length) along the route are also covered by bajajs.

c) **Along Corridor 3:** This route is gravel surfaced and with numerous curves and passes through difficult topography. The sole means of transport in this Corridor is midi bus of about 37 seats (locally known as kitkit). The passengers' movement has gradually changed from tractor and trucks before intervention to the use of midi buses after intervention. Overloading and unregulated tariff is also common as also observed by the researcher. The market day is characterized by high level of passenger mobility including the use of trucks.

a)Tractors (common before intervention) **b)Kitkit (common after intervention)**

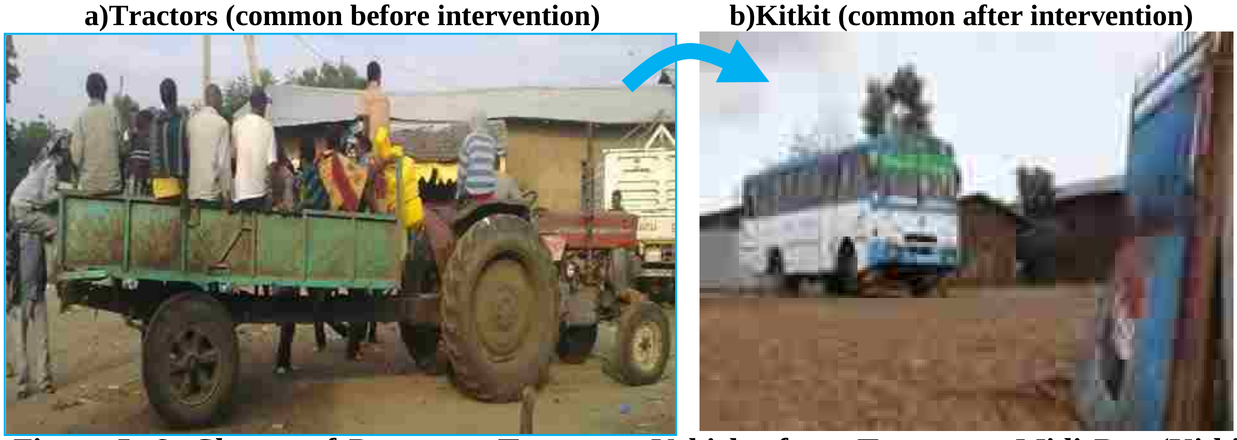


Figure 5. 6: Change of Passenger Transport Vehicles from Tractor to Midi Bus (Kitkit) (Corridor 3)

Source: Photo by the Author, 2014.

5.2.5 The Use of Hired Means of Transport in Agricultural Marketing

The respondents were asked to state whether they hire transport services to transport their produce to the market. Accordingly, households in all corridors were found to be hiring transport services although with huge spatial variations. The P value is significant at less than 0.01, 0.10 and 0.01 for ZOI, COZs and for both zones, respectively, in all the three corridors (Table 5.7).

Accordingly, the results summarized in the table show that:

- The practice of hiring transportation services is very high in Corridor 1 than the other corridors. The percentage increase is 4.8, 3.7 and 4.7 for ZOI, COZs and for both zones, respectively. The mean value shows that hiring of transport services is higher in ZOIs than COZs both before and after the road intervention. The P value is found to be significant at less than 0.01, NS, and at less than 0.05 for ZOI, COZ and for both zones.
- The respective change for Corridor 2 is also 7.1, nil, and 2.6 percent in which the P value is insignificant for all zones.
- Furthermore, the change is also very low in Corridor 3.
- Generally both temporal and spatial changes are observed with particular evidence that households in ZOI are hiring transport services more than COZs in all Corridors.

Table 5. 7: The Use of Hired Means of Transport for Agricultural Outputs

Corridors	Period	Mean value			Percentage change			T-value		
		ZOI	COZ	Both				ZOI	COZ	Both
1	Before	1.26	1.34	1.29	-4.76	-3.73	-4.65	2.05****	1.43(NS)	3.51***
	After	1.2	1.29	1.23						
2	Before	1.5	1.42	1.52	-4.00	0.00	-2.63	1.44(NS)	-	1.43(NS)
	After	1.44	1.42	1.48						
3	Before	1.68	1.64	1.66	-0.60	-1.83	-0.60	1.00(NS)	1.00(NS)	1.42(NS)
	After	1.67	1.61	1.65						
All	Before	1.51	1.49	1.5	-2.65	-2.01	-2.00	2.69**	1.75****	3.21**
	After	1.47	1.46	1.47						

*NB: NS: Not significant, ****: significant at p < 0.1, ***: significant at p < 0.05, **: significant at p < 0.01,*
Source: Computed by the Author based on field survey data, 2014.

5.2.6 Transport Cost in Case of Hired Transport Services

The household respondents were also asked to indicate their transport related expenses per quintal when travelling to and from the market using hired means of transport. Accordingly, the mean values in ETB and the significance test for the change is illustrated in the Table 5.8. The result shows changes in the mean value between before and after intervention by 47.65, 66.70 and 55.75 percent for ZOI, COZ and for both zones. The COZ experienced highest change because of their furthest location from the roads under study. This shows the dramatic increase in transport cost in case of COZs affecting mobility. Put differently, mobility using hired means of transport is higher in ZOIs than COZs as illustrated in Section 5.2.5 above. Generally, it shows a very high significant value at P value of less than 0.001 in all zones of all the three corridors. When we consider the change in each corridor significant temporal and spatial disparities are observed.

Table 5. 8: Average Transport Cost of Hired Means of Transport for Agricultural Produce (ETB/Qt)

Corridors	**Period**	**Mean value**			**Percentage change**			**T-value**		
		ZOI	COZ	Both	ZOI	COZ	Both	ZOI	COZ	Both
1	Before	19.36	21.72	20.45						
	After	27.35	35.51	30.85	41.27	63.49	50.86	-1.79*	-7.47*	-8.09*
2	Before	13.18	16.53	14.77						
	After	18.82	26.87	21.68	42.79	62.55	46.78	-6.29*	-4.50**	-6.46*
3	Before	9.97	8.93	9.68						
	After	17.69	19.33	18.37	77.43	116.46	89.77	-3.24*	-13.04*	-5.47*
All	Before	15.74	18.2	16.79						
	After	23.24	30.34	26.15	47.65	66.70	55.75	-7.49*	-9.68*	-11.63*

*NB: **: significant at p < 0.01, *: significant at p < 0.001,*
Source: Computed by the Author based on field survey data, 2014.

Corridor 1 is mainly a cash crop producing area and households make use of both motorized and NMT to bring their products to the market. The average amount paid in ETB in the ZOI is 19.36 and 27.35 before and after the intervention, respectively. This shows an increase of about 41.27 per cent. In COZ, the transport cost that was paid per quintal was 21.72 and 35.51 ETB before and after intervention, respectively. The degree of percentage change at 63% is higher than the case of ZOI. Furthermore, the P value is significant at less than 0.001for all three zones.

In case of Corridor 2, the change is 42.79, 62.55 and 46.78 percent for ZOI, COZs and for both zones, respectively, while the P value is significant at less than 0.001, 0.01 and 0.001, respectively.

The change for Corridor 3 is also very high as compared to other corridors. The respective changes are 77.43, 116.46 and 89.77 percent. As explained above, although the transport demand in this area is high due to, among others, economic growth, the road's improvement is found to be very slow accompanied by low volume of vehicular traffic along the route. The length from Kachisi up to Ginchi is 105 kms which is the shortest road among the three corridors under study and is not located in a remote area like the other corridors. But the limited attention given by ERA to maintain this road has brought about the escalation of transport cost. The findings in Corridor 3 shows that though it has favourable conditions for agricultural productions, the availability of transport services is very poor and this has resulted in a rapid rise in transport tariffs.

5.2.7. Accessibility Changes on Farm Places and the Market due to Road Development

The respondents were also asked to estimate the distance between their farm and the road under study. The mean value of the distance has shown the expected positive changes (accessibility) by 23.64, 4.04, 1.1 and 12.56 percent for Corridor 1, 2, 3 and for all corridors taken together, respectively (Table 5.9). The p value is only significant at less than 0.5 for Corridor 1 and for all corridors taken together, respectively.

To mention some points: Corridor 1 was full of open and extensive hitherto uncultivated arable land due to the hot climate of the areas and its infestation with malaria. Gradually, with the road penetration, pioneering farmers adopted to produce cotton and sesame that have good market. This Corridor is now the second most important sesame producing area after Humera (in Tigray Regional State), which has also contributed in making Ethiopia the second largest sesame producer in the world (World Bank, 2014). Sorghum is the major staple cereal crop produced in this area. Farmers get a good yield in the virgin and un-degraded areas, while some are using fertilizer to increase yields. Additionally, teff which is the main staple cereal crop in most parts of Ethiopia has been recently introduced in this Corridor (Quara and Metema *Weredas*) helped by the availability of improved varieties and fertilizer. At present the study road is upgraded large trucks frequent the area particularly during the harvesting periods. Therefore, these opportunities, among others, have encouraged farmers in the study areas to use the land extensively and register more notable transformation than any other corridor under study.

As mentioned above, farming is not yet significant in the study area of Corridor 2 except at Hara study area. Corridor 3 is of moderate climate area that is very favourable for any agricultural activity. Although the area is characterized by high population and agricultural density, the attention so far given to road maintenance and upgrading is quite limited. The interviews and FGDs also confirm that residents along Corridor 3 complain about the road condition. According to traffic count made in the areas, the most dominant means of transport is the use of midi buses (kitkit) and few very old trucks for passengers.

Table 5. 9: Changes in Average Farm and Markets Distances from Roads Under Study(km)

a) Accessibility changes of farm places(km)					b) Accessibility changes of the market (km)		
Corridors	Period	Mean value	**Percentage change**	T-value	Mean value	**Percentage change**	T-value
1	Before	12.1	-23.64	2.27***	14.75	-33.08	3.47**
	After	9.24			9.87		
2	Before	4.45	-4.04	1.64(NS)	4.47	-5.37	2.46***
	After	4.27			4.23		
3	Before	6.3	-1.11	1.08(NS)	6.8	-78.82	14.81*
	After	6.23			1.44		
All	Before	7.8	-12.56	2.39***	9.23	-19.93	3.61*
	After	6.82			7.39		

*NB: NS: Not significant, ***: significant at p < 0.05, **: significant at p < 0.01, *: significant at p < 0.001,*
Source: Computed by the Author based on field survey data, 2014

Concerning changes in terms of access to markets, these have experienced positive improvements by 33.08, 5.37, 78.82 and 19.93 percent and have significant value at P less than

0.01, 0.05, 0.001 and 0.001 for Corridors 1, 2, 3 and for all corridors respectively. The change in the mean value is the highest for Corridor 3 followed by Corridor 1. Small towns and some *kebele* centres could serve as market outlets for the agricultural outputs helped by road improvements in recent years. For instance, as mentioned above, large warehouses have been constructed at Gelago and Shinfa study centres, for collecting sesame from farmers who bring using donkeys on market days.

In conclusion, the distance between farms and the road under study as well as between the farms and markets are reduced after the road intervention.

5.3 Impacts of Road Development on Income.

This subtopic includes the analysis and comparisons made on the spatiotemporal results of individual incomes, and depicts the results in the form of quintiles, percentage changes, multiple regression results in double difference and independent t tests.

5.3.1 Changes in Individual Income with Distance from the Study Road

Theories in impact literature suggest that the distance of individual households from a road is found to be inversely related to their income entailing that the longer the distance of individual's from the road, the lower is the income.

To balance the problem of inflation and allow international comparisons, the data on household incomes obtained in Ethiopian Birr had been converted in to USD equivalent for pre and post road intervention periods. That is in 2002 1$=8.94 ETB, whereas in 2013 1$=18.19 ETB. Finally all the coefficients were multiplied by PPP (*purchasing power parity conversion factor* [4]private consumption (LCU per international $) of the respective years estimated for Ethiopia by World Bank. That is 2002 =1.67, and 2013 = 6.97. Finally to find out the individual income the

[4]As World Bank, International Comparison Program database *Purchasing power parity conversion factor"... is the number of units of a country's currency required to buy the same amounts of goods and services in the domestic market as U.S. dollar would buy in the United States. This conversion factor is for private consumption (i.e., household final consumption expenditure).*

products (household income) had been divided by each household size and is applied in this study.

Figure 5.7 depicts the growth in household incomes in ZOI and COZs before and after intervention. Accordingly, the ZOI in Corridor 1 has exhibited a reduction in income by 724 and by 241 USD than COZ after and before intervention, respectively. The real reason for such change is that the Corridor is cash crop (sesame and cotton) producing area more of which is handled by rural residents who live outside the road corridor under the study. The majority of the residents in Gelago and Shinfa towns (particularly in ZOI) are migrants who came to these areas after the road penetration. Out of 59 sample households at Shinfa study corridor, 32 are located in ZOI of which 25% of the household heads are migrants and had 157 family members. After road intervention, each family member in ZOI gets average income of USD 52 as compared to USD 45 in the COZ (Table 5.1).

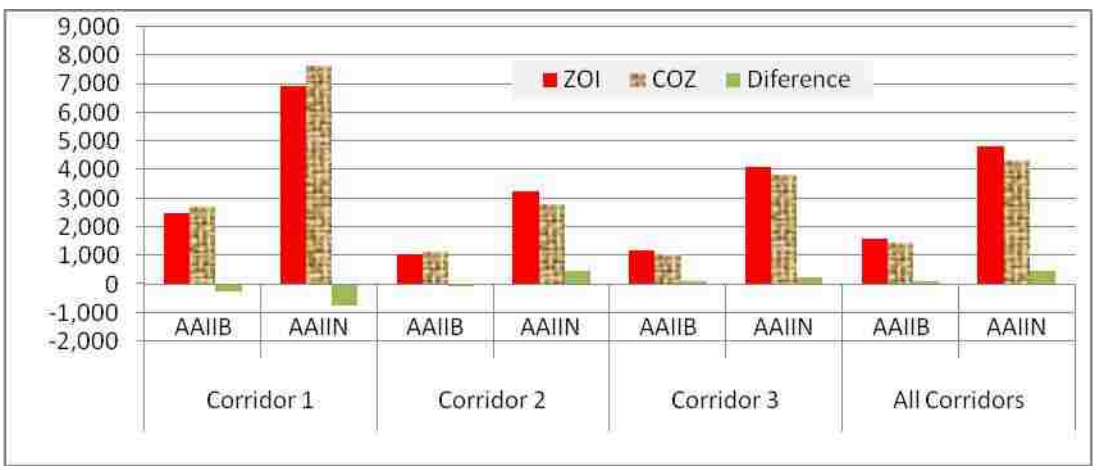


Figure 5. 7: Individual Income Change with Distance from the Study Road (USD)

AAIIB: Average Annual Individual Income before Intervention
AAIIN: Average Annual Individual Income after Intervention
Source: Computed by the Author based on field survey data, 2014.

On the other hand, out of 56 sample households at Gelago study centre, 41 households (with 209 family members) are in the ZOI of which 37% had migrated to the area after road intervention. Each family member has the ratio of individual income of 1:35 USD which is lower than the members at COZ (1:94 USD). Unlike in Shinfa, the impact at this study highway does not support the change theory since the income is increasing with distance. The main reason is identified to be the influence of cash crop production at the distance greater than five kms managed by few members with very large amount of cultivated land and production as FGD confirmed. The newly arriving migrants in Gelago Center, as revealed by the field observation, interviews and FGDs, although currently living in improvised shelters and with low incomes, they express their optimism in view of the new penetration of the road.

As mentioned in Table 5.10, in Corridor 1, particularly in Gelago study corridor where the road extension is relatively recent than in Shinfa centre, the distribution of incomes is lower for the samples selected during the study at the ZOI.

In case of Corridors 2 and 3, both have generally exhibited positive changes (Figure 5.7). The change is rapid after the interventions in both corridors and the cumulative change for all corridors is positive (change by 484 and 172 USD, respectively).

Table 5. 10: Individual Income Distribution and Migration in Corridor 1.

Location	Shinfa Study Centre				Gelago Study Centre			
	Family members*	Individual Income (USD)	Ratio of income (USD)	Proportion of migration since intervention	Family members**	Individual Income (USD)	Ratio of income (USD)	Proportion of migration since intervention
ZOI	157	8168	1:52	25%	209	7208	1:35	37%
COZ	132	5943	1:45	19%	77	7261	1:94	26%

**Number of HHs*4.9 (Average family size in Shinfa town)*

*** Number of HHs*5.1 (Average family size in Gelago town)*

Source: Computed by the Author based on field survey data, 2014.

5.3.2 Comparing Changes in Household and Individual Incomes

Table 5.11 shows the income distribution in quintiles and percentage changes in income. In Corridor 1, about 53.3 and 51.8 percent of the average income after intervention is accumulated by the upper (5th) quintile of households and individuals respectively. Whereas, before intervention, the average annual income was less in the same quintile showing 47.9 and 48.4 percent for households and individuals, respectively. The annual income is found to exhibit very high accumulation in the last income quintile in the case of Corridor 1 as compared to the situation in Corridors 2 and 3.

Table 5. 11:Annual Average Household and Individual Income Changes (USD in Quintiles)

Quintile	AAHIbI **(n(%)**	AAHIaI **(n(%)**	AAIIbI **(n(%)**	AAIIaI **(n(%)**	Change of Household Income	Change of Individual Income
	Corridor 1: N=115					
1st	2652(6)	10007(6)	719(6)	2088(6)	277.3%	190.4%
2nd	4461(10)	16415(10)	1260(10)	3439(10)	268.0%	172.9%
3rd	6672(15)	21552(13)	1845(14)	4961(14)	223.0%	168.9%
4th	10251(22)	31495(19)	2807(22)	6831(19)	207.2%	143.4%
5th	22062(48)	90856(53)	6229(48)	18603(52)	311.8%	198.7%
	Corridor 2: N=119					
1st	1715(6)	7694(9)	442(8)	1654(11)	348.6%	274.2%
2nd	3277(12)	11098(13)	589(11)	2030(13)	238.7%	244.7%
3rd	4367(16)	13644(16)	857(16)	2504(16)	212.4%	192.2%
4th	5962(22)	17987(21)	1245(23)	3190(21)	201.7%	156.2%
5th	11363(43)	34179(40)	2323(43)	6149(40)	200.8%	164.7%
	Corridor 3:N=158					
1st	1655(6)	9619(7)	355(6)	1454(7)	481.2%	309.6%
2nd	2506(9)	14378(10)	540(9)	2029(10)	473.7%	275.7%
3rd	3861(14)	19677(14)	716(13)	2673(13)	409.6%	273.3%
4th	5490(20)	28947(20)	1028(18)	3899(19)	427.3%	279.3%
5th	14014(51)	69949(49)	3100(54)	10315(51)	399.1%	232.7%

AAHbI: Average Annual Household Income before Intervention
AAHaI: Average Annual Household Income after Intervention
AAIIbI: Average Annual Individual Income before Intervention
AAIIaI: Average Annual Individual Income after Intervention
Source: Computed by the Author based on the field survey

The change in income between the "before" and "after" situation is found to be the highest in the 5th quintile of Corridor 1, showing 311.8 percent change in case of household incomes and 198.7 percent for individual income. In the case of other corridors, however, the highest change is observed in the 1st quintiles. Generally, keeping other factors constant, the result shows that road intervention in all study areas has resulted in considerable changes in income

Table 5.12 below illustrates the dynamics of individual and household income in ZOIs and COZs in each study corridors. The paired sample t test shows that there are significant changes between the before and after situation throughout the study corridors. All are significant at p value of less than 0.001 except the income of households in the COZ of Corridor 1 which is significant at p value less than 0.05. The impact is strong in the ZOIs than COZs in all of the study corridors.

Table 5. 12: Changes in the Monthly Individual and Household Income (USD)

a)Monthly Individual Income(USD)										
Corridors	**Period**	**Mean value**			**Percentage Change**			**T-value**		
		ZOI	**COZ**	**Both**	**ZOI**	**COZ**	**Both**	**ZOI**	**COZ**	**Both**
1	Before	234.8	192.1	219.3	177.90	252.70	179.20	-5.9*	-4.1*	-7.2*
	After	652.5	677.6	612.3						
2	Before	92.4	92.0	91.7	193.83	185.30	181.00	-10.3*	-7.3*	-13.1*
	After	271.5	262.5	257.7						
3	Before	98.5	88.6	96.4	250.15	259.10	251.90	-7.3*	-5.3*	-8.8*
	After	344.9	318.2	339.2						
All	Before	134.5	123.5	131	203.87	192.39	201.22	-12.9*	-10.8*	-7.1*
	After	408.7	361.1	394.6						
b)Monthly HH Income(USD)										
1	Before	858.5	677.6	790.6	243.91	325.58	271.00	-6*	-3.5***	-6.6*
	After	2952.5	2883.7	2932.9						
2	Before	474.3	445.1	448.4	230.00	222.40	213.10	-9.1*	-6.7*	-12.2*
	After	1531.9	1435.1	1403.9						
3	Before	470.1	449.2	467.6	388.90	468.70	407.80	-8.6*	-5.2*	-9.9*
	After	2298.4	2554.5	2374.4						
All	Before	578.7	508.9	556.5	289.65	335.00	303.16	-12*	-6.5*	-13.3*
	After	2254.9	2213.7	2243.6						

*NB: *: Significant at p < 0.001, ***: Significant at p < 0.001,*

Source: Computed by the Author based on field survey data, 2014.

5.3.3 **Impact Analysis by the Double Difference Methods**

The double difference (DD) (differences in differences) method compares a treatment zone (zone of influence abbreviated as ZOI) and a comparison zone (control zone abbreviated as COZ). It also compares the changes happening before and after the intervention. In this study and as commonly used in many other studies, the comparison between ZOI and COZ is said to be the first difference and the comparison between the conditions before and after the intervention is said to be the second difference. DD method is also applied in both experimental and quasi-experimental designs. Both baseline and follow-up data were collected using the outcome indicators for untreated (COZs) and treated (ZOI) groups after intervention (at the end of 2013 and in the first quarters of 2014). The mean difference between the "after" and the "before" values of the outcome indicators was calculated for each of the ZOI and COZ groups. The second difference (that is, the difference in difference) is therefore the estimate of the impact of the programme.

5.3.3.1 The Regression Approach

The *regression model* used to build the relationship between the outcome variable and the explanatory variables is:

$$Y = a + bX + u$$

Based on the explanations outlined in the Methodology chapter (Section 3.5.3.2) the variables are regressed for each progressive, traditional and control zones.

A regression-based estimate for the double difference (DD) can be obtained by estimating using the following model:

$$Y_{ijt} = \beta_0 + \beta_1 D_{ij}^{TC} + \beta_2 D_{it}^{AD} + \beta_3 D_{ij}^{TC} D_{it}^{AD} + \varepsilon_{ijt}$$

where Y_{ij} is the value of an indicator for i^{th} household in j^{th} village at time t, ε_{ijt} are error terms which are assumed to be uncorrelated across villages but not necessarily within villages, D_{ij}^{TC} and D_{it}^{AD} are dummy variables defined as:

$$D_{ij}^{TC} = \begin{cases} 1, & \text{if } j^{th} \text{ household resides in a treated village} \\ 0, & \text{if } j^{th} \text{ household resides in a control village} \end{cases}$$

$$D_{it}^{AD} = \begin{cases} 1, & \text{if } i^{th} \text{ observation is from the follow-up survey} \\ 0, & \text{if } i^{th} \text{ observation is from the baseline survey} \end{cases}$$

In the above setting, a significant β_2 is an indication of a significant difference in the average (expected) value of the characteristic of interest between the baseline and follow-up periods for the control group. Similarly, a significant β_1 indicates a significant difference in the average value of the characteristic of interest between the treated and control groups (villages) during the baseline period. The parameter of much interest is the double-difference estimator, β_3. A significant β_3 is an indication of a significant impact of the programme (treatment) on the average value of the characteristic under consideration (Y). Note that the double-difference estimator controls for any differences between households (or individuals) in treated and control groups at the baseline period.

5.3.3.2 The Independent Samples T-test

Let T_0 and C_0 denote the mean value of an indicator of interest in the baseline period for the

ZOI and COZ groups, respectively, and let T_1 and C_1 denote the respective figures obtained from a follow-up (current) survey. Before the intervention, if we assume the averages to be similar for the two groups (that is, the quantity $(T_0 - C_0)$ to be close to zero), we expect the difference $(T_1 - C_1)$ to measure the effect directly attributable to the intervention. This is referred to as the first difference. However, a more robust measure of the effect would account for any pre-existing observable or unobservable differences between the two groups. This is the double difference (DD) obtained by subtracting the pre-existing differences between the groups, $(T_0 - C_0)$, from the difference after the intervention, $(T_1 - C_1)$, that is,

$$DD = (T_0 - C_0) - (T_1 - C_1) = (T_0 - T_1) - (C_0 - C_1)$$

The task is then to determine whether or not DD is significantly different from zero. The

appropriate statistical test of significance is the independent samples t-test which compares the

matched pair differences $(T_0 - T_1)$ and $(C_0 - C_1)$.

5.3.3.3 Results of Double Difference Regression Model

i) Comparing Progressive with Control Zones

The Table below illustrates that 70.1% of the variation in individual income is explained by the explanatory variables included in the model. The results from the ANOVA table also indicate that the model is a good fit to the data at the 1 percent level of significance. Accordingly:

- For a one family member increase in the household, an individual income decreases by about $1,001.16 per year.
- For a one hectare increase in cultivated land, an individual income increases by about $527.25 per year;
- For a one quintal production of cash crop, an individual income increases by about $38.024 per year;
- The mean individual income after the road intervention is $4,951.80 per year higher than that of the period before road intervention period for the control group;
- The mean individual income in the treated (progressive) villages is $1,557.81 higher than that of the control village before the intervention period;
- Controlling for any pre existing differences between the treated and control villages before the intervention, the mean individual income is $1839.80 higher for the treated villages as compared to control villages.

Therefore, the DD is significant at P value of less than 0.10 for progressive versus control villages. In other words, the result shows that with an increase of distance from the either side of the study road line, a significant decrease is observed in individual/ household income. Keeping other factors constant, the progressive zones are found to have significant difference/ spatial and temporal impact due to road intervention.

Table 5. 13: Comparing Results of Double Difference Regression between Progressive and Control Zones

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.837[a]	.701	.683	3317.112

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4185534049.568	10	418553404.957	38.039	.000[b]
	Residual	1782523103.761	162	11003229.036		
	Total	5968057153.329	172			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1254.917	857.180		1.464	.145
	Use of chemical fertilizers	1100.410	934.754	.062	1.177	.241
	Use of herbicides/pesticides	-1107.000	758.280	-.084	-1.460	.146
	Use of irrigation	392.253	1098.619	.016	.357	.722
	Household size	-1001.163	140.173	-.320	-7.142	.000*
	Area of cultivated land (ha)	527.249	57.381	.506	9.189	.000*
	Annual household production of cereals in Qt	7.354	10.697	.041	.687	.493
	Annual household production of cash crops in Qt	38.024	13.843	.179	2.747	.007*
	Time dummy	4951.806	848.486	.422	5.836	.000*
	Dummy for progressive versus control	1557.800	739.292	.131	2.107	.037**
	Double difference for progressive versus control zone	1839.798	1030.232	.141	1.786	.076***

*Dependent Variable: Annual individual income(USD), * Significant at P<0.01, ** Significant at P<0.05, *** Significant at P<0.10*

Source: Computed by the Author based on field survey data, 2014.

ii) Comparing Traditional with Control Zones

Table 6.14 below illustrates that 57.5% of the variation in individual income is explained by the explanatory variables included in the model. The results from the ANOVA table also indicate that the model is a good fit to the data at the 1 % level of significance. Accordingly:

- For a one quintal increase in the utilization of fertilizers, an individual's income increases by about $1620.13 per year;
- For a one hectare increase in cultivated land, an individual's income decreases by about $178.966 per year. As explained above, the model is comparing the impacts between households located within 2.5-4.9 kms from the road (traditional villages) and those located 5 kms from the road and beyond (control villages). The reason for such result may be the geographic location of the residences of the households, which is far away at

minimum by 2.5 kms from the study road, and the respondents may be located in areas that are less productive due to topographic and climatic conditions. As explained in Section 5.2, the agricultural productivity of households exhibited a decline as compared to the situation before road intervention. The second reason may be the nature of the data obtained from the households;

- For a one quintal production of cereals, an individual's income increases by about $42.90 per year;
- For a one quintal production of cash crop, an individual's income increases by about $83.368 per year;
- keeping other factors constant, the mean individual income after road intervention is $3419.167 higher than before the road intervention for the control group;

Table 5. 14: Comparing Results of Double Difference Regression between Traditional and Control Zones

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.758[a]	.575	.520	2399.941

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	607242083.935	10	60724208.393	10.543	.000[b]
	Residual	449257787.503	78	5759715.224		
	Total	1056499871.438	88			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1169.680	874.312		1.338	.185
	Use of chemical fertilizers	1620.126	923.314	.155	1.755	.083***
	Use of herbicides/pesticides	519.978	700.592	.069	.742	.460
	Use of irrigation	-16.828	970.754	-.001	-.017	.986
	Household size	-188.100	129.967	-.116	-1.447	.152
	Area of cultivated land (ha)	-178.966	82.985	-.187	-2.157	.034**
	Annual household production of cereals in Qt	42.904	11.158	.322	3.845	.000*
	Annual household production of cash crops in Qt	83.368	22.902	.333	3.640	.000*
	Time dummy	3419.167	672.193	.496	5.087	.000*
	Dummy for traditional versus control	-314.080	1140.309	-.032	-.275	.784
	Double difference for traditional versus control zone	-190.467	1501.509	-.015	-.127	.899

*a. Dependent Variable: Annual individual income(USD), * Significant at P<0.01, ** Significant at P<0.05, *** Significant at P<0.10*

Source: Computed by the Author based on field survey data, 2014.

Therefore, though the above mentioned variables show significant differences, the integrated variables' model (DD) does not show significant change in comparison to the traditional and control villages.

iii) Comparing ZOI (Progressive and Traditional) with COZs (Control Zones)

Table 5.15 below illustrates that 58.9% of the variation in individual's income is explained by the explanatory variables included in the model. The results from the ANOVA table also indicate that the model is a good fit to the data at the 1 % level of significance. Accordingly:

- For a one family member increase in the household, individual income decreases by about \$827.92 per year;
- For a one hectare increase in cultivated land, individual income increases by about \$343.83 per year;
- For a one quintal production of cereals, an individual income increases by about \$20.0 per year;
- The mean individual income after road intervention period is \$4449.45 higher than before road intervention for the control group;
- The mean individual income in the ZOI is \$1472.10 higher than that in the COZ before the intervention;

Therefore, though the above mentioned variables show significant differences, the integrated variables' model (DD) does not show significant change in comparison to that of ZOIs and COZs.

Table 5. 15: Comparing Results of Double Difference Regression between Zone of Influence and Control Zones

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.768[a]	.589	.565	2612.750

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1676275102.247	10	167627510.225	24.556	.000[b]
	Residual	1167325465.446	171	6826464.710		
	Total	2843600567.692	181			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1963.230	687.905		2.854	.005*
	Use of chemical fertilizer	-221.070	728.250	-.018	-.304	.762
	Use of herbicides/pesticides	-167.569	567.725	-.019	-.295	.768
	Use of Irrigation	-502.392	812.143	-.032	-.619	.537
	Household size	-827.924	103.481	-.412	-8.001	.000*
	Area of cultivated land (ha)	343.827	53.375	.363	6.442	.000*
	Annual household production of cereals in Qt	19.998	8.263	.160	2.420	.017**
	Annual household production of cash crops in Qt	14.101	11.136	.086	1.266	.207
	Time dummy	4449.445	661.823	.563	6.723	.000*
	Dummy for progressive or traditional versus control	1472.093	569.556	.183	2.585	.011**
	Double difference for progressive or traditional versus control zone	679.012	794.238	.078	.855	.394

*a. Dependent Variable: Annual individual income(USD), * Significant at P<0.01, ** Significant at P<0.05*

Source: Computed by the Author based on field survey data, 2014.

5.3.3.4 Results of Double Difference Independent Samples Test

Tables 5.16 to 5.19 below summarize the results of the independent samples test. The test shows the significant difference in mean household incomes throughout the study area between progressive and COZ at 1 % level of significance. Therefore, both the independent test and ANOVA models show significant difference between the various categories of villages in all of the study corridors. For the remaining study areas (comparison of traditional villages with COZ indicated in Table 5.17) and (comparison of ZOI and COZ indicated in Table 5.18), the test shows that there is no significant individual income difference due to road intervention.

Similarly, as also shown in the previous section, the ANOVA model does not show the presence of any significant difference.

i) Comparing Progressive with Control Zones

Table 5. 16: Comparing Results of Double Difference Independent Samples Test between Progressive and Control Zones

Group Statistics					
	Treatment Type	N	Mean	Std. Deviation	Std. Error Mean
Difference	Progressive	172	3315.0465	5589.14648	426.16842
	COZ	133	2390.5865	3225.10851	279.65237

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	95% Confidence Interval of the Difference Upper
Difference	Equal variances assumed	3.974	.047	1.701	303	.090	924.46005	543.56825	-145.18665	1994.10674
	Equal variances not assumed			1.814	282.190	.071	924.46005	509.73030	-78.89623	1927.81632

Source: Computed by the Author based on field survey data, 2014

ii) Comparing Traditional with Control Zones

Table 5. 17: Comparing Results of Double Difference Independent Samples Test between Traditional and Control Zones

Group Statistics					
	Treatment	N	Mean	Std. Deviation	Std. Error Mean
Difference	Traditional	83	2977.7711	4550.64490	499.49817
	COZ	133	2390.5865	3225.10851	279.65237

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Difference	Equal variances assumed	1.660	.199	1.108	214	.269	587.18462	529.90663	-457.32031	1631.68954
	Equal variances not assumed			1.026	133.325	.307	587.18462	572.45425	-545.08238	1719.45161

Source: Computed by the Author based on field survey data, 2014.

iii) Comparing ZOI (Progressive and Traditional) with COZ (Control Zones)

Table 5. 18 : Comparing Results of Double Difference Independent Samples Test between ZOI and COZ

Group Statistics					
	Progressive + traditional (ZOI)	N	Mean	Std. Deviation	Std. Error Mean
Difference	COZ	133	2390.5865	3225.10851	279.65237
	Progressive or traditional	255	3205.2667	5266.98535	329.83142

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Difference	Equal variances assumed	3.690	.055	-1.631	386	.104	-814.68020	499.53084	-1796.82215	167.46175
	Equal variances not assumed			-1.884	376.277	.060	-814.68020	432.42828	-1664.95897	35.59857

Source: Computed by the Author based on field survey data, 2014.

5.4 Impacts of Road Development on Households' Saving and Borrowing

The impact analysis and comparisons made under this subtopic is about households' savings and borrowing status "before" and "after" road intervention along with spatial changes in the study areas. Amhara Micro-finance, Equib, rural bank, urban bank, Afar Micro-finance, Oromia Micro-finance and other institutions are used for saving and borrowing money.

5.4.1 Changes in Households' Money Saving

Taking into account the importance of saving to meet the financial requirements of ensuring continuity or expansion of economic activities to be undertaken at household level, among others, households were asked to indicate whether they are members of a saving group or not based on response options of Yes =1/No =1. As illustrated in Table 5.19a, the extent of membership in saving and credit cooperatives shows positive change by 11.64, 7.77 and 10.0 percent for ZOI, COZs and for both zones, respectively. The results for all zones were found to be significant at P value of less than 0.001. Comparison between the three corridors shows that, Corridor 1 has the highest change of 17.9, 16.67 and 18.09 percent for the respective zones, which are significant at P value of less than 0.001. The responses to the open ended questions included in the survey show that, the majority of farmers in Amhara region consider saving as a very important mechanism to purchase agricultural inputs particularly for their cash crop production and to pay for labour during harvesting season.

The saving members were asked to indicate the amount of money they save per month before the road intervention. As explained in Table 5.19b, the average amount saved is ETB 127.83 and ETB 46.67 for ZOI and COZ, respectively. The saving in the respective zones, on the other hand, had increased to ETB 226.17 and 76.17 after road intervention. The respective significance range is at P value less than 0.01 and 0.05. The mean value change for all corridors is 76.93, 63.08 and 75.08 percent for ZOI, COZs and for both zones. A corridor wise comparison of these changes shows that, Corridor 3 has exhibited the highest change (192.11, 118.18 and 182.16 percent for ZOI, COZ and for both zones respectively). Except the COZ in Corridor 3 and all zones in Corridor 2, the changes in the remaining zones are significant at P value less than 0.10

In conclusion, in terms of membership in saving institutions and the amount saved, the performance of COZ is very low as compared to ZOI and that of Corridor 2 is among the least.

Table 5. 19: Membership of Households in a Saving Group and Average Amount of Money Saved

Corridors	Period	Mean value			**Percentage change**			T-value		
		ZOI	COZ	Both	ZOI	COZ	Both	ZOI	COZ	Both
a)Membership of households in a saving group										
1	Before	1.89	1.86	1.88						
	After	1.55	1.55	1.54	-17.99	-16.67	-18.09	5.98*	4.29*	7.40*
2	Before	1.84	1.98	1.89						
	After	1.7	1.96	1.79	-7.61	-1.01	-5.29	3.56**	1(NS)	3.64*
3	Before	1.92	1.96	1.94						
	After	1.73	1.84	1.77	-9.90	-6.12	-8.76	5.19*	2.35***	5.66*
All	Before	1.89	1.93	1.9						
	After	1.67	1.78	1.71	-11.64	-7.77	-10.00	8.514*	4.7*	9.63*
b) Average amount of money saved by the households per month (ETB)										
1	Before	113.75	50	86.43						
	After	238.13	71.67	166.79	109.35	43.34	92.98	-1.95****	-2.38****	-2.10****
2	Before	161.54	10	150.71						
	After	190	15	177.5	17.62	50.00	17.78	-1.22(NS)	-	-1.24(NS)
3	Before	91.67	55	92.5						
	After	267.78	120	261	192.11	118.18	182.16	-2.01****	-1.86(NS)	-2.14****
All	Before	127.83	46.67	111.71						
	After	226.17	76.11	195.53	76.93	63.08	75.03	-2.919**	-2.7***	-3.10**

*NB: NS: Not significant, ****: significant at p < 0.1, ***: significant at p < 0.05, **: significant at p < 0.01, *: significant at p < 0.001,*
Source: Computed by the Author based on field survey data, 2014.

5.4.2 Change on the Status of Households' Money Borrowing

Saving in many cases is a precondition for borrowing, and in this connection household respondents were asked about their borrowing experience before and after road intervention. Table 5.20, illustrates those who borrowed (who said yes =1) and those who did not borrow (who replied No = 2) as indicated by mean values. The mean values show positive change of 5.67, 5.24 and 5.70 percent and are significant at P value of less than 0.001, 0.01 and 0.001 for ZOI, COZs and for both zones, respectively. The highest share of membership in saving is found in Corridor 1; the same is true in case of borrowing. The status of the change in this Corridor is well above the average of the three corridors (change by 14.13, 15.34, and 14.75

percent for ZOI, COZs and for both zones, respectively, and is significant at p value of less than 0.001.

Concerning the amount of the money borrowed, the mean value ranges is shown as follows (Table 5.20)

i. **<u>The range in COZs</u>**
   - Before road intervention: ETB 525 in Corridor 2 to ETB 2,780 in Corridor 1
   - After road intervention: ETB 3,250 in Corridor 2 to ETB 4,540 in Corridor 1

   Therefore, the increment in this case is ETB 2,725 in Corridor 2 and by ETB 1,760 in Corridor 1.

ii. **<u>The range in the ZOI</u>**
   - Before road intervention: ETB 500 in Corridor 3 to ETB 31,500 in Corridor 2
   - After road intervention : ETB 2000 in Corridor 3 to ETB 33,000 in Corridor 2

   Therefore, the increment in this case is ETB 1,500 in Corridor 3 and by ETB 2,500 in Corridor 2.

Table 5. 20: Borrowing Status of Households and Amount of Money Borrowed

Corridors	Period	Mean value			**Percentage change**			T-value		
		ZOI	COZ	Both	ZOI	COZ	Both	ZOI	COZ	Both
a)Money borrowing status of households										
1	Before	1.84	1.83	1.83						
	After	1.58	1.55	1.56	-14.13	-15.30	-14.75	4.71*	4.05*	6.23*
2	Before	1.97	1.91	1.95						
	After	1.94	1.94	1.93	-1.52	1.57	-1.03	1.76****	-0.57(NS)	0.82(NS)
3	Before	1.99	2	1.99						
	After	1.91	1.96	1.92	-4.02	-2.00	-3.52	3.11**	1.43(NS)	3.43**
All	Before	1.94	1.91	1.93						
	After	1.83	1.81	1.82	-5.67	-5.24	-5.70	5.709*	3.3**	6.55*
b)Amount of money borrowed by households (ETB)										
1	Before	2318.18	2780	2462.5						
	After	5400	4540	5131.25	132.94	63.31	108.38	-3.31**	-2.99***	-3.97**
2	Before	31500	525	16012.5						
	After	33000	3250	18125	4.76	519.05	13.19	-3(NS)	-1.06(NS)	-1.87(NS)
3	Before	500	_	500						
	After	2000	_	2000	300.00	_	300.00	_	_	_
All	Before	6357.14	2135.71	4950						
	After	9100	4171.43	7457.14	43.15	95.32	50.65	-3.667**	-2.8***	-4.58*

*NB: NS: Not significant, ****: significant at p < 0.1, ***: significant at p < 0.05, **: significant at p < 0.01, *: significant at p < 0.001,*

Source: Computed by the Author based on field survey data, 2014.

The average change for all corridors is 43.15, 95.53 and 50.66 percent, respectively, which is significant at P value less than 0.01, 0.05 and 0.01 for ZOI, COZs and for both zones, respectively. The major change is observed in Corridor 1 (respective change of 233.84, 63.31 and 108.32 percent which is significant at P value of less than 0.01, 0.05 and 0.01)

The change in COZ of Corridor 2 is a somehow different (519.05 percent) which is because one individual in the Chifra study centre had borrowed 20,000 ETB for construction purpose after the road intervention. Based on the summary made on the responses to the open ended questions, the main purposes for which households borrow are to buy agricultural inputs (this response is dominant in Corridor 1), to establish and/or expand small scale trade establishments, and to establish new businesses (for instance buying oxen for fattening). As per the interviews, the number of borrowing institutions in the study areas had increased after road intervention. Accordingly, the extent of borrowing has increased after road intervention and in ZOI.

5.5 Impacts of Road Development on Asset Ownership

The spatiotemporal impact analysis and comparisons made under this subtopic refers to households' fixed asset (residential house) and movable property (such as radio, television, cell phone, beds and bee colonies) ownership.

5.5.1 Impacts on the Ownership and Use of Housing Units

With regard to house ownership, there is no significant change as compared to the situation before intervention despite the presence of slight increase in ZOI. As illustrated in Table 5.21, out of 392 household heads, 94 percent are owners. The number of tenants declined from 6 percent to the current 5 percent of the surveyed households.

Table 5. 21: Ownership of Household Residence (%)

	Owner		**Tenant**		**Inherited**		**Other**		**Total**	
Location	Before	Now	Before	Now	Before	Now	Before	Now	Before	Now
ZOI	90.5	91.6	8 .6	8.0	0.8	0.4	0.0	0.0	100	100
COZ	99.3	99.3	0.7	0.7	0.0	0.0	0.0	0.0	100	100
Total	93.9	94.4	5.6	5.4	0.5	0.3	0.0	0.0	100	100

Source: Computed by the Author based on the field survey, 2014.

Table 5.22 depicts that about 90 percent of the households use their housing units exclusively for residential purpose, while about 3 percent use them for commercial purposes as well. Comparison in the use of residential units during the base line and after the intervention in both the ZOI and COZs shows reductions from 91 to 87, from 99 to 96 and from 94 to 90 percent for ZOI, COZ and for all zones, respectively. The study corridor and centres in Oromia exhibited relatively the highest share in this regard.

Table 5. 22 : Percentage Distribution of the Use of Housing Units

Location	Residential		Commercial		Residential and Commercial		Other		Total	
	Before	Now	Before	Now	Before	Now	Before	Now	Before	Now
ZOI	90.9	87.1	2.9	3.6	5.3	8.8	0.8	0.4	100	100
COZ	98.7	95.8	0.0	0.7	1.3	3.5	0.0	0.0	100	100
Total	93.9	90.3	1.8	2.6	3.8	6.9	0.5	0.3	100	100

Source: Computed by the Author based on the field survey, 2014.

5.5.2 Impacts on Moveable Assets

Under this subtitle, changes in assets like radio, television, cell phones, beds and bee colonies are discussed as temporally and spatially impacts of the road intervention. The researcher did not see road development impacts on many of domestic animal assets except on beast of burden which are related to transport services as explained in Section 5.2.4.

i) **Changes in ownership of radio:** As illustrated in Table 5.23, the temporal change from the results of the mean values is 1.94, 13.86 and 6.93 percent for ZOI, COZ and for both zones respectively. The change is positive and is significant at P value of less than 0.10. From spatial perspective, COZs exhibited relatively low level of ownership than ZOI before the road intervention. But after road intervention, the COZ could have higher ownership than the ZOI. This shows that households in ZOI are in favour of television (that require access to electricity) than radio (that can work with dry cell batteries) after the intervention to enjoy news and any information. Among all study corridors, the use of radios is more prevalent in Corridor 3 (Oromia) and particularly in COZs.

ii) **Changes in television ownership:** As shown in Table 6.23, there is no television ownership in the COZs and we cannot compare the value of significance. Accordingly, the change in rate of ownership is calculated to be 16.50 percent higher for ZOI only. Since the number of households owning televisions are small (only 11), the changes of P value are found to be insignificant.

iii) **Changes in cell phone ownership:** The temporal change in cell phone ownership is 73.08, 50.00, and 67.92 percent for ZOI, COZ and for both zones, respectively. This impact is positive and is significant at P value of less than 0.001. Regarding the ownership spatially, ZOI has 1.05 times greater than ownership in COZs. Corridor wise, the use of cell phones is more common among households in Corridor 2 (particularly the road segment in Afar)). The evidence shows that the majority of residents in the Hara study centre are Muslims and keep strong telephone-based communication with their relatives that currently reside outside Ethiopia in neighbouring predominantly Muslim countries and that also send them remittances. As highlighted during the interviews and observations made during the field survey, many youth at Hara town remain unemployed, while they receive remittances from abroad. From the perspective of the Chifra study centre that is found in Afar Region, it is worth noting that part of the predominantly pastoral and semi pastoral population move away from their usual place of residence in search of grazing and water. It has been observed in this connection that many of them communicate with their families using cell phones. It is also worth noting that some of these mobile phones can be used to listen to FM radio programmes which could be a good means to follow-up market information regarding the price of goats and other products.

iv) **Changes in bed ownership**: The respondents were asked to indicate whether they have beds of any sort (e.g., manufactured from wood or metallic bars, and having mattress frames made from synthetic plastic fibres or hides and skin), which are provided with accessories like bed sheets, blankets, and pillows. As illustrated in Table 5.23, there are significant improvements in all study corridors that are calculated to be 26.25, 37.91 and 28.48 percent for ZOI, COZs and for both zones, respectively. The results are significant at p value of less than 0.001. Spatially, the ownership of bed was high in ZOI than COZs before the road intervention, which also exhibited higher increase after the road intervention in COZs than ZOI suggesting that such changes are to be attributed to other factors than the road intervention.

Table 5. 23: Changes in Ownership of Selected Movable Assets

Asset ownership	Period	Mean value			**Percentage change**			T-value		
		ZOI	COZ	Both	ZOI	COZ	Both	ZOI	COZ	Both
Quantity of radio	Before	1.03	1.01	1.01						
	After	1.05	1.15	1.08	1.94	13.86	6.93	-1(NS)	-1.69(NS)	-1.93****
Quantity of television	Before	1.09	_	1.09						
	After	1.27	_	1.27	16.51	_	16.51	-1.49(NS)	_	-1.49(NS)
Quantity of cell phone	Before	1.04	1.14	1.06						
	After	1.8	1.71	1.78	73.08	50.00	67.92	-4.88*	-1.92(NS)	-0.27*
Quantity of sleeping bed	Before	1.6	1.53	1.58						
	After	2.02	2.11	2.03	26.25	37.91	28.48	-5.61*	-2.75**	-5.87*
Quantity of bees in hive		19.25	13.3	16.71						
	After	7.13	8.17	7.57	-62.96	-38.57	-54.70	1.53(NS)	1.09(NS)	1.87****

*NB: NS: Not significant, ****: significant at p < 0.1, **: significant at p < 0.01, *: significant at p < 0.001,*
Source: Computed by the Author based on the field survey, 2014

v) **Changes in bee colony ownership:** Some of the households included in the study undertake bee keeping activities parallel to their primary source of livelihoods. Out of the total of 392 respondents, 14 were found to have bee colonies before the road intervention, most of which are found in Corridor 1. The average number of bee colonies for all the corridors taken together is calculated to be 16.71 and 7.57 before and after the road intervention, respectively. The result also shows a decline of 62.96, 38.57 and 54.70 percent for ZOI, COZs and both zones, respectively (Table 5.23), which is found to be significant at P value of less than 0.10. In terms of spatial change, although ZOI had greater mean value than COZ before the road intervention, this was reversed after the road intervention as shown above. This was also highlighted in the responses to open ended questions in the household questionnaires as well as the FGDs and interviews. The introduction and widespread use of pesticides and herbicides in agriculture must have negatively affected bees. The cutting of trees and shrubs for fuel wood and construction purposes also contributed in terms of reducing flowers from which bees collect nectar.

5.6 Road Development Impacts on Small Scale Trading and Business

It is obvious that with road penetration and upgrading, new businesses, particularly small scale trading activities flourish influenced by proximity to roads. From the total respondents, 62 are engaged in small scale trading activities either as their main source of livelihood or as additional source of income. The major types of businesses are retail shops, restaurants, cafes and grain mills the majority of which are located in the ZOI. They also include itinerant traders. During the survey, households engaged in trade related activities had been asked questions such as the distance of their business from the main road, their capital and number of employees (Table 5.24). The summarized results revealed that:

- The mean value (the distance in km) between the business location and the road under study had been shortened as compared to before road intervention (3.6%), but shows insignificant change. This may be due to the data of the businessmen is small in number,
- In terms of the use of the road by the businessmen the status of the change shows 16.67 percent and is significant at P value of less than 0.01.This shows that the majority of the businessmen are using the road under study for their purposes
- In terms of fixed and variable capital, the average initial capital before the road intervention was ETB 12,093.18, whereas it increased to ETB 138,229.84 after intervention. The percentage increase is 1,043 percent and is significant at P value of less than 0.001.
- Related to tax payments the businessmen pay to the government, the average payment is calculated to be ETB 1,231.04 and 4,380.56 before and after the road intervention respectively. The percentage increase is found to be 245.85 percent, which is significant at P value of less than 0.05.
- In terms of the average number of customers of businesses they operate in fixed locations such as retail shops, grain mills, cafes and restaurants, the mean value before and after the road intervention was calculated to be 27 and 28 persons, respectively, with a percentage change of 8.45 that is not found to be significant.
- In terms of average daily earnings, the mean value is calculated to be ETB 199.10 and 689.13 before and after the road intervention, which exhibited an increase by 246.12

percent, although the change is not found to be significant. As revealed by open ended questions in the household level questionnaires as well as FGDs and interviews, too many businesses exist and additional ones are opened in a given line of business despite the saturation of the market that results in their declining daily earnings. .

- In terms of changes in the number of hired employees, the mean value is calculated to be 1.9 and 2.7 before and after the road intervention, respectively. This is a percentage increase of 41.89 percent, which is found to be significant at P value of less than 0.05.

In conclusion, in all the points considered for analysis, the road intervention is found to have impacts on the expansion of small scale trading activities in the study Corridors.

Table 5. 24: Small Scale Trade Development along the Study Corridors

Corridors	Period	Mean value	Percentage change	T-value
Number of employees	Before	1.9	41.89	-2.17***
	After	2.69		
Average daily earnings from the business (ETB)	Before	199.1	246.12	-1.66(NS)
	After	689.13		
No of customers per day	Before	26.64	8.45	-0.32(NS)
	After	28.89		
Amount of tax paid per year (ETB)	Before	1231.04	255.84	-2.35***
	After	4380.56		
Use the road under study (Yes = 1,No = 2)	Before	1.38	-16.67	3.38**
	After	1.15		
Distance of the business from the road under study (km)	Before	1.39	-3.62	1.56(NS)
	After	1.34		
Capital of the business (ETB)	Before	12093.18	1043.04	-4.45*
	After	138229.84		

*NB: NS: Not significant, ***: significant at p < 0.05, **: significant at p < 0.01, *: significant at p < 0.001,*
Source: Computed by the Author based on the field survey, 2014

Related to the above mentioned business, the following five questions were posed to the respondents that refer to the impact of road development on market of the businessmen (Figure 5.8), namely: “*Has the road under study shortened the distance you travel to reach the market? Has it eased your access to services? Has it impacted on better price for the products you sell in the market? Has it contributed to reduction in the cost of transport?* and *Has it impacted in terms of better access to buyers?*

Accordingly, the cumulative likert scale answers summarized by using factor analysis are that 80.05 and 70.03 percent of the total respondents disagreed and agreed on the impact of road before and after road intervention respectively. The respective evidence is found to be stronger in Corridor 3 followed by Corridor 1 (78.6 and 85.1 percent in Corridor 3 and 82.61 and 67.3 percent for Corridor 1).

It can therefore be inferred that in Corridor 3, which is climatically favourable and populous area, road penetration has enhanced the market access. Similarly, in Corridor 1, which is a major sesame producing area, road penetration has contributed to the further expansion of markets for this cash crop. But in Corridor 2, which is inhabited by pastoralists and semi- pastoralists, the expansion in the market is found to be limited. As the government has upgraded this road to facilitate the import /export trade via the port of Djibouti, the study road accommodates large number of heavy trucks to and from Djibouti that are destined to the northern regions of Ethiopia including as Afar, Amhara and Tigray. The interviews and FGDs revealed that the upgrading of the route from gravel to asphalt have had positive impact on the livelihoods of those residing in the study corridor, although they underlined that the main beneficiaries from the resulting transport efficiency are the national economy and truck owners.

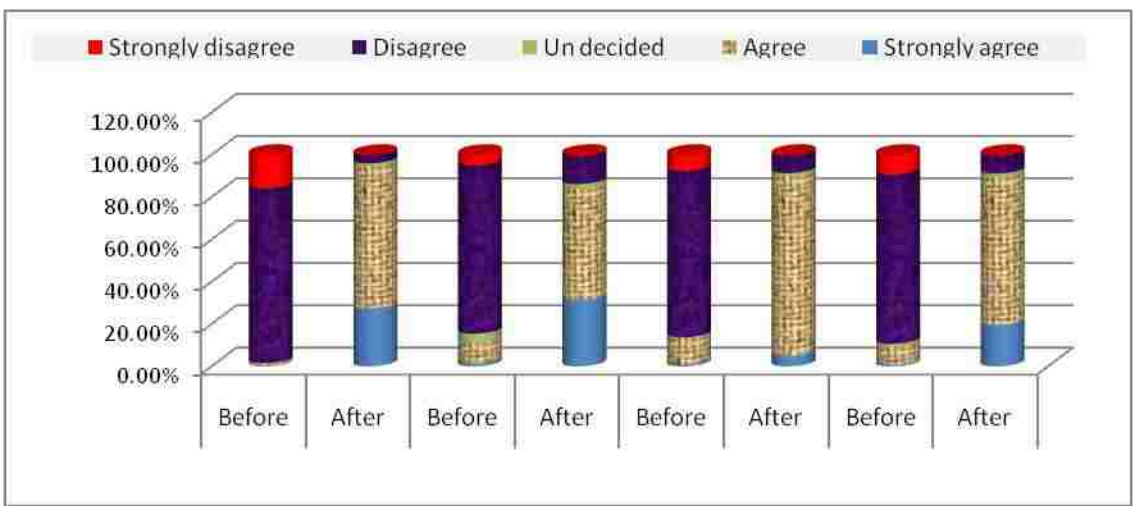


Figure 5. 8: Opinions of Households on Road Impacts of Market

Source: Computed by the Author based on field survey data, 2014.

5.7 Road Development Impacts on Accessibility of Market

The respondents were also asked to indicate the distance between their residence and the market they frequently use in terms of kms and minutes/ hours. The response was summarized in kms and the mean value of the change is calculated to be 21.44, 24.55, 7.44 and 15.19 percent which the significance level is indicated as NS, significant at p value less than 0.001, 0.01 and 0.01 for Corridor 1, 2, 3 and for all corridors respectively. For Corridor 2, as also confirmed by interviews and focus group discussions, the upgrading (pavement) of the road has created better opportunity for improving access to market. (Table 5.25)

Table 5. 25 : Residence to Market Distance (kms)

Corridors	Period	Mean value	Percentage change	T-value
1	Before	5.36	21.46	1.5(NS)
	After	4.21		
2	Before	3.87	24.55	4.76*
	After	2.92		
3	Before	6.59	7.44	2.68**
	After	6.1		
All	Before	5.4	15.19	3.36**
	After	4.58		

*NB: NS: Not significant, **: significant at $p < 0.01$, *: significant at $p < 0.001$,*
Source: Computed by the Author based on field survey data, 2014.

5.8Impacts of Road Development on Traffic Mobility

Under this subtitle, the results of traffic counts made in the three study corridors is described and analysed. Traffic count is a measurement of traffic volume, which helps to evaluate how busy a given track is. It is serves as the main indicator of mobility changes in case of both motorized and non motorized modes. It is one of the major variables used in impact analysis. Furthermore, it is also useful for policy makers in the areas of transport planning and engineering. The counting can be done automatically or manually. This study managed to manually count the traffic in the study corridors by hiring enumerators that were given orientation by the researcher that also closely supervised their work. The format was developed based on Kadiyali, 2006 and ERA (See Annex B5).

The survey had been undertaken in all three corridors of the study areas. The scope of the counting includes all motorized and NMT (excluding walking).The procedure of counting applied in all three corridors was the same. The results of three days which were counted from 6 am up to 6pm were divided by three days to know the average daily mobility.

5.8.1 Traffic Count of Corridor 1 (Gendewuha –Gelago)

The total length of this Corridor is 125 kms. The upgrading of the Corridor to gravel was completed in 2006 up to Gelago by the Amhara Regional State's Rural Roads Authority. The corridor is located in north-western part of Ethiopia. The survey at this Corridor had been executed at two strategic points. The first was at the exit of Gelago town to the Shinfa side and the second was at the exit of Shinfa town on Gendewuha side. The count was done from June 10 to 16, 2013 in two normal days and one market day. The total traffic count was 116 per day, of which motorized and NMT (carts and pack animals) accounted for 74 (63.8%) and 42 (36.2%), respectively. From motorized vehicles, the first rank goes to 4-WD cars (mainly Land Rovers and Land Cruiser types, which accounted for 18 (15.5%) followed by medium trucks that were 16 (13.8%). Regarding NMT, Corridor 1 is ranked the first in the use of carts among all corridors under study with 38 (32.8%) carts per day. As illustrated in Figure 5.9, their frequency between 8:00-9:00 am and 2:00-3:00 pm is very high.

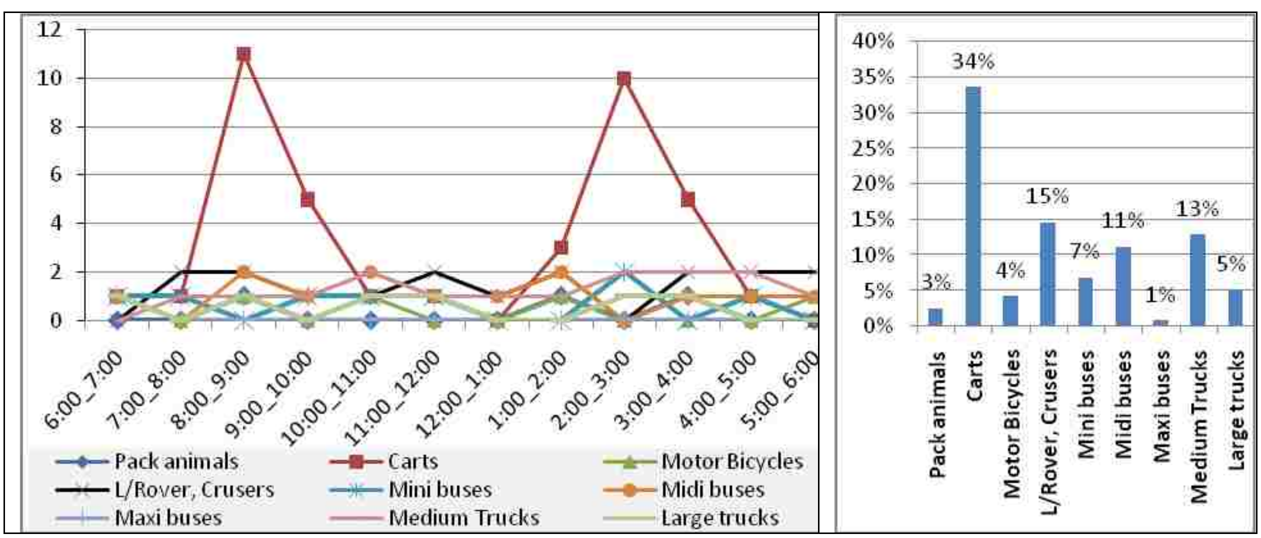


Figure 5. 9: Traffic Count of Corridor 1
Source: Computed by the Author based on field survey data, 2014.

5.8.2 Traffic Count at Corridor 2 (Mile - Weldya)

This study corridor has the longest distance (165 kms) as compared to corridors 1 and 3. It is located in the North-Eastern part of Ethiopia. The previous earthen road was gravel surfaced between 2000-2002, whilst the pavement was completed in 2010 by ERA. The highway connects major urban centres in the northern part of the country including Mekelle (Tigari), Weldiya (Amhara) with Mile (Afar) and extends up to Djibouti. The traffic count had been executed at three places. The first was in Mile near the outlet to Chifra (between April 14 and 17, 2014). The second point was at the exit of Chifra on the Hara side (between April 25 and 29, 2014) and the third was at Hara exit on the Weldiya side (between April 06 and 08, 2014).

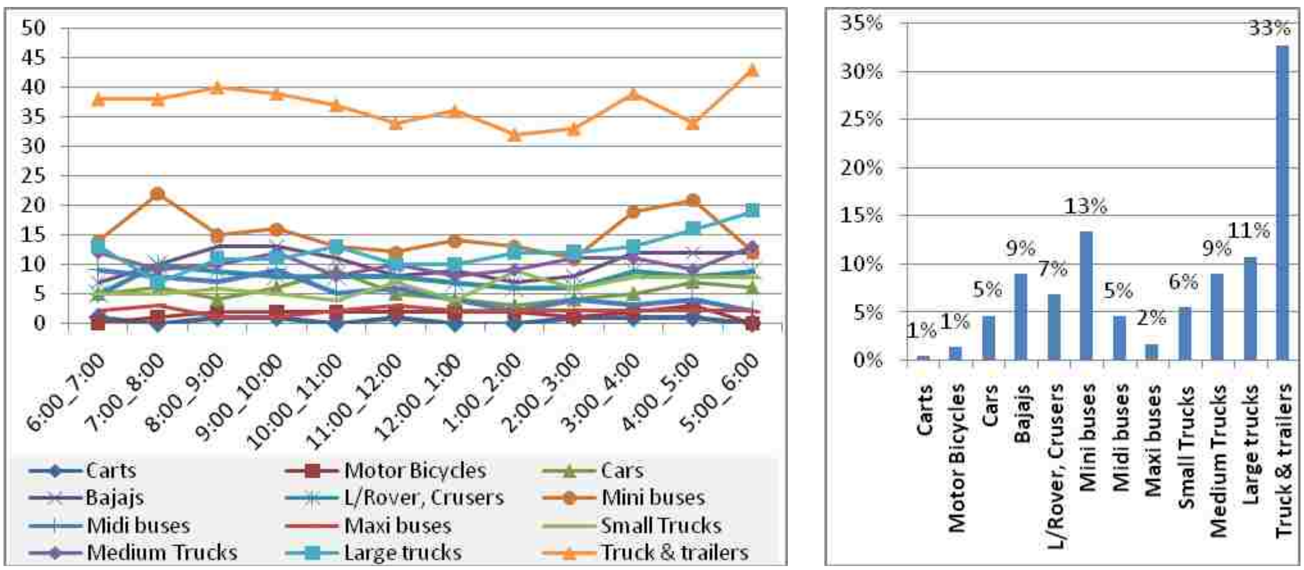


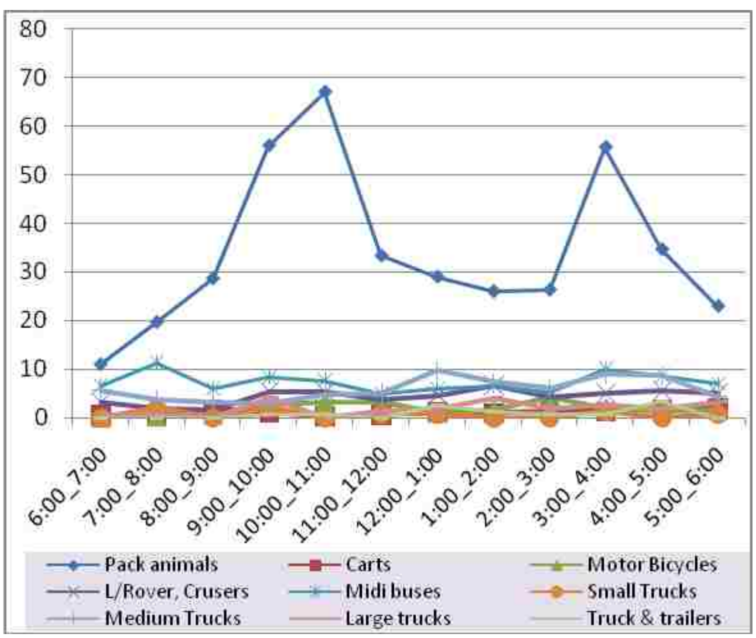
Figure 5. 10: Traffic Count Result of Corridor 2
Source: Computed by the Author based on the field survey, 2014.

The total traffic count recorded was 1,361 per day, of which almost all (99.5%) are found to be motorized. Out of the total daily traffic, 58.1percent are freight vehicles ranging from the ISUZU type midi- trucks up to large trucks, while they also include trailers (Figure 5.10 and Annex5.5). The modal count and share is calculated to be 443 (32.6%) for trucks and trailers, 182 (13.4%) for minibuses, 147 (10.8%) for large trucks, 123 (9%) for medium trucks, and 122 (9%) for bajas. Animal drawn carts mobility is insignificant except about 7 carts pr day in Chifra line. As illustrated in Figure 6.7, the frequency is very high for passenger vehicles among which mini buses dominate between 7:00-8:00 am and 4:00-5:00 pm.

5.8.3Traffic Count at Corridor 3 (Ginchi-Kachisi)

The total length of this Corridor, which is located west of Addis Ababa, is 105 kms. Its upgrading was completed in 2003 by the Oromia Region Rural Roads Authority. The traffic count had been undertaken at two strategic points. The first was at the exit of Shikute on the Gojo-Ginchi side, while the second was at the exit of Kachisi on Shikute side. The survey duration was from June 13- 17, 2014 and from July 10- 15, 2014 at Kachisi and Shikute exits, respectively.

The total daily traffic count was 519, of which 324 (62.4%) belong to NMT, while the rest 195 (37.6%) are motorized types. The modal count and share is 311 (59.9%) for pack animals, 57(11.0%) for medium trucks, 54 (10.5%) for midi buses, and 47 (9.1%) for four wheel drive vehicles such as Land Rovers and Land Cruisers.



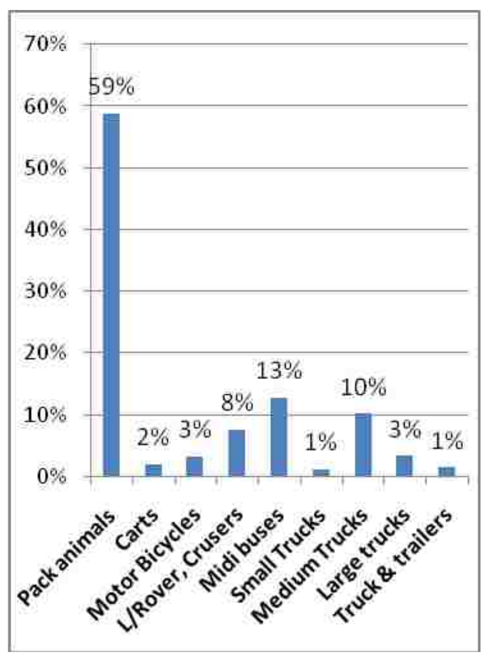


Figure 5. 11: Traffic Count of Corridor 3
Source: Computed by the Author based on field survey data, 2014.

Corridor 3, which is gravel surfaced, is located in a densely populated area and the most affordable means of transport used by the community is observed to be pack animals (104 times greater than the total pack animals of two Corridors (See Figure 5.10)

From the figure we can see that pack animals' peak hours occur between 10:00-11:00 am and 3:00-4:00 pm.

5.8.4 Explanations

- The data show that paved roads create special mobility patterns as compared to unpaved Corridors. In this regard Corridor 2 has 18 times greater motorized vehicles modal share than Corridor 1 per day. No automobiles and bajajs were registered during the traffic count undertaken in both unpaved roads.

- Despite its asphalt pavement, carts are not utilized in the Hara study area. This is because 95 percent of the paved road at Hara is elevated from the ground that does not provide any crossing for animal-drawn carts that might have come from different parts of the study area (FGD, 2014). Regarding Mile town, which is found along the main Addis Ababa Djibouti highway, the high traffic volume and traffic accidents along this route preclude the use of animal-drawn carts.

- After the Pavement of Corridor 2, the mobility of trucks was diverted from the Addis Ababa- Dessie – Weldiya Mekele highway which used to be the main route used by trucks. As highlighted during interview and FGDs, truck drivers prefer to use Corridor 2 despite the additional distance to be travelled as the Ababa- Dessie – Weldiya Mekele highway is sloppy and full of dangerous curves.

- Along Corridors 3, the road between Kachisi and Shikute is very sloppy and full of curves which is not preferred by minibuses and large trucks. As a result, passengers do not have any options other than using midi buses (about 37 seats) the majority of which are very old and in poor condition.

5.9 Conclusions

Chapter Five provided detail analyses on economic development indicators based on empirical data obtained from sample households in the three study corridors. Accordingly, keeping other factors constant, significant temporal and spatial changes were observed following road interventions in the study areas.

It is well known fact that investment to be made on roads is worth it provided the roads is put in to effective use. This is dependent on the extent to which road improvements result in: the provision of more efficient and effective transport services by modern vehicles (enhanced mobility); and increased opportunities for higher agricultural productivity, expansion of trade, employment creation, asset ownership, access to markets and saving and borrowing.

Compared to the baseline and the situation in COZs, the majority of economic variables employed in the models applied in this study have demonstrated the presence of positive economic impacts in the ZOI after the road interventions.

In the next chapter, attention is given to the analysis of the social impact of road development-related interventions in the three study road corridors.

CHAPTER SIX: SOCIAL IMPACTS OF ROAD DEVELOPMNT

As discussed in section 5.1, economic impacts in most cases are the results of direct processes and also make conduits for social impacts. Due to this, most social impacts are the results of indirect processes triggered by road interventions. Based on the GIS outputs generated using satellite imageries and the cross sectional data gathered from households, this Chapter discuses social impact indicators like changes in population and expansion of built up areas as well as issues related to poverty, education, health and gender. The analyses and comparisons made on temporal and spatial changes have been supported by maps, statistical graphs and tables.

6.1 Spatiotemporal Impacts of Road Development on Population

The main driving force of urbanization is the expansion of transport and the evolving population growth (Rui 2013). People shift their residence in search of better life as more facilities such as transportation and the accompanying innovations spawn urban areas. This subtopic depicts the spatial changes in population using base line data of CSA in 2007 and comparing it with the 2014 data obtained for selected corridors (Corridor 1 and 3 respectively). Similar assessment could not be done for Corridor 2, mainly because of confusing naming of *kebeles* before and after the road intervention particularly in Afar Regional State.

6.1.1 Corridor 1

Corridor 1 which is situated in Amhara Regional State has a length of 125 kms and traverses two *weredas* (Metema and Quara). For both *weredas* there are about 40 *kebeles*. In this study, only 28 *kebeles* that are within an air distance of around 20 kms from the road under study have been considered to see whether or not the population distribution trend in these *kebeles* is being pulled by the road intervention. The study zone is purposely widened to cover 20kms because of the sparse population distribution induced by the semi arid climate. The spatial extent of the boundaries of each *kebeles* is found to be very wide (Figure 6.1).

The total population of the 28 *kebeles* in 2007 was 136,072 (see the left side of figure 6.1). After seven years, the size of the population in these *kebeles* grew to 217,830 in 2014 (right side of Figure 6.1). The total percentage increase is 60 percent, which gives a growth rate of about 8.8 percent per year. In both maps the population density is more visible near the road but it is more visible in 2014.

Spatially, using the same population size class intervals (3000), *kebeles* such as Dibaba in Quara *wereda* and Gendewuha in Metema *wereda* that were within the maximum population interval (12001 – 15000) shown maximum black shade in 2007. But after seven years (2014) the range could grow to three fold (15001-24000) (See the map at the right side on Figure 6.1).

6.1.2 Corridor 3

Corridor 3 which is located in Oromia Regional State has a length of 105 kms and traverses four *weredas* (Dendi, Jeldu, Abuna Gindeberet and Gindeberet), which taken together have 167 *kebeles*. In this study, only 110 *kebeles* which are found within about 15 kms of air distance from the road under study had been considered to see whether or not the population distribution trend was pulled by the road intervention. The observation is also based on pre and post intervention periods. Accordingly, as illustrated in Figure 6.2, there were 408,885 people in 2007, which had increased to 502,811 people in 2014. This shows a percentage increase of 22.97 during the whole period (a growth by about 3.28% per year).

Spatially the maximum population per *kebele* was less than 12000 people in 2007, whereas in 2014 it could reach about 15,000. As shown in Figure 6.2, the population distribution is more concentrated near the road but very high in 2014

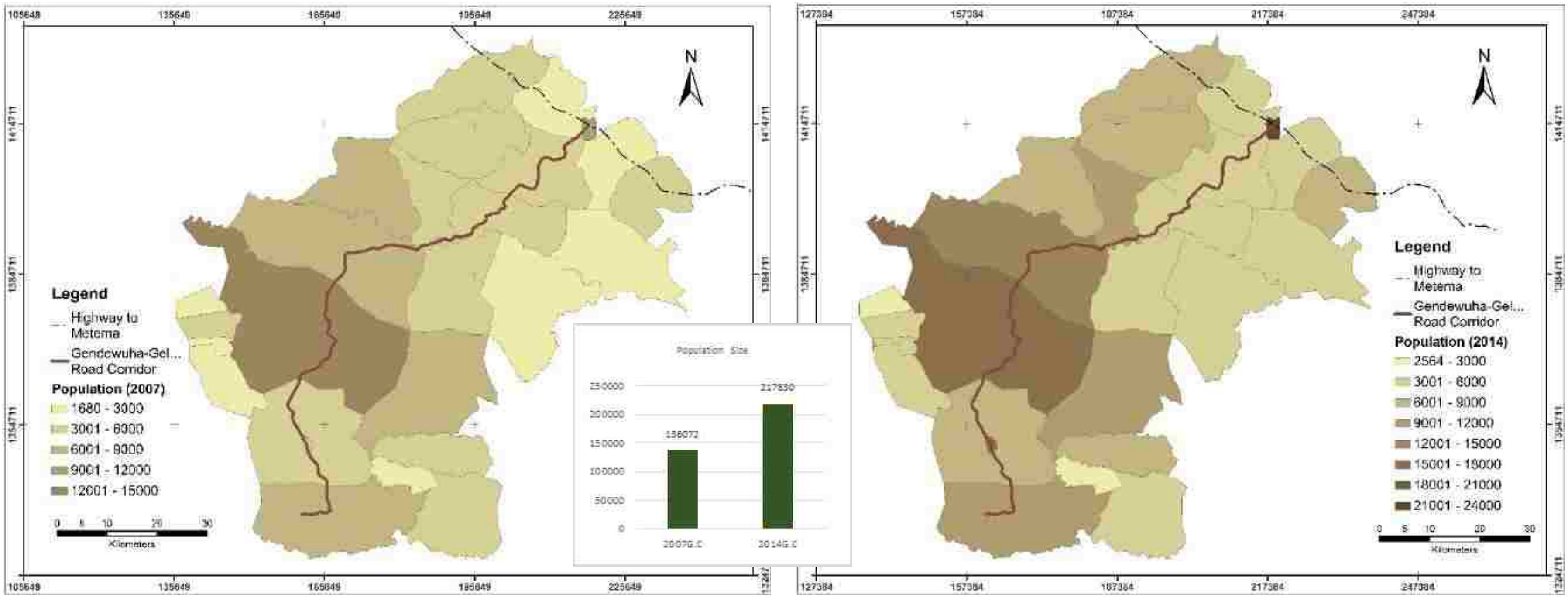


Figure 6. 1: Trend of Population Distribution in Corridor 1 in 2007 and 2014

Source: Analysis by the Author based on CSA 2007, and Metema and Quara weredas, 2014,

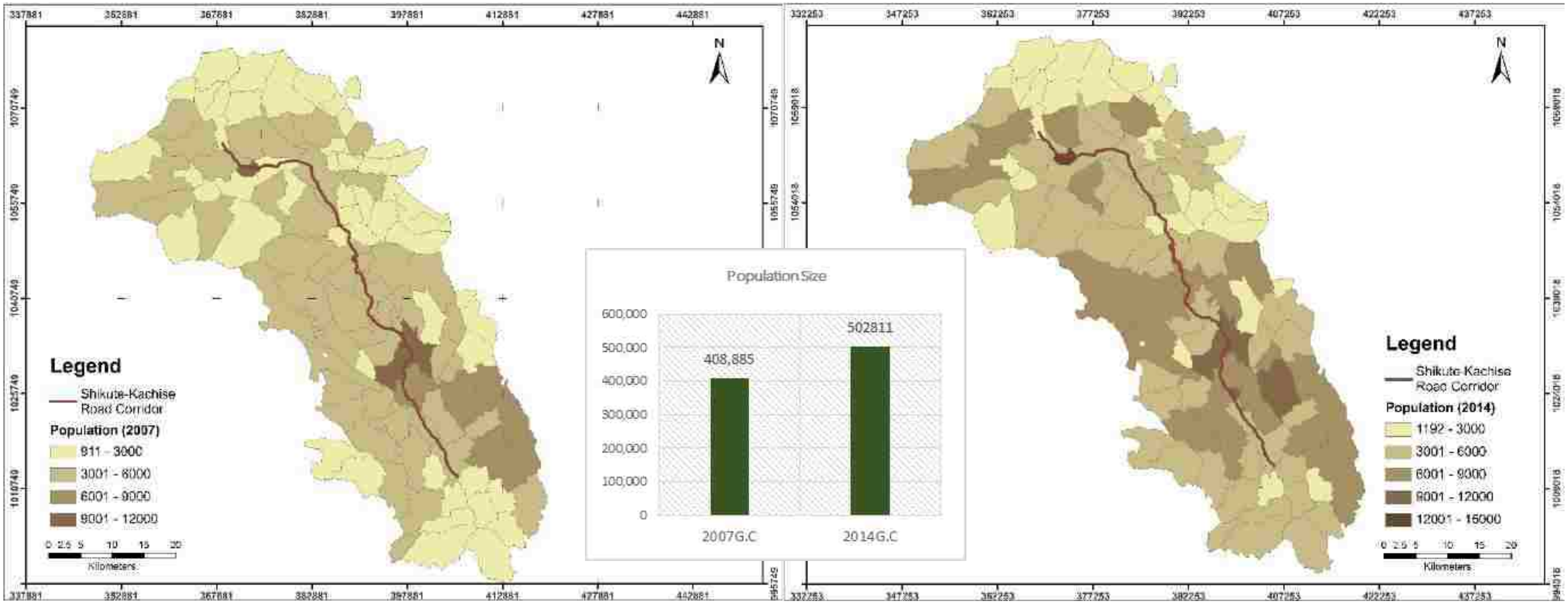


Figure 6. 2: Trend of Population Distribution in Corridor 3 in 2007 and 2014
Source: Analysis by the Author based on CSA 2007; Data Provided by weredas, 2014.

6.2 Spatiotemporal Impacts of Road Development on Settlement Expansion

Settlement study is one of the important examples of scientific approaches in geography (Christaller in Bradford 1987). It is obvious that urbanization and transport are interconnected concepts. Transport infrastructure is one of the most important driving forces in the attraction of population and leads to urbanization and suburbanization (urban sprawl) along with economic development and technologies (Rui 2013). Rodrigue *et al* (2012) also contends that though transport is an important component in rural spatial organization, it is at the urban level that transportation has the most significant local spatial impact. According to him with the facilitation of transportation, local areas continue to benefit from various opportunities. The main study of central place theory is also about spatial organization of settlement; there is a certain hierarchy of services within an urban area ranging from the CBD offering diversified basic services to small local centres. In the following subtitles spatiotemporal changes that have occurred in the study highways have been shown using GIS analysis. The SPOT and Google Earth imageries utilized in the study were obtained from the Ethiopian Mapping Agency (EMA) and the Institute of Network Security Agency (INSA), respectively. The analysis in this section also compares the changes in the settlement pattern in the paved and unpaved roads of Corridor 2 and Corridor 3, respectively. To bring Corridor 1 into comparison INSA and EMA could not find the SPOT or the imagery maps of Gelago and Gendewuha routes.

6.2.1 Settlement Expansion in Chifra and Hara Study Centres in Corridor 2

6.2.1.1 Chifra Study Area

Time series data extracted from the satellite imageries of the study area employing GIS are indicated in Annex 6.1-6.3 and the summary of spatial change is illustrated in Figure 6.3. The result shows that the spatial structure of Chifra study area is affected by road development and distance from the road. That means, the lower the distance, the higher is the settlement density. In 2006 (when the road under study was of gravel), the built up area had only 29.8ha. After five years, it expanded to 53.2ha (an increase of 78.5%).This shows that the expansion rate was about

17.7 percent per annum. Such growth is expected because, the road pavement is completed at the end of 2010 and people could use the new opportunities engendered by the road intervention, particularly towards the direction of Mile (north east of Chifra town). During the following two years (in 2012 and 2013), the growth was not so rapid as before (from 53.2 to 54.27 ha), which shows only one percent growth rate per annum (See the spatial change from Figure 6.3.) The rate of expansion is slow because of the peak time had already passed.

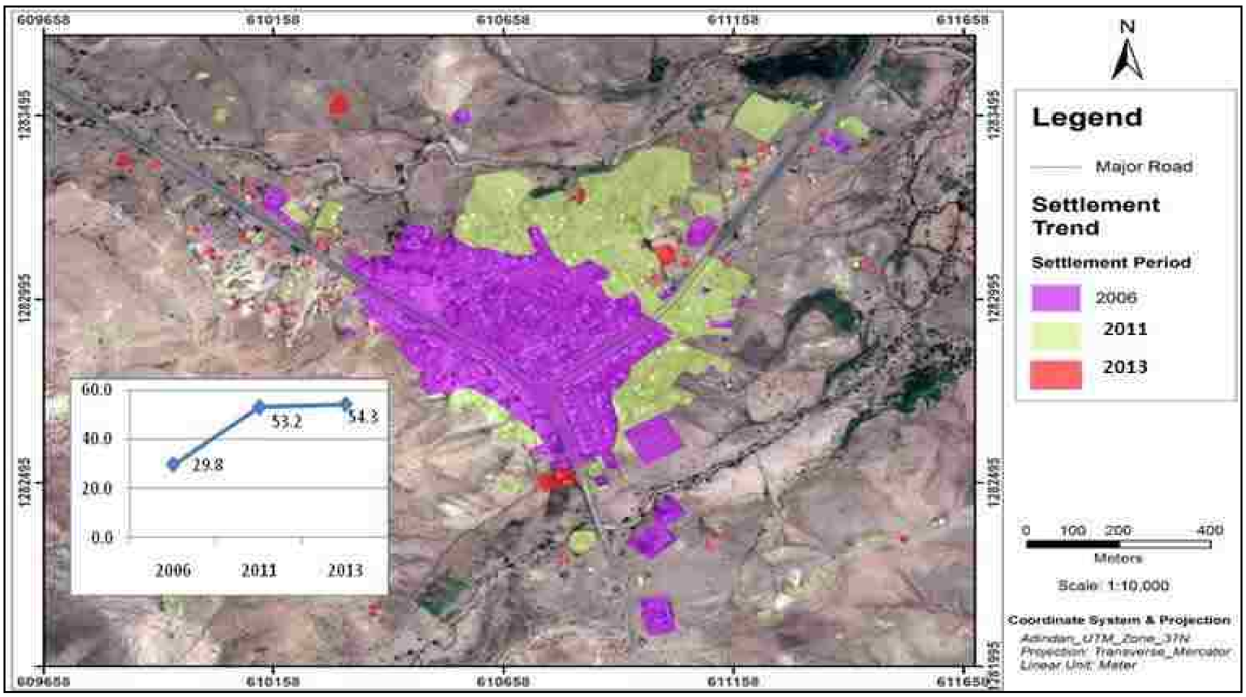


Figure 6. 3: Settlement Trend of Chifra Town between 2006 and 2013(ha)
Source: Own analysis, based on satellite imageries obtained from EMA and INSA.

6.2.1.2 Hara Study Area

As explained in section 5.1.2, the Hara study highway had gravelled road in 2006. The SPOT Imagery map of 2006 shows that the built up area during this time was 63.0 ha. After four years, the area had expanded to 81.6ha (a total increase of 29.5%).The rate of settlement expansion was about 7.4 percent per annum, which is less than the changes in Chifra. During the next four years (2011-2014), the growth was not so rapid as before (changed from 81.6 to 85.7ha). This is a growth rate of about 1.3percent per annum, which is slightly higher than Chifra (See the spatial change from Figure 6.4). As illustrated in the same Figure, the settlement expansion of Hara in

2010 was not generally following the highway line. According to interviews and FGDs, the main reason for this state of affairs is that the paved road is elevated from the ground level and thus it does not that much attract people to settle near the right-of-way of the route. The main fact considered is the need to save their children, aged family members, domestic animals and homes from transport related and other accidents that might arise.

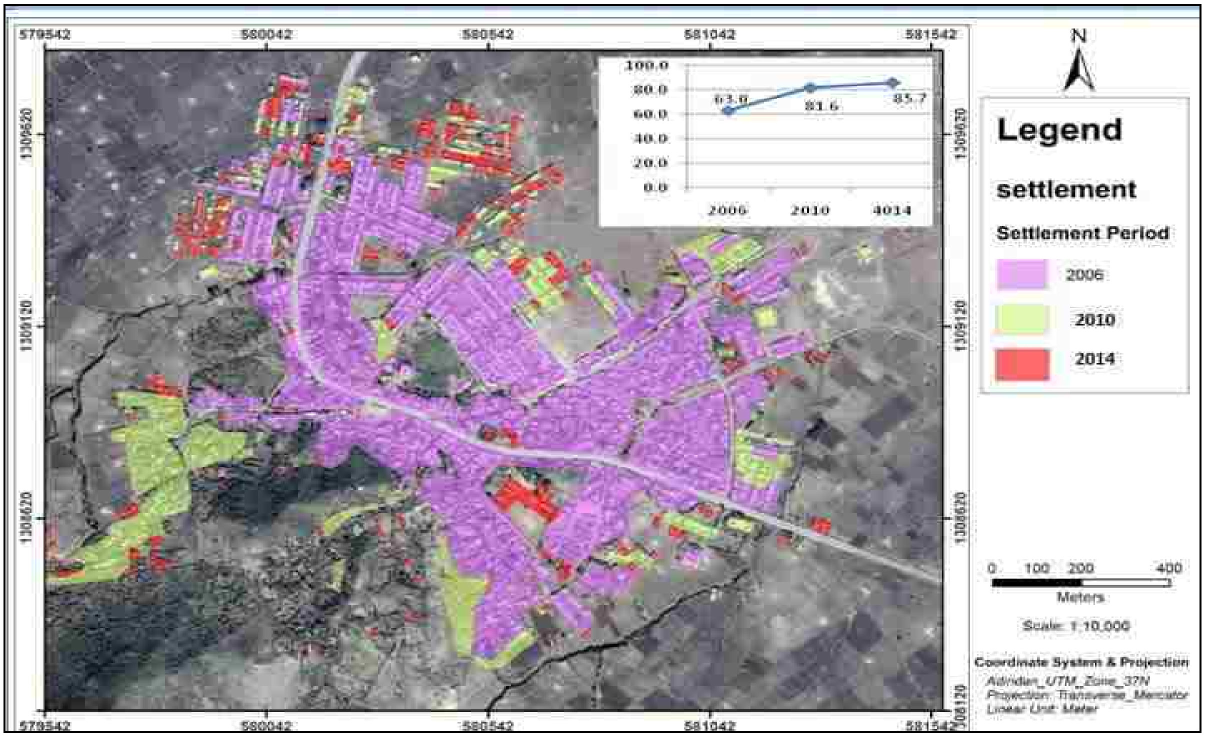


Figure 6. 4: Settlement Trend of Hara Town between 2006 and 2014

Source: Own Analysis based on satellite imageries obtained from EMA and INSA

In summary, the settlement in Chifra study highway had been expanded by 82.1 percent between 2006 and 2013, which gives an average growth rate of 11.7 percent per annum during the last seven years. The percentage increase of the settlement expansion in Harra study highway is 36.0 percent between 2006 and 2014 and this shows 4.5 percent average growth rate per annum during the last eight years. The average annual growth rate for Chifra is 2.6 times greater than that of Hara, although the size of the built up area in Hara is 1.6 times greater than Chifra. This may be due to the fact that the hinterland of Hara town, which also has better connectivity with nearby towns, is more productive than Chifra which is characterized by harsh climate.

6.2.2 Settlement Expansion in Shikute and Kachisi Study Areas in Corridor 3

6.2.2.1 1Shikute Study Area

As indicated in Figure 6.5, the Shikute study area is located along a gravel surfaced highway. The discussion is based on two satellite images taken in 2006 and 2014 that are the only maps available. The Google Earth map of 2006 shows that the built up area was 65ha. After eight years, the area expanded to 71ha (a total increase of 9.2%), which gives an average growth rate of about 1.15 percent per annum. This growth is less than the change that took place both in Chifra and Hara (See Figure 6.5). As described in section 5.1.3, the earthen road had been upgraded to gravel surface between 1998 and 2003. Therefore, the peak of the settlement's expansion must have already occurred before 2006. That is probably why new settlement expansion near the study line is scantly in recent years. As explained in section 1.6.3 (Chapter One and as Figure 1.6), this corridor is suffering from absence of frequent maintenance and further upgrading. Although it experienced drastic expansion before 2006, it has been observed that the changes are very slow during the last eight years.

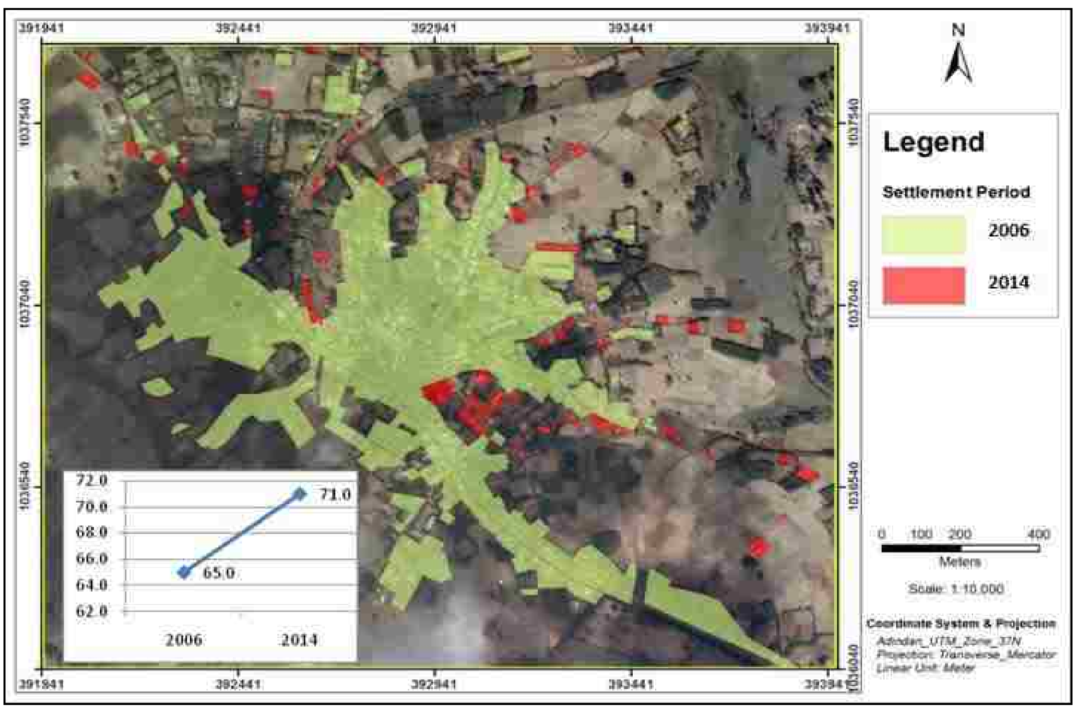


Figure 6. 5: Settlement Trend of Shikute Town between 2006 and 2014

Source: Own Analysis based on satellite imageries obtained from EMA and INSA.

5.2.2.2 Kachisi Study Area

Kachisi town is the capital city of Gindeberet *wereda*, which is found to be with the largest extent of built up areas as compared to the other centres under study. Like Shikute centre, the discussion for Kachisi is also based on satellite imagery maps obtained for 2006 and 2014. The SPOT Imagery map puts the built up area in 2006 at 159.36ha. After eight years, it has expanded to 173.21ha (a total increase of 8.6%), which gives an average growth rate of about 1.1 percent per annum and is slightly less than that of Shikute centre. This is due to the fact that Kachisi is located in a remote area that does not attract people to settle in the area. During the survey time, it was observed that many houses constructed by farmers at the outskirts in anticipation of opportunities of potential roads improvement remain without any service. Such growth is less than what has occurred in those study areas located along paved roads (Chifra and in Hara). The spatial growth trends are shown in Figure 6.6. As described in section 5.1.3, the earthen road of Corridor 3 had been changed into gravel surface at the end of 2003. Therefore, as explained for Shikute above, the peak of the settlement expansion must have already occurred before 2006.

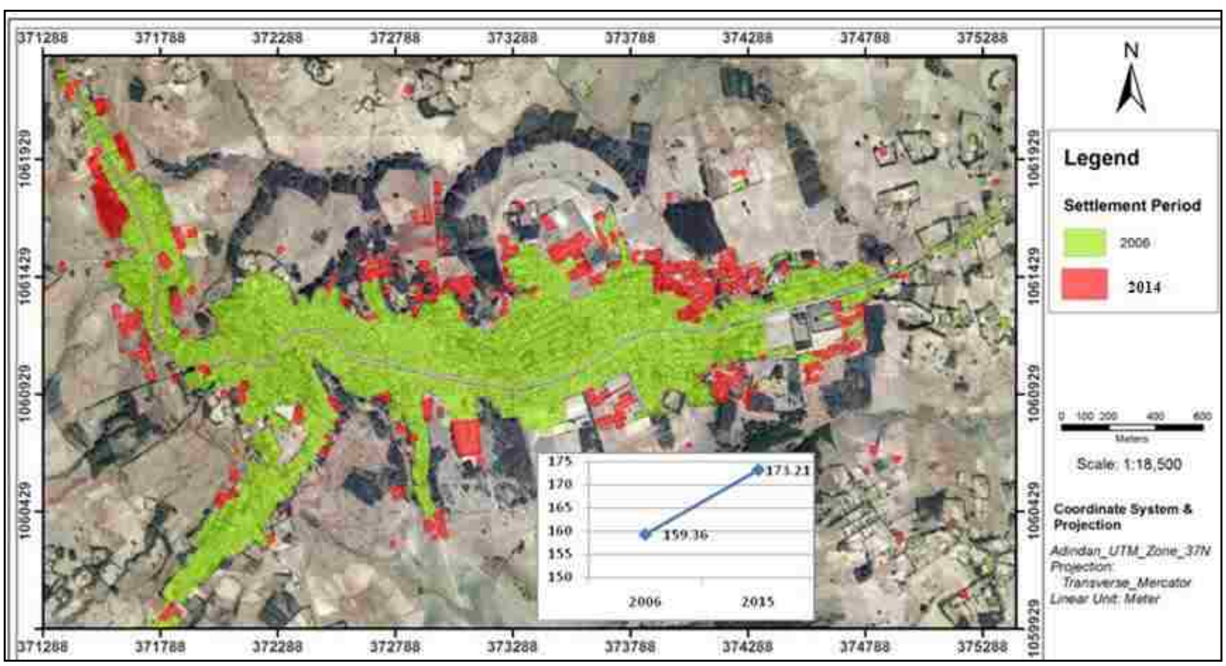


Figure 6. 6: Settlement Trend of Kachisi Town between 2006 and 2014
Source: Own Analysis, based on satellite imageries obtained from EMA and INSA.

6.2.3 Summary of Settlement Expansion

Taking the SPOT map of 2006 as the base line and satellite imagery form Google Earth (through INSA) for the follow up time, the settlement trend has been computed as shown in Figure 6.7. Keeping many other variables constant, the settlement expansion trend shows that Chifra and Hara towns with paved road penetration had the fastest settlement expansion, whereas, Shikute and Kachisi study centres of gravel road had performed slow growth rate during the last eight years.

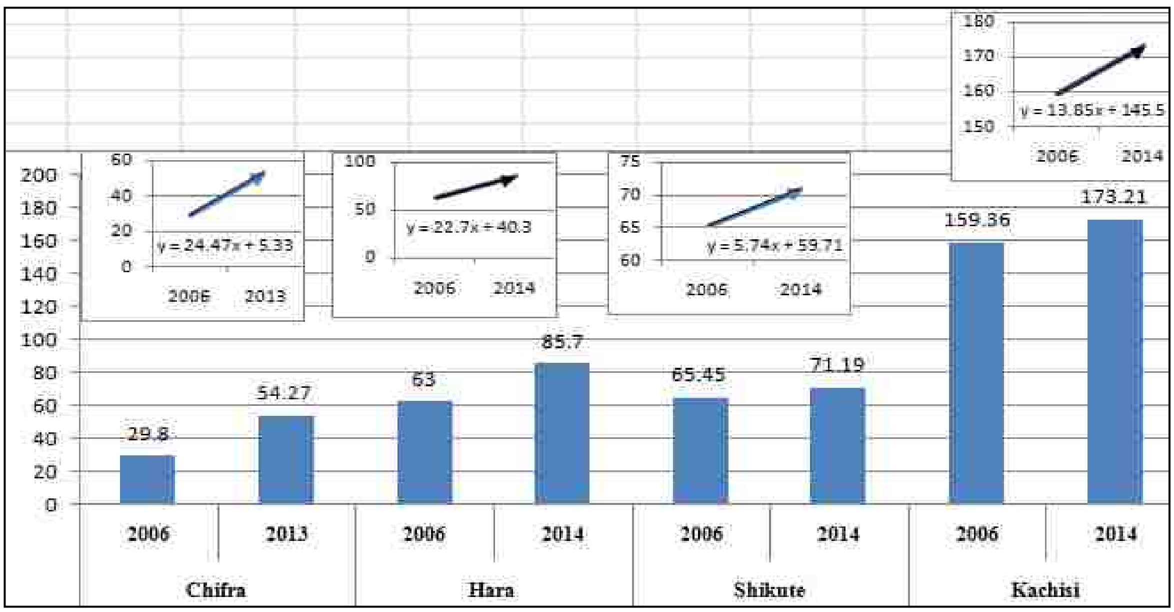


Figure 6. 7: Summary of Settlement Expansion (hectares)
Source: Computed by the Author, based on satellite imageries obtained from EMA and INSA.

6.3 Impact of Road Intervention on Poverty

Theory of change supports that road development reduces poverty. To proof this theoretical argument, households in the study areas had been asked questions related to housing, nutrition, and clothing. Income, which is one of poverty related indicator, is already discussed in Section 5.3

6.3.1 Road Development Impacts on Housing

6.3.1.1Type of Houses Constructed

In Africa in general and in Ethiopia in particular, the roof type of a house is said to be one of the indicators of a household's social status. Compared to the situation before the road intervention, the proportion of houses with thatched roof in the study corridors have *decreased* from 47.33 to 28.51 percent for ZOI, and from 47.65 to 27.27 percent for COZ (Figure 6.8). While those covered with corrugated iron roofing have *increased* from 45.68 to 65.06 percent for ZOI and from 38.26 to 58.04 percent for COZ. This change is more marked in those corridors in Oromia (at Shikute and Kachisi study highways) and Amhara (at Hara, Gelago and Shinfa study highways). Figure 6.8 depicts a photograph of corrugated iron roofing dominated expansion that has taken place in Kachisi.. The roofing type in the study corridor located in Afar region is found to be mixed, although the thatched roofed ones are dominant.

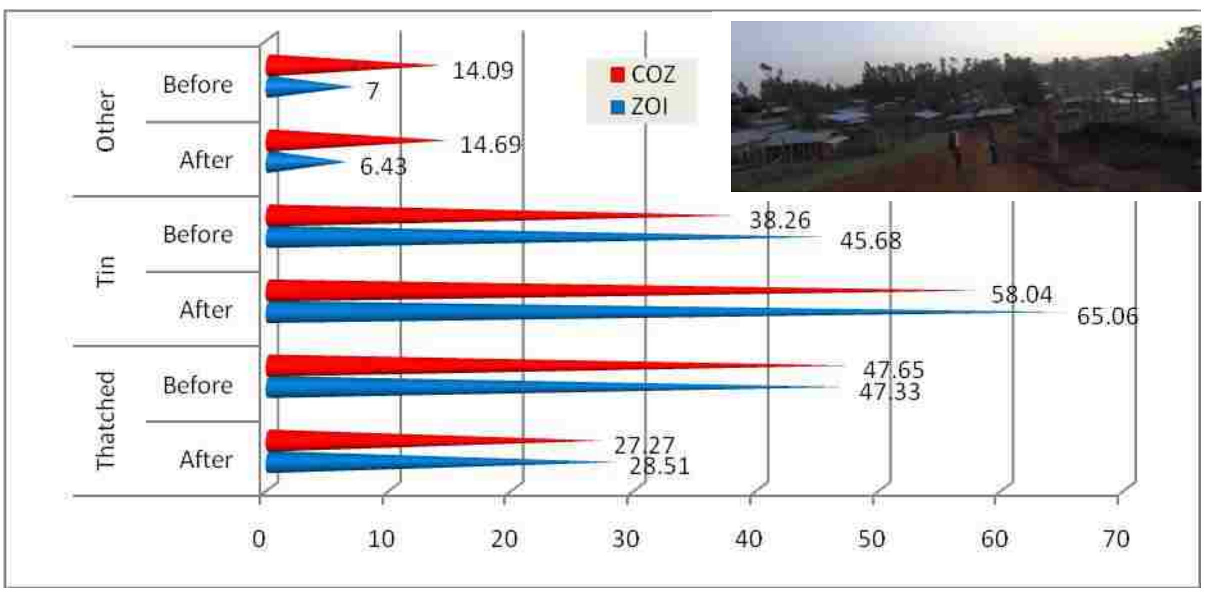


Figure 6. 8: Distribution of Housing Units in the Study Corridors (%) by Roofing Types
Source: Computed by the Author based on field survey data, 2014.

To check whether changes between the "before" and "after" situations are significant, paired sample t test for thatched = 1 and corrugated iron = 2 roofs has been undertaken and the result is summarized in Table 6.1 below**.** Accordingly, the level of significance is compared between ZOI and COZs for all three corridors. Keeping other factors constant, the p value result shows the existence of a strong difference between the "before" and "after" situation for ZOI than COZs. The difference is found to be the highest in Corridor 1 followed by Corridor 3. The cumulative result also shows the presence of a very high difference (i.e., change from thatched to corrugated iron roofing) as a result of the road intervention.

Table 6. 1: Results of Paired Sample T Test for Distribution of Houses by Roof Type

Corridors	**Period**	**Mean value**			**Percentage change**			**T-value**		
		ZOI	**COZ**	**Both**	**ZOI**	**COZ**	**Both**	**ZOI**	**COZ**	**Both**
1	Before	1.16	1.02	1.11						
	After	1.55	1.16	1.41	33.62	13.73	27.03	6.3*	2.6**	6.65*
2	Before	1.84	2.16	1.95						
	After	1.87	2.21	1.98	1.63	2.31	1.54	1.4(NS)	1.76***	2.03**
3	Before	1.73	1.76	1.75						
	After	1.98	1.98	1.98	14.45	12.50	13.14	5.9*	3.55**	6.7*
All	Before	1.61	1.63	1.62						
	After	1.83	1.77	1.81	13.66	8.59	11.73	-8.3*	-4.6*	-9.32*

NB: Significant at 0.01 p value, ** significant at 0.05 p value; *** significant at 0.10 p value*

Source: Computed by the Author based on field survey data, 2014

6.3.1.2 Materials Used in the Construction of Houses

With regard to the materials used in the construction of the main structures of housing units in the study areas, the majority are built with wood and mud both before and after the road intervention. Some changes had occurred in type of construction materials used as illustrated in Figure 6.9. Construction with wood and mud in ZOI had declined from 91 to 87 percent, whereas the use of stones and hollow concrete blocks had increased from 2 to 4 percent and from 1 to 2 percent, respectively. In case of COZ, construction using wood and mud exhibited a slight reduction from 92 to 90 percent. In all the study corridors, wood and mud construction had declined from 91 to 88%, while construction using stone increased from 1 to 3 percent.

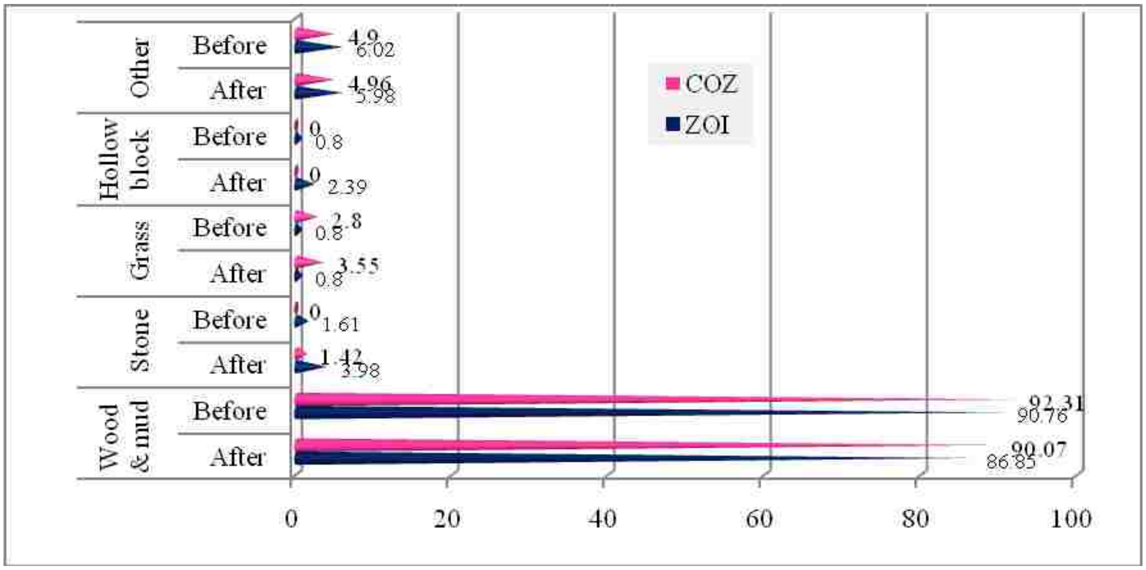


Figure 6. 9: Distribution of Housing Units in the Study Corridors (%) by Types Material Used in their Construction
Source: Computed by the Author based on field survey data, 2014.

6.3.2. Meal Consumption per Day

Another issue considered as part of the social impact of road interventions is the nutritional status of households in the study areas. One of the questions posed to respondents was *"How many meals do your family members get per day?"* As illustrated in Figure 6.10, out 392 households, about 59.7 percent were getting meals three times a day before the road intervention, whilst this figure had increased to 71.2 percent after the road intervention. A spatial comparison shows that 64.9 percent of the households in the ZOI were getting meals three times per day before the road intervention, which increased to 77 percent after the intervention. Whereas, the corresponding proportion in the COZs was 49.2 and 59.4 percent, respectively.

From all corridors' cumulative result, one can understand that after road intervention households were getting higher average number of meals per day than before road intervention. Similarly, after the road intervention, those households who live near the road (ZOI) were getting 1.3 times higher than households away (COZs) from the study road.

Corridor wise, the proportion of households who enjoy three meals per day after road intervention are dominant in Corridor 1 (90.4%), followed by Corridor 2 (73.1%) and Corridor 3 (55.7%). Although Corridor 3 is the lowest in terms of the proportion of households having three meals per day, the change after the road intervention is the highest as compared to other study areas. The proportion of households that were getting three meals per day before intervention was 27.2 percent, which increased to 55.7 percent after intervention. From the graph and Annex 6.6 we can conclude that the number of meals households consume per day has exhibited positive temporal and spatial changes except in case of those households in some parts of Corridor 2 (Afar and Surrounding).

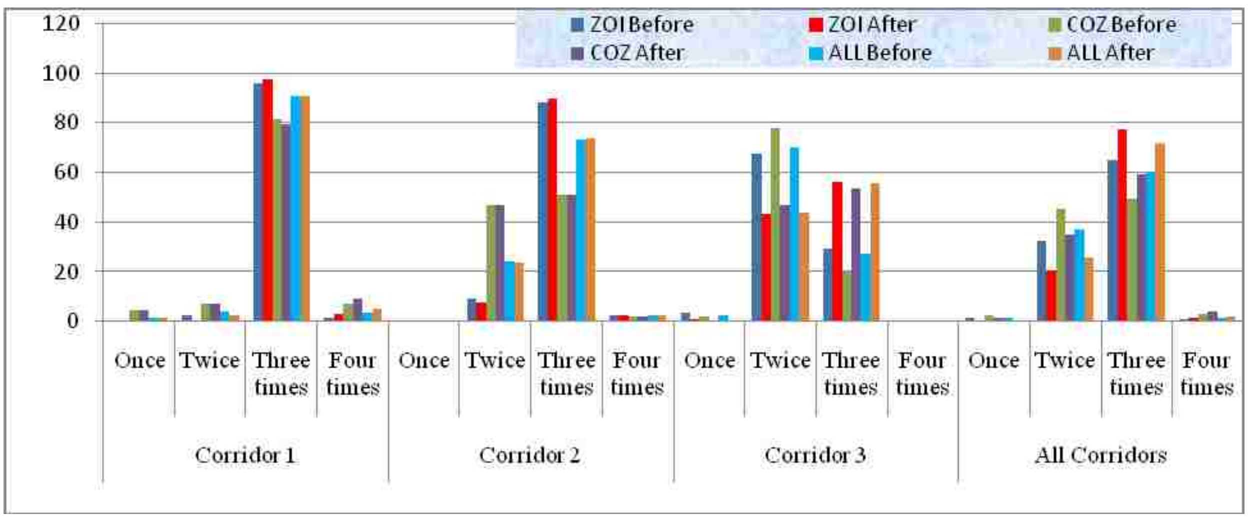
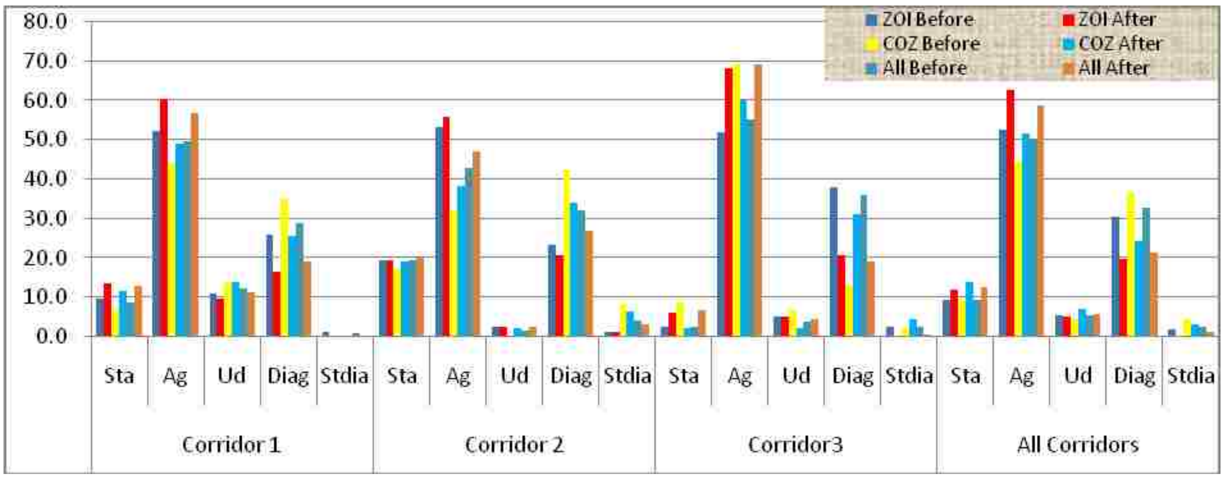


Figure 6. 10: Proportion of Households by Number of Meals Consumed per Day in the Study Corridors
Source: Computed by the Author based on field survey data, 2014.

6.3.3. Variety of Food Consumed

Respondents were asked to indicate the variety of foods they consume based on a Likert scale. Positive options (strongly agree and agree answers) are added together and defined as agreed in this explanation. As illustrated in Figure 6.11 and Annex 6.6, the temporal change shows that about 59.1 and 71.5 percent of the households were getting more diversified food before and after the road intervention, respectively. From spatial variation standpoint, 61.9 and 74.7 percent of the respondents in ZOI indicated that they were getting more diversified food before and after the road intervention, respectively. Whereas the respective change in the COZ is indicated to be from 53.9 to 65.7 percent.



*NB: **Sta**= Strongly agree; **Ag** = Agree; **Ud**= Undecided; **Diag**=Disagree; **Stdiag**= Strongly disagree*

Figure 6. 11: Use of Variety of Food by the Households in the Study Corridors

Source: Computed by the Author based on field survey data, 2014.

Corridor wise: the temporal change is very high in Corridor 3 followed by Corridor 1. The proportion of respondents who agreed and disagreed (summed) before and after the road intervention are 57.6 and 76.0 percent for Corridor 3; 58.3 and 69.5 percent for Corridor 1 and 62.2 and 67.3 percent for Corridor 2 respectively. The change is found to be the biggest in Corridor 3, which is not so remote as compared to the other two corridors. Moreover, the agro-climatic condition of the study area is suitable for the production of various kinds of agricultural products (crops, fruits, vegetables and livestock) must have allowed the diversification of local food production. In addition, although the road intervention in Corridor 3 took place several years ago as compared to the other roads and it had not been upgraded so far, the road offers the possibility to import various kinds of food items from other surplus producing areas.

In conclusion, the proportion of households who are consuming more diversified food items is found to be high after intervention than before and at ZOI than COZ in all the study corridors (except in COZ of Corridor 3).

6.3.4. Children's Access to Full Diet

Households had been asked whether their children are getting full diet (like milk, egg, vegetables etc.) before and after the intervention. As illustrated in Table 6.2, the changes in dietary pattern is 8.03, 5.66 and 7.07 percent which is significant at P value of less than 0.001, 0.01 and 0.001 for ZOI, COZ and for both zones, respectively.

Corridor wise, the change is very high in Corridor 1 with the respective change of 15.09, 10.14 and 13.29 percent, which is found to be significant at P value of less than 0.001, 0.01 and 0.001. Therefore, as indicated in Table 6.2, the change in dietary patterns is low in COZs as compared to ZOI.

Table 6. 2 : Status of Children Getting Full Diet

		Mean value			Percentage change			T-value		
Corridors	Period	ZOI	COZ	Both	ZOI	COZ	Both	ZOI	COZ	Both
1	Before	1.45	1.60	1.50	-15.09	-10.14	-13.29	4.5*	2.86**	5.34*
	After	1.23	1.44	1.30						
2	Before	1.53	1.8085[a]	1.64	-4.24	0.00	-2.57	2.3(NS)	_	2.28***
	After	1.47	1.8085[a]	1.60						
3	Before	1.63	1.58	1.61	-6.88	-8.45	-6.30	3.81*	2.21***	3.94*
	After	1.52	1.44	1.51						
All	Before	1.55	1.66	1.59	-8.03	-5.66	-7.07	6.13*	3.33**	6.86*
	After	1.43	1.56	1.47						

*NB: NS: Not significant, ****: significant at p < 0.1, ***: significant at p < 0.05, **: significant at p < 0.01, *: significant at p < 0.001,*

Source: Computed by the Author based on field survey data, 2014

6.3.5. Family Members with Pair of Shoes and Proper Clothing

Household heads were also asked whether they had pair of shoes before and after the road intervention. According to the mean value of the responses, there is a change of 10.26, 9.33 and 9.58 percent for ZOI, COZs and for both zones, respectively, and the result is significant at P value of less than 0.001.

Corridor wise, the change is very high in Corridor 3 with the respective change of 15.94, 19.64 and 16.40 percent for ZOI, COZs and for both zones, respectively, which is significant at P value of less than 0.001. All corridors exhibited positive change except Corridor 2 where the impact might not be necessarily due to road development.

Similarly, household heads were asked to indicate the number of family members with pair of shoes before and after the road intervention. The mean value change shows 31.73, 40.66 and 34.61 percent for ZOI COZs and for both zones, respectively.

Corridor wise, the change is found to be very high in Corridor 3 followed by Corridor 1. The respective mean value change for Corridor 3 is 48.50, 67.55 and 53.56 where as for Corridor 1 it is 32.65, 45.80 and 37.33 percent for ZOI, COZs and for both zones, respectively.

From the above explanation, we understand that shoe wearing at family member level exhibited faster change in COZs than ZOI in all of the study corridors. A rapid change in the extent of wearing shoes could not be observed in ZOI since the majority of family members were already wearing shoes even before the road intervention.

Apart from shoe wearing, households were asked to indicate as to whether they were wearing better clothing to protect themselves from heat and cold before and after the road intervention. Accordingly, the change in the mean value between the " before" and "after" situation is found to be 2.07, 4.55 and 2.74 percent for ZOI, COZs and for both corridors, respectively, which is significant at P value of less than 0.05.

Corridor wise, the change is found to be very high for Corridor 1 followed by Corridor 3. The respective mean value change is 5.68, 5.26 and 5.59 percent for Corridor 1 and 1.58, 9.21 and 2.74 percent for Corridor 3 in ZOI, COZs and in all zones, respectively. In terms of better clothing fast change is expected in COZs. Due to economic changes and cultural changes (demonstration effect) people residing far from the study roads have more propensity to improve their clothing and this is found to be especially true for Corridor 3 and Corridor 2 which are found to be significant at P values of less than 0.01 and 0.001, respectively.

Table 6. 3: Status of Family Members in Terms of Wearing Shoes and Better Clothing

i) Household Heads who wear shoes (Yes = 1, No = 2)										
Corridors	**Period**	**Mean value**			**Percentage change**			**T-value**		
		ZOI	**COZ**	**Both**	**ZOI**	**COZ**	**Both**	**ZOI**	**COZ**	**Both**
1	Before	1.15	1.23	1.18	-11.90	-9.43	-11.03	3.38**	2.35***	4.14*
	After	1.01	1.12	1.05						
2	Before	1.05	1.04	1.04	1.24	4.08	2.42	-1(NS)	-1.43(NS)	-1.75****
	After	1.06	1.09	1.07						
3	Before	1.19	1.24	1.20	-15.94	-19.64	-16.40	5.19*	3.77*	6.19*
	After	1.00	1.00	1.00						
All	Before	1.14	1.17	1.15	-10.26	-9.33	-9.58	5.71*	3.44*	6.45*
	After	1.02	1.06	1.04						
ii) Number of family members who wear shoes										
1	Before	3.36	3.05	3.26	32.65	45.80	37.33	-6.71*	-5.92*	-8.97*
	After	4.45	4.44	4.48						
2	Before	4.84	4.53	4.80	10.45	15.96	11.38	-2.63***	-3.56**	-3.84*
	After	5.35	5.26	5.34						
3	Before	4.03	4.18	4.09	48.50	67.55	53.56	-9.54*	-6.15*	-10.93*
	After	5.99	7.00	6.28						
All	Before	4.08	4.02	4.06	31.73	40.66	34.61	-10.74*	-7.9*	-13.31*
	After	5.37	5.65	5.47						
iii) Family members with better clothing to protect from heat and cold(Yes = 1, No = 2)										
1	Before	1.21	1.33	1.24	-5.68	-5.26	-5.59	2.3**	1.77****	2.92**
	After	1.14	1.26	1.17						
2	Before	1.4286[a]	1.68	1.51	0.00	169.61	0.56	_	-7.21*	-0.45(NS)
	After	1.4286[a]	4.53	1.52						
3	Before	1.64	1.69	1.65	-1.58	-9.21	-3.46(NS)	0.52(NS)	2.85**	1.45(NS)
	After	1.61	1.53	1.59						
All	Before	1.46	1.55	1.49	-2.07	-4.55	-2.74(NS)	1.3(NS)	2.37(NS)	2.23***
	After	1.43	1.48	1.45						

*NB: NS: Not significant, ****: significant at p < 0.1, ***: significant at p < 0.05, **: significant at p < 0.01,*
**: significant at p < 0.001,*
Source: Computed by the Author based on field survey data, 2014.

6.4 Impacts of Road Development on Access to Education and Literacy

Some of the social and economic development issues associated with road improvement interventions include among others access to education (Patarasuk, 2014). As discussed in Chapter Four, Ethiopia has been implementing RSDP since 1998. Likewise, Education Sector Development Programme (ESDP) has been under implementation, whilst the third ESDP had commenced in 2006. Since then, as mentioned in a report prepared by Egis International and Urbalyon (2014:80), due to improvements in road infrastructure, improvements had been achieved in terms of school accessibility and distribution (4.9%), students' enrolment (3.0%) and number of teachers (6.7%) during the last five years (2009-2013). The analysis in this section is based on secondary and primary data obtained from *weredas* (districts) and households. Out of the three corridors under study, the *kebele* level time series data obtained from Corridor 2 was not complete. Therefore, spatiotemporal analyses and comparisons of changes in the distribution of schools by using GIS software could only be done for Corridor 1 and Corridor 3. The accessibility of each school had been analyzed, however, by using cross sectional data gathered from all three corridors.

6.4.1. Changes in Access to School Facility, Corridor 1

In this Section, a similar mapping procedure employed in Section 5.2.1 is utilized to check changes in the distribution of schools. Accordingly, based on the data obtained from the *weredas* in 2014 and illustrated in the GIS output (Figure 6.12), 11 *kebeles* had no school before 2006, but after 2006, it could be only two *kebeles* (Yakaho and Bermel) which had no schools.. In other words, the number of schools within an air distance of about 20kms from the road before 2006 was 50, but after 2006, the trend could rise to 71 schools (a growth by about 4.2%).

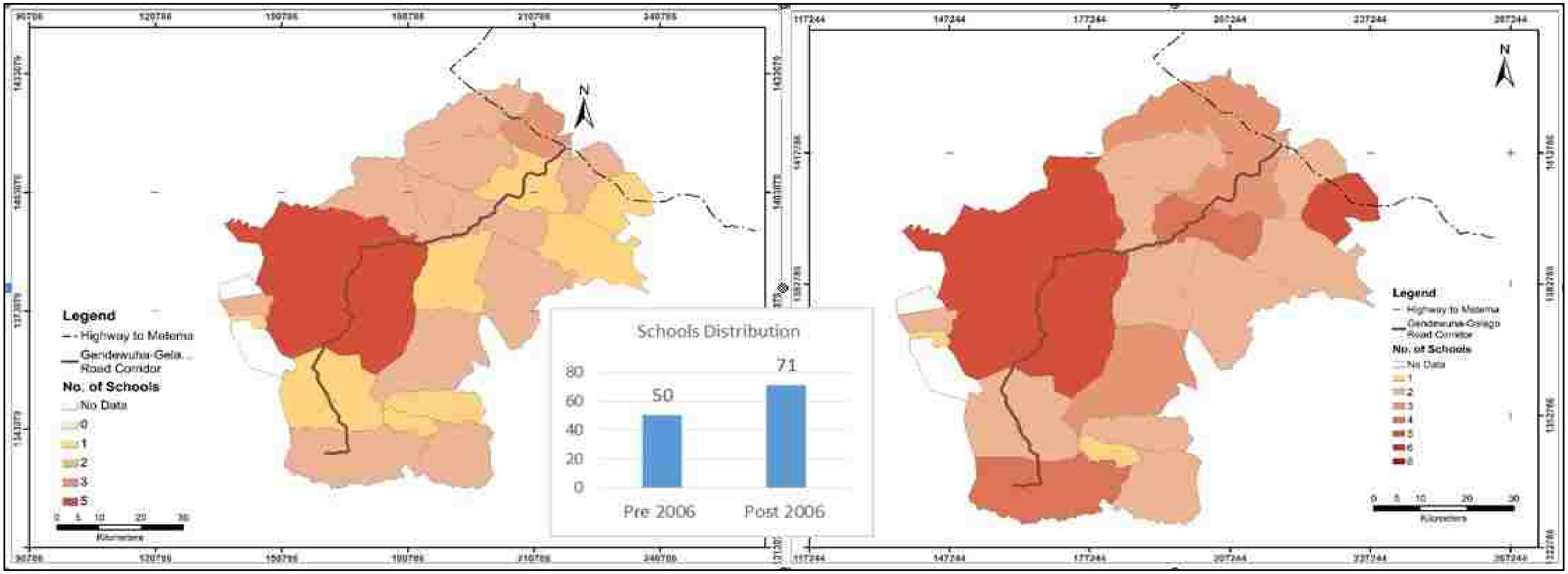


Figure 6. 12: Trend in School Facility Distribution in those *Kebeles* within 20km of the Study Road, Corridor 2

Source: Own analysis based on Secondary Data Obtained from Gendewuha and Quara weredas, 2015

6.4.2. Changes in Access to School Facility, Corridor 3

Adopting the same mapping procedure employed in Section 6.1.2, the changes in the distributions of schools are also discussed for Corridor 3. As illustrated in Figure 6.13, there were 39 schools before 2002, while their number increased to 124 after 2002 (a total growth of about 218% over 12 years, or an annual growth rate of 18 percent). As can be seen from both figures, the road under study has pulled the location of new schools towards it, whilst a more visible change is observed after 2002.

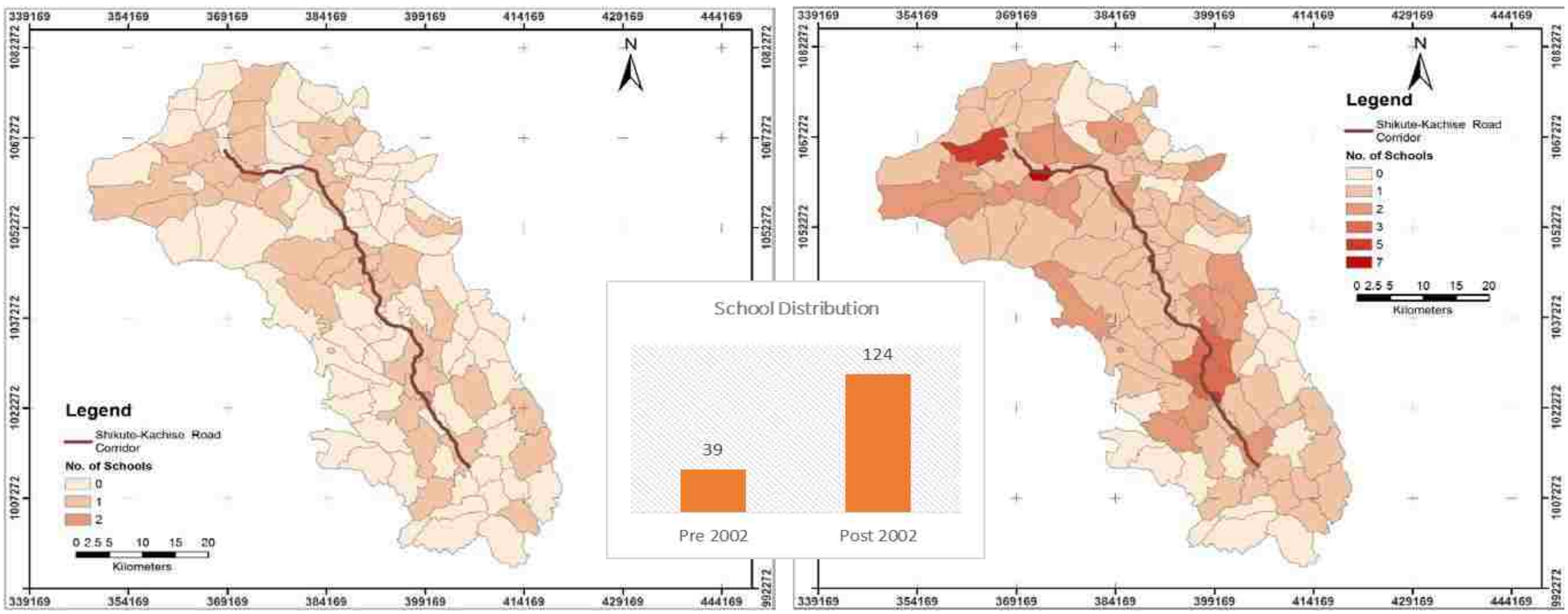


Figure 6. 13: Trend in School Facility Distribution in those *Kebeles* within 15km of the Study Road, Corridor 3
Source: Own analysis based on Secondary Data Obtained from Dendi, Jeldu, Gindeberet and Abunagindeberet weredas, 2015

6.4.3 Accessibility of School Types for the Households

Road development contributes towards better access to schools by minimizing the friction of distance between the school and the residence of potential students. Accordingly, households were asked to estimate the type and distance of the nearest school accessible to them before and after the road intervention. From the mean values shown in Table 6.4, the pattern of the change had been computed. Keeping other factors constant, access to 1st cycle schooling (from grade 1 up to 4) is improved by 50.00, 8.84, 33.81 and 34.01 percent for Corridor 1, 2, 3 and for all the corridors, respectively, while the results were significant at P values of less than 0.001, 0.01 0.001, 0.001. The highest change is observed in Corridor 1 (Amhara region) followed by Corridor 3 (Oromia region).

Table 6. 4: Changes in Accessibility of Schools

a)Distance of the nearest 1st cycle school from household's residence (km)					***b)Distance of the nearest 2nd cycle school from household's residence (km)***		
Corridors	Period	Mean value	Percentage Change	T-value	Mean value	Percentage Change	T-value
	Before	2.64			4.44		
1	After	1.32	-0.50	5.65*	4.07	-8.33	3.01**
	Before	1.47			1.53		
2	After	1.34	-8.84	3.32**	1.4	-8.50	1.95****
	Before	4.2			4.32		
3	After	2.78	-33.81	5.98*	3.1	-28.24	5.16*
	Before	2.94			3.69		
All	After	1.94	-34.01	8.21*	3.01	-18.43	5.96*
c)Distance of the nearest 3rd cycle school from household's residence (km)					***d)Distance of the nearest preparatory school from household's residence (km)***		
	Before	125.0					
1	After	4.12	96.70	3.01*			
	Before	1.77					
2	After	1.57	11.30	1.16(NS)		_	_
	Before	6.39			6.65		
3	After	5.77	9.70	1.7****	6.46	2.86	0.51(NS)
	Before	49.63			6.65		
All	After	4.75	90.43	9.49*	6.46	2.86	0.51(NS)

*NB: NS: Not significant, ****: significant at p < 0.1, ***: significant at p < 0.05, **: significant at p < 0.01, *: significant at p < 0.001,*

Source: Computed by the Author based on field survey data, 2014.

Considering the 2nd cycle (grade 5- 8), the changes calculated were 8.33, 8.50, 28.24 and 18.43 percent, which is significant at P value of less than 0.001, 0.10, 0.001 and 0.001 for Corridor 1, 2, 3 and for all corridors, respectively. Furthermore, the highest significant change is observed in Corridor 3.

Regarding the 3rd cycle (grade 9- 10), the change is estimated at 96.70, 11.3, 9.70 and 90.43 percent, which is found to be significant at P value of less than 0.001, NS, 0.10 and 0.001 for Corridor 1, 2, 3 and for all corridors, respectively. Furthermore, the highest significant change is observed in Corridor 1 followed by Corridor 3. The change observed in Corridor 1 is attributed to the opening of a high school at Gelago in 2007. Previously, students had to go to the high school located at Gendewuha which is 125 km away from Gelago.

Regarding preparatory schools (grade 11- 12), there was no such school during the survey period except for Corridor 3 where a change of 2.86 percent is observed with statistically insignificant value.

6.4.4 Impact of Road on Literacy Status in the ZOI and COZs

The educational status of households can be assessed in terms of literate and illustrate. Literate people are those who can read and write, while the illiterate persons are those who cannot read and write.

As shown in Table 6.5, the proportion of literate population including those with formal education in ZOI is 68, 66 and 84 percent for Corridor 1, 2 and 3, respectively. The remaining proportions refer to illiterate persons, and the highest is found in Corridor 2. On the other hand, the proportion of literate persons in the COZ of the respective corridors is found to be 49, 61 and 84 percent. Out of the total household members in the COZs 81, 51 and 39 percent are found to be illiterates in Corridor 1, 2 and 3, respectively. Corridor 3 has the lowest illiteracy rate in both ZOI and COZs. A comparison between the literacy status of household heads and their family members shows that the proportion of literates is considerably high in case of the latter. The majority of family members now attend school. The result confirms that literacy rate decreases as one goes away from the study roads towards COZs.

Table 6. 5: Impact of Road on Literacy Status in the ZO1 and COZs

Corridors	Members	Literate [n(%)]			Illiterate [n(%)]		
		ZOI	COZ	Total	ZOI	COZ	Total
Corridor 1	HH Heads	37(51)	8(19)	45(39)	36(49)	34(81)	70(61)
	Other household members	180(73)	86(58)	266(67)	68(27)	62(42)	130(33)
	Total	217(68)	94(49)	311(61)	104(32)	96(51)	200(39)
Corridor 2	HH Heads	41(53)	17(40)	58(49)	36(47)	25(60)	61(51)
	Other household members	206(70)	101(67)	307(69)	89(30)	49(33)	138(31)
	Total	247(66)	118(61)	365(65)	125(34)	74(39)	199(35)
Corridor 3	HH Heads	89(77)	35(81)	124(78)	26(23)	8(19)	34(22)
	Other household members	513(86)	233(85)	746(85)	87(15)	42(15)	129(15)
	Total	602(84)	268(84)	870(74)	113(16)	50(16)	163(16)
All Corridors	HH Heads	167(63)	60(47)	227(58)	98(37)	67(53)	165(42)
	Other household members	899(79)	420(73)	1319(77)	244(21)	153(27)	397(23)
	Total	1066(76)	480(69)	1546(73)	342(24)	220(31)	562(27)

Source: Computed by the Author based on field survey data, 2014.

6.5 Impacts of Road Development on Access to Health Facilities

Like RSDP and ESDP, the Ethiopian Government has been implementing the Health Sector Development Plan (HSDP) starting from 1997. In this Section, two sets health facility related data are employed. The first one refers to time series data obtained from health institutions in the study areas (since their establishment). The second refer to *kebele* level data that is obtained from *weredas* (districts) of corridor 3. These data have been analyzed both spatially and temporally using GIS software by adopting a periodization of pre and post 2002 (i.e., before and after the road intervention). On the other hand, obtaining complete time series health institution related data including the year of their establishment with correct and generic naming of their location (*kebeles* at the local level) was difficult in Corridor 1(Amhara region) and Corridor 2 (Afar and part of Amhara regions). Generally, the persons in charge could not readily know the historical background of the health institutions under their jurisdictions due to frequent re-classifications and/ or merging of *kebeles* and turnover of officials and personnel. Therefore, analysis and comparisons on the spatiotemporal changes of access to health facilities could not be undertaken for the two corridors due to data gaps. However, to compensate for such gaps, the second set of data is employed, namely secondary health and population related data for 2012, 2013, or 2014 (depending to their availability) to assess the status of accessibility with respect to nationally set standards. The third is the analysis done using cross sectional data to gather the households' opinion on the accessibility of the nearest health facility by type and test the statistical significance of the results.

6.5.1 Changes in Accessibility of Health Facilities, Corridor 3

As discussed in Section 6.1.2 above, the same number of *kebeles* within the same distance from the road has been considered among which only one *kebele* (Gojo 01) had a health centre before the road intervention (Figure 6.14). Following the road intervention (i.e., the construction of the gravel road) and particularly since 2005 many *kebeles* (about 92.2 percent) now have health facilities. In other words, out of the total 114 *kebeles*, 100 of them now have 1 to 3 health centres and health posts that serve as primary health care centres (there is only one general hospital at Gindeberet). In other token, there is no specialized hospital (ratio set as 1:5,000,000 people) and even general hospitals are very limited performing below the standard already set. Figure 6.14 shows the growth in the availability of health institutions from only one before 2002 to as high as 110 that include all those constructed after 2002 until the survey period.

Egis International and Urbalyon (2014) employed the standards set by the Ethiopian Ministry of Health to compare the access to existing health institutions at national and regional levels. Using this data as the base, access to health facilities at the wereda level has been computed by the author taking the raw data (on population and health institutions) for 2014 obtained from the *weredas* (See Table 6.6 up to 6.9).

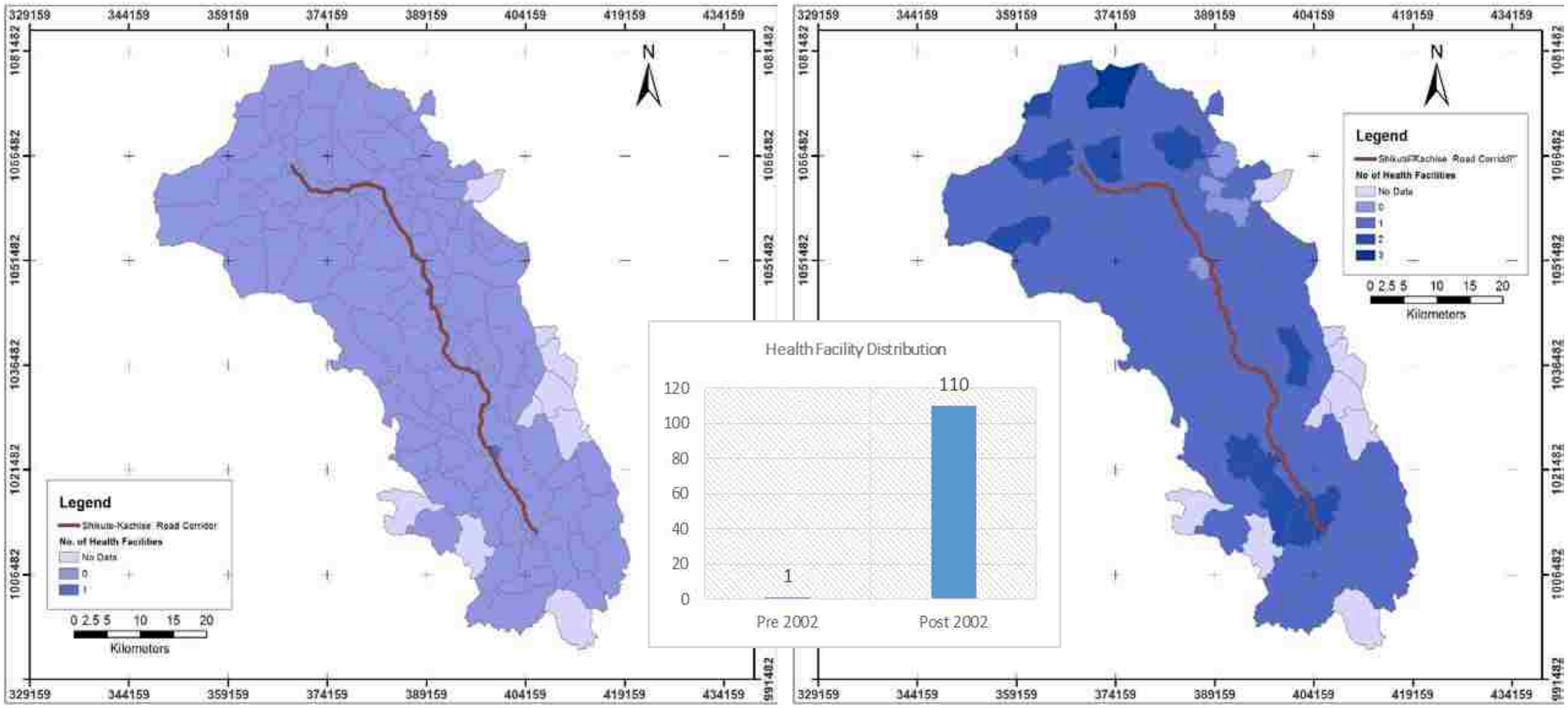


Figure 6. 14: Trend in Health Facility Distribution in Those *Kebeles* within 15km of the Study Road, Corridor 3
Source: Own analysis based on Secondary Data Obtained from Dendi, Jeldu, Gindeberet and Abunagindeberet weredas, 2015

6.5.2. Household's Access to Hospitals, Health Centres and Health Posts

6.5.2.1 Access to Hospitals

Improved access is measured by changes in the population – health institution ratio (Egis International and Urbalyon/World Bank, 2014). Accordingly, access to hospitals in all of the corridors under study is calculated to be 1:431,140 which is 4.3 times lower than the national standard (1:100,000), but about 1.6 times higher than the current national and the regional performance (Table 6.6).

Table 6. 6: Population – Hospital Ratio by *Wereda* in the Study Corridors

Corridors	Study *Wereda*	*Wereda* Population (2014)*	Corridor Population (2014)*	Hospital*	Hospital per Population (2014)**	National Standard Set for Hospital***	National Performance for Hospital (2013)***	Regional Performance for Hospital (2012)***
Corridor 1 (Amhara)	Quara	139,534	281,486	0	1:281,486	1:100000	1:675,000	1:992947
	Metema	141,952		1				
Corridor 3 (Oromia)	Jeldu	345,810	473,047	0	1:473,047	1:100000	1:675,000	1:763292
	Gindeberet	127,237		1				
Corridor 2 (Afar)	Chifra	107,747	107,747	0	nil	1:100000	1:675,000	1:320599
Total	**5**	**862,280**	**862,280**	**2**	**1:431140**	**1:100000**	**1:675,000**	**1:692279**

*Source: *Weredas, ** Own computation, ***World Bank, 2014,*

Corridor wise, Corridor 1 is found to be in a better status in terms of hospital access. The ratio is 1:281,486 which is higher than the national performance (1:675,000) and the host region (Amhara) (1:992,947). Therefore, one can discern that there is a positive change. But when we compare it with the national standard (1:100,000), it shows low performance. With regard to Corridor 2, there is no hospital in Chifra *wereda* and, therefore, the ratio could not be calculated although it is definitely below the set standard. Corridor 3 has the highest concentration of population and the ratio is 4.73 times lower than the standard but higher than the actual performance both at the national level and in the host region (Oromia Regional State).

6.5.2.2 Access to Health Centres

In terms of access to health centres, Corridor 1 at *wereda* level has 12 health posts and it enjoys better level of access as compared to the remaining two corridors (Table 6.7). The access ratio, 1:23,457 is higher than the host region's and national performances as well as the national standard for health centres (1:25,000). Access to health centres is low in Corridor 3 followed by Corridor 2. When we consider all corridors, although there are 28 health centres, they do meet not meet the access standard as well as the national and the regional performances.

Table 6. 7: Population – Health Centre Ratio by *Wereda* in the Study Corridors

Corridors	Study *Wereda*	*Wereda* Population (2014)*	Corridor Population (2014)*	Health Centre *	Health Centre per Population (2014)**	National Standard Set for Health Centre ***	National Performance for Health Centre (2013)***	Regional Performance for Health Centre (2012)***
Corridor 1 (Amhara)	Quara	139,534	281,486	6	1:23,457	1:25000	1:27700	1:23,701
	Metema	141,952		6				
Corridor 3 (Oromia)	Jeldu	345,810	473,047	8	1:36,388	1:25000	1:27700	1:28,843
	Gindeberet	127,237		5				
Corridor 2 (Afar)	Chifra	107,747	107,747	3	1:35,916	1:25000	1:27700	1:26,279
Total	**5**	**862,280**	**862,280**	**28**	**1:30,796**	**1:25,000**	**1:27,700**	**1:26,274**

*Source: *Weredas, ** Own computation, ***World Bank, 2014*

6.5.2.3 Access to Health Posts

In terms of access to health posts, Corridor 2 (Chifra *wereda*) has 21 health posts and enjoys better access as compared to the remaining two corridors (Table 6.8). The access ratio 1:5,231 is higher than the national performance but lower than the standard for the health posts (1:5,000). We could not compare it with the regional performance due to the absence of data on the number of health posts to compute the regional performance.

Table 6. 8: Population – Health Post Ratio by *Wereda* in the Study Corridors

Corridor	Study *Wereda*	*Wereda* Population (2014)*	Corridor Population (2014)*	Health Post*	Health Post per Population (2014)**	National Standard Set for Health Post***	National Performance (2013) ***
Corridor 1 (Amhara)	Quara	139,534	281,486	26	1: 5,864	1:5,000	1 : 5,350
	Metema	141,952		22			
Corridor 3 (Oromia)	Jeldu	345,810	473,047	40	1 : 6,757	1:5,000	1 : 5,350
	Gindeberet	127,237		30			
Corridor 2 (Afar)	Chifra	107,747	107,747	21	1 :5,231	1:5,000	1 :5,350
Total	**5**	**862,280**	**862,280**	**139**	**1:6,203**	**1:5,000**	**1:7,569**

*Source: *Weredas, ** Own computation, ***World Bank, 2014*

Corridor 3 with 62 health posts still has the lowest access (1:6,757). The reason is that its population density is very high as compared to the other corridors. The Ginchi-Gojo-Shikute-

Kachisi gravel road has a long history, as explained in Section 5.1.3, but it has not been upgraded so far and, as discussed above, it could not promote access to health facilities.

In summary, access to hospital is found to be higher than the current performance both at the national and regional levels in 2013 and 2012, respectively, but lower than the national standard (1:100,000). On the other hand, access to health centre is found to be lower in all cases. Similarly, access to health post is found to be lower than the standard although higher than the national performance in 2013.

6.5.3 Opinions of Households on Access to Health Facilities

Respondents were asked to estimate the distance of the nearest health facility from their home. As computed from the mean values, there is positive change of 1.71, 5.77, 8.94 and 6.24 percent for Corridor 1, 2, 3 and for all corridors, respectively, and the results are significant for all corridors only at p value of less than 0.10. Given other actors constant, the change is not attractive in Corridor 1 (Table 6.9). As illustrated in Figure 6.15, the major types of health facilities before the road intervention were health post as 166 (42.3%) of the households confirmed. However, after the road intervention, health centres had become more dominant. During the survey period, 178 (45.4%) of the households had health centres as the nearest health facility as compared to the situation before the road intervention.

Table 6. 9: Distance of the Nearest Health Facility from Home (km)

Corridors	Period	Mean value	Percentage Change	T-value
1	Before	4.39		
	After	4.31	-1.71	0.9(NS)
2	Before	2.76		
	After	2.60	-5.77	1.27(NS)
3	Before	5.78		
	After	5.26	-8.94	1.6(NS)
All	Before	4.69		
	After	4.40	-6.24	1.93****

*NB: NS: Not significant, ****: significant at p < 0.1, Source: Computed by the Author based on field survey data, 2014*

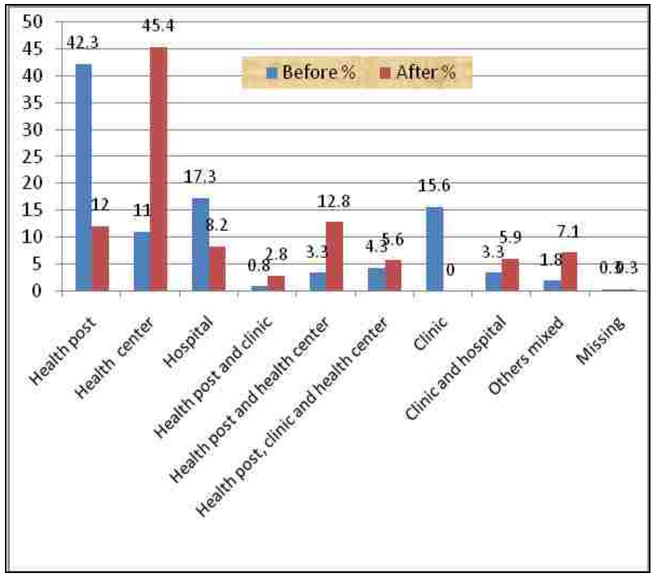


Figure 6. 15 : Accessible Types of Health Facilities(%)

6.6 Gender Related Impacts of Road Intervention

Women play significant productive and reproductive roles at the household level. Accordingly, gender orientated questions were posed to households to see changes that might have occurred as a result of road development. Questions related to the types of transport they use when going to the market, the time spent in connection with the mobility involved in travelling to and from market places, source of potable water and to collect fuel wood and get medical assistance were asked in reference to the situation before and after the road intervention. The results are discussed as follows:

6.6.1 Use of Human Portage to Transport Goods

For any person who comes to a market as a seller or a buyer, the means of transport he/she would use to transport goods to and from the market are either human portage, pack animals or different types vehicles. As the researcher's focus here is human portage, households were asked to indicate *who shares the major burden* (The Wife? The Husband? Others) in transporting goods using human portage? 'Others' hear can be boys, girls relatives or any hired labourers. The responses of households are summarized in Table 6.10, and out of 392 households in all of the three corridors 122 (31.1%) and 109 (27.8%) were using human portage to transport their goods before and after the road intervention, respectively.

Table 6. 10: Proportion of Wives and Husbands that do Human Portage (%)

Period	**Human portage**	**Corridor 1**			**Corridor 2**			**Corridor 3**			**All Corridors**		
		ZOI	**COZ**	**Both**	**ZOI**	**COZ**	**Both**	**ZOI**	**COZ**	**Both**	**ZOI**	**COZ**	**Both**
Before	Wife	5.5	2.3	4.3	20.8	8.5	16.0	22.4	44.4	29.1	17.7	18.8	17.9
	Husband	4.1	2.3	3.5	1.3	10.6	5.0	4.3	_	3.2	3.4	4.7	3.8
	Other	-	-	-	15.6	10.6	12.6	15.5	8.9	13.9	11.3	6.3	9.4
	Total	9.6	4.7	7.8	37.7	29.8	33.6	42.2	53.3	46.2	32.5	29.7	31.1
	Not Using	90.4	95.3	92.2	62.3	70.2	66.4	57.8	46.7	53.8	67.5	70.3	68.9
	Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
After	Wife	5.5	4.7	5.2	20.8	8.5	16.0	18.1	24.4	20.3	15.8	12.5	14.5
	Husband	2.7	2.3	2.6	1.3	6.4	3.4	4.3		3.2	3.0	3.1	3.1
	Other	-	-	-	15.6	10.6	12.6	15.5	15.6	15.8	11.3	8.6	10.2
	Total	8.2	7.0	7.8	37.7	25.5	31.9	37.9	40.0	39.2	30.2	24.2	27.8
	Not Using	91.8	93.0	92.2	62.3	74.5	68.1	62.1	60.0	60.8	69.8	75.8	72.2
	Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: Computed by the Author based on field survey data, 2014

The number of house wives carrying goods themselves were 70 (17.9%) and 57 (14.5%), whereas the number husbands carrying goods themselves were 15(3.8%) and 12 (3.1%) before and after the road intervention, respectively. Of the other members 37 (9.4%) and 40 (10%) were carrying goods on themselves. Spatially, the summary result shows that a larger proportion of wives in the ZOI carry the goods they bring to or from the market themselves than those in COZs. The main reason for this kind of mobility pattern is reckoned to be the proximity of the market for those in ZOI than those in COZs. Regarding those women in COZs, they generally find using pack animals more convenient than carrying good themselves as their residence is far from the road under study.

Corridor wise, as illustrated in Table 6.10, women's share is found to be very high in Corridor 3 than the remaining two corridors. It shares 22.4, 44.4 and 29.1 percent to the house wives in ZOI, COZ and in both zones before the road intervention. Keeping the respective trend the figure for the same Corridor is declined to 18.1, 24.4 and 20.3 percent after road intervention. Still the women's burden is high in COZ than ZOI. However such burden, the trend is declining in all corridors as compared to before road intervention due to overall economic development.

6.6.2 Women Specific Household Activities Other Than the Main Occupation

Under this Section, more of women's domestic activities related to time consumed are discussed

6.6.2.1 Time Spent by Women to Purchase Household Items from the Market

The type and extent of transport technology to be used in mobility associated with trips to the market depends upon the socioeconomic development of a given geographical area. Accordingly, to measure the changes that have occurred after the road intervention, households were asked to estimate the total time it would take for a woman to purchase household items from the market. As illustrated in Table 6.11a, the average number of minutes spent per week has declined by 5.97, 1.79 and 3.44 percent in ZOI, COZs and both areas, respectively.

The change observed in the COZs is very small, which is mainly because of limited opportunities for innovation that are available due to the relatively far location of the road from their residence. Thus, except for ZOI and for both zones taken together, in which case the results are significant at P value of less than 0.001, the result for COZ is insignificant. The change observed in ZOI of Corridor 3 is very high (6.71%) as compared to the other corridors.

a)Average time spent by women to purchase household items from market (1 and 2 are from Shikute and Kachsi, respectively)

b) Average time spent by women to fetch water (2 and 3 are from Shinfa and Chifra, respectively)

1 2 3 4

Figure 6. 16: Women Specific Household Activities other than the Main Occupation
Source: Photo by the Author, 2014.

6.6.2.2 Time Spent by a Woman to Fetch Water

The family cannot survive without drinking water and it needs to be fulfilled every day. But since every need is not located everywhere, transport fills this gap. But *which type of transport*? and *by whom can this basic need mainly be provided*? are the questions which should be raised. The study highways of this research is at the marginalized areas, so that the most dominant and affordable transport is own human energy and women take highest share. But *how is the extent of the change of fetching drinking water after the road intervention?* Table 6.11b shows temporal and spatial trends performed by women in the study area. The change of the mean value is 29.66, 12.31 and 22.54 percent for ZOI, COZs and for both zones respectively. The respective significance level is at P value of less than 0.001, 0.05 and 0.001. The change resulted in COZs low as compared to ZOI. The figure shows that many women in COZs of Corridor 1 and Corridor 2 pass more than one hour per day for water need purposes. Although slower change than ZOI, the trend is showing a declining trend in all corridors. For both zones very high change of mean value is observed in Corridor 2 where the study road is paved.

Unless and otherwise modern electric energy use is introduced in each residence of households, there is no other alternative than using traditional energy (fuel wood) to cook food. Since majority of women are engaged in household food preparation, fuel wood which is used for cooking is mostly collected by them. The extent of the average change of hours spent for fuel wood collection is 1.87, 1.57 and 1.52 percent for ZOI, COZs and for both zones respectively (Table 6.12a). Corridor 1 has the mean value hours increased by 8.6, 5.6 and 7.4 percent for ZOI COZs and for both zones respectively which is a reverse to the rest of the corridors. Women in this Corridor pass about 3 hours per week to collect fuel wood. Since road penetration, population increased and urban settlements expanded (Chapter Five); but trees are degraded for fuel purpose. Therefore, in Corridor 1 (Quara and Metema waredas of Amhara regions) women are searching fuel wood far away from their residence due to the negative indirect impact generated by road penetration. The situation is that the mentioned *weredas* due not give due attention to conserve the environment.

Table 6. 11: Change on Time Spent by a Woman to Purchase Household Items from Market and to Fetch Drinking Water

		Mean value			**Percentage change**			T-value		
a)Change in Time Spent by a Woman to Purchase Household Items from Market (Average Minutes Per Week)										
Corridors	Period	ZOI	COZ	Both	ZOI	COZ	Both	ZOI	COZ	Both
	Before	112.73	322.79	190.7						
1	After	111.1	316.74	187.39	-1.45	-1.87	-1.74	1.62(NS)	1(NS)	1.41(NS)
	Before	70.36	135.43	95.49						
2	After	62.53	130.32	89.79	-11.13	-3.77	-5.97	2.61***	1.611(NS)	2.62***
	Before	97.03	172.89	117.44						
3	After	90.52	169.56	112.83	-6.71	-1.93	-3.93	2.67**	0.66(NS)	2.29***
	Before	93.29	212.15	132.27						
All	After	87.72	208.36	127.72	-5.97	-1.79	-3.44	3.96*	1.34(NS)	3.65*
b) Change in Time Spent by a Woman to Fetch Drinking Water (Average Minutes Per Day)										
	Before	37.63	68.61	49.19						
1	After	28.89	66.98	43.03	-23.23	-2.38	-12.52	1.55(NS)	1.16(NS)	1.7***
	Before	55.27	76.06	62.78						
2	After	31.61	55.53	40.79	-42.81	-26.99	-35.03	3.02**	2.75**	3.79*
	Before	39.13	46.11	40.85						
3	After	30.98	43	33.95	-20.83	-6.74	-16.89	4.14*	0.96(NS)	4.028*
	Before	43.33	63.75	49.95						
All	Ater	30.48	55.9	38.69	-29.66	-12.31	-22.54	4.42*	2.63***	5.14*

*NB: NS: Not significant, ***: significant at $p < 0.05$, **: significant at $p < 0.01$, *: significant at $p < 0.001$,*
Source: Computed by the Author based on field survey data, 2014.

6.6.2.4 Time Spent by a Woman for Medical Assistance

There are times when family members seek medical attention and it is adult family members, particularly women that escort their relatives to medical centres. As road intervention is expected to contribute to the reduction of the time to be spent in obtaining medical assistance, households were asked to estimate the average time women will spend per month while they are assisting family members for medical issue in the health centres. The mean value computed (Table 6.12b) shows that 16.72, 3.9 and 10.31 percent changes for ZOI, COZs and for both zones, respectively. The results are found to be significant at P values of less than 0.001, 0.10 and 0.001, respectively. Corridor 3 has exhibited the highest change (29.71, 9.04 and 16.66 percent), which is found to be significant at P values of less than 0.001, NS and 0.001 respectively. As shown in the Table, a considerably long time is spent in Corridor 1 followed by Corridor 3. According to the results of FGDs and interviews, Corridor 1 is widely affected by diseases such as malaria and kalazar. Secondary data obtained from the Metema Hospital show that kalazar is the first ranked disease which is the cause of morbidity in the area.

Table 6. 12: Change in Time Spent by Women to Collect Fuel Wood and Get Medical Assistance

a) Change in Time Spent by a Woman to Collect Fuel Wood (Average Minutes Per Week)										
		Mean value			**Percentage change**			T-value		
Corridors	Period	ZOI	COZ	Both	ZOI	COZ	Both	ZOI	COZ	Both
1	Before	186.44	133.5	161.8						
	After	202.54	141	173.8	8.64	5.62	7.42	-1.56(NS)	-1.96****	-2.143***
2	Before	81.81	100.54	86.27						
	After	80.29	92.06	83.41	-1.86	-8.43	-3.32	0.29(NS)	1.67(NS)	0.77(NS)
3	Before	70.49	84.77	74.79						
	After	61.38	78.02	66.76	-12.92	-7.96	-10.74	2.61***	2.13***	3.02**
All	Before	96.79	104.71	99.49						
	After	94.98	103.07	97.98	-1.87	-1.57	-1.52	0.57(NS)	0.7(NS)	0.69(NS)
b) Change in Time Spent by a Woman for Medical Assistance (Average Minutes Per Month)										
1	Before	143.56	340	216.7						
	After	137.81	327.91	208.52	-4.01	-3.56	-3.77	1.32(NS)	1.33(NS)	1.87****
2	Before	70.39	88.72	75.17						
	After	64.03	75.64	67.9	-9.04	-14.74	-9.67	2.4***	2.33***	2.82**
3	Before	114.05	165.67	127.69						
	After	80.17	163.78	103.86	-29.71	-1.14	-18.66	4.22*	0.26(NS)	3.81*
All	Before	109.25	196.6	137.86						
	After	90.98	188.94	123.65	-16.72	-3.90	-10.31	4.71*	1.77****	4.81*

*NB: NS: Not significant, ****: significant at $p < 0.1$, ***: significant at $p < 0.05$, **: significant at $p < 0.01$, *: significant at $p < 0.001$,*
Source: Computed by the Author based on field survey data, 2014.

In summary, the time women spend for purchasing items, fetching water, collecting fuel wood, and get medical assistance for their family members is found to be very high in COZ with slight changes as compared to ZOI between the situation before and after the road intervention. Therefore, women's work burden is found to be lightened after the road intervention than before, which is more pronounced in the ZOI than COZ.

6.7 Socioeconomic Impacts of Road Development, Opinions by Respondents

A total of 20 questions, which refer to potential social and economic impacts of the roads under study, were posed to household respondents. These questions were about the contributions of road development in relation to access to the *market, prices of products sold/goods purchased, health, education, mobility, gender, job opportunities, urban expansion and housing,* *technological innovation and attitudinal changes within the community*. Respondents had to indicate their responses out of five scaled options (i.e., in a Likert Scale), and their responses were summarized employing the factor analysis model. Finally, the graph shown in Figure 6.17 had been prepared for descriptive analysis per corridor.

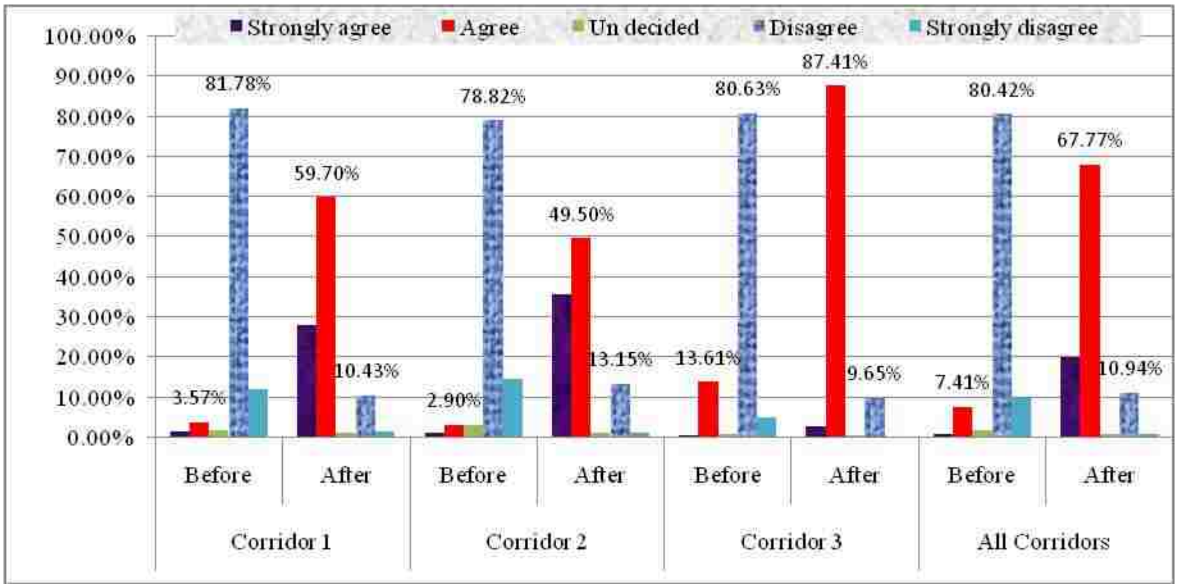


Figure 6. 17: Socioeconomic Impacts of Road Development (Opinions)
Source: Computed by the Author based on the field survey, 2014

According to the summarized responses, the roads under study had strong socioeconomic impacts as 80.42 and 67.77 percent of the respondents replied that they disagree and agree before and after the road intervention, respectively. According to the findings, the highest impact is achieved in Corridor 3 (as 80.63 and 87.41 percent disagree and agree before and after road intervention) respectively followed by Corridor 1 (with a corresponding figure of 81.78 and 59.7 percent). The impacts in Corridor 2 after road intervention is relatively low as only 49.5 percent of the respondents agreed about the impact.

6.8 Conclusions

Based on the GIS outputs generated using satellite imageries, secondary and cross sectional data gathered from the field, this Chapter has discussed the impacts of road interventions on social indicators like population increase, settlement area expansion, and poverty, education, health and gender issues. In line with this, comparisons had been made between base line and follow-up data and between ZOI and COZs. Accordingly, the follow-up data provide factual evidences on the impact of the three road corridors spatially and in the livelihood of the households within 5 kms radius. Road penetration and improvements have contributed to reduction in household poverty as well as work burden of particularly women located in the immediate vicinities of the study roads through their accessibility, mobility and income related impacts. In the next chapter, attention is given to the analysis made on the challenges that have affected the expected positive road development-related impacts in the three study road corridors.

CHAPTER SEVEN: CHALLENGES AFFECTING IMPACTS OF ROAD DEVELOPMENT AND SUMMARY OF STUDY FINDINGS

This Chapter has two main sections: The first one focuses on the factors that influence the expected positive socioeconomic impacts. These factors can be categorized as *external factors*, particularly natural factors which are tough to be controlled by management, and *internal factors, which are* manmade factors that arise from lack of good governance. The second section provides a summary of the findings outlined in previous chapters.

7.1 Challenges Affecting Positive Impacts of Road Development

7.1.1 Natural Factors

The main natural factors are relief and climate. The nature of the land in the study corridors is full of varieties of terrains difficult and costly to the development and operation of transport services such as by inviting frequency of maintenance. Corridor 3 is the most affected as the line between Shikute and Kachisi is full of curves and prone to landslides.. According to FGDs and information obtained from Kachisi traffic police office, accidents frequently occur in this area. The route between Ginchi town and Chillimo Forest passes through a low lying ground that gets muddy during the wet season.

The Afar (the largest part of Corridor 2) as well as Amhara (Corridor 1) regions are characterised by harsh climate, which hinder the productivity of the road. Drivers for instance hesitate to use gravel roads located in areas with hot climate to save their tyres from damage. A typical example is the Gendewuha – Shinfa- Gelago route (Corridor 1).

Generally a road facility deteriorates in its characteristics due to various causes as shown in Figure 7.1. According to Flaherty, positive roles and road condition decline with the increase of challenging conditions listed in the circles of the Figure.

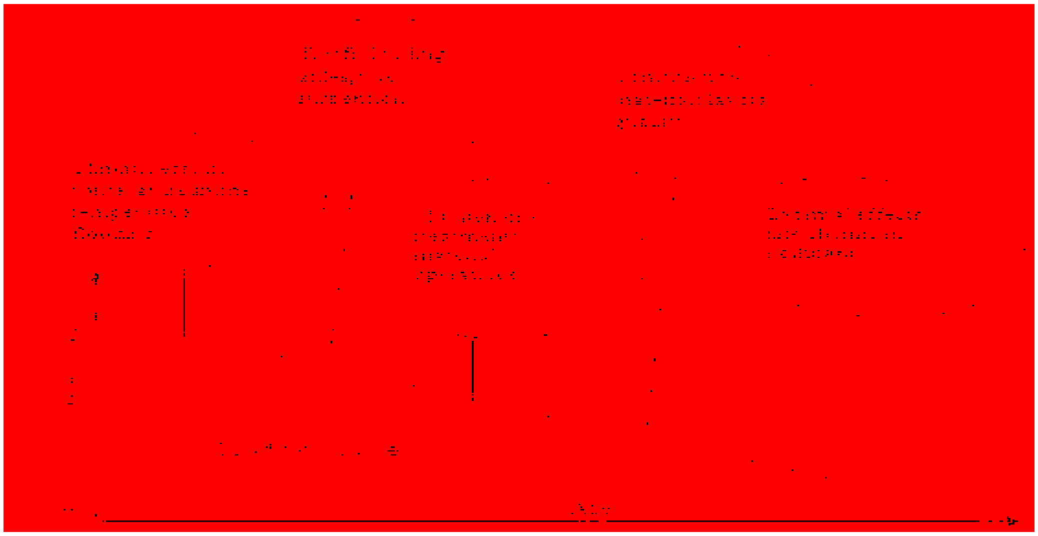


Figure 7. 1: Typical Factors Affecting Pavement Condition
Source: Adopted from Flaherty, 2002

7.1.2 Man Made Factors

Positive socio-economic contributions are expected to occur once roads are constructed with the aim of facilitating the movement of vehicles. However, there are also negative impacts of road interventions among which traffic accidents and environmental degradations are the major ones. Respondents were asked to indicate whether family members including household heads had encountered traffic accidents along the study corridor (question 1). Table 7.1 illustrates that the traffic accidents encountered are almost insignificant. However, as observations and data obtained from traffic police office, more accidents occur along the paved route (Corridor 2) as compared to non-paved corridors although the causalities are sustained by vehicle owners most of which are not from the study areas.

Another impact related issue that was posed to respondents was whether family members were negatively affected due to the road intervention (question 2). This can occur during the construction and maintenance of roads, affecting their property and land holdings. Accordingly, the maximum change computed from the mean value of the “Yes” and “No” responses (3.08 percent) is found for Corridor 2. According to the FGDs held at Hara study centre, about 95 percent of the paved route is elevated from the ground level thus challenging to livestock and even old people that try to cross it (Figure 5.5 in section 5.2.4). Among all the corridors, this problem is pronounced in Corridor 2 and the result is significant at P value of less than 0.01 followed by Corridor 1 at less than 0.05.

Table 7. 1: Status of Negative Impacts of Road Development

1) Occurrence of Traffic Accidents (Yes=1,No=2)					2) Persons affected due to road development and vehicles' mobility (Yes=1 ,No=2)			3)Place affected due to road development and vehicles' mobility (Yes=1,No=2)		
Corridors	**Period**	**Mean value**	**Percentage change**	**T-value**	**Mean value**	**Percentage change**	**T-value**	**Mean value**	**Percentage change**	**T-value**
1	Before	1.99	-0.5	0.58(NS)	1.99	-2.51	2.51***	2.00	-1	1.42(NS)
	After	1.98			1.94			1.98		
2	Before	2.00	-0.5	1.00(NS)	1.95	-3.08	2.72**	1.97	-4.06	3.29**
	After	1.99			1.89			1.89		
3	Before	1.99	0	0.00(NS)	1.97	-0.51	1.42(NS)	1.92	2.6	-1.9****
	After	1.99			1.96			1.97		
All	Before	1.99	0	0.82(NS)	1.97	-2.03	3.94*	1.99	-3.02	5.05*
	After	1.99			1.93			1.93		

*NB: NS: Not significant, ****: significant at p < 0.1, ***: significant at p < 0.05, **: significant at p < 0.01, *: significant at p < 0.001,*
Source: Computed by the Author based on field survey data, 2014.

Similarly, a question on the effects of road development on specific areas (question 3) was posed to households. According to the summarized results, the percentage change calculated for all corridors is 3.02, which is significant at p value of less than 0.001. Still the highest share is along Corridor 2, where the impact change is 4.06 percent with significant level of p less than 0.01.

Due to poor road designs, some sections of the study roads that have sharp curves and sloppy are prone to frequent traffic accidents. A good example is the locality named as Allewuha (Figure 7.2), which is 11 kms from Hara study area and where nine passengers had been killed in 2014. Especially, very large freight trucks that commute along Corridor 2 are susceptible to traffic accidents. According to FGDs and observations made by the author, the residents of Hara town and its surrounding have intervened by way of putting warning signs at some intervals around this black spot, which is reckoned to have significantly reduced the occurrence of traffic accidents in these areas.

In addition to this problem, the community in collaboration with the local administration had painted zebra crossings along the paved road in Hara town incurring about ETB 21,600. Interviews held with key informants further revealed the achievement of positive impact after these measures.

Another major manmade factor is the lack of proper good governance with regard to the implementation of policies, of creation of sufficient awareness about traffic rules and regulations, promoting stakeholders' participation in the planning and implementation of road projects and other issues that require the commitment of the general public. These are discussed as follows.

Source: Photo by the Author, 2014 Slop direction in the same location

Figure 7. 2: Road Curve with Steep Slopes at Allewuha (11 kms form Hara Town along Corridor 2)

7.1.2.1 Households' Awareness about Traffic Rules and Regulations

Household respondents in all corridors were asked to indicate whether they are sufficiently aware about traffic rules and regulations using five options on a Likert Scale. As shown in Table 7.2, though their level of awareness has improved after the road intervention, the majority of the respondents do not still have sufficient awareness about traffic related rules and regulations. The responses can help identify those households who do not know well about traffic rules and regulations by summing up the responses of those who indicated that they disagree and strongly disagree. Accordingly, 68.3 and 51.7 percent of the respondents in the ZOI did not have sufficient knowledge about traffic rules and regulations before and after the road intervention, respectively. Whereas, in COZs the respective figures were as high as 83.6 and 65.9 percent for the periods before and after the intervention, respectively.

These results suggest that respondents in ZOI have higher level of awareness about traffic-related rules and regulations than those in COZ. From temporal perspective, a better level of awareness is observed after the road intervention than before. But in all cases, the proportion of those who are aware in each corridor is below 50% even in the follow up time. This situation is more prevalent in Corridor 2, where the route is paved and experiencing more frequent occurrence of traffic accidents.

Regarding awareness about the direction pedestrians should follow while they are walking parallel to the highway, out of 392 respondents, 26.0 and 44.4 percent, said that they keep their right; 13.8 and 11.5 percent indicated that keep their left; whilst 24.5 and 21.7 percent said that they do not follow any regular pattern before and after the road intervention, respectively. As shown in Annex 7.1, the proportion of those who belong to the "I don't know" category during the follow-up period are more dominant in Corridor 2 followed by Corridor 3 (25.2 and 21.5 percent, respectively). The proportion of those who indicated that they keep their right during the follow-up period are more dominant in Corridor 1 (55.7 percent) followed by Corridor 3 (45.6 percent).

From the spatial perspective, in the ZOI, 32.5 and 49.8 percent indicated that they keep their right; 14.0 and 10.9 percent said they keep their left; 18.9 and 19.2 percent said they keep both their right and left; while those who said “I don’t know” were 34.7 and 20.0 before and after the road intervention respectively. In terms of COZ the awareness status is almost the same.

Table 7. 2:Households’ Awareness About Traffic Safety Rules and Regulations

		ZOI				COZ				Both			
		Before		After		Before		After		Before		After	
Questions	Options	N	Percent	N	Percent	N	Percent	N	Percent	N	Percent	N	Percent
1) Do you believe that you have sufficient awareness about traffic safety?	SA	15	5.7	23	8.7	5	3.9	15	11.7	20	5.1	38	9.7
	A	49	18.5	88	33.2	12	9.4	25	19.5	61	15.6	112	28.6
	U	20	7.5	17	6.4	4	3.1	4	3.1	24	6.1	21	5.4
	D	154	58.1	121	45.7	86	67.2	71	55.5	239	61	192	49
	SD	27	10.2	16	6	21	16.4	13	10.2	48	12.2	29	7.4
	Total	265	100	265	100	128	100	128	100	392	100	392	100
2) Which direction do you follow while you are walking parallel to the highway?	Right	86	32.5	132	49.8	16	12.5	44	34.4	102	26	174	44.4
	Left	37	14	29	10.9	17	13.3	16	12.5	54	13.8	45	11.5
	Both	50	18.9	51	19.2	47	36.7	37	28.9	96	24.5	88	22.4
	I don't know	92	34.7	53	20	48	37.5	31	24.2	140	35.7	85	21.7
	Total	265	100	265	100	128	100	128	100	392	100	392	100

NB: SA= Strongly agree; A = Agree; U= Undecided; D=Disagree; SD= Strongly disagree
Source: Computed by the Author based on field survey data, 2014.

What can we see from the results is that respondents who replied *I don’t know* and *I keep left* are declining, whereas those who replied that they keep their right are increasing after the road intervention than before. During the survey time, the response of a woman who was randomly asked by the author in Corridor 1 at Gelago (in Quara *wereda*)was quite surprising: “*I walk against the direction of the wind*”. From the responses to questions 1 and 2 (summarized in Table 7.2), one can discern that despite the road intervention, the community generally lack sufficient awareness about traffic rules and regulations. This is one of the major factors for the negative impacts of road development by being the cause of traffic accidents. For instance, according to data obtained from the traffic police, the total number of traffic accidents that occurred in Guba Lafto *wereda* was 42 in 2013, which increased to 60 in 2014, which represents an increase of 42.86 percent in a single year. As per information obtained from interviews held with the *Wereda* Transport Officer, 57 traffic accidents had occurred in Allewuha locality alone during the space of nine months (2014) alone.

7.1.2.2 Promotion of Community Participation

To check the level of participation of households in traffic safety related meetings, workshops or trainings, close ended questions with Yes/No answers were posed. The change observed in the level of participation of households is 3.33, 3.17 and 3.29 percent for ZOI, COZs and for both zones, which is found to be significant at p values of less than 0.001, 0.01 and 0.001, respectively (Table 7.3).

The magnitude of the change was considerably high in Corridor 2 followed by Corridor 1. This question was posed with the intention of measuring the extent to which the facilitators or transport operators are eager to mitigate traffic accidents. Local and international traffic rules and regulations are available everywhere but their implementation by regulators is generally very weak. In addition, regions lack harmonized and organizational structures as well as rules and regulations.

As the results of FGDs and interviews suggest, the issuance of driving licenses is one of the areas with huge problems. For instance, from 57 accidents that occurred in Gubalafto *wereda* (mentioned above), only 18 drivers were with long experience as drivers, whereas the remaining 39 drivers were very young and with limited driving experience. Drivers as young as 18 years old drive trucks with trailers or low-beds, which is indicated as one of the major causes for traffic accidents. Another factor is lack of enforcement of driving licensing regulations; even though traffic police or transport operation controllers may confiscate the driving licenses of those drivers with serious misconduct, such drivers can readily obtain a new license from another region with illegal means. As a matter of fact, there is no harmonized system for regulating the operations of transport operators across the various regions of the country.

Table 7. 3: Participation of Households in Traffic Safety Related Trainings/ Workshops

Corridors	Period	Mean value			Percentage Change			T-value		
		ZOI	COZ	Both	ZOI	COZ	Both	ZOI	COZ	Both
1	Before	1.92	1.98	1.94	-4.29	-2.35	-3.59	1.93****	1.43(NS)	2.35***
	After	1.84	1.93	1.87						
2	Before	1.9351[a]	1.98	1.96	_	-3.23	-1.29	_	1.77****	1.75****
	After	1.9351[a]	1.91	1.93						
3	Before	1.92	1.93	1.92	-4.93	-3.45	-4.61	3.17**	1.77****	3.63*
	After	1.83	1.87	1.84						
All	Before	1.92	1.97	1.94	-3.33	-3.17	-3.29	3.63*	2.91**	4.6*
	After	1.86	1.91	1.88						

*NB: NS: Not significant, ****: significant at p < 0.1, ***: significant at p < 0.05, **: significant at p < 0.01, *: significant at p < 0.001,*
Source: Computed by the Author based on field survey data, 2014.

Another aspect of the lack of good governance which contributes to negative impact of road interventions is the lack of measures towards enhancing the all rounded participation of the community during the planning and implementation of transport related policies and regulations. Accordingly, households were asked to indicate their involvement by responding to a Yes = 1 and No = 2 question.

As illustrated in Table 7.4, the participation of the community in the planning and implementation of road related issues has changed by 6.73, 6.50 and 6.54 percent for ZOI, COZs and for both zones, respectively, while the results were significant at P value of 0.001. The level of participation is found to be very high in Corridor 3 followed by Corridor 2. The respective zones of Corridor 3 have mean value changes of 12.32, 12.05 and 12.15 percent, which is significant at P values of less than 0.001, 0.01 and 0.001. Marginal changes are observed in Corridor 1.

Table 7. 4: Participation Status of Households in Planning and Implementation of Road Development Projects

Corridors	Period	Mean value ZOI	Mean value COZ	Mean value Both	Percentage Change ZOI	Percentage Change COZ	Percentage Change Both	T-value ZOI	T-value COZ	T-value Both
a)Participation status of households in planning for road penetration										
1	Before	1.85	1.95	1.89						
	After	1.79	1.86	1.82	-2.96	-4.76	-3.69	1.65(NS)	1.67(NS)	2.35***
2	Before	1.90	1.96	1.92						
	After	1.86	1.91	1.88	-2.05	-2.17	-2.18	1.76****	1.43(NS)	2.27***
3	Before	1.82	1.84	1.82						
	After	1.59	1.62	1.60	-12.32	-12.05	-12.15	5.5*	3.55**	6.45*
All	Before	1.85	1.92	1.87						
	After	1.72	1.80	1.75	-6.73	-6.50	-6.54	5.74*	3.98*	6.91*
b)Status of membership of households in road development committee										
1	Before	1.89	1.86	1.88						
	After	1.88	1.77	1.83	-0.72	-5.00	-2.31	0.57(NS)	1.67(NS)	1.68****
2	Before	1.94	1.96	1.95						
	After	1.92	1.94	1.93	-0.67	-1.09	-0.86	1(NS)	1(NS)	1.42(NS)
3	Before	1.88	1.98	1.91						
	After	1.77	1.84	1.79	-5.96	-6.74	-5.98	3.81*	2.6***	4.49*
All	Before	1.90	1.94	1.91						
	After	1.84	1.85	1.85	-2.98	-4.44	-3.34	3.73*	3.16**	4.77*
c) Households' participation by contributing money for road development										
1	Before	1.66	1.74	1.69						
	After	1.60	1.67	1.63	-3.31	-4.00	-3.61	1.42(NS)	1.35(NS)	1.97***
2	Before	1.95	1.96	1.96						
	After	1.94	1.91	1.94	-0.67	-2.17	-0.86	1(NS)	1.43(NS)	1.42(NS)
3	Before	1.53	1.73	1.58						
	After	1.21	1.24	1.22	-21.35	-28.21	-22.80	7.21*	6.49*	9.16*
All	Before	1.69	1.81	1.73						
	After	1.53	1.62	1.56	-9.40	-10.78	-9.75	6.52*	5.3*	8.31*
d)Households' participation by contributing labour for road development										
1	Before	1.67	1.72	1.69						
	After	1.52	1.63	1.56	-9.02	-5.41	-7.73	2.99***	1.67(NS)	3.42**
2	Before	1.83	1.87	1.87						
	After	1.82	1.79	1.83	-0.71	-4.55	-1.80	0.57(NS)	2.07***	1.64(NS)
3	Before	1.52	1.58	1.53						
	After	1.27	1.31	1.28	-16.48	-16.90	-16.12	6.19*	4*	7.17*
All	Before	1.65	1.73	1.68						
	After	1.50	1.59	1.53	-9.15	-8.11	-8.81	6.3*	4.29*	7.64*

*NB: NS: Not significant, ****: significant at $p < 0.1$, ***: significant at $p < 0.05$, **: significant at $p < 0.01$, *: significant at $p < 0.001$,*

Source: Computed by the Author based on field survey data, 2014.

During survey time, the researcher had managed to cross the Gelago River (Figure 7.3a) in Quara *wereda* with the help of the local people. The name of the village at the crossing point is Asol, which is about 4kms away from Gelago town. A recently constructed school in the area is yet to start providing services (October 2014) as, though the road penetration has arrived Gelago, the big river which is located between Gelago and Asol does not allow the mobility of teachers and students during some part of the year. As the researcher observed during the field survey, residents of the area cross the river to go to the market by swimming or at the back of camels. According to interviews held with some of the residents of the locality, the local community was never approached by any one for any kind of contribution towards the construction of a bridge over the river, while they could have volunteered to make financial or labour contributions if someone took the initiative.

As already pointed out in previous sections, Corridor 1 is a cash crop producing area and business owners and residents in this area can afford to contribute to the construction of a bridge across this river which interrupts road transport mobility for about five months of the year from June to October. Similar to Gelago river, Shinfa river (Figure 7.3b), which is bordering Quara and Metema *weredas* at Shinfa town, also interrupts mobility during similar part of the year. As per the information obtained from interviews, the fatality of persons at the crossing point of Shinfa River in Shinfa town is estimated to be about 6 persons per year.

Once the highway is penetrated, one would expect to further attract mobility but this is hindered by the lack of bridge over Shinfa and Gelago rivers. In fact, the nearby areas could have been linked with the main road if the participation of the local community was promoted.

Likewise, the summarized responses to an additional question posed to households and that is related to membership in local road development committee suggests the presence of positive change: 2.98, 4.44 and 3.34 percent which is significant at P value of less than 0.001,0.01 and 0.001 for ZOI, COZs and for both zones respectively. Among the three corridors, (except in Corridor 3), the results for the remaining corridors are insignificant at all P values.

a)Gelago River b)Shinfa River

Figure 7. 3: Gelago and Shinfa Rivers Challenging Mobility of Users along the Study Road (Corridor 1)
Source: Photo by the Author, 2014

Households were asked to indicate the way in which they contributed to solve the problem of links to the highway before and after the road intervention. As illustrated in Table 6.38, the percentage changes have been computed from the mean value of Yes = 1and No = 2 answers for financial and labor contributions. In this regard, the response of households indicates the extent to which the community is motivated to upgrade the road infrastructure around their village. The change observed in the willingness of the contribution of money 9.40, 10.78 and 9.75 percent for ZOI, COZs and for both zones respectively, which is significant at P value of less than 0.001. The level participation as well as the change is the highest in Corridor 3 followed by Corridor 1. The respective change in this corridor is 21.35, 28.21 and 22.80 percent, which is found to be significant at P value of less than 0.001. The level of contribution and the change is again very high in Corridor 3 followed by Corridor 1. The respective change in terms of contribution in Corridor 3 is 16.68, 16.90 and 16.12 percent and is significant at P value of less than 0.001.

Although the model suggests significant results between the “before” and “after” situations, the FGD revealed that the communities of Corridor 1 and Corridor 3 would be interested to further contribute towards improving the road situation. They know well about the importance of roads but the main reason for the persistence of the problem is the lack of initiative towards starting making contributions for upgrading the road infrastructure. This is important as road links to a highway are the feeders that contribute to the overall positive impact of the study corridors. In addition, as household respondents, key informants and FGD participants from Corridor 1 and 2 stressed, paved roads have better socioeconomic impact as compared to non-paved roads.

7.1.2.2 Other Good Governance Related Issues

The other governance related weakness observed along the study roads is the lack of strong commitment on the part of the concerned authority with the mandate to maintain the roads. For instance, as observed during the survey period, heaps of gravel meant for road maintenance had been dumped along the road near the entrance of Gelago town from Shinfa town (Figure 7.4) on the elevated sides of these sloppy roads over an extended distance and covering about half of the right-of-way of the roads. The observed encounters are:

- During the survey period (December, 2013), the road got soaked with autumn rain that poured early in the morning, and this sloppy road caused a small truck to slip to a lower ground. Then the road gets blocked by another big truck that was trying to pass the road. \A dozer had to come, and while it managed to pull out the first truck, the dozer itself got stuck. Another big dozer had to come later and the problem could only be solved after about five hours.

- Such problems arise due to poor management. Firstly, the gravel should be dumped at the lower side of elevated roads to protect slipping of vehicles. Secondly the distribution of the gravel should not take days.

Figure 7. 4: Accidents Caused by Lack of Timely Maintenance and Improper Dumping of Gravel (Corridor 1 Near GelagoTown)

Source: Photo by the Author, 2014.

- The researcher was also able to observe in Corridor 3 (at Kachisi town) heaps of gravel covering part of vehicle lane at the route in front of the high school that remained for several weeks without being distributed.

- During the occurrence of traffic accidents along the highways, measures towards freeing blocked highways are generally sluggish and inefficient. There are no proactive measures taken to pre-empt and immediately resolve emergency situations in remotely located roads. For instance, there are no standby dozers and/or cranes at certain intervals nor any rapid emergency response units along the study highways.
- Apart from the use of old vehicles (including freight trucks) for transporting passengers, the absence of effective inspection of vehicles using standard instruments is another weak side of the transport management system the researcher observed during survey time.
- The FGDs, interviews and observations highlighted that the absence of harmonized organizational structures and manpower allocation in the various regions, which invariably results in lack of uniformity in the implementation of rules and regulations, quality of training (drivers and traffic police) and licensing profound with direct/indirect negative socioeconomic impacts.
- The Majority of drivers, particularly those hired by private transport operators, work for long hours without rest, and this is found to be one of the factors for traffic accidents and fatalities that frequently occur along highways. These show that there is no strict control by concerned bodies on the length of driving time limit of drivers.
- Non-physical barriers such as long waiting time at customs check points on transit routes also constitute negative socio-economic impacts on the transport operators and the national economy at large. For instance, an observation during the field survey, heavy trucks were queuing for more than 25 kms (from Mile customs' check point office up to Harsis) creating very long delays in transportation of goods and passengers. The customs inspections were not supported by modern technologies and the customs office works only for part of the day (it is not a 24 hours service) due to manpower related constraints.
- The findings show that, although rural road access has exhibited significant improvement at the national level, the delivery of transport services has not kept up with the huge growth in the demand, showing gaps in terms of accessibility, geographical coverage and inter-connectivity. There are no regular passenger transport services in many of the study areas. The situation in Corridor 2 is found to be better because it is paved and attracts different sized passenger vehicles as observed from traffic count. On the other hand, a chronic supply-demand gap is observed in Corridor 3 which is a poorly maintained gravel

road. Here, the fact that the road is not paved does not encourage transport operators to provide regular passenger transport.

- A significant increase in the cost of implementing road development projects due to delays in the commencement and finalization of the projects after securing finance (i.e., financing agreement is signed).

7.2 Summary of the Findings

In the preceding chapters, secondary and primary data obtained from different sources had been analyzed employing different tools such as descriptive and inferential statistics. Using time series secondary data on road network expansion, road access (road densities, random model approach), and indexes, status of road quality, traffic trends and RTA-related impacts had been computed and analyzed. Satellite imageries for the study areas that refer to different points in time were obtained and geo referenced to analyze the spatiotemporal impacts of road development. In line with this, road impacts on the distribution of population and settlement expansion as well as access to education and health facilities had been demonstrated using GIS software. Furthermore, cross sectional data that are entered in to the SPSS programme, are used to prepare cross tabulations and compute paired sample t tests. Accordingly, from mean values calculated for the “before” and “after” road interventions, the percentage changes had been used to compare temporally and spatially. In addition, statistical significance was tested using different models. Farther more, double difference regression model (by using ANOVA) has been used particularly for the analysis on income changes. The results obtained are briefly summarized as follows in line with the objectives formulated:

7.2.1 Temporal Analysis of Road Development, its Financing and Impacts

- The road density of Ethiopia per 1,000 people has increased from 0.30 in 1951 to 1.0 kms in 2013.Despite this more than threefold increase, the current road density is still low as compared to that of low income countries which are at average of 1.2 kms per 1000 people in 2012. But the density per 1000km^2 which was 48.8kms in 2012 is greater than that achieved by low income countries (40kms in the same year).

- Regarding the accessibility of all weather roads in Ethiopia, the mean distance of the network has decreased from 95.31kms in 1951 to 70.93kms in 1970 (during the Imperial period); and to 32.20kms in 1990 (during the Derg period) and finally to 6.4kms in 2013 (during the EPRDF period). The proportion of those areas, for instance, located beyond 5 km from all weather road networks in 1951 and 2013 was 95 and 61percent, respectively. This shows that road accessibility (proximity to the network) is increasing from time to time thus contributing to reductions in the average distance within each network.
- The growth of the road network is very fast particularly after 1992 as the EPRDF period saw better road infrastructure financing opportunities. The development and implementation of the Road Sector Development Programme (RSDP): I, II, III and IV, since 1997 has played a significant role in improving both the quantity and quality of roads. The changes in road accessibility have been accompanied by increments in traffic mobility.
- On the other hand, RTA, which is one of the main direct negative impacts of road development, is increasing from time to time and has impacted on fatalities, disabilities and property damages which is estimated to be equivalent to about 1 percent of the national GDP.
- The rate of road pavement (proportion of asphalted roads) is calculated to be 42, 27 and 14 percent of the total roads during the Imperial, Derg and EPRDF periods, respectively. When it is compared with Ethiopian population trend since 1951, the correlation between the density of the total and asphalt roads is 0.87 and 0.38, respectively. This shows that the emphasis given to the expansion of paved roads in recent years is rather weak.

7.2.2 Economic Impacts

7.2.2.1 Impacts of Road Development on Occupation

- As distance increases from the study roads, the study found out that the engagement of household heads and other family member in governmental organizations and trading activities decreases.
- On the other hand, unemployment is found to decrease with an increase in distance for Corridor 1, where as the opposite was found in case of Corridor 3; whereas, the

number of dependent family members in all corridors increases with increasing distance from the study roads.

- The nearer households are to the road, the higher is the diversification of their livelihood and vice versa.

7.2.2.2 Impacts of Road Development on Agriculture

- As one moves to COZs agricultural engagement increases, while diversification in economic activity decreases.
- Cereals and cash crops in ZOI of all study corridors have better productivity than COZs. This means, better productivity is achieved as one move nearer to the study roads.
- The road intervention has strong significant impact on the productivity of maize in the ZOI than COZs. On the other hand, the significant differences in Corridor 2 and in all Corridors show negative road intervention impacts for sorghum.
- Households before the road intervention were producing better than after road intervention except in Corridor 3 for cereals. The main reasons identified based on FGD and interviews include the depletion of the land overtime, while farmers do not have the knowhow to make use of modern fertilizers.
- Regarding the use of agricultural technologies, improvements have been achieved due to road intervention though still at infant stage. Fertilizer use in Corridor 1, 2 and 3 is found to be 1.15, 1.02 and 1.18 times greater after road intervention than before.
- As compared to other corridors, Corridor 1 is found to have better utilization of animal drawn carts in transporting agricultural produce to the market, whereas the use of human portage and pack animals is found to be limited.
- Utilization of pack animals is found to be very high in COZs than ZOI. This shows that the longer the distance from the study roads, the more is the utilization of pack animals in transporting households' produce to the market.
- Given other factors constant, the longer the distance from the study road, the more is the utilization of carts to transport agricultural produce to the market.

- Although Corridor 3 has favourable agro-climatic endowments, the availability of transport services is very limited and this has resulted in high and rapidly increasing tariff structures for transporting agricultural produce that has its own negative impact on agricultural productivity.
- Generally, there are temporal changes in terms of hiring modern transport services after road intervention than before. On the other hand, households in ZOI are hiring more transport services than COZs in all study corridors to transport agricultural produce.

7.2.2.3 Impacts of Road Development on Individual Income

- The income of individual household respondents is found to be inversely related to their distance from the study roads (i.e., the longer the distance of individual households from the road, the lower is their income). This study has checked the theory of change and corridor wise, individual incomes are found to increase with distance in Corridor 1(does not support the change theory) unlike the other two corridors. As revealed by FGDs and interviews, this is due to the fact that farmers in Corridor 1 who are located further from the study roads have bigger land holdings and are producing cash crops particularly sesame that fetches good price in the market. In other words, the temporal changes in income are found to be very high in both ZOI and COZs. But spatially, the changes are found to be lesser in ZOI than COZs.
- The paired sample t test shows that there are significant changes in individual incomes between the "before" and "after" situation throughout the study corridors. All results are significant at p value of less than 0.001.
- Results of double difference(DD) regression model had been used to compare the changes in individual income in:
    1) Progressive villages (within 2.5 km of the study road), and COZs (beyond five kms of the study road);
    2) Traditional villages (those located between 2.5 and 4.9kms from the study road), and COZs (beyond five kms from the study road);

3) Progressive + traditional villages (ZOI) (within 5 km of the study road), and COZs (beyond five kms from the study road).

- Accordingly, for the first comparison (progressive versus COZs) the results are shown as follows:
  - ➢ For a one family member increase in the household, an individual income decreases by about $1001.16;
  - ➢ For a one hectare increase in cultivated land, individual income increases by about $527.25;
  - ➢ For a one quintal production of cash crop, an individual income increases by about $38.024;
  - ➢ The mean individual income after the road intervention is $4,951.80 times higher than before the road intervention for the control group;
  - ➢ The mean individual income in the treated (progressive) villages was $1557.81 times higher than in the control villages before intervention period;
  - ➢ Controlling for any pre existing differences between treated and control villages, before the intervention period, the mean individual income is $1839.80 higher for treated villages as compared to control villages.
- Therefore, the overall result of the DD model is significant at P value less than 0.10 for progressive versus control villages. In other words, the result shows that with increased distance from both sides of the study roads, individual income exhibits significant decrease. Keeping other factors constant, a progressive zone will have significant difference/ impact spatially and temporally due to road intervention.
- In case of the second comparison, many of the explanatory variables included in the model exhibited significant difference, but the integrated variables' model (DD) does not show significant result.
- The results of double difference independent samples test for individual income in the respective locations mentioned above is found to be almost the same.

7.2.2.4 Impacts of Road Development on Households' Saving and Borrowing:

- Membership in saving groups and amount of savings in COZ are found to be very low as compared to ZOI, with Corridor 2 showing the lowest figures. The changes in mean value were calculated to be 5.67, 5.24 and 5.70 percent and that are found to be significant at P values of less than 0.001, 0.01 and 0.001 for ZOI, COZs and for both zones, respectively.

- The extent of borrowing is also found to be very high after the road intervention and in ZOI. The change for all corridors is calculated to be 43.15, 95.53 and 50.66 percent and found significant at P value of less than 0.01, 0.05 and 0.01 for ZOI, COZs and for both zones, respectively.

7.2.2.5 Impacts of Road Development on Asset Ownership

- *Changes in house ownership*: out of the total 392 household heads, 94 percent are owners (the same as before road intervention). The number of tenants has declined from 6 percent to the current 5 percent of the surveyed households.
- *Change in ownership of radio*: the temporal change in the mean values is 1.94, 13.86 and 6.93 percent for ZOI, COZ and for both zones, respectively. The change is positive and is significant at P value of of less than 0.10. From the spatial perspective, COZs had less ownership than ZOI, before the road intervention.
- *Changes in ownership of cell phones*: The temporal change for this personal item is 73.08, 50.00, and 67.92 percent for ZOI, COZ and for both zones, respectively. The impact is positive and significant at P value of less than 0.001. From the spatial perspective, ZOI has 1.05 times greater ownership than in COZs
- *Changes in ownership of bees colonies*: The average number of bee colonies in all corridors is calculated to be 16.71 and 7.57 before and after the road intervention, respectively. The result shows that there is a decline by 62.96, 38.57 and 54.70 percent for ZOI, COZs and for both zones, respectively. The change is negative (P value of less than 0.10). In terms of spatial change, ZOI has greater mean value than COZ before road intervention but the situation is reversed after the road intervention.

7.2.2.6 Road Development Impacts on Small Scale Trading and Business

- The road intervention in the study corridors has generated considerable positive impacts in terms of business expansion.
- In terms of fixed and variable capital, the average initial capital before road intervention was ETB 12,093.18, whereas, during the follow-up period, it has

increased to ETB 138,229.84. The increase is 1043 percent and is significant at P value of less than 0.001.

- As regards the average amount of tax businessmen pay per year is calculated to be ETB 1,231.04 and 4,380.56 before and after the road intervention, respectively. The increase in this regard is 245.85 percent and is significant at P value of less than 0.05.

7.2.2.7 Road Development Impacts on Accessibility of Market

- Distance between the farm place and the road under study as well as between the market is reduced as compared to before intervention.

7.2.2.8 Road Development Impacts on Traffic Mobility

- In case of gravel roads, the share of pack animals and carts is very high, whereas, in case of paved roads motorized transport has the highest share.
- Corridor 2 (which is a paved road) has 18 times greater motorized vehicles modal share than Corridor 1.

7.2.3 Social Impacts

7. 2.3.1 Spatiotemporal Impacts of Road Development on Population Distribution

- The density of population is found to be higher near the study roads, which was observed to be even higher in 2014 as compared to the base line situation in 2007.

7. 2.3.2 Spatiotemporal Impacts of Road Development on Settlement Expansion

- The expansion of the built up areas in general exhibited a peak immediately after the road interventions as shown in Chifra study highway. It is expected that this pattern also holds true in the others study roads.
- The annual average expansion rate of settlements along paved study roads is found to be higher than that has occurred in the gravel roads. This shows that paved roads have more strong impacts in settlement expansion than gravel roads. As computed employing GIS software, the annual average settlement expansion in Chifra and Hara (along paved road of Corridor 2) is 11.7 and 4.5 percent, respectively, whereas, in Shikute and Kachisi (along gravel road of Corridor 3) is 1.1 percent.

7.2.3.3 Impact of Road on Poverty

- In all the study corridors, the proportion of houses with wood and mud walls has exhibited a slight decline from 91 to 88%, while those with stone walls increased from 1 to 3 percent. On the other hand, there has been considerable conversion from thatched to corrugated iron roofed houses after the road intervention. That is those covered with corrugated iron roofing have increased from 45.68 to 65.06 percent for ZOI and from 38.26 to 58.04 percent for COZ.
- Households were getting lower number of meals per day before than after the road intervention, with households located near the study roads (ZOI) getting 1.3 times higher number of meals than those households located away (COZs) after the road intervention except in some parts of Corridor 2 (in Afar region).
- Corridor wise, households who get meals three times a day after road intervention are dominant in Corridor 1 (90.4%), followed by Corridor 2 (73.1%) and Corridor 3 (55.7%).
- The extent of and change in the consumption of full diet by children at the household level is found to be lower in COZs than ZOI.
- The proportion of households getting more diversified food items is found to be high during the follow-up period than before the road intervention (except in COZ of Corridor 3), and in ZOI than COZ in all of the three corridors.
- The status of family members with regard to the wearing of shoes and proper clothing has exhibited both temporal and spatial improvements with some exceptions in case of clothing in Corridors 2 and 3.

7.2.3.4 Road Impacts on Educational Status of Households and Family Members

- The empirical analysis undertaken in the changes in the distribution of schools show that they had been attracted towards the road lines under study. Road development, therefore, has both temporal and spatial impact on the pattern of school distribution. The same impact is observed in the case of health facilities.
- The longer the distance of a household from the study roads, the lower is students' school enrolment.

- The result also confirms that literacy rate decreases as moves from the study roads towards COZs and vice versa.

7.2.3.5 Road Impacts on Access to Health Facilities

- Access to hospital facilities in the study corridors is found to be higher than the current performance both at the national and regional levels in 2013 and 2012, respectively, although lower than the national standard (1:100,000). Access to health centres is low in all cases. Similarly, access to health posts is lower than the national standard though higher than the national performance in 2013.
- As computed based on mean values, there is positive change in terms of access to health facilities (km) by 1.82, 5.80, 9.0 and 6.18 percent for Corridor 1, 2, 3 and for all corridors, respectively, and the result is found to be significant for all corridors taken together at p value of less than 0.10 only.

7.2.3.6 Gender Impacts of Road Development

- The time spent by women in the study areas to purchase household consumer items, fetch water and collect fuel wood as well as to get medical assistance for members of their family is found to be very high in COZ with slight changes as compared to ZOI during before and after road intervention.

7.2.3.7 Opinions of Household Respondents on the Socioeconomic Impacts of Road Development

- According to summarized responses to the 20 questions posed to household respondents as to whether the roads under study have strong socioeconomic impacts, 80.42 and 67.77 percent of them indicated that they *disagree* and *agree* about the occurrence of socio economic changes after the road intervention respectively.

7.2.4 Challenges which Affected Positive Impacts of Road Development

- Both natural and manmade factors affect the achievements of potential positive impacts by road development.
- Generally, respondents in the ZOI are found to be better aware of traffic related rules and regulations than those in COZ. From temporal perspective, the level of awareness is better after road intervention than before.

- The low level of awareness about traffic safety is one of the factors for the negative impact of road development through traffic accidents. For instance as data obtained from traffic police indicate, the number of traffic accidents that occurred in Guba Lafto *wereda* in 2013 was 42, which increased to 60 in 2014 showing an increase of 42.86 percent in a single year. As per information gathered through FGDs and interviews held with the *Wereda* Transport Officer, a total of 57 traffic accidents had occurred in the *wereda* during the space of nine months.
- Based on the date of issuance of driving licenses and the occurrence of traffic accident, from 57 accidents (in 2014), 18 licenses are owned by experienced drivers but the remaining 39 licenses are new of mostly owned by very young drivers.
- Poor road designs, as it is elaborated in the case in Hara town, and lack of good governance in transport management also contravene from achieving the potential positive impacts of road development.

7.3 Conclusions

This chapter has discussed the challenges that directly and/or indirectly affect the achievement of sustained socioeconomic impacts which are expected from investments already made on roads. This is examined by considering natural and manmade constraints. The former, which includes weather, climate and relief, is considered as external and more challenging to mitigate, while it is also capital intensive. The man made factors, on the other hand, are well entrenched particularly in developing countries like Ethiopia although not very difficult to tackle. For instance, there are no effective systems in place to monitor and evaluate the positive and negative impacts of road development in all of the three study areas as well as to check the implementation of road and road transport related rules and regulations. Moreover, the efforts so far made in terms of promoting community participation in road development and creating awareness about traffic safety have been generally limited thus leading to undesirable outcomes of road development. Such undesirable consequences, which mainly include road traffic accidents, are caused by, among others, poor road designs (as observed along the highway at Hara), the use of less efficient transport equipment (such as the use of old vehicles) and the use of trucks for passenger transport.

A summary of the analysis undertaken in Chapter Four, Five, Six and the first part of chapter Seven have been summarized here, whilst Chapter Eight – which is the last chapter – provides the conclusions and recommendations of the study in line with the objectives of the dissertation.

CHAPTER EIGHT: CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

It has been pointed out that the first tracks made by the ancient men enabled them to move from one place to another. Such tracks are believed to be the skeletal frameworks of today's more sophisticated road networks, which have become among the most essential infrastructure for the socioeconomic development and well-being of the society. Accordingly, it can be generally understood that, the availability of roads facilitate rural development; well maintained or upgraded roads improve mobility and solve transport access-related problems; while improved road access enhances living conditions and income earning opportunities that in turn foster the achievement of sustainable development.

It is economists' and geographers' philosophy that transport infrastructure is not an end by itself, but it becomes productive when it is responsive to the demand for transport generated in the production and consumption of goods and services. The need for transport infrastructure is always a derived call for and the study of transport is perceived as a study of different sectoral activities in the economy. In this research, transport is approached from a geographic viewpoint which emphasizes that transport is an infrastructural element with powerful implications for overall development, most importantly for the spatial distribution of socioeconomic development. This Chapter concludes by distilling the finding of the study by way of answering the objectives formulated in Chapter One and relates them with the theoretical frameworks of the study.

The **first** objective is about the efforts undertaken towards expanding the road network in Ethiopia since 1950s and assessing the status and quality of roads during the last three consecutive political regimes, namely the Imperial, Derg and EPRDF periods and an overview of the induced impacts at the national level. The study relates this analysis with Programme Theory and to a certain extent with Graph Theory. Programme Theory is understood as the underlying assumptions and delivery mechanism of how a programme set should work. It is related to the development of programme goals and objectives. Programme Theory is also related to how the programme is implemented through the tasks of funding mechanisms and monitoring. RSDP in Ethiopia is a good example in this regard. The assumptions are related to how the programme's outcomes can be measured via programme determinants (Rogers, Petrosino, Huebner, & Hacsi 2000 in Hubbard 2010:27). Whereas Graph Theory is about the transport network analysis discussed by Rodrgue *et al* 2012).

Although huge disparities exist among the three political regimes in terms of mobilizing finance for road development in the Country, the investments made on road development by mobilizing internal and external financial resources have achieved considerable increases in road density as well as road standards (quality). The various road development-related interventions in turn have brought about direct and indirect socioeconomic impacts both at the macro and microeconomic levels. The examples that can be mentioned include its contribution to GDP and increased level of traffic mobility as well as negative impacts such as road traffic accidents

Based on the above temporal national level road development background, the **second** objective is about the main body of the dissertation, i.e., examining using quasi-experimental research design the direct and indirect socioeconomic impacts (by comparing the "before" and "after" situation) of road development interventions in the study areas. The foundation of this analysis is the Theory of Change. The Theory of Change is about the outcome of the implemented programme (Davies, 2012). In this regard, it is about impact phenomena based on origin and destination programmes whether short, intermediate or long processed changes.

By taking out outliers from the originally selected 400 sample households, the responses of 392 (98%) of the respondents are summarized and analysed under four sub objectives which are concerned about the economic and social impacts as well as the challenges that affected the positive impacts of road development.

The t tests, the percentage changes calculated using the mean values, the results of the multiple regression model for DD and the incomes based quintiles that were employed in the process of the study enabled the researcher to investigating the impacts of road infrastructure on economic and social aspects of households as well as the challenges that contravene in achieving the potential positive impacts. Based on the out puts of the models, temporal (before and after road intervention) and spatial (zone of influence (ZOI) versus control zone (COZ) impacts have been analyzed.

As regards the **first sub objective** (economic impact of road development), road intervention is found to have impacted on employment. Ethiopia is a predominantly agrarian country, whilst the majority (72.4%) of surveyed households in the three study corridors were engaged in farming as their first most important source of livelihood, while it was identified as the second major source of livelihood for eight percent of the households. Furthermore, as one moves to COZs, the proportion of households engaged in agriculture and households members' dependency ratio increases. Other employment opportunities in government offices as well as small scale trading decrease with distance from the study roads.

Road intervention has impacted on agricultural productivity. In other words, the findings depict that the nearer to the road, the higher is the fertilizer usage and productivity of cereals. When we see maize productivity the road intervention has strong significant impact in the ZOI than COZs in all corridors. Farmers reiterated that the use of improved varieties of maize and the application of fertilizers gives better results in case of maize, while the reverse is true in case of sorghum. In other words, in all corridors except maize and teff, other types of crops (sorghum, sesame and cotton) are showing declining productivity trend as the findings of the study suggest. The reason for the decline of the yield as the FGD participants and interviewees raise is that gradual land depletion, climatic variations and un expected low returns even when modern fertilizer is used.

Agricultural produce is mainly transported by pack animals. Utilization of pack animals in the three corridors is very high in COZs than ZOI. This shows that the longer the distance from the study roads, the more is the utilization of pack animals. The majority of households are using donkey, which is the most popular beast of burden as it is also true in other parts of Ethiopia.

Although Corridor 3 has favourable conditions for agricultural production, the level of road transport infrastructure and services is found at a very low level and this has resulted in a generally high and rapidly increasing road transport tariff structure, with consequences on the cost of transporting agricultural inputs and surplus produce and hence on the incentives to increase agricultural productivity. Generally, there are both temporal and spatial changes whereby households are using more modern means of transport after the road intervention than before. Meanwhile, households in ZOI are using more modern means of transport than those in COZs in all corridors to transport agricultural produce.

Improved road access has also induced the establishment of small scale trading and other business activities. In such small scale businesses, the size of employment created, the amount of average daily earnings, the number of customers, the amount of taxes paid, the use of the road under study to bring products for sale, and size of capital of the business have been significantly increased. All these are evidences for the positive economic impacts of accessibility improvements due to road intervention.

Theory of change postulates that distance of individuals' residence from the road is inversely related to their income, suggesting that the longer the distance of individuals from the road, the lower is their income. The findings show that the impact is strong in the ZOI than COZs in all the three study corridors. In terms of temporal changes, the paired sample t test shows that there are significant changes between the "before" and "after" situation throughout the study corridors. The results of the double difference (DD) regression model are also found to be significant as compared to the locations within 2.5 kms (progressive) and beyond 5kms (COZs). In other words, there is no significant difference between those located within 5kms and beyond 5 kms.

The paired sample t test used in the analysis also depicts significant positive impacts with regard to saving and borrowing money, movable and immovable asset ownership such as houses, radio, television, beds and cell phones. The availability of these properties is found to be very high in ZOI than COZs. However, after road intervention, the ownership of radios exhibited more significant increase in COZs than ZOI where the majority of households are observed to have switched to the use of television. Another movable asset considered was bee colonies which experienced significant reduction due to the widespread use of herbicides (that affected flowers) and pesticides (that killed bees).

The findings of the study also showed that paved roads create higher mobility patterns as compared to unpaved ones. In this regard, Corridor 2 (which is paved) is found to have 18 times larger motorized vehicles than Corridor 1. No automobiles and bajajs were registered during the traffic count undertaken on both of the unpaved roads.

Assessing the social impact, the **second sub objective,** is about the analysis and comparison of spatiotemporal impacts of road development on selected social indicators considering pre- and post- road intervention periods in the selected study corridors. Spatiotemporal analysis, particularly on the expansion of built up areas along the study roads is about the Central Place Theory (as explained by Christaller in Brandford, 1987) and Trickle-Down Theory (by Oguzer in Adadeji 2014). In case of Christaller Theory in particular, the more productive land will be located closer to the road, while the non productive land will be the one farther located with higher transport cost (built up areas become smaller and smaller).

Taking the highway as advantage, households, commercial enterprises and institutions race for the proximity to CBD as had been observed in Corridor 2 (Chifra and Hara), and in Corridor 3 (Shikute and Kachisi).

GIS-based analysis that is conducted based on satellite imageries taken at different times as well as secondary socioeconomic data show that the distribution of population, and the pattern of the built up areas along the study corridors illustrate positive temporal and spatial changes. The population density and settlement expansion, which are measured based on socioeconomic indicators considered by the study in both the pre- and post- road intervention periods is found to be concentrated towards the roads under study. As explained by Liu *et al* (2005), a number of urban expansions are defined as linear spreading out from a settlement because it usually arises along the main transportation axis, linking the urban areas in a long narrow trip. A distinctive example is observed along the study corridors among which the settlement expansion at Shikite town is a typical example. As evidenced by cross sectional household level data, the construction of walls shows temporal and spatial changes from wood and mud to stone and hollow concrete blocks, and from thatched to corrugated iron roofing.

The **Third sub objective** under social impact is about changes in proximity/accessibility of road and its relationships with poverty related indicators (such as housing, use of meals, and clothing), education, health and gender issues. Some of the poverty-related indicators such as income and housing conditions had been explained under sub objective one and two above. Regarding the remaining indicators, based on cumulative results that refer to all the three corridors, households before road intervention were getting lower number of meals per day than after road intervention and those households located near the road (ZOI) are getting number of meals that are higher than those of households located away from the road (COZs) after road intervention. Corridor wise, the proportion of households who get meals three times a day after road intervention are dominant in Corridor 1.

Wearing shoes by family members exhibited very fast change in COZs than ZOI in all of the three corridors. Rapid change should not be expected near towns (ZOI), however, since household members in this zone have been wearing shoes any way even before the road intervention.

The distribution of educational facilities in the study corridors that are mapped using GIS exhibit positive changes both temporally and spatially. According to the responses obtained from 392 respondents, the average distance between the residence of households and primary schools is strongly significant. The result also confirms that literacy rate decreases as one moves away from the study roads (towards COZs).

The distribution of health facilities in the study corridors displayed on GIS maps exhibit positive changes both temporally and spatially. According to the summarized responses from the household survey, the average distance between the residence of households and the nearest health facility is improved at significant. In this regard, the improvement in terms of access to the nearest health facility is less than that achieved in case of access to the nearest school. With respect to the nearest type of health facility, health posts were accounting for the largest share before road intervention, whereas this is overtaken by health centres which are now made available by the government after the road intervention.

An attempt was also made to compare access to health facilities by taking the standard set by the Ethiopian Ministry of Health and secondary data obtained from relevant government offices. Regarding hospitals, the ratio per 100,000 people is computed to be higher than the actual performance both at the national and regional levels in 2013 and 2012, respectively, whereas it is lower than the national standard set (the access of one hospital per 100,000 people). In terms of access to health centres, the findings show that the calculated ratio is low in all cases. Similarly, access to health posts is found to be lower than the national standard set though higher than the actual performance at the national level in 2013. Since the access to hospitals and health posts in the study corridors is found to be greater than the national performance, it is obvious that the road intervention must have contributed to these achievements.

The time spent by women to purchase basic household items, fetch drinking water and collect fuel wood as well as to get medical assistance for family members is found to be high in COZ with slight temporal changes as compared to ZOI. Therefore, women in general had more intense work burden before the road intervention than after and in the COZs than ZOI.

The **final objective** of this study was to explore the challenges that contravened in the achievement of the potential positive impacts that should have been generated from road intervention. These were categorized under natural factors such as the topography, weather and climate impacting on the frequency of maintenance of roads and costs of mobility, and manmade factors that include among others poor management accompanied by:

First: Poor efforts towards awareness creation among the community; the findings confirm that respondents in the ZOI are better aware of the traffic rules and regulations than those in COZ. Temporally, the awareness is better after road intervention than before. Furthermore, the majority of the respondents do not know whether they should keep their left or right while they walk parallel to the highway. In all cases the awareness level in all the corridors is below 50 percent even after road intervention. This problem is dominant in Corridor 2 which is paved and the occurrence of traffic accidents is the highest.

Second: Weak follow-up and control mechanisms that do not allow optimal maintenance and upgrading of roads, bridges and drainage canals where they exist; and delays in spreading heaps of gravel dumped along roads. This problem has been observed along Corridor 1 and 3 where highest proportion of roads is under poor condition. Moreover, the majority of the bridges are narrow and do not allow two vehicles to pass in two directions. Due to the absence of drainage canals particularly along the gravel roads in corridors 1 and 3, unmanaged flooding contributes to wear and tear of the roads.

Third: According to data obtained from household respondents, the manifestation of RTA along the study corridors is insignificant. But secondary data and additional information gathered from FGDs confirm that RTA recurring due to poor road design that does not take into account topographic conditions, sharp curves, weak vehicle testing and periodic inspection, overloading, and the use of old vehicles that are prone to mechanical failure. On the other hand, persons and places directly or indirectly affected due to road intervention show significant value in case of corridor 2, which is highly affected by RTA.

Fourth: There are no effective participatory mechanisms in the design and construction as well as maintenance and upgrading of road infrastructure. To minimize the frequent occurrence of RTAs along corridor 2 particularly at Hara line, the initiative taken by the local community in terms of putting traffic accident waning signs and zebra crossings in coordination with the local traffic police is commendable. The community has also contributed finance and labour to upgrade the bus terminal, although it was not completed during the survey period. In addition, unless highway are connected with road links similar to what URRAP is doing in other parts of the country, the community will not get the expected advantage from the highway.

Fifth: Despite significant improvements in density of all roads, the density of paved roads per 1,000km^{2}s in Ethiopia is set below low income countries. In this connection, the attention is given to pave the study roads along Corridor 1 and 3 is very limited and this has been a source of grievances among the local population.

Sixth: Weak emphasis is given to establish and upgrade vehicle terminals; the presence of well located terminals would enable taking advantage of the geographical locations and play a role in improving the efficiency of transportation systems. Apart from serving as key origin and destination point, they also play as the intermediary nodes which any planner should consider in any road network expansion project. In all of the study corridors, there are no terminals which meet international standards. Their absence and/or the low standard of available terminals will force drivers to park alongside the road, which will have unwarranted consequences such as illegal loading and/or overloading, RTA, and loss of municipal and national tax revenues. The exiting low standard bus terminals are not well managed although some of them are collecting service fees from transport operators.

Seventh: Weak emphasis given to harmonize the organizational structures and staffing plans of those sectoral organizations with road and transport related mandates.: Transport sector structure from national up to local is classified into two: One is ERA which is responsible for fixed facilities such as highways; and the second one is Federal Transport Authority (FTA) which is responsible for managing the software (moving entities). Both have empowered the management up to regions; and the regions, up to *wereda*. ERA's structure is uniform up to *wereda*. But TA's structure and implementation rules as well as manpower (transport professional) allocation vary from region to region. These anomalies often lead to mismanagements in the regions as well as at *wereda* level. Such challenges have directly/indirectly affected the sustained socioeconomic impacts.

Eighth: Weak attention given to minimize RTA: a) The most important causes of fatality are driver (human), natural (road) and vehicle induced factors. In case of developing countries like in Ethiopia, the human induced factors are the major ones because of majority of drivers drive beyond the specified speed. As TLR cited in Rodrigue *et al*, 2011, any impact happening at a speed of above 60 km/h witnesses a dramatic increase in the probability of a fatality. Furthermore, any collision with a pedestrian encountering at more than 80 km/h is almost certain to result in a fatality. As WHO (cited in Samson 2012) quoted, in 2030 RTA will be the third leading burden on health worldwide. Therefore, the findings confirm that there is a huge work to be done to resolve such catastrophic impact particularly along the paved roads of Ethiopia. b) As per the evidence obtained from traffic police, most RTA is caused by young and inexperienced drivers. The strictness of the procedures adopted in issuing driving licenses also differs from region to region; c) There are few efforts aimed at improving sharp curves black spots, d)The provision of traffic safety related trainings for the pedestrians, drivers and traffic police is minimal.

In conclusion, while sustaining positive socioeconomic impacts requires integrated work, weak management in the road and transport sectors directly and/or indirectly brings about negative socioeconomic impacts both at the individual, household, locality, regional and national levels.

8.2 Recommendations

Under this subsection, recommendations derived from the findings of the study, particularly those pertaining factors contravening positive socioeconomic impacts, are provided for further consideration by policy makers, executive bodies and researchers. The main focus areas of the recommendation are: road pavement, road maintenance, vehicle terminals, and road links to main highways, RTA risk and environmental impacts. Additional points considered include: the need to harmonize organization structures and staffing plans as well as rules and regulations related to road and transport planning and management, the need to institute workable mechanisms for road transport impact assessment and main issues for further research.

8.2.1 Road Pavement

The study found out that, although the total per capita road length is increasing, this is not matched by a corresponding increase in that of paved roads per capita. In other words, the availability of total roads per 1000 people had been increased from 0.30kms in 1951 to 1.0km in 2013, whereas the length of paved roads per capita declined from 0.16kms in 1951 to 0.13kms in

2013. Unpaved roads support limited traffic as shown by traffic counts undertaken in the study corridors that are gravel surfaced.

One can therefore infer from these trends that the potential socioeconomic impacts that could have been derived from the expansion of paved roads could not be achieved due to the slow performance in terms of increasing the stock of paved roads, particularly during the last two regimes.

One of the key informant at Hara said, *"Road is road, but no road is like a paved road. Not only people, but also animals like it. For instance, cattle, equines, goats, sheep, and even lions etc are reluctant to leave away from the paved road: instead they prefer walking forming a line, and even they sleep on it"*.

Enhancing road pavement is therefore a mandatory measure to be taken to accommodate the growing traffic that is driven by fast economic growth coupled with increasing demand for mobility. The latter, in particular, is a reflection of increases in per capita income but also consistent with the fast rate of urbanization being experienced by the country, which also implies heightened level of rural-urban, urban-urban and intra-urban mobility.

Put differently, Ethiopia can benefit from paving its roads as it possesses huge areas with favourable agro ecological zones where different exportable crops and animal breeding can be undertaken. For instance, according to a World Bank study (2014), Ethiopia is the world's second largest exporter of sesame (sesame accounts for 14% of total export earnings after coffee). Corridors 1 and 3 where this research has been undertaken have immense potentials for export orientated agricultural development. Corridor 1, for example, has enormous potential for sesame and is in fact the major producer of this cash crop, apart from its potentials for cattle rearing and gum and incense production. Likewise, Corridor 3 has untouched potential for the production of sesame as well as gum and incense. But these potentials remain basically untapped as the available road infrastructure is unpaved and low standard.

Therefore, government at all levels have to do with appropriate measures towards upgrading the unpaved roads that exist in corridor 1 and 3 including mobilizing the community and other actors.

8.2.2 Timely Road Maintenance

No asset lasts long without due maintenance and rural roads are no exemption. The achievement of long-term social and economic benefits from highways is often threatened by the lack of regular maintenance. It is obvious that gravel roads quickly deteriorate if they are not regularly maintained. Road users are generally risk averse and will not engage in new activities or mobility once they know that the roads on which their livelihood depends is temporarily unusable or if its poorer condition in the following year will mean additional costs and time. Since similar problems are already being experienced particularly in corridors 1 and 3, and as paving the whole length of existing roads would take some time, it would be prudent to give priority to the maintenance of old bridges and widening of narrow ones, maintaining the existing roads, and instituting a mechanism for mobilizing the community towards the proactive management of local roads at the local level.

8.2.3. Vehicle Terminals

The available few bus terminal facilities are found to be below the standard, whereas the planning and implementation of road expansion projects should integrate auxiliary facilities that include vehicle terminals, stations and parking lots. Adequate heed should also be given to other facilities such as offices, passenger waiting areas, cafeterias and toilets that are critical for the proper day to day operation of such facilities. In addition, the areas where such facilities are located should be properly lighted and guarded so that the safety and security of passengers and transport operators as well as transport equipment can be ensured. The upgrading and expansion of such facilities should take into account the existing and future traffic (i.e., growth in vehicles and passengers).

8.2.4 Bridges and Road Links

The community knows well about the importance of roads, whereas there are few initiatives to promote their participation in the upgrading of nearby roads as well as the construction of bridges over river crossings and new links with the existing main roads. This would require serious commitment on the part of the various sector offices and other stakeholders to provide continuous support that would enable to achieve enhanced access of the rural population. This will create significant opportunities for facilitating the mobility of workers, women, students, the elderly and persons with disabilities, etc. to commute to the workplace, markets, schools, health facilities, and recreational and other cultural facilities and public service providing institutions.

8.2.5 Minimizing RTA Risks and Negative Environmental Impacts

Despite remarkable improvements had been achieved in terms of road interventions, the general public is yet to have sufficient awareness about traffic rules and regulations, which is one of the factors for the negative impacts of road development such as traffic accidents. The findings confirm that there is a huge work to be undertaken to effectively regulate vehicle speeds and night time passenger mobility. The use of modern technologies like radar and GPS to be mounted on vehicles could help resolve such problems. In addition, the construction of additional tolls along highways can help enforce speed and overloading related regulations.

Road transport offices established at the regional and district (*wereda*) levels should resolve such weaknesses via awareness creations, trainings and workshops to be organized in collaboration with the traffic police. ERA with the help of an active participation of the community should identify and make improvements on traffic accident prone areas (black spots). These include sharp curves to be straightened, sloppy areas to be supported by road calmer and fixed warning notice, raised road sides with protecting metallic or concrete cement (bollard) and preparing free passages across highways to support the provision of sustained service to markets and other public facilities (for old people, women, children, persons with disability, livestock and pets, carts and rickshaws) where ever possible. By filling the areas in between the elevated right of way of the road and the adjoining strips with selected materials to facilitate crossing to be synchronized with speed bumps and zebra crossings are obligatory particularly in Hara and Chifra corridors. Moreover, regional and district transport offices need to control the use of old vehicles with mechanical problems as well as freight trucks for passenger transport. Drivers who continuously drive beyond the permissible duration should abide by the rules and regulations through the use of modern operation management and technology accompanied by strict monitoring and evaluation.

Highway obstructions due to RTA, which sometime take hours, should be resolved by adopting mobile emergency solutions that employ modern information and communication technology and standby cranes along the study highways. This should be a major focus area for the Federal Transport Authority and that should handle these issued in collaboration with regional states and local administrations.

8.2.6 Harmonizing Organizational Structures and Rules and Regulations

The Federal Transport Authority and the corresponding institutions established at the regional and district level should collaborate towards harmonizing organizational charts, rules and regulations, staffing plans and HRM policies. These are expected to ensure that the various operational and regulatory activities that include the provision of driving licenses would be undertaken in a transparent and accountable manner.

8.2.7 Performance Monitoring and Evaluation and Regular Impact Assessment

Regular monitoring and evaluation of the socio-economic and environmental impacts of road development interventions need to be undertaken. These have to be carried out taking into account baseline conditions as well as employing standard indicators. This will ensure that, in the future, impacts of road development on poverty and sustainable development are captured, rather than assumed.

8.2.8 Recommendation for Further Research

Research on the socio economic impact assessment of road development provides a framework for addressing several purposes. Due to time and financial constraints, this study could not widely utilize satellite imageries and time series data on other types of land use cover as well as investment types pulled due to road intervention in the localised study areas. Secondly temporal and spatial distribution of schools and health facilities under this study were not supported by GPS along the study corridors except the distribution at *kebele* level. Therefore, one can upgrade this study by adding the mentioned variables with complete time series socioeconomic data.

REFERENCES

ActKnowledge and related community site theory of change, [Online]. http://www.actknowledge.org/ Accessed on 22 July 2013.

African Development Bank (ADB), 2006. *When do rural roads benefit the poor and how? An in-depth analysis based on case Studies*. by Hemamala. Hettig: Philippines. http://www.adb.org/sites/default/files/publication/29406/when-rural-roads-benefit-poor.pdf. Accessed on 23 March, 2013.

Adedeji, O A.; Olafiaji, E M.; Omole, F K.; Olanibi, J A.; and Yusuff Lukman, 2014. An assessment of the impact of road transport on rural development: a case study of Obokun local government area of Osun state, Nigeria. *British Journal of Environmental Sciences*, 2(1):34-48.

Afar National Regional State, 2010. Programme of plan on adaptation to climate change. Semera, Ethiopia: Afar National Regional State.

African Development Fund (ADF) and ADB, 2009. *Country governance profile*. Federal Democratic Republic of Ethiopia: Governance, Economic & Financial Reforms Department, Country Regional Department East.

Affi, N'guessan M. 2010. Impact of transportation infrastructure improvement project on residential property values; a case study of Interstate 10/ Katy Freeway. PhD Dissertation, Southern University, Texas.

Agunga, R. 1997. *Developing the Third World: A Communication approach*. New York: Nova Science Commack

Algirdas, J. Diana, M. & Jurgita P. 2005.The main principles of modelling the interaction between transport infrastructure development and economy. *Transport,* 20(3):117-122. http://dx.doi.org/10.1080/16484142.2005.9638007 (Accessed October 2011).

Alonso, W. 1964. *Location and land use: Toward general theory of land rent*. Cambridge: Massachusetts, Harvard University Press.

Amhara National Regional State (ANRS), 2011. Geography and climate, BoFED, BahirDar, Ethiopia. (www.amharabofed. Tov.et/ geography – climate.htm l (Accessed 13 June, 2015).

Anderson, A. 2005.*The community builder's approach to theory of change: A practical guide to theory development.* New York: Aspen Institute Roundtable on Community Change.

Baker,J. 2000. *Evaluating the impact of development projects on poverty — A handbook for practitioners*. Directions in Development Series: Washington, D.C.: World Bank.

Bamberger, M. & Fujita, N. 2008. *Impact evaluation of development assistance designing methodologically sound impact evaluations under budget, Time and Data Constraints A Practical Handbook.* Foundation for Advanced Studies on International Development.

Banerjee, A, Duflo, E. and Qian, N.2009. *On the road: Access to transportation infrastructure and economic growth in China*. Preliminary Version.[SI:sn].

Banji, G. Gordon, H. and Riverson, J. 2012. Rural Transport: Improving its contribution to growth and poverty reduction in Sub-Saharan Africa. SSATP Working Paper No. 93

Bhatta, B. 2004. Socioeconomic transformations and road accessibility: Evidence from northern Ethiopia. MA thesis, Norwegian University of Life Sciences.

Binns, T. 1995. Geography in development; development in geography. *Geography*, 80: 303–322 [online]. http://www.jstor.org/stable/40572706 (Accessed 11August 2011).

Binswanger, H P.Khandker, S R. Rosenzweig, M R. 1993. How infrastructure and financial institutions affect agricultural output and investment in India. *Journal of Development Economics.* (41):337–366.

Black, W R. 2003. *Transportation: A Geographical Analysis*. New York: The Guilford Press.

BoFED, 2011. Physical and socio economic profile of West Shewa Zone and Districts. Oromia Region, Addis Ababa: Bureau of Finance and Economic Development

Bogale, B. 2009a. Physical infrastructure development in Ethiopia with emphasis on electric power. *Ethiopian Journal of Business & Development* 4(1):77-105.

Bogale, D. 2009b. Road infrastructure development efforts and challenges in Ethiopia. *Proceedings of the Third National Conference on Assessment of the Practices of Civil Service Reform Programme in Ethiopia*. Ethiopian Civil Service College and Ethiopian Management Institute: 306-344.

Bravo, A.2002. The impact of improved rural roads on gender relations in Peru. *Mountain research and development.* 22 (3): 221–224

Brandford M G. and Kent W A.,1987. *Human geography, Theories and their applications*. Great Britain: Oxford University Press.

Bryman, A E. 2001. Social Research Methods. UK: Oxford University Press. http://www.referenceworld.com/sage/socialscience/mmr.pdf(Accessed 13 January 2009)

Burger, M.2010. *Bibliographic style & reference technique*. Pretoria: University of South Africa.

Caprio, G.and Getnet H. 2010. The Federal PFM Performance Report a Repeat Assessment, Addis Ababa: The Federal Democratic Republic of Ethiopia.

Central Statistical Agency (CSA), 2011. *Statistical abstract 2010*. Addis Ababa: Central Statistical Agency.

Central Statistical Agency & the World Bank, 2013. Ethiopia rural socioeconomic survey (ERSS) Report. Addis Ababa: Central Statistical Agency & the World Bank

Chen, H T.,1990. *Theory-driven evaluation,* Newbury Park, California: Sage Publications,

Connolly, P., 2003. Ethical principles for researching vulnerable groups. Irelands: University of Ulster Belfast.

Cooley, C. 2007.The theory of transportation, originally published as: Charles Horton Cooley.

"The Theory of Transportation." Pp 17-118 in *Sociological Theory and Social Research: Being Selected Papers of Charles Horton Cooley*. Originally published in *Publications of the American Economic Association* 9 (1894).

Creswell,J W.,2009. *Research design: qualitative, quantitative and mixed methods approaches,* 3rd ed, London, SAGE Publications Inc.

Cypher, J. and Diethz. 1997. *The process of economic development*. Britain: Redwood Books.

Dagnew, B.;Tugume, D.;Sango, I.; Akola, J.;and Teshome, T. 2012. Urban development policies, Course Handbook -MUM 611, Urban Management Masters Programme**,** Institute of Urban Development Studies, Addis Ababa: Ethiopian Civil Service University

Dantas, A. and Ribeiro, K. 2006. Impacts of transport infrastructure policies. University of Canterbury, Queenstown, New Zealand: IPENZ Transportation Conference 2006, 8-11 Oct 2006. 13pp. http://hdl.handle.net/10092/212 (Accessed on 22,March, 2013).

Davies, R. 2012. Blog post on the criteria for assessing the evaluability of a theory of change [Online] http://mandenews.blogspot.co.uk/2012/04/criteria-for-assessing-evaluablity-of.html (Accessed on 01 March,2013).

Denzin, N K., 1970. *The Research Act: A Theoretical Introduction to Sociological Methods.* Aldine, Chicago.

Dercon, S.; Gilligan, D O., Hoddinott, J.; Woldehanna, T.; 2008. The impact of agricultural extension and roads on poverty and consumption growth in fifteen Ethiopian villages. IFPRI Discussion Paper 00840. http://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/29342/filename/29343.pdf (Accessed on 11 March, 2013).

Edwards, Mary M. (2000). Community guide to development impact analysis. Madison: University of Wisconsin.

Einstein College of Engineering, Department of Civil Engineering CE – 46[nd] HIGHWAY ENGINEERING Lecture notes Prepared by R. VANDHIYAN. https://zemubarek.files.wordpress.com/2014/03/ce46-highwayengineering.pdf (Accessed on 20 September 2013).

Ethiopian Roads Authority (ERA), 2014a. Federal road network master plan, Final Report. Addis Ababa: Prepared by KDEC- KOTI Consultant in JV with CWCE.

ERA, 2014b. RSDP Performance and MDG transport indicators 2012/13 (E.F.Y 2005) – Final Report. Addis Ababa: Prepared by W.T Consult PLC.

ERA, 2013. Road sector development programme, 16 years performance assessment. Addis Ababa: Ethiopian Roads Authority.

ERA, 2011.Road sector development programme, RSDP years performance and phase IV. Addis Ababa: Ethiopian Roads Authority.

ERA, 2010.Transport and poverty observatory study, monitoring indicators update: Final Report – 2009. Addis Ababa: Selam Development Consultants.

ERA, 2008a. Pre-feasibility report of Mille-Chifra-Alewuha Road Project. Addis Ababa: Ethiopian Roads Authority.

ERA. 2008b. Enhancing rural accessibility, concept paper. Addis Ababa: Federal Democratic Republic of Ethiopia, Ministry of Works and Urban Development.

ERA, 2007a. Road sector development programme III (2007-2010). Addis Ababa: Ethiopian Roads Authority

ERA, 2007b. Gelego-Guba and Guba-Wenbera Roads Project, Feasibility Study, Final Report. Addis Ababa: Ethiopian Roads Authority

ERA, 2005. Pre-feasibility report detailed engineering design (Phase-I) and construction supervision (Phase-II) of Mille-Chifra-Alewuha Road Project, Addis Ababa: Ethiopian Roads Authority

Flowerdew, R. and Martin, D. (ed) 2005. *Methods in human geography: a guide for students doing research projects.* London : Longman

Eskinder D. 2007.The automotive industry and trend analysis in Ethiopia, MBA Thesis, Addis Ababa University, Addis Ababa: Faculty of Business & Economics.

Gay, L. & Airasian, P. 2000. *Educational research: Competencies for analysis and application.* Upper Saddle River, NJ: Merrill.

Gkritza K, 2006.Economic development effects of highway investment, PhD dissertation, United States: Purdue University.

Global Road Safety Partnership (GRSP) 2004. Annual report.(Sl): www.worldBank.org/bpd (Accessed on 02 January, 2013).

Hammersely, M. and Atkinson, P. 1994. *Ethnography: Principles in Practice,* London: Routledge.

Harmse, A.C. 2004. *Development regions in the South African space economy: a multivariate approach.* Pretoria: University of South Africa,

Hubbard, W G.2010. Application of theory-based evaluation on a voluntary non-formal adult education programme. PhD Dissertation, Georgia, Athens: University of Georgia

Hulten, C. 2005.Transportation infrastructure, productivity, and externalities. Paris: University of Maryland and National Bureau of Economic Research.

Hursakar, G K. 1997. *Fundamentals of town planning,* London:(Sn)

Ibrahim Worku, 2010. Road sector development and economic growth in Ethiopia, Working Paper 004. Addis Ababa: Ethiopian Development Research Institute (EDRI).

ien, D. 2009. Model of the impact of transport corridor road infrastructure on internal economic growth, summary of doctoral dissertation. Kaunas: Kaunas University of Technology.

Iles R. 2005. *Public transport in developing countries*, Netherlands, Amsterdam: Elsevier B.V.

Inoni , O. and Omotor, D. 2009. Effect of road infrastructure on agricultural output and income of rural households in delta state,Nigeria. *Agricultura Tropica et Subtropica* Rearview Article,42(2):90-97.

Islam, M. Wieland, R. and Adiv, R. 2008. *Roads socio-economic impact assessment, Part 1 and 2.* By USAID/AFGHANISTAN, Washington DC: Checchi and Company Consulting, Inc.

Jacoby, H. 1998. Access to markets and the benefits of rural roads: A Nonparametric Approach. Nepal: World Bank.

James, C. 2011.Theory of change review. A report commissioned by Comic Relief, Comic Relief. [Online]. http://mande.co.uk/2012/uncategorized/comic-relief-theory-of-change-review/ (Accessed on 11 December, 2012)

Jones P.and Lucas K. 2012. The social consequences of transport decision-making: clarifying concepts, synthesising knowledge and assessing implications, *Journal of transport geography:* 21 (2012) 4–16

Kadyali, L R & Lal.N B 2004. *Principles and practice of highway engineering*. New Delhi: Khanna Publisher.

Keeling, D J. 2007. Transportation geography: new directions on well-worn trails *Progress in Human Geography*.31(2): 217-225

Khandker S. Koolwal, G.,Samad, H.2010. *Handbook on impact evaluation, quantitative methods and practices*. Washington DC: World Bank

Kitchin, R. and Tate, NJ. 2000. *Conducting research in human geography: Theory, methodology and practice*. Harlow: Prentice Hall.

Lawson, V. and Staeheli, A. 1990. Realism and the practice of Geography. *The professional Geographer* 42(1):13-19.

Leeuw F. and Vaessen J. 2009. Impact evaluations and development NONIE guidance on impact evaluation. Draft version for discussion at the Cairo conference March-April, 2009, Cairo: Cairo Conference.

Lowe , D. 2002. *The dictionary of transport and logistics*, London: Biddles Ltd, Guildford and King's Lynn.

Liu,J., Zhan, J and Deng, X.2005. Spatio-temporal patterns and driving forces of urban land expansion in China during the economic reform era. 34(6): 450-455. *Springer Royal Swedish Academy of Sciences*. http://www.jstor.org/stable/4315633 (Accessed on 08 July, 2015)

Map of Africa, 2015. *https://www.cia.gov/library/publications/the-world-actbook/graphics*/ref_maps/political/pdf/africa.pdf, (Accessed 25 June, 2015)

Mark, M. in Weiss, H C. 2005. The evaluation exchange: A periodical on emerging strategies in evaluating child and family services, Harvard Family Research Project, Volume xi number 2. Cambridge: Harvard Graduate School of Education.

Matebie, A. 2009. An assessment of the socio-economic impacts of road infrastructure on the development of Debremarkos Town, Amhara Region, MA Thesis, Unpublished, Addis Ababa: Ethiopian Civil Service University.

Meron K. 2007. Public transportation system and its impact on urban mobility: The case of Addis Ababa, Addis Ababa: Faculty of Technology, Addis Ababa University,.

Metema *Wereda* Annual Report, 2013. Gendewuha, Ethiopia: Metema *Wereda*.

Ministry of Infrastructure, 2003. Annual statistical bulletin 1994 E,F.Y(2001/2002). Addis Ababa Planning: and Research Department.

Ministry of Transport, 2014. Annual statistical bulletin in 2012/13(2005). Addis Ababa: Planning and Research Department.

Ministry of Transport and Communication (MoTAC), 2008. Annual statistical bulletin 2000 E,F.Y(2007/2008). Addis Ababa: .Planning and Research Department.

Ministry of Finance and Economic Development (MoFED), 2010. *Growth and transformation plan (GTP) 2010/11-2014/15*. Addis Ababa: Ministry of Finance and Economic Development.

MoFED, 2012. *Federal Democratic Republic of Ethiopia growth and transformation Plan (GTP)(2010/11-2014/15) annual progress report for F.Y. 2010/11*. Addis Ababa: Ministry of Finance and Economic Development.

Musekene E N. 2010. A geographic perspective of labour-intensive methods in the development and maintenance of transport infrastructure, PhD Thesis, South Africa: Department of Geography, University of South Africa,

National Planning Commission, 2013. *Demographic and socioeconomic profile of Ethiopia*. Addis Ababa: Population and Development Directorate

Ochieng, G. 2002. *Socioeconomic impact assessment of rural roads: Methodology and Questionnaires*, First draft, [SN:sn].

O'Donoghue, T. and Punch, K. 2003. *Qualitative Research in Action: Doing and Reflecting*, London: Routledge.

O' Falharity, 2005. *Transport engineering and planning*, New York: Elsevier Butterworth Heinemann.

Organization for Economic Cooperation and Development (OECD), 2002. *Impact of transport infrastructure investment on regional development*, Paris: Organization for Economic Cooperation and Development.

Oosterhaven, J. and Knaap, T. 2000 . Spatial economic impacts of transport infrastructure investments. Paper prepared for the TRANS-TALK Thematic Network, Brussels(Sn).

Operations Research Group Technical Support Consultants, 2009. Socio-economic impact assessment report- Chhattisgarh, India: Rural Roads Project – 1. Chhattisgarh,

Organizational Research Services (ORS), 2004. Theory of change: A practical tool for action, results and learning. Washington: .Annie E. Casey Foundation,[Online] www.organizationalresearch.com (Accessed on 22 June, 2013).

Pankaj, T.2000. *Framework for quantifying social and economic benefits from rural road development*; Some thoughts and practical insights. World Bank. http://www.transport-links.org/transport_links/filearea/documentstore/322_Thampil%20Pankaj%20Paper%201.pdf (Accessed on 27 June, 2013).

Papí, J.; Halleman, B.; Antonissen, T.; Falco, F.; Vizcarra-Mir, B.. and Dezes, L. 2007. *The socio-economic benefits of roads in Europe*. Brussels: International Road Federation (IRF) Research Council.

Patarasuk, R.2013. Road network connectivity and land-cover dynamics in Lop Buri province, Thailand. *Journal of Transport Geography*. 28 (2013):111–123.
Pedersen, P. 2007. The role of freight transport in economic development: an analysis of the interaction between global value chains and their associated transport chains. DIIS Working Paper no 2007/12. Copenhagen: Danish Institute for International Studies.
Queiroz, C. and Gautam,S.1992. Road infrastructure and economic development, some diagnostic indicators, Working paper. Washington DC: World Bank.
Porter, S.2005. Enhancing rural road policy: the case for incorporation of the capabilities approach in to rural road appraisal in Africa, Working Papers No 115. Cape Town: Centre for Social Science Research,
Ravallion, M. 2001.The mystery of the vanishing benefits: An introduction to impact evaluation. *The World Bank economic review* 15(I):115-140.
Roberts, P.; KC, Shyam, and Rastogi, C. 2006. *Rural Access Index: A key development indicator*, Transport Paper TP-10. Washington DC: Transport Sector Board.
Rodrigue, J-P; Comtois**,** C**.** Slack B**.** 2006. The geography of transport systems, New York
Rodrigue, J-P; Comtois**,** C**.** Slack B. 2011. *The geography of transport systems*. http://people.hofstra.edu/geotrans/eng/. Accessed 11August 2011.
Rodrigue, J-P; Comtois**,** C**.** Slack B. 2012. *The geography of transport systems*. http://people.hofstra.edu/geotrans/eng/. Accessed 20 June 2012.
Rodrigue, J-P; Comtois**,** C**.** Slack B**.** 2014. *The geography of transport systems*. http://people.hofstra.edu/geotrans/eng/. Accessed 02 May 2014.
Rogeerson, P.2010. *Statistical methods for geography, a student's guide*, Third ed. London: SAGE Publication Ltd.
Rui Yikang, 2013. Urban growth modelling based on land-use changes and road network Expansion, Doctoral Thesis in Geodesy and Geo-informatics with Specialization in Geoinformatics. Stockholm, Sweden: Royal Institute of Technology
Sabandar, W P. 2004. Transport development and the rural economy: Insights from Indonesia, PhD Thesis. United Kingdom: University of Canterbury.
Samson k; Bonngwa A.and Van Dijk M P.(EDS), 2012. Cities as engines of growth and transformation in Ethiopia. Addis Ababa: Lesan Printing Press.
Sayer, A. 1992. *Method in Social Science: A Realist Approach.* London: Routledge.
Sengupta, R. Coondoo, D.and Route, B.2007. *Impact of a highway on the socio-economic well-being of rural households living in proximity*, centre for economic studies and planning. New Delhi: Jawaharlal Nehru University.
Shiferaw D. 2008. The impact of road accessibility on investment: The case of Sheka Zone, an Essay, Un published, Addis Ababa: Ethiopian Civil Service University.
The Role of Transport [nd], Unpublished. .[SI:sn].
University of South Africa (UNISA), Department of Geography.2011a.Guidelines to geographical

research and compiling a research proposal: tutorial letter 101/0/2011 for DPGGR00. Pretoria: University of South Africa

UNISA, Department of Geography.2011b.Guidelines to geographical research and compiling a research proposal: tutorial letter 103/0/2011 for DPGGR00. Pretoria: University of South Africa.

UNISA, Department of Geography.2011c.Guidelines to geographical research and compiling a research proposal: tutorial letter 105/0/2011 for DPGGR00. Pretoria: University of South Africa.

UNISA, 2011d. Workshop documents of: May 9-20, 2011; July 3- 8, 2011. Pretoria: University of South Africa.

UNISA, 2011e. Workshop documents of: May 9-20, 2011. June 27-July 8, 2011; September 14-23, 2011. South Africa: SANTRUST.

van de Walle, Dominique and D. Cratty. 2002. *Impact evaluation of a rural road rehabilitation project in Viet Nam*. Washington, DC: The World Bank/Development Research Group, Public Services Research.

Victoria Transport Policy Institute, 2005. Economic development impacts: Evaluating TDM impacts on productivity, employment, business activity and investment. Canada: Victoria Transport Policy Institute.

Vogel, I. and Stephenson, Z. 2012. Examples of theory of change, DFID EVD, [Online], www. iIsabelvogel.co.uk. (Accessed on March 06, 2013).

Von Thunen, Johann Heinrich, 1966(1826). Von Thunen isolated state, Ed. Hall, Peter. Oxford; Pergamon Press. First published in 1926 as Der Isolierte staaf Beziebung Landwritschaft und Nationalekonomie. Homburg: Perthes.

Wei-Bin, Z. 2007. Economic geography and transportation conditions with endogenous time distribution amongst work, travel, and leisure. *Journal of Transport Geography,* 15(6):476-493.

Weiss, H C. 2005. The evaluation exchange: A periodical on emerging strategies in evaluating child and family services, Harvard Family Research Project, Volume xi number 2. Cambridge: Harvard Graduate School of Education.

White, H. 2009.Theory-based impact evaluation: principles and practice. 3ie Working Paper No. 3. New Delhi: International Initiative for Impact Evaluation.

Wimpy S. 2005, *An evaluation of road network performance*. Indonesia: Parahyangan Catholic University.

World Bank, 2014. National urban development scheme, existing situation and diagnostic final report, Prepared by Egis International in association with IAU-IdF & Urba Lyon, Addis Ababa, Urban Planning, Sanitation & Beautification Bureau

World Bank, International comparison programme database. (Sl):World Bank.

http://www.indexmundi.com/facts/ethiopia/ppp-conversion-factor (Accessed on 13,Jan.2014).

World Bank, 2006. *Social analysis in transport projects: guidelines for incorporating social dimensions into bank-supported projects,* Washington DC: Social Development Department

World Bank, 1996. Morocco - socioeconomic influence of rural roads: Fourth Highway Project. Washington, D.C.: Operations Evaluation Department, World Bank.

ANNEX -A: DIFFERENT DATA INPUTS AND OUTPUTS

Annex 4.1: Trend of Road Network Development in Ethiopia and its Index

	Trend of road network development in Ethiopia (km)*					Road network index, 1951=100)**				
Year	**Asphalt**	**Gravel**	**Rural**	***Wereda*** **(District)**	**Total**	**Asphalt**	**Gravel**	**Rural**	***Wereda***	**Total road length index**
1951	3400	3000			6400	100.00	100.00			100.00
1959	3450	3500			6950	101.47	116.67			108.59
1963	3500	4100			7600	102.94	136.67			118.75
1968	3450	4500			7950	101.47	150.00			124.22
1969	3300	5100			8400	97.06	170.00			131.25
1970	3100	5500			8600	91.18	183.33			134.38
1971	3150	5600			8750	92.65	186.67			136.72
1972	3250	5650			8900	95.59	188.33			139.06
1973	3600	5800			9400	105.88	193.33			146.88
1974	3360	5900			9260	98.82	196.67			144.69
1975	3280	6080			9360	96.47	202.67			146.25
1976	3200	6200	120		9520	94.12	206.67	100.00		148.75
1977	3126	6290	652		10068	91.94	209.67	543.33		157.31
1978	3051	6801	790		10642	89.74	226.70	658.33		166.28
1979	3115	7328	1091		11534	91.62	244.27	909.17		180.22
1980	3285	7328	1595		12208	96.62	244.27	1329.17		190.75
1981	3515	7430	1830		12775	103.38	247.67	1525.00		199.61
1982	3769	8532	2630		14931	110.85	284.40	2191.67		233.30
1983	3916	8532	3053		15501	115.18	284.40	2544.17		242.20
1984	4000	8738	3420		16158	117.65	291.27	2850.00		252.47
1985	4042	8788	3808		16638	118.88	292.93	3173.33		259.97
1986	4050	8989	4198		17237	119.12	299.63	3498.33		269.33
1987	4062	8994	5158		18214	119.47	299.80	4298.33		284.59
1988	4109	9270	5232		18611	120.85	309.00	4360.00		290.80
1989	4109	9270	5232		18611	120.85	309.00	4360.00		290.80
1990	4109	9287	5550		18946	120.85	309.57	4625.00		296.03
1991	4109	9298	5610		19017	120.85	309.93	4675.00		297.14
1992	3542	8966	5573		18081	104.18	298.87	4644.17		282.52
1993	3555	9011	5800		18366	104.56	300.37	4833.33		286.97
1994	3622	10100	7812		21534	106.53	336.67	6510.00		336.47
1995	3630	12000	8043		23673	106.76	400.00	6702.50		369.89
1996	3656	12133	9100		24889	107.53	404.43	7583.33		388.89
1997	3708	12162	10680		26550	109.06	405.40	8900.00		414.84
1998	3760	12240	11737		27237	110.59	408.00	9780.83		425.58
1999	3812	12250	12600		28662	112.12	408.33	10500.00		447.84
2000	3824	12250	15480		31554	112.47	408.33	12900.00		493.03
2001	3924	12467	16480		32871	115.41	415.57	13733.33		513.61
2002	4053	12564	16680		33297	119.21	418.80	13900.00		520.27
2003	4362	12340	17154		33856	128.29	411.33	14295.00		529.00
2004	4635	13905	17956		36496	136.32	463.50	14963.33		570.25
2005	4972	13640	18406		37018	146.24	454.67	15338.33		578.41
2006	5002	14311	20164		39477	147.12	477.03	16803.33		616.83
2007	5452	14628	22349		42429	160.35	487.60	18624.17		662.95
2008	6066	14363	23930		44359	178.41	478.77	19941.67		693.11
2009	6938	14234	25640		46812	204.06	474.47	21366.67		731.44
2010	7476	14373	26944		48793	219.88	479.10	22453.33		762.39
2011	8295	14136	30712	854	53997	243.97	471.20	25593.33	100.00	843.70
2012	9875	14675	31550	6983	63083	290.44	489.17	26291.67	817.68	985.67
2013	11301	14455	32582	27628	85966	332.38	481.83	27151.67	3235.13	1343.22

*Source: *Data Obtained from ERA and **Own Computation, 2015*

Annex 4.2: Trend of Road Density in Ethiopia and its Index

Year	Population (000,000)	Population index	Road Density /1000 km^2	Road Density /1000 population	Road density per 1000 population index	Density Index, Imperial	Density Index, Derg Period	Density Index, EPRDF
1951	21.5	100.00	5.2	0.30	100.00	100.00		
1959	22.2	103.26	5.7	0.31	104.35	104.35		
1963	24.2	112.56	6.2	0.31	104.68	104.68		
1968	24.5	113.95	6.5	0.32	108.16	108.16		
1969	28.9	134.42	6.9	0.29	96.89	96.89		
1970	28.9	134.42	7.0	0.30	99.19	99.19		
1971	29.7	138.14	7.2	0.29	98.20	98.20		
1972	30.5	141.86	7.3	0.29	97.27	97.27		
1973	31.3	145.58	7.7	0.30	100.11	100.11		
1974	32.1	149.30	7.6	0.29	96.67	100.98	100.00	
1975	32.9	153.02	7.7	0.28	94.83		98.10	
1976	33.8	157.21	7.8	0.28	93.89		97.12	
1977	34.8	161.86	8.3	0.29	96.44		99.76	
1978	35.7	166.05	8.7	0.30	99.37		102.79	
1979	36.7	170.70	9.5	0.31	104.76		108.37	
1980	37.7	175.35	10.0	0.32	107.94		111.66	
1981	38.8	180.47	10.5	0.33	109.75		113.54	
1982	39.9	185.58	12.2	0.37	124.74		129.04	
1983	41	190.70	12.7	0.38	126.02		130.37	
1984	42.2	196.28	13.2	0.38	127.63		132.03	
1985	43.4	201.86	13.6	0.38	127.79		132.19	
1986	44.7	207.91	14.1	0.39	128.54		132.97	
1987	46.1	214.42	14.9	0.40	131.70		136.24	
1988	47.6	221.40	15.3	0.39	130.33		134.82	
1989	49.3	229.30	15.3	0.38	125.84		130.17	
1990	51.2	238.14	15.5	0.37	123.35		127.60	
1991	53	246.51	15.6	0.36	119.60		123.73	
1992	53.3	247.91	16.4	0.34	113.33		118.92	100.00
1993	54.8	254.88	16.7	0.34	111.72			98.57
1994	54.9	255.35	19.6	0.39	130.75			115.36
1995	56.5	262.79	21.5	0.42	139.66			123.23
1996	58.2	270.70	22.6	0.43	142.55			125.78
1997	59.8	278.14	24.1	0.46	153.33			135.29
1998	61.3	285.12	24.8	0.46	153.33			135.29
1999	62.8	292.09	26.1	0.47	156.67			138.24
2000	64.3	299.07	28.7	0.50	166.67			147.06
2001	65.3	303.72	29.9	0.50	166.67			147.06
2002	67.2	312.56	30.3	0.49	163.33			144.12
2003	69.1	321.40	30.8	0.49	163.33			144.12
2004	71.1	330.70	33.2	0.51	170.00			150.00
2005	73.9	343.72	33.7	0.51	170.00			150.00
2006	75.1	349.30	35.9	0.53	176.67			155.88
2007	77.1	358.60	38.6	0.55	183.33			161.76
2008	77.4	360.00	40.3	0.56	186.70			164.73
2009	77.7	361.40	42.6	0.58	191.93			169.35
2010	79.8	371.16	44.4	0.59	196.19			173.11
2011	82.1	381.86	49.1	0.65	217.12			191.57
2012	84.5	393.02	57.3	0.76	253.65			223.81
2013	86	400.00	78.2	1.04	345.66			305.00
								154.52

Source: Own Computation, Based on the Data from ERA, 2015

Annex 4.3: Trends in Share of Roads in Ethiopia, by Type

Year	Asphalt	Share of asphalt from the total	Gravel	Share of gravel from the total	Rural	Share of community roads from the total	*Wereda*	Share of *wereda* roads from the total	Total	Total community and *Wereda* roads	Share of community and *wereda* roads from the total
1951	3400	53.13	3000	46.88		0.00			6400	0	0.00
1959	3450	49.64	3500	50.36		0.00			6950	0	0.00
1963	3500	46.05	4100	53.95		0.00			7600	0	0.00
1968	3450	43.40	4500	56.60		0.00			7950	0	0.00
1969	3300	39.29	5100	60.71		0.00			8400	0	0.00
1970	3100	36.05	5500	63.95		0.00			8600	0	0.00
1971	3150	36.00	5600	64.00		0.00			8750	0	0.00
1972	3250	36.52	5650	63.48		0.00			8900	0	0.00
1973	3600	38.30	5800	61.70		0.00			9400	0	0.00
1974	3360	36.29	5900	63.71		0.00			9260	0	0.00
1975	3280	35.04	6080	64.96		0.00			9360	0	0.00
1976	3200	33.61	6200	65.13	120	1.26			9520	120	1.26
1977	3126	31.05	6290	62.48	652	6.48			10068	652	6.48
1978	3051	28.67	6801	63.91	790	7.42			10642	790	7.42
1979	3115	27.01	7328	63.53	1091	9.46			11534	1091	9.46
1980	3285	26.91	7328	60.03	1595	13.07			12208	1595	13.07
1981	3515	27.51	7430	58.16	1830	14.32			12775	1830	14.32
1982	3769	25.24	8532	57.14	2630	17.61			14931	2630	17.61
1983	3916	25.26	8532	55.04	3053	19.70			15501	3053	19.70
1984	4000	24.76	8738	54.08	3420	21.17			16158	3420	21.17
1985	4042	24.29	8788	52.82	3808	22.89			16638	3808	22.89
1986	4050	23.50	8989	52.15	4198	24.35			17237	4198	24.35
1987	4062	22.30	8994	49.38	5158	28.32			18214	5158	28.32
1988	4109	22.08	9270	49.81	5232	28.11			18611	5232	28.11
1989	4109	22.08	9270	49.81	5232	28.11			18611	5232	28.11
1990	4109	21.69	9287	49.02	5550	29.29			18946	5550	29.29
1991	4109	21.61	9298	48.89	5610	29.50			19017	5610	29.50
1992	3542	19.59	8966	49.59	5573	30.82			18081	5573	30.82
1993	3555	19.36	9011	49.06	5800	31.58			18366	5800	31.58
1994	3622	16.82	10100	46.90	7812	36.28			21534	7812	36.28
1995	3630	15.33	12000	50.69	8043	33.98			23673	8043	33.98
1996	3656	14.69	12133	48.75	9100	36.56			24889	9100	36.56
1997	3708	13.97	12162	45.81	10680	40.23			26550	10680	40.23
1998	3760	13.80	12240	44.94	11737	43.09			27237	11737	43.09
1999	3812	13.30	12250	42.74	12600	43.96			28662	12600	43.96
2000	3824	12.12	12250	38.82	15480	49.06			31554	15480	49.06
2001	3924	11.94	12467	37.93	16480	50.14			32871	16480	50.14
2002	4053	12.17	12564	37.73	16680	50.09			33297	16680	50.09
2003	4362	12.88	12340	36.45	17154	50.67			33856	17154	50.67
2004	4635	12.70	13905	38.10	17956	49.20			36496	17956	49.20
2005	4972	13.43	13640	36.85	18406	49.72			37018	18406	49.72
2006	5002	12.67	14311	36.25	20164	51.08			39477	20164	51.08
2007	5452	12.85	14628	34.48	22349	52.67			42429	22349	52.67
2008	6066	13.67	14363	32.38	23930	53.95			44359	23930	53.95
2009	6938	14.82	14234	30.41	25640	54.77			46812	25640	54.77
2010	7476	15.32	14373	29.46	26944	55.22			48793	26944	55.22
2011	8295	15.36	14136	26.18	30712	56.88	854	**1.58**	53997	31566	58.46
2012	9875	15.65	14675	23.26	31550	50.01	6983	**11.07**	63083	38533	61.08
2013	11301	13.15	14455	16.81	32582	37.90	27628	**32.14**	85966	60210	70.04
		23.94		**48.47**		**26.71**		**14.93**			**27.63**

Source: Data Obtained from ERA and Own computation, 2015

Annex 4.4: Trend of Road Type Index in Ethiopia

Year	Road Network(km)					Imperial Period Index	Derg Period Index	EPRDF Period Index
	Asphalt	Gravel	Rural	*Wereda*	Total			
1951	3400	3000			6400	100.00		
1959	3450	3500			6950	108.59		
1963	3500	4100			7600	118.75		
1968	3450	4500			7950	124.22		
1969	3300	5100			8400	131.25		
1970	3100	5500			8600	134.38		
1971	3150	5600			8750	136.72		
1972	3250	5650			8900	139.06		
1973	3360	5800			9160	143.13		
1974	3360	5900			9260	126.23	100.00	
1975	3280	6080			9360		101.08	
1976	3200	6200	120		9520		102.81	
1977	3126	6290	652		10068		108.73	
1978	3051	6801	790		10642		114.92	
1979	3115	7328	1091		11534		124.56	
1980	3285	7328	1595		12208		131.84	
1981	3515	7430	1830		12775		137.96	
1982	3769	8532	2630		14931		161.24	
1983	3916	8532	3053		15501		167.40	
1984	4000	8738	3420		16158		174.49	
1985	4042	8788	3808		16638		179.68	
1986	4050	8989	4198		17237		186.14	
1987	4062	8994	5158		18214		196.70	
1988	4109	9270	5232		18611		200.98	
1989	4109	9270	5232		18611		200.98	
1990	4109	9287	5550		18946		204.60	
1991	4109	9298	5610		19017		205.37	
1992	3542	8966	5573		18081		155.53	100.00
1993	3555	9011	5800		18366			101.58
1994	3622	10100	7812		21534			119.10
1995	3630	12000	8043		23673			130.93
1996	3656	12133	9100		24889			137.65
1997	3708	12162	10680		26550			146.84
1998	3760	12240	11737		27237			150.64
1999	3812	12250	12600		28662			158.52
2000	3824	12250	15480		31554			174.51
2001	3924	12467	16480		32871			181.80
2002	4053	12564	16680		33297			184.15
2003	4362	12340	17154		33856			187.25
2004	4635	13905	17956		36496			201.85
2005	4972	13640	18406		37018			204.73
2006	5002	14311	20164		39477			218.33
2007	5452	14628	22349		42429			234.66
2008	6066	14363	23930		44359			245.33
2009	6938	14234	25640		46812			258.90
2010	7476	14373	26944		48793			269.86
2011	8295	14136	30712	854	53997			298.64
2012	9875	14675	31550	6983	63083			348.89
2013	11301	14455	32582	27628	85966			475.45
								205.89

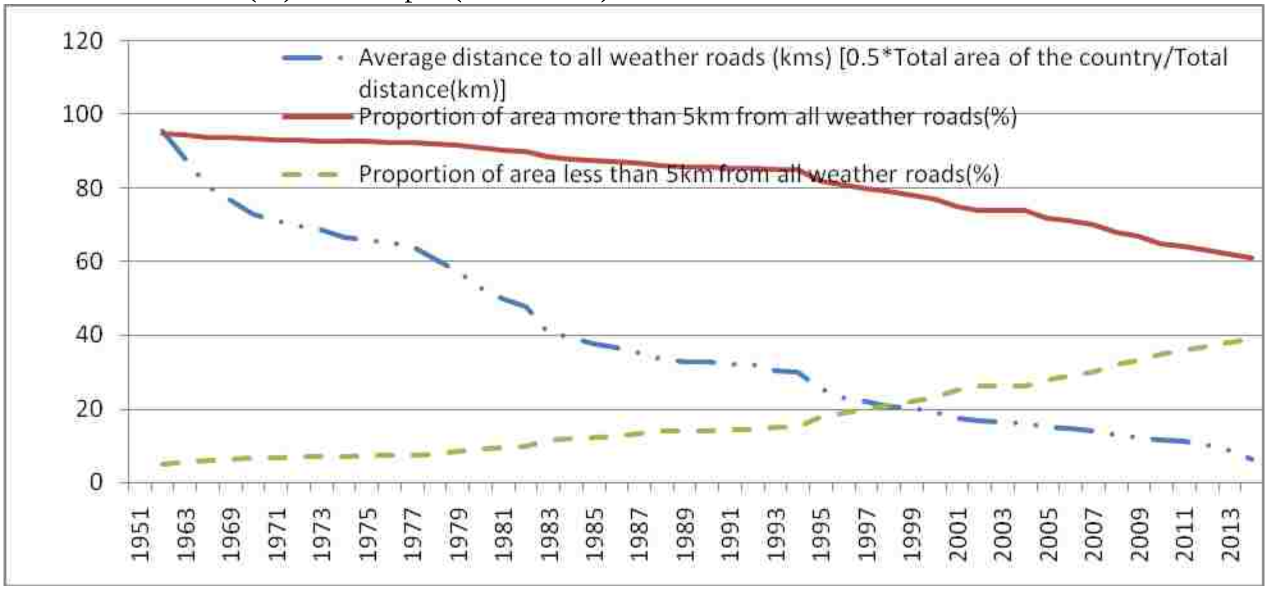
Source: Data Obtained from ERA and Own Computation, 2015

Annex 4. 5:Trend of Average Distance to all Weather Roads(km) and Proportion of Areas More than 5kms from all Weather Roads (%) in Ethiopia

Year	Average distance (km)	Proportion (%) for more than 5km	Proportion (%) for less than 5km
1951	95.31	95	5
1959	87.77	94	6
1963	80.26	94	6
1968	76.73	94	6
1969	72.62	93	7
1970	70.93	93	7
1971	69.71	93	7
1972	68.54	93	7
1973	66.59	93	7
1974	65.87	93	7
1975	65.17	93	7
1976	64.08	92	8
1977	60.59	92	8
1978	57.32	92	8
1979	52.89	91	9
1980	49.97	90	10
1981	47.75	90	10
1982	40.85	88	12
1983	39.35	88	12
1984	37.75	88	12
1985	36.66	87	13
1986	35.39	87	13
1987	33.49	86	14
1988	32.78	86	14
1989	32.78	86	14
1990	32.2	86	14
1991	32.08	86	14
1992	30.42	85	15
1993	29.95	85	15
1994	25.54	82	18
1995	23.23	81	19
1996	22.1	80	20
1997	20.72	79	21
1998	20.19	78	22
1999	19.19	77	23
2000	17.43	75	25
2001	16.73	74	26
2002	16.52	74	26
2003	16.25	74	26
2004	15.07	72	28
2005	14.86	71	29
2006	13.93	70	30
2007	12.96	68	32
2008	12.4	67	33
2009	11.75	65	35
2010	11.27	64	36
2011	10.19	63	37
2012	8.72	62	38
2013	6.4	61	39

Source: Own Computation, Based on Data from ERA, 2015

Annex 4.6 Average Distance to all Weather Roads (km) and Proportion of Areas Beyond/within 5km from all Weather Roads (%) in Ethiopia (1951-2013)



Source: Computed by the Author Based on Data Obtained from ERA, 2015

Annex 4.7 Comparing Networks of Different Countries by Their Income Level as of 2012

Country	**Area ('000km^2)**	**Population ('000)**	**Population Density**	**GDP per Capita (2011, $)**	**Road Length (km)**	**Share of road paved (%)**	**Road Density (km/ 1000 km^2)**	**Road Density (km/ 1000 people)**	**Vehicle Ownership (unit)**	**Vehicle Density (vehicle/1000 people)**
Low-income Countries (less than 1000$)										
Liberia	111.4	4128.6	37.1	297	10600	6	95.2	2.6	12,000	2.9
Ethiopia	1147.0	84020.6	73.3	360	56000	16	48.8	0.7	274,000	3.3
Niger	1267.0	16274.7	12.8	399	18949	21	15.0	1.2	130,000	8.0
Madagascar	587.0	22005.2	37.5	458	49827	12	84.9	2.3	572,000	26.0
Uganda	236.0	35873.3	152.0	477	27000	7	114.4	0.8	287,000	8.0
Guinea	245.9	10058.0	40.9	492	30500	17	124.0	3.0	50,000	5.0
Mali	1240.2	14517.2	11.7	668	15100	12	12.2	1.0	203,000	14.0
Chad	1284.0	10329.2	8.0	891	33400	1	26.0	3.2	62,000	6.0
Average	**764.8**	**24650.9**	**46.7**	**505.3**	**30172.0**	**11.5**	39.5	**1.2**	**198,750.0**	**9.1**
Middle-income Countries (1001-5000$)										
Cameroon	475.4	20130.0	42.3	1230	34300	13	72.1	1.7	282000	14.0
Egypt	1002.5	90000.0	89.8	2970	110778	89	110.5	1.2	3870000	43.0
Mongolia	1564.1	2554.7	1.6	3042	49249	4	31.5	19.3	206000	80.6
Morocco	446.6	32644.4	73.1	3083	58256	70	130.4	1.8	2285000	70.0
Iraq	437.3	31129.2	71.2	3513	44900	84	102.7	1.4	840000	27.0
Ukraine	603.6	45888.0	76.0	3621	169496	98	280.8	3.7	7663000	167.0
Turkmenistan	491.2	5125.7	10.4	4658	58592	81	119.3	11.4	543000	105.9
Average	**717.2**	**32496.0**	**52.1**	**3159.6**	**75081.6**	**62.7**	104.7	**2.3**	**224,1286**	**72.5**

Source; Adapted from ERA, 2014a

Annex 4.8 Densities of Road and Vehicles in Ethiopian Regions (2013)

Region	Aea Km^2	Road length(km)	Vehicles	Population	Road Density/1000 km^2	Road Density/1000 Persons	Vehicle Density /1000 Persons
Tigray	50,079	4538	23477	4866000	90.62	0.93	4.82
Afar	139,300	2662	1427	1634000	19.11	1.63	0.87
Amhara	159,174	15766	15251	19626000	99.05	0.80	0.78
Oromia	353,007	33340	43126	31948000	94.45	1.04	1.35
Somali	209,000	5160	6529	5165000	24.69	1.00	1.26
SNNP	112,343	20230	38573	17403000	180.07	1.16	2.22
Benishangul-Gumz	49,289	2036	1131	947000	41.31	2.15	1.19
Gambella	25,802	1615	794	383000	62.59	4.22	2.07
Total& avreage	**1,097,994**	**85347**	**130308**	**81972000**	**77.73**	**1.04**	**1.59**

NB: Data for Addis Ababa, Harari, and Dire Dawa are excluded Since their data of vehicles is from only urban

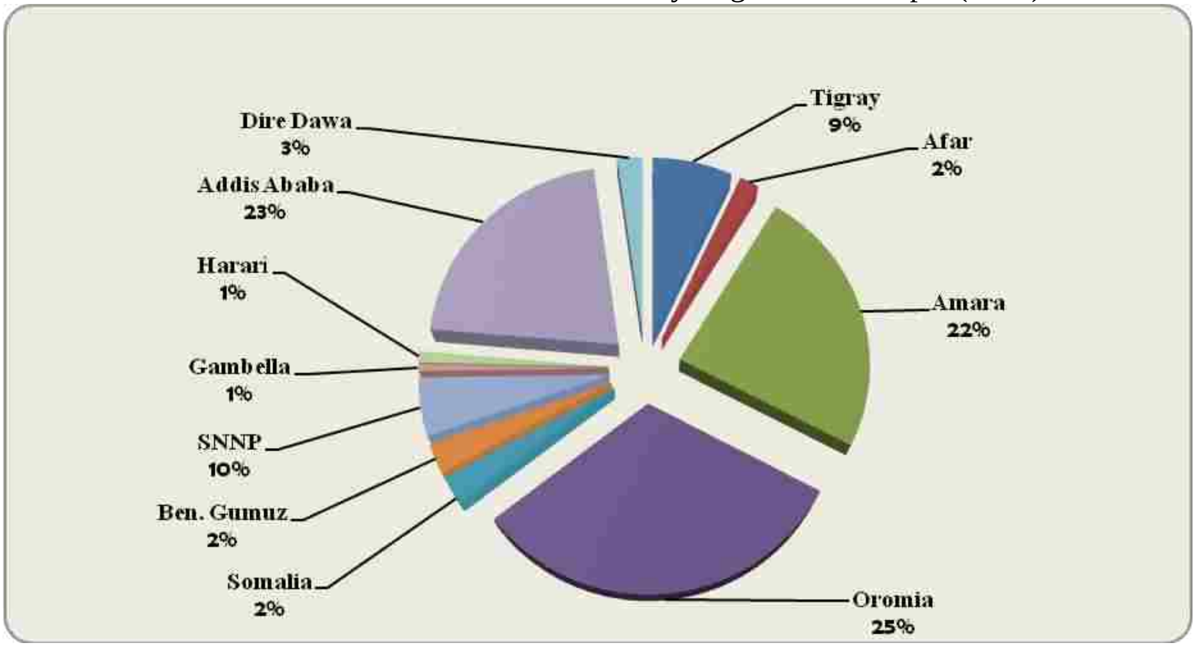
Source: ERA and Ministry of Transport, 2014

Annex 4.9: Distribution of RTA Casualties in Ethiopia 1996-2013

Year	Fatality	Severe injury	light injury	Total Causalities	Population of Ethiopia	Fatality per Mill population	Rate of Causality (%)
1996	1957	2612	3893	8462	58.2	145	
1997	1715	2823	4137	8675	59.8	145	2.52
1999	1693	3159	4276	9128	62.8	145	5.22
2000	1274	1771	2120	5165	64.3	80	-43.42
2001	1558	2684	3715	7957	65.3	122	54.06
2002	1628	2888	3714	8230	67.2	122	3.43
2003	1811	2904	4111	8826	69.1	128	7.24
2004	2111	3135	4872	10118	71.1	142	14.64
2005	2190	3968	4917	11075	73.9	150	9.46
2006	2522	4356	5035	11913	75.1	159	7.57
2007	2517	4424	5129	12070	77.1	157	1.32
2008	2161	3367	3773	9301	79.2	117	-22.94
2009	2613	4177	4312	11102	81.3	137	19.36
2010	2121	2789	3655	8565	79.8	107	-22.85
2011	2541	3545	4570	10656	82.1	130	24.41
2012	3132	4333	4932	12397	84.5	147	16.34
2013	3362	5042	6316	14720	86	171	18.74
Average	**2171**	**3410**	**4322**	**9904**	**73**	**136**	**5.94**

Source: ERA, 2014b and Ministry of Transport, 2014

Annex 4.10: Distribution of Casualties by Regions in Ethiopia (2013)



Source: ERA, 2014b

Annex 5.1 Main Occupation Types of Households in the ZOI and COZs (%)

	HH Livelihood	Farming			Animal Husbandry			Small Scale Trading/shops			Others		
		ZOI	**COZ**	**Total**	**ZOI**	**COZ**	**Total**	**ZOI**	**COZ**	**Total**	ZOI	COZ	Total
Corridor 1	1st	83.6	95.2	87.8	0.0	0.0	0.0	12.3	0.0	7.8	4.1	4.8	4.4
	2nd	5.7	0.0	3.6	77.4	90.3	82.1	3.8	3.2	3.6	13.1	6.5	10.7
Corridor 2	1st	54.5	45.2	51.3	16.9	50.0	28.6	15.6	2.4	10.9	13.0	2.4	9.2
	2nd	7.1	31.6	17.0	85.7	63.2	76.6	0.0	0.0	0.0	7.2	5.2	6.4
Corridor 3	1st	73.0	88.4	77.2	0.0	0.0	0.0	17.4	2.3	13.3	9.6	9.3	9.5
	2nd	6.3	10.5	7.6	70.0	76.3	72.0	3.8	2.6	3.4	19.9	10.6	17.0
All Corridors	1st	70.6	76.4	72.4	4.9	16.5	8.7	15.5	1.6	11.0	9.0	5.5	7.9
	2nd	6.2	11.4	8.0	75.2	78.4	76.3	3.1	2.3	2.8	15.5	7.9	12.9

Source: Field Survey, 2014

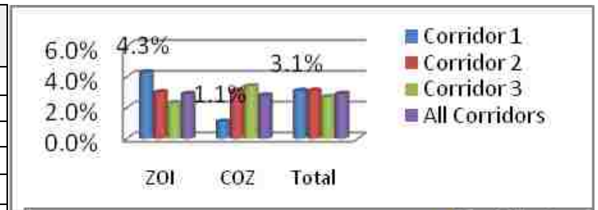
Annex 5.2a Engagement Types of Family Members in the ZOI and COZs per each Study Corridor

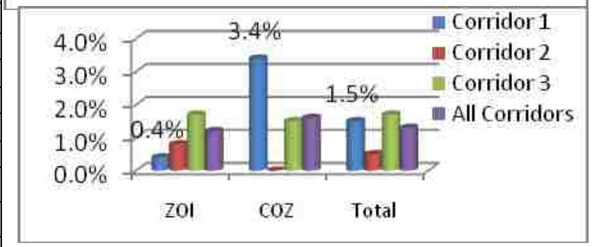
Family Members' Engagement	Zone	Frequency					Percentage			
		Corridor 1	Corridor 2	Corridor 3	All Corridors		Corridor 1	Corridor 2	Corridor 3	All Corridors
Unemployed	ZOI	12	11	16	39		4.30%	3.00%	2.30%	2.90%
	COZ	2	6	11	19		1.10%	3.10%	3.40%	2.80%
	Total	14	17	27	58		3.10%	3.10%	2.70%	2.90%
Daily labourer	ZOI	1	3	12	16		0.40%	0.80%	1.70%	1.20%
	COZ	6	0	5	11		3.40%	0.00%	1.50%	1.60%
	Total	7	3	17	27		1.50%	0.50%	1.70%	1.30%
Agriculture	ZOI	36	58	14	108		12.80%	16.00%	2.00%	8.10%
	COZ	39	36	4	79		22.40%	18.70%	1.20%	11.40%
	Total	75	94	18	187		16.40%	16.90%	1.80%	9.20%
Student	ZOI	121	132	420	673		42.90%	36.40%	60.90%	50.40%
	COZ	63	57	195	315		36.20%	29.50%	60.40%	45.70%
	Total	184	189	615	988		40.40%	34.00%	60.70%	48.80%
small scale trading/shops	ZOI	7	2	2	11		2.50%	0.60%	0.30%	0.80%
	COZ	3	2	0	5		1.70%	1.00%	0.00%	0.70%
	Total	10	4	2	16		2.20%	0.70%	0.20%	0.80%
Handicrafts	ZOI	5	1	0	6		1.80%	0.30%	0.00%	0.40%
	COZ	0	0	0	0		0.00%	0.00%	0.00%	0.00%
	Total	5	1	0	6		1.10%	0.20%	0.00%	0.30%
Government employee	ZOI	1	9	20	30		0.40%	2.50%	2.90%	2.20%
	COZ	0	4	2	6		0.00%	2.10%	0.60%	0.90%
	Total	1	13	22	36		0.20%	2.30%	2.20%	1.80%
House lady	ZOI	48	55	107	210		17.00%	15.20%	15.50%	15.70%
	COZ	30	32	48	110		17.20%	16.60%	14.90%	15.90%
	Total	78	87	155	320		17.10%	15.60%	15.30%	15.80%
Hired in private organization	ZOI	1	1	6	8		0.40%	0.30%	0.90%	0.60%
	COZ	0	0	1	1		0.00%	0.00%	0.30%	0.10%
	Total	1	1	7	9		0.20%	0.20%	0.70%	0.40%
Agriculture & Government employee	ZOI	0	0	0	0		0.00%	0.00%	0.00%	0.00%
	COZ	0	0	0	0		0.00%	0.00%	0.00%	0.00%
	Total	0	0	0	0		0.00%	0.00%	0.00%	0.00%
Agriculture &Hired in private organization	ZOI	0	0	0	0		0.00%	0.00%	0.00%	0.00%
	COZ	0	0	0	0		0.00%	0.00%	0.00%	0.00%
	Total	0	0	0	0		0.00%	0.00%	0.00%	0.00%
Others	ZOI	3	18	12	33		1.10%	5.00%	1.70%	2.50%
	COZ	1	4	0	5		0.60%	2.10%	0.00%	0.70%
	Total	4	22	12	38		0.90%	4.00%	1.20%	1.90%
Kids	ZOI	47	73	89	209		16.70%	20.10%	12.90%	15.70%
	COZ	31	49	48	128		17.80%	25.40%	14.90%	18.60%
	Total	78	122	137	337		17.10%	21.90%	13.50%	16.60%
Total	ZOI	282	363	698	1343					
	COZ	175	194	314	683					
	Total	457	557	1012	2026					

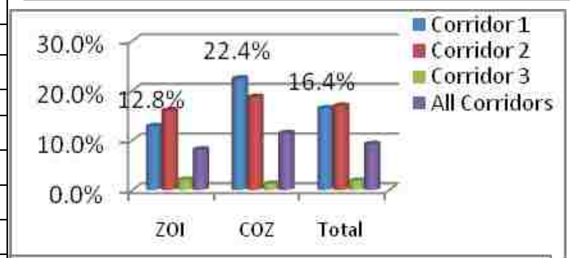
Source: Field Survey, 2014

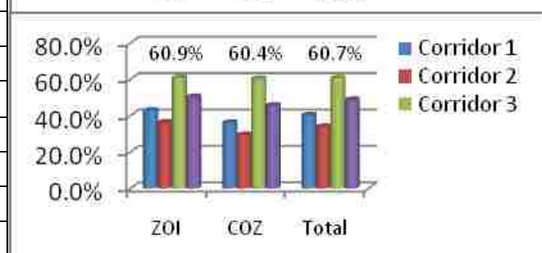
Annex 5.2b Engagement Types of Family Members in the ZOI and COZs per each Study Corridor

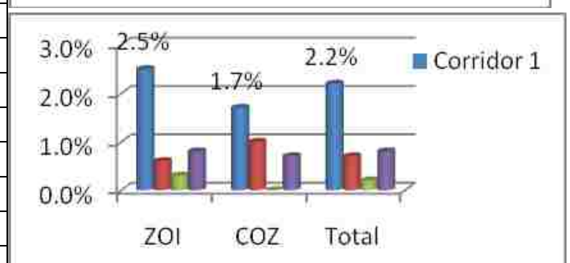
Occupation	Corridors	ZOI	COZ	Total
Unemployed (ages ≥ 18)	**Corridor 1**	4.3%	1.1%	3.1%
	Corridor 2	3.0%	3.1%	3.1%
	Corridor 3	2.3%	3.4%	2.7%
	All Corridors	2.9%	2.8%	2.9%
Daily laborers	**Corridor 1**	0.4%	3.4%	1.5%
	Corridor 2	0.8%	0.0%	0.5%
	Corridor 3	1.7%	1.5%	1.7%
	All Corridors	1.2%	1.6%	1.3%
Agriculture	**Corridor 1**	12.8%	22.4%	16.4%
	Corridor 2	16.0%	18.7%	16.9%
	Corridor 3	2.0%	1.2%	1.8%
	All Corridors	8.1%	11.4%	9.2%
Students	**Corridor 1**	42.9%	36.2%	40.4%
	Corridor 2	36.4%	29.5%	34.0%
	Corridor 3	60.9%	60.4%	60.7%
	All Corridors	50.4%	45.7%	48.8%
Small scale trading/shops	**Corridor 1**	2.5%	1.7%	2.2%
	Corridor 2	0.6%	1.0%	0.7%
	Corridor 3	0.3%	0.0%	0.2%
	All Corridors	0.8%	0.7%	0.8%
Handicrafts	**Corridor 1**	1.8%	0.0%	1.1%
	Corridor 2	0.3%	0.0%	0.2%
	Corridor 3	0.0%	0.0%	0.0%
	All Corridors	0.4%	0.0%	0.3%
Government employee	**Corridor 1**	0.4%	0.0%	0.2%
	Corridor 2	2.5%	2.1%	2.3%
	Corridor 3	2.9%	0.6%	2.2%
	All Corridors	2.2%	0.9%	1.8%
House Wives	**Corridor 1**	17.0%	17.2%	17.1%
	Corridor 2	15.2%	16.6%	15.6%
	Corridor 3	15.5%	14.9%	15.3%
	All Corridors	15.7%	15.9%	15.8%
Hired in private organizations	**Corridor 1**	0.4%	0.0%	0.2%
	Corridor 2	0.3%	0.0%	0.2%
	Corridor 3	0.9%	0.3%	0.7%
	All Corridors	0.6%	0.1%	0.4%
Others	**Corridor 1**	1.1%	0.6%	0.9%
	Corridor 2	5.0%	2.1%	4.0%
	Corridor 3	1.7%	0.0%	1.2%
	All Corridors	2.5%	0.7%	1.9%
Kids	**Corridor 1**	16.7%	17.8%	17.1%
	Corridor 2	20.1%	25.4%	21.9%
	Corridor 3	12.9%	14.9%	13.5%
	All Corridors	15.7%	18.6%	16.6%

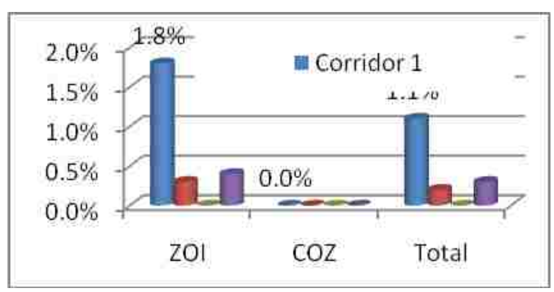












Source: Field Survey, 2014

Annex 5.3 Types of Equines as Draft Animals for Households

Period	Use of Animal Back	Corridor 1						Corridor 2						Corridor 3						All Corridors					
		ZOI		COZ		Both		ZOI		COZ		Both		ZOI		COZ		Both		ZOI		COZ		Both	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
	Donkey	45	61.6	34	79.1	78	67.8	13	16.9	10	21.3	20	16.8	67	57.8	26	57.8	92	58.2	125	47.2	67	52.3	190	48.5
	Horse	3	4.1			3	2.6							1	.9			1	.6	4	1.5			4	1.0
	Camel	1	1.4	1	2.3	2	1.7	5	6.5	7	14.9	12	10.1							6	2.3	8	6.3	14	3.6
	Other							5	6.5	3	6.4	7	5.9	15	12.9	10	22.2	24	15.2	19	7.2	11	8.6	31	7.9
	Donkey & camel	1	1.4																	1	.4			1	.3
	Total	50	68.5	35	81.4	84	73.0	23	29.9	20	42.6	39	32.8	83	71.6	36	80.0	117	74.1	155	58.5	86	67.2	240	61.2
	Not Using	23	31.5	8	18.6	31	27.0	54	70.1	27	57.4	80	67.2	33	28.4	9	20.0	41	25.9	110	41.5	42	32.8	152	38.8
Before	Total	73	100	43	100	115	100	77	100	47	100	119	100	116	100	45	100	158	100	265	100	128	100	392	100
	Donkey	39	53.4	33	76.7	71	61.7	15	19.5	9	19.1	22	18.5	70	60.3	35	77.8	104	65.8	124	46.8	75	58.6	197	50.3
	Horse	4	5.5			4	3.5							1	.9			1	.6	5	1.9			5	1.3
	Camel	1	1.4			1	.9			4	8.5	4	3.4							1	.4	4	3.1	5	1.3
	Other							7	9.1	5	10.6	10	8.4	15	12.9	7	15.6	21	13.3	21	7.9	9	7.0	31	7.9
	Donkey & camel																								
	Total	44	60.3			76	66.1	22	28.6	18	38.3	36	30.3	86	74.1	42	93.3	126	79.7	151	57.0	88	68.8	238	60.7
	Not Using	29	39.7	10	23.3	39	33.9	55	71.4	29	61.7	83	69.7	30	25.9	3	6.7	32	20.3	114	43.0	40	31.3	154	39.3
After	Total	73	100	43	100	115	100	77	100	47	100	119	100	116	100	45	100	158	100	265	100	128	100	392	100

Source: Field Survey, 2014

Annex Table 5.4Types of Animals Used as Cart Modes

Period	Use of Animal Back	Corridor 1						Corridor 2						Corridor 3						All Corridors					
		ZOI		COZ		Both		ZOI		COZ		Both		ZOI		COZ		Both		ZOI		COZ		Both	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Before	Donkey	31	42.5	21	48.8	52	45.2	1	1.3			1	.8	4	3.4	1	2.2	5	3.2	36	13.6	22	17.2	58	14.8
	Horse	1	1.4			1	.9			1	2.1	1	.8	1	.9	1	2.2	2	1.3	2	.8	2	1.6	4	1.0
	Mule							2	2.6			2	1.7	2	1.7			2	1.3	4	1.5			4	1.0
	Camel	1	1.4			1	.9			1	2.1	1	.8							1	.4	1	.8	2	.5
	Dokey & camel	1	1.4			1	.9													1	.4			1	.3
	Total	34	46.6			55	47.8	3	3.9	2	4.3	5	4.2	7	6.0	2	4.4	9	5.7	44	16.6	25	19.5	69	17.6
	They don't have	39	53.4	22	51.2	60	52.2	74	96.1	45	95.7	114	95.8	109	94.0	43	95.6	149	94.3	221	83.4	103	80.5	323	82.4
	Total	73	100	43	100	115	100	77	100	47	100	119	100	116	100	45	100	158	100	265	100	128	100	392	100
After	Donkey	38	52.1	24	55.8	62	53.9							4	3.4	1	2.2	5	3.2	42	15.8	25	19.5	67	17.1
	Horse							1	1.3	1	2.1	2	1.7	1	.9	1	2.2	2	1.3	2	.8	2	1.6	4	1.1
	Mule							2	2.6			2	1.7	1	.9	2	4.4	1	.6	3	1.1			3	.8
	Camel									1	2.1	1	.8									1	.8	1	.3
	Dokey & camel																								
	Total							3	3.9	2	4.3	5	4.2	6	5.2	2	4.4	8	5.1	47	17.7	28	21.9	75	19.1
	They don't have	35	47.9	19	44.2	53	46.1	74	96.1	45	95.7	114	95.8	110	94.8	43	95.6	150	94.9	218	82.3	100	78.1	317	80.9
	Total	73	100	43	100	115	100	77	100	47	100	119	100	116	100	45	100	158	100	265	100	128	100	392	100

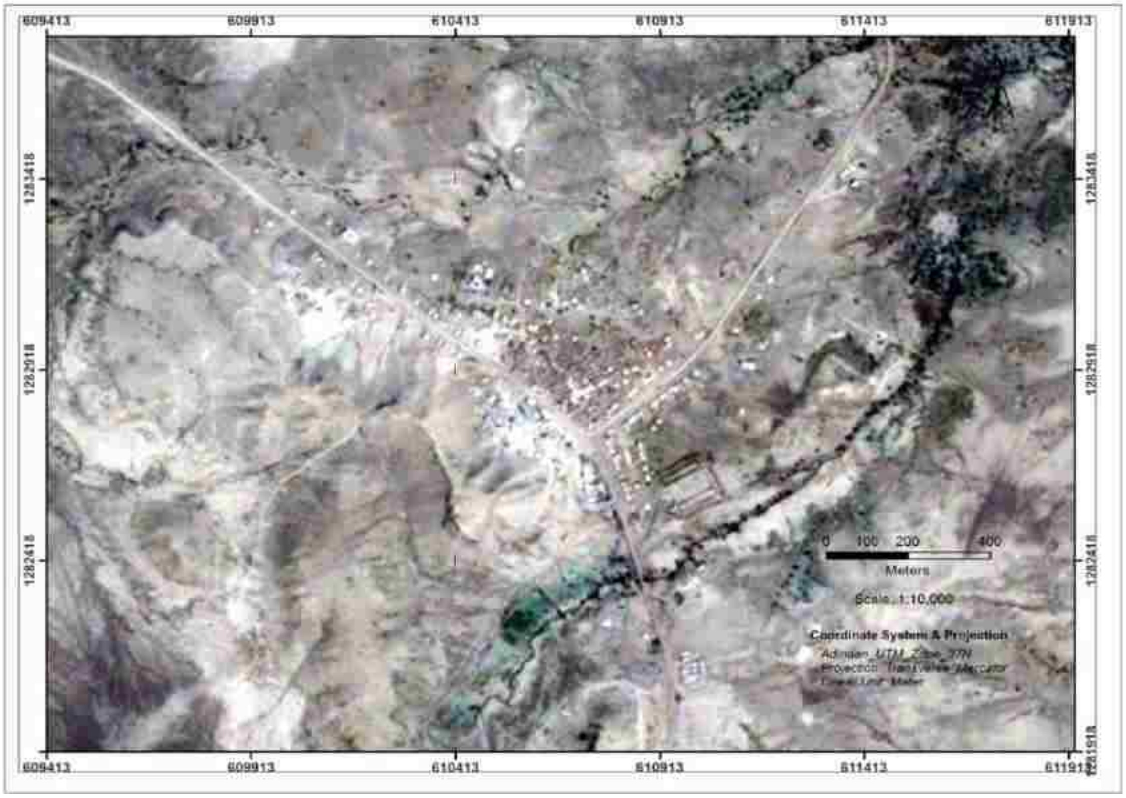
Source: Field Survey, 2014

Annex 5.5 Traffic Count Results

Hours (AM)	Pack animal	Carts	Other slows	Motor Bicycle	Car	Bajaj	L/Rover, Cruiser	Mini bus	Midi bus	Maxi bus	Small Truck	Medium Truck	Large truck	Truck & trailer	Total	NMT	Motorized
Corridor 1 (Total Traffic Count along Gendewuha - Gelago Line (10 -14/10/13;12 -16/10/13))																	
6:00_7:00	0	1	0	1	0	0	0	1	1	1	0	0	1	0	6	1	5
7:00_8:00	0	1	0	0	0	0	2	1	0	0	0	1	0	0	5	1	4
8:00_9:00	1	11	0	1	0	0	2	0	2	0	0	1	1	0	21	12	9
9:00_10:00	0	5	0	0	0	0	1	1	1	0	0	1	0	0	10	5	5
10:00_11:00	0	1	0	1	0	0	1	1	2	0	0	2	1	0	9	1	8
11:00_12:00	0	1	0	0	0	0	2	1	1	0	0	1	1	0	7	1	6
12:00_1:00	0	0	0	0	0	0	1	0	1	0	0	1	0	0	5	0	5
1:00_2:00	1	3	0	1	0	0	2	0	2	0	0	1	0	0	11	4	7
2:00_3:00	0	10	0	0	0	0	0	2	0	0	0	2	1	0	16	10	6
3:00_4:00	1	5	0	0	0	0	2	0	1	0	0	2	1	0	12	6	6
4:00_5:00	0	1	0	0	0	0	2	1	1	0	0	2	0	0	8	1	7
5:00_6:00	0	0	0	1	0	0	2	0	1	0	0	1	0	0	6	0	6
Total	**3**	**39**	**0**	**5**	**0**	**0**	**17**	**8**	**13**	**1**	**0**	**15**	**6**	**0**	**116**	**42**	**74**
Percent	**3%**	**34%**	**0%**	**4%**	**0%**	**0%**	**15%**	**7%**	**11%**	**1%**	**0%**	**13%**	**5%**	**0%**	**100%**	**36%**	**64%**
Corridor 2(Total Traffic Count along Mile - Weldiya Line (14-17/04/14;25-29/04/14;06-08/05/14))																	
6:00_7:00	0	1	0	0	5	7	5	14	9	2	5	12	13	38	111	1	110
7:00_8:00	0	0	0	1	6	10	10	22	8	3	5	9	7	38	120	0	120
8:00_9:00	0	1	0	2	4	13	9	15	7	1	6	10	11	40	118	1	117
9:00_10:00	0	1	0	2	6	13	8	16	9	1	5	12	11	39	123	1	121
10:00_11:00	0	0	0	2	9	11	8	13	5	2	4	8	13	37	112	0	112
11:00_12:00	0	1	0	2	5	8	8	12	6	3	7	10	10	34	106	1	105
12:00_1:00	0	0	0	2	4	9	7	14	4	2	4	8	10	36	99	0	99
1:00_2:00	0	0	0	2	3	7	6	13	2	2	9	9	12	32	97	0	97
2:00_3:00	0	1	0	1	4	8	6	11	4	2	6	11	12	33	99	1	98
3:00_4:00	0	1	0	2	5	12	9	19	3	2	8	11	13	39	123	1	122
4:00_5:00	0	1	0	3	7	12	8	21	4	2	8	9	16	34	126	1	125
5:00_6:00	0	0	0	0	6	12	9	12	2	2	8	13	19	43	127	0	127
Total	**0**	**7**	**0**	**19**	**64**	**122**	**93**	**182**	**63**	**24**	**75**	**122**	**147**	**443**	**1361**	**7**	**1353**
Percent	**0%**	**1%**	**0%**	**1%**	**5%**	**9%**	**7%**	**13%**	**5%**	**2%**	**6%**	**9%**	**11%**	**33%**	**100%**	**1%**	**99%**
Corridor 3 (Total Traffic Count along Ginchi-Kachise Line (13-17/06/14;10-15/07/14))																	
6:00_7:00	9	1	0	0	0	0	3	0	5	0	0	6	0	0	24	10	14
7:00_8:00	13	0	0	0	0	0	2	0	6	0	1	3	0	0	26	13	13
8:00_9:00	19	1	0	1	0	0	2	0	4	0	0	2	0	0	29	20	9
9:00_10:00	37	1	0	2	0	0	4	0	5	0	1	2	2	0	55	38	17
10:00_11:00	60	0	0	3	0	0	5	0	5	0	0	3	0	0	76	60	16
11:00_12:00	28	1	0	3	0	0	3	0	3	0	0	4	1	0	43	28	15
12:00_1:00	26	1	0	1	0	0	4	0	5	0	0	8	1	1	48	27	21
1:00_2:00	22	1	0	1	0	0	6	0	5	0	0	6	2	1	43	23	21
2:00_3:00	21	1	0	3	0	0	4	0	4	0	0	5	1	0	40	22	18
3:00_4:00	44	1	0	1	0	0	4	0	7	0	1	7	1	0	67	46	21
4:00_5:00	25	2	0	1	0	0	6	0	6	0	0	6	1	2	48	27	21
5:00_6:00	15	2	0	2	0	0	5	0	5	0	0	4	2	0	35	17	17
Total	**319**	**12**	**0**	**18**	**0**	**0**	**48**	**0**	**60**	**0**	**3**	**56**	**11**	**4**	**534**	**331**	**203**
Percent	**60%**	**2%**	**0%**	**3%**	**0%**	**0%**	**9%**	**0%**	**11%**	**0%**	**1%**	**10%**	**2%**	**1%**	**100%**	**62%**	**38%**

Source: Field Survey, 2014

Annex 6.1.Satellite Imagery of Chifra Town (Archive of 2006)

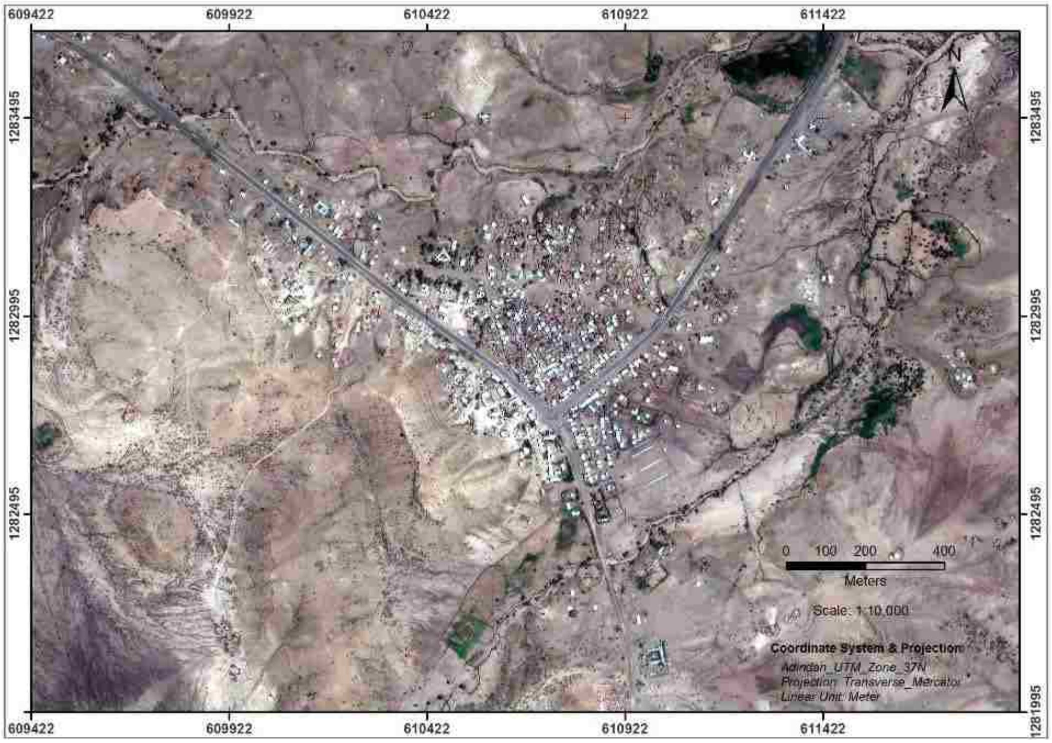


Source: SPOT Imagery, 2006

Annex 6.2.Satellite Imagery of Chifra Town (Archive of 2011)

Source: Google Earth, 2011

Annex 6.3 Satellite Imagery of Chifra Town (Archive of 2013)

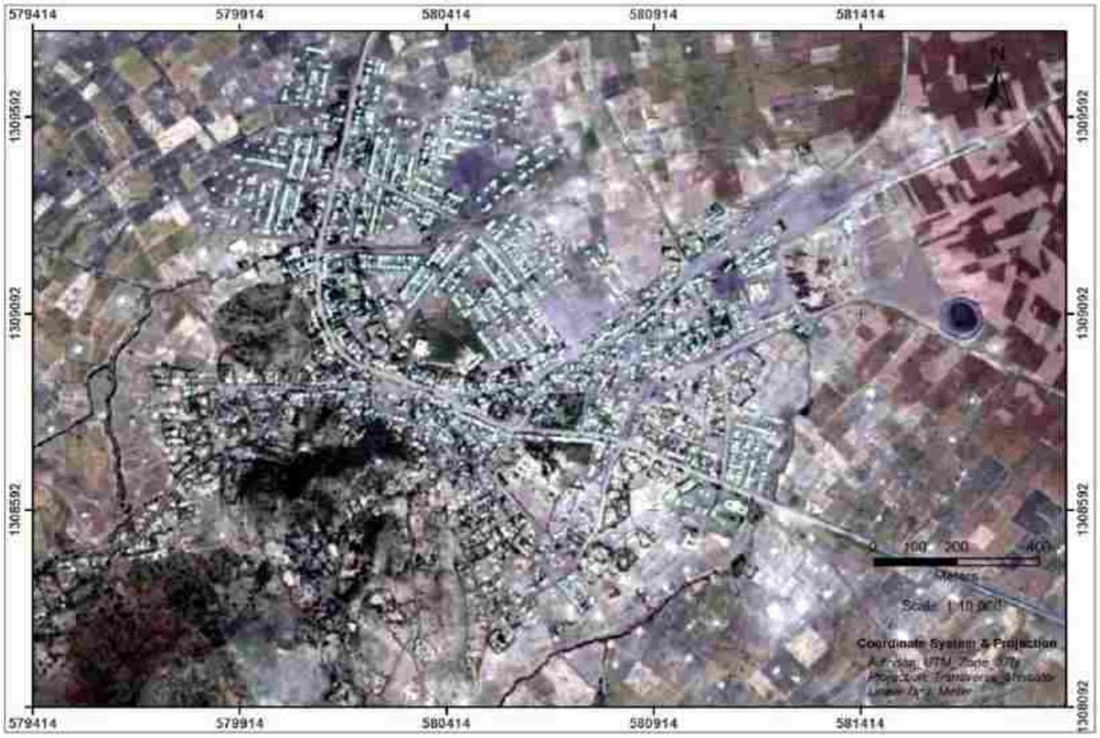


Source: Google Earth, 2013

Annex 6.4 Satellite Imagery of Hara Town (Archive of 2006)

Source: SPOT Imagery, 2006

Annex 6.5 Satellite Imagery of Hara Town (Archive of 2010)

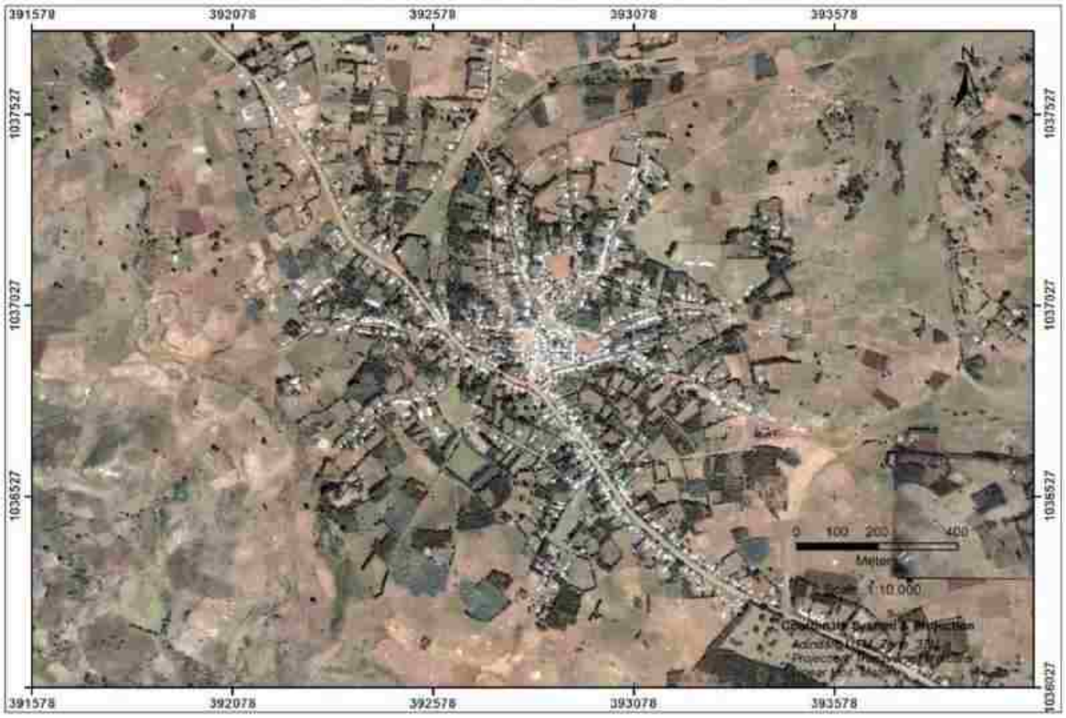


Source: Google Earth, 2010

Annex 6.6. Satellite Imagery of Hara Town (Archive of 2014)

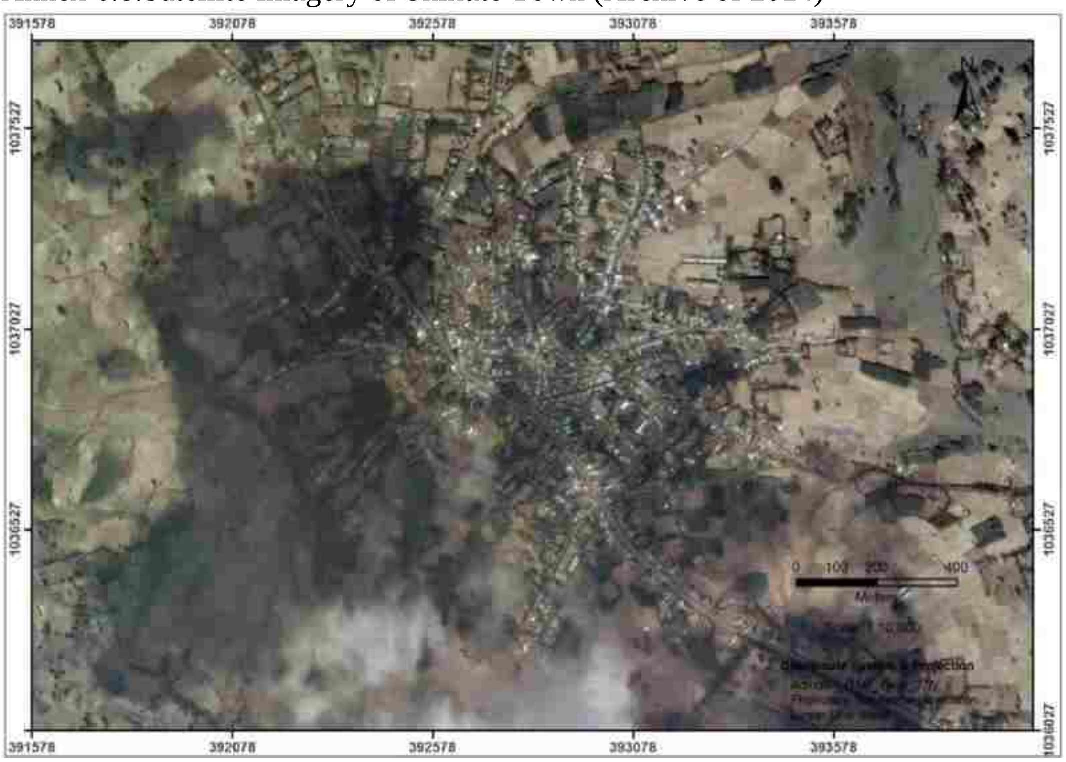
Source: Google Earth, 2014

Annex 6.7.Satellite Imagery of Shikute Town (Archive of 2006)



Source: Google Earth, 2006

Annex 6.8.Satellite Imagery of Shikute Town (Archive of 2014)

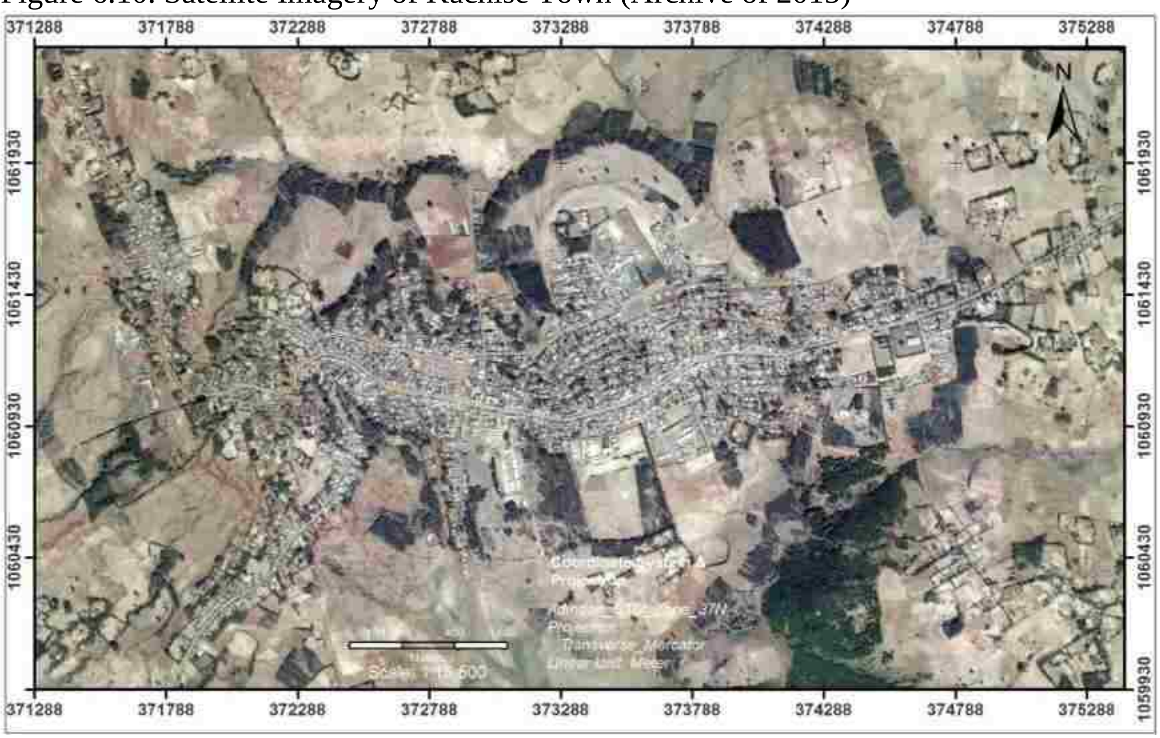


Source: Google Earth, 2014

Annex 6.9 Satellite Imagery of Kachisi Town (Archive of 2006)

Source: SPOT Imagery, 2006

Figure 6.10. Satellite Imagery of Kachise Town (Archive of 2015)



Source: Google Earth, 2015

Annex 6.11 Simple Regression Model in Settlement Expansion

Chifra	**y=24.47x+5.33**					**Shikute**	**y=5.74x+59.71**			
year	**b**	**x**	**a**	**y**		**year**	**b**	**x**	**a**	**y**
2006	24.47	1	5.33	29.8		2006	5.74	1	59.71	65.45
2014	24.47	2.26	5.33	60.6		2014	5.74	2	59.71	71.19
Hara	**y=22.7x+40.3**					**Kachisi**	**y=5.74x+59.71**			
2006	22.7	1	40.3	63		2006	13.85	1	145.5	159.35
2014	22.7	2	40.3	85.7		2014	13.85	2	145.5	173.2

**Considered as 2014*

NB: It should be noted that Chifra's settlement expansion data obtained is up to 2013. But other three study centres are up to 2014. Therefore, since Chifra's annual settlement expansion computed is 11.7% we should compute for one additional year (2014) to use the same summary graph:

Chifra =	
2013=54.3ha	y = 24.47x+5.33
2014?	(54.43*0.117) +54.43 = 60.6
	60.6 = 24.47x + 5.33
	x = 2.26
	2014 =2.26
	2022 = 3.26
	2030 = 4.26
	etc

Annex 6.12 Number of Meals and their Variety Used by Households' Family in the Zones of Study Corridors

Corridors	Durations of meal per day	ZOI				COZ				Both			
		Before		**After**		**Before**		**After**		**Before**		**After**	
		N	Percent	N	Percent	N	Percent	N	Percent	N	Percent	N	Percent
Number of Meals per Day													
Corridor 1	Once	0	0	0	0	2	4.7	2	4.7	2	1.7	2	1.7
Corridor 1	Twice	2	2.7	0	0	3	7.0	3	7.0	5	4.3	3	2.6
Corridor 1	Three times	70	95.9	71	97.3	35	81.4	34	79.1	104	90.4	104	90.4
Corridor 1	Four times	1	1.4	2	2.7	3	7.0	4	9.3	4	3.5	6	5.2
Corridor 1	Total	73	100.0	73	100.0	43	100.0	43	100.0	115	100.0	115	100.0
Corridor 2	Once	0	0	0	0	0	0	0	0	0	0	0	0
Corridor 2	Twice	7	9.1	6	7.8	22	46.8	22	46.8	29	24.4	28	23.5
Corridor 2	Three times	68	88.3	69	89.6	24	51.1	24	51.1	87	73.1	88	73.9
Corridor 2	Four times	2	2.6	2	2.6	1	2.1	1	2.1	3	2.5	3	2.5
Corridor 2	Total	77	100.0	77	100.0	47	100.0	47	100.0	119	100.0	119	100.0
Corridor 3	Once	4	3.4	1	.9	1	2.2	0	0.0	4	2.5	1	.6
Corridor 3	Twice	78	67.2	50	43.1	35	77.8	21	46.7	111	70.3	69	43.7
Corridor 3	Three times	34	29.3	65	56.0	9	20.0	24	53.3	43	27.2	88	55.7
Corridor 3	Four times	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Corridor 3	Total	116	100.0	116	100.0	45	100.0	45	100.0	158	100.0	158	100.0
All Corridors	Once	4	1.5	1	.4	3	2.3	2	1.6	6	1.5	3	.8
All Corridors	Twice	86	32.5	55	20.6	58	45.3	45	35.2	145	37.0	100	25.5
All Corridors	Three times	172	64.9	205	77.4	63	49.2	76	59.4	234	59.7	280	71.4
All Corridors	Four times	3	1.1	4	1.5	4	3.1	5	3.9	7	1.8	9	2.3
All Corridors	Total	265	100.0	265	100.0	128	100.0	128	100.0	392	100.0	392	100.0
Use of Variety of Food													
Corridor 1	Strongly agree	7	9.6	10	13.7	3	7.0	5	11.6	10	8.7	15	13.0
Corridor 1	Agree	38	52.1	44	60.3	19	44.2	21	48.8	57	49.6	65	56.5
Corridor 1	Un decided	8	11.0	7	9.6	6	14.0	6	14.0	14	12.2	13	11.3
Corridor 1	Disagree	19	26.0	12	16.4	15	34.9	11	25.6	33	28.7	22	19.1
Corridor 1	Strongly disagree	1	1.4	0.0	0.0	0	0.0	0	0.0	1	.9	.0	.0
Corridor 1	Total	73	100.0	73	100.0	43	100.0	43	100.0	115	100.0	115	100
Corridor 2	Strongly agree	15	19.5	15	19.5	8	17.0	9	19.1	23	19.3	24	20.2
Corridor 2	Agree	41	53.2	43	55.8	15	31.9	18	38.3	51	42.9	56	47.1
Corridor 2	Un decided	2	2.6	2	2.6	0	0.0	1	2.1	2	1.7	3	2.5
Corridor 2	Disagree	18	23.4	16	20.8	20	42.6	16	34.0	38	31.9	32	26.9
Corridor 2	Strongly disagree	1	1.3	1	1.3	4	8.5	3	6.4	5	4.2	4	3.4
Corridor 2	Total	77	100.0	77	100.0	47	100.0	47	100.0	119	100.0	119	100.0
Corridor3	Strongly agree	3	2.6	7	6.0	4	8.9	1	2.2	4	2.5	11	7.0
Corridor3	Agree	60	51.7	79	68.1	31	68.9	27	60.0	87	55.1	109	69.0
Corridor3	Un decided	6	5.2	6	5.2	3	6.7	1	2.2	6	3.8	7	4.4
Corridor3	Disagree	44	37.9	24	20.7	6	13.3	14	31.1	57	36.1	30	19.0
Corridor3	Strongly disagree	3	2.6	0	0.0	1	2.2	2	4.4	4	2.5	1	.6
Corridor3	Total	116	100.0	116	100.0	45	100.0	45	100.0	158	100.0	158	100.0
All Corridors	Strongly agree	25	9.4	32	12.1	12	9.4	18	14.1	37	9.4	50	12.8
All Corridors	Agree	139	52.5	166	62.6	57	44.5	66	51.6	195	49.7	230	58.7
All Corridors	Un decided	15	5.7	14	5.3	6	4.7	9	7.0	22	5.6	23	5.9
All Corridors	Disagree	81	30.6	52	19.6	47	36.7	31	24.2	128	32.7	84	21.4
All Corridors	Strongly disagree	5	1.9	1	.4	6	4.7	4	3.1	10	2.6	5	1.3
All Corridors	Total	265	100.0	265	100.0	128	100.0	128	100.0	392	100.0	392	100.0

Source: Field Survey, 2014

Annex 7.1 Knowledge of Respondents about Traffic Rules and Regulations

a) Direction the respondent following while walking parallel to the highway

Corridors	Options	ZOI				COZ				Both			
		Before		After		Before		After		Before		After	
		N	Percent	N	Percent	N	Percent	N	Percent	N	Percent	N	Percent
Corridor 1	Right	30	41.1	44	60.3	7	16.3	20	46.5	37	32.2	64	55.7
	Left	9	12.3	7	9.6	7	16.3	8	18.6	16	13.9	15	13.0
	Both	7	9.6	9	12.3	15	34.9	7	16.3	21	18.3	15	13.0
	I don't know	27	37.0	13	17.8	14	32.6	8	18.6	41	35.7	21	18.3
	Total	73	100.0	73	100.0	43	100.0	43	100.0	115	100.0	115	100.0
Corridor 2	Right	26	33.8	34	44.2	5	10.6	8	17.0	28	23.5	38	31.9
	Left	21	27.3	17	22.1	9	19.1	7	14.9	29	24.4	24	20.2
	Both	9	11.7	9	11.7	18	38.3	19	40.4	26	21.8	27	22.7
	I don't know	21	27.3	17	22.1	15	31.9	13	27.7	36	30.3	30	25.2
	Total	77	100.0	77	100.0	47	100.0	47	100.0	119	100.0	119	100.0
Corridor 3	Right	30	25.9	54	46.6	7	15.6	20	44.4	37	23.4	72	45.6
	Left	7	6.0	5	4.3	2	4.4	1	2.2	9	5.7	6	3.8
	Both	35	30.2	34	29.3	16	35.6	13	28.9	49	31.0	46	29.1
	I don't know	44	37.9	23	19.8	20	44.4	11	24.4	63	39.9	34	21.5
	Total	116	100.0	116	100.0	45	100.0	45	100.0	158	100.0	158	100.0
All Corridors	Right	86	32.5	132	49.8	16	12.5	44	34.4	102	26.0	174	44.4
	Left	37	14.0	29	10.9	17	13.3	16	12.5	54	13.8	45	11.5
	Both	50	18.9	51	19.2	47	36.7	37	28.9	96	24.5	88	22.4
	I don't know	92	34.7	53	20.0	48	37.5	31	24.2	140	35.7	85	21.7
	Total	265	100.0	265	100.0	128	100.0	128	100.0	392	100.0	392	100.0

b)know well about traffic safety

Corridors	Options	ZOI				COZ				Both			
		Before		After		Before		After		Before		After	
		N	Percent	N	Percent	N	Percent	N	Percent	N	Percent	N	Percent
Corridor 1	Strongly agree	3	4.1	6	8.2	3	7.0	8	18.6	6	5.2	14	12.2
	Agree	13	17.8	24	32.9	4	9.3	9	20.9	17	14.8	33	28.7
	Un decided	7	9.6	6	8.2	0	0.0	1	2.3	7	6.1	7	6.1
	Disagree	40	54.8	32	43.8	28	65.1	19	44.2	68	59.1	51	44.3
	Strongly disagree	10	13.7	5	6.8	8	18.6	6	14.0	17	14.8	10	8.7
	Total	73	100.0	73	100.0	43	100.0	43	100.0	115	100.0	115	100.0
Corridor 2	Strongly agree	6	7.8	6	7.8	2	4.3	4	8.5	8	6.7	10	8.4
	Agree	17	22.1	20	26.0	4	8.5	5	10.6	19	16.0	23	19.3
	Un decided	4	5.2	5	6.5	3	6.4	3	6.4	7	5.9	8	6.7
	Disagree	41	53.2	38	49.4	29	61.7	28	59.6	67	56.3	63	52.9
	Strongly disagree	9	11.7	8	10.4	9	19.1	7	14.9	18	15.1	15	12.6
	Total	77	100.0	77	100.0	47	100.0	47	100.0	119	100.0	119	100.0
Corridor3	Strongly agree	6	5.2	11	9.5	0	0.0	3	6.7	6	3.8	14	8.9
	Agree	19	16.4	44	37.9	6	13.3	13	28.9	25	15.8	56	35.4
	Un decided	9	7.8	6	5.2	1	2.2	0	0.0	10	6.3	6	3.8
	Disagree	74	63.8	52	44.8	32	71.1	28	62.2	104	65.8	78	49.4
	Strongly disagree	8	6.9	3	2.6	6	13.3	1	2.2	13	8.2	4	2.5
	Total	116	100.0	116	100.0	45	100.0	45	100.0	158	100.0	158	100.0
All Corridors	Strongly agree	15	5.7	23	8.7	5	3.9	15	11.7	20	5.1	38	9.7
	Agree	49	18.5	88	33.2	12	9.4	25	19.5	61	15.6	112	28.6
	Un decided	20	7.5	17	6.4	4	3.1	4	3.1	24	6.1	21	5.4
	Disagree	154	58.1	121	45.7	86	67.2	71	55.5	239	61.0	192	49.0
	Strongly disagree	27	10.2	16	6.0	21	16.4	13	10.2	48	12.2	29	7.4
	Total	265	100.0	265	100.0	128	100.0	128	100.0	392	100.0	392	100.0

Source: Field Survey, 2014

ANNEX-B DATA COLLECTION TOOLS

UNISA

Annex B1: Road Corridor's Household Survey Questionnaire

Questionnaire No: ………

Name of the interviewer………………**Date**………S**tarted at(hr)** …….; **Completed at**……..**(hr); Signature**…………

The name of the investigator is Belew Dagnew from Ethiopian Civil Service University, Transport Management Masters Programme, Addis Ababa. He is conducting PhD study on the title *Socioeconomic Impacts of Road Development in Ethiopia: Case Studies of Weldiya-Mile,Gelago-Shehedi and Ginchi-Kachise Roads* in the University of South Africa (UNISA).The purpose of this questionnaire is to capture first hand information to assess the socio economic impacts of road infrastructure development. All Questions you are going to be asked are purely for academic purpose. So you are thoughtfully requested to respond honestly to all items stated in the questionnaire. Be sure that the information you provide will be kept confidential.

Thank you in advance for your heartfelt cooperation.

GPS Position of the Household:

GPS NORTH: ___________________ ___GPS EAST:_______________________

GPS ELEVATION _____________ (in metre)

1. Household Identification

1.1	Full name………………………………	1.2	Surname……………………
1.3	Sex: 1= male 0= female	1.4	Age:……………
1.5	Ethnic affiliation: ………………..	1.6	Marital status: ……………
1.7	Religion………………..	1.8	Telephone no: ………………..
1.9	**Residence address, family and education:**	**Now**	**Before road intervention**
i	Region:		
ii	Zone:		
iii	*Wereda*:		
iv	*Kebele*:		
v	Town:		
vi	Village:		
vii	Distance from the road under study:	……m/km/ …… hours/ minutes/	….. m/.km/ …… Hours/ minutes/
viii	Household size(Family members):		
ix	Your educational status:		

2. Household Characteristics Excluding Household Head at Present:

Use the cods for the family members

	Sex	Age	Marital status	Relation	Education	Occupation	Health
	1=male **0**=female		**1**= Married **2**= Divorced **3**=Widowed **4**= Widower **5**= Single **6**=Any other	**1**= Husband/Wife **2**=Child/Grand child **3**=Father/mother **4**=Grand father/mother Great grand father/mother **5**=Brother/sister **6**=Any other...........		0=Unemployed(for≥18 age) **1**=Daily laborer **2**=Agriculture **3**=Student **4**=Small scale trade **5**=Handicrafts **6**=Govt employee **7**=House lady **8**=Hired in private organization **9**=2&6 **10**=2&8	0=Patient 1=Healthy 2=Any other
1							
2							
3							
4							
5							
6							
7							
8							
9							

3. Nature and Ownership of the Residential House

		Now	Before intervention
3.1	**House rooftop type:** **(Use cods)** 1 = Thatched; 2 = Tin roof 3 = Any other (specify)		
3.2	**Wall construction type** 1 = Wood & mud 2 = Stone; 3 = Grass; 4 = Brick; 5 = Mud brick;6 = Hollow bloc 7 = Any other (specify)		
3.3	**Floor type**: 1= Mud; 2= Plastic on mud; 3= Cement; 4= Plastic on cement; 5= Tiles; 6= Wooden floor; 7= Other…		
3.4	**Number of rooms/verandah** **i. Where is the toilet room:** 1= Inside house ; 2= Outside house; 3= Commonly with neighbors; 4=No at all/we use on open land		

		Now	Before intervention
3.4	**ii. Is there service room outside your main house?** 1= Yes; 2= No;		
	iii . Where is the kitchen? 1= Inside home 2= Outside home		
	iv= Have you verandah? 1= Yes 2= No		
	v.Where is the animal's house?1= Inside 2= Outside 3=No at all		
	vi. Number of main house rooms		
3.5	**Use of property:** 1 = Residential; 2 = Commercial; 3 = Both 4 = Other (specify)		
3.6	**Ownership of the property** 1 = Owner; 2 = Tenant; 3 = Inherited; 4= Other		

3.7 For how many years you live here? ....

3.8 If your location were not here, why you changed the location**?** ……………………………………

4. Livelihood

		Now	Before interv.
4.1	What do you do for your livelihood? Rank according to their importance: **use codes:** *1=Farming;2= Animal husbandry;3=Dairy farming; 4=Cattle rearing; 5=Poultry; 6=Bee keeping; 7=Handicrafts;8= Planting trees and selling their products; 9= small scale trading/shops; 10 = Daily laborer; 11=Land/ animal renting; 12=By remittance;13=Others….*	1st… 2nd…. 3rd … 4th …	1st…… 2nd …… 3rd …… 4th ……
4.2	If farming (Q 4.1):		
i	Which land do you have? *You can answer more than once* 1= own; 2= rented; 3= share type; 4=other		
ii	What is the area of each land(ha)(use cods above)		
iii	What is the estimated size of your cultivated land area in one year (ha)		
iv	Have you irrigated land? 1=Yes; 2=No		
v	If Irrigated, how many(ha)?		
vi	If you cultivate land yourself, what **resources** do you use? *You can answer more than once* 1 = Ox; 2 = Horse; 3 = Donkey; 4 = Hoe; 5=Tractor; 6 = Any other (specify)....		
vii	**Who are in the activity of (assisting) farming (write the number only)?**		
	a)HH leader(if he is farming)		
	b)Number of family members (if they are assisting [excluding HH leader])	M.. F..	M… F…
	c)Members seasonally in contractual base		
	d) Any other (explain)………	…	…
viii	Do females practice ploughing? 1=Yes; 2=No		
ix	If 'Yes' or 'No' for Q viii, Why? *After intervention:* …………………………………….. ………………………………………………………….. *Before the intervention*: ……………………………		

		Now	Before intervention
x	Do you use any modern agricultural inputs in farming? 1=Yes; 2=No		
xi	If 'Yes' for Q x, what type and **amount** of input you use in the year(kg,lit) for the following:		

	Improved Seeds(kg)	ha	Fertilizer (Qt)	ha	Pesticides (Lit)	ha	Herbicides(Lit)	ha
Now								
Before								

xii	If your answer for Qx is 'No' why? *Now* ………………………………............................. *After intervention* ………………………………............................. *Any other suggestion* ……………………………….........................…… ……		
xiii	Which months at most are you busy with farming activities in a year	…….	…………..
xiv	With the reference of Q 4.1 if you are pursuing any other activities (allied with the main[1stt]) write by using their code.		
xv	What is the estimated distance of this business from the study road (km)?		
xvi	Why you pursue this economic activity? *Now* ………………………………............................... *After intervention* …………………………………………………………		

4.3. What type of crops do you cultivate? What is the amount of area (in hectares) and production (quintal)?

	Crop Type	Now		Before road intervention	
		Area Cultivated (ha)	Production Quantity (in Qt)	Area Cultivated (ha)	Production Quantity (Qt)
i	**Cereals**				
a	Maize				
b	Sorghum				
c	Wheat				
d	Teff				
e	Barely				
f	Any other specify				
ii	**Pulses**				
a	Peas				
b	Bins				
c	Chick-peas				
d	Soya been				
e	Haricot-beans				
f	Any other specify				
iii	**Oil seeds**				
a	Niger seed				
b	Linseed				
c	Any other specify				
iv	**Vegetables & Fruits**				
a	Banana				
b	Tomato				
c	Lettuce/Costa				
d	Cabbage				
e	Orange				
f	Mango				
g	Papaya				
h	Inset				
i	Red Pepper				
j	Any other specify				
v	**Root-crops**				
a	Potato				
b	Onion				
c	Carrot				
d	Any other specify				
vi	**Cash crops**				
a	Cotton				
b	Sesame				
c	Coffee				
d	Incense				
e	Ginger				
f	Any other specify				
vii	**Any other specify**				
a					
b					

4.4. Please give detail explanations you **gained** or **lost** due to road investment for each under **i-vii** above
……
……
……

4.5. Based on 4.3 above, of the total crop production, what quantity (in Qt) do you allocate for the following types of use?

		Now					**Before road intervention**				
	Type of Crops	**Annual Crop Production(Qt)**	**Household Consumption**	**Cattle Food**	**Seeds Reserve**	**Marketable Surplus**	**Annual Crop Production(Qt)**	**Household Consumption**	**Cattle Feed**	**Seeds Reserve**	**Marketable Surplus**
i	**Cereals**										
a	Maize										
b	Sorghum										
c	Wheat										
d	Teff										
e	Barely										
f	Any other specify										
ii	**Pulses**										
a	Peas										
b	Bins										
c	Chick-pea										
d	Soya been										
e	Haricot-beans										
f	Any other specify										
iii	**Oil seeds**										
a	Niger seed										
b	Linseed										
c	Any other specify										
iv	**Vegetables & Fruits**										
a	Banana										
b	Tomato										
c	Cabbage/Costa										
d	Orange										
e	Mango										
f	Papaya										
g	Inset										
h	Red Pepper										
i	Any other specify										
v	**Root-crops**										
a	Potato										
b	Onion										
c	Carrot										

	Type of Crops	Now					Before road intervention				
		Annual Crop Production(Qt)	Household Consumption	Cattle Food	Seeds Reserve	Marketable Surplus	Annual Crop Production(Qt)	Household Consumption	Cattle Feed	Seeds Reserve	Marketable Surplus
d	Any other specify										
vi	**Cash crops**										
a	Cotton										
b	Sesame										
c	Coffee										
d	Incense										
f	Ginger										
g	Any other specify										
vii	**Any other specify**										
a											
b											

viii. Own suggestion for the above i-**vii**

……………………………………………………………………………………………………

……………………………………………………………………………………………………

4.6	**If your answer to Q 4.1 is small scale / shopping answer the following questions**	**Now**	**Before intervention**
i	What is the name of your business?		
ii	Where is the place of the business/establishment?		
iii	Number of employees		
iv	What are the daily average earnings of your business?		
v	How many customers visit (meet) your business every day at an average?		
vi	What is the amount of tax that you pay?		
vii	Are you using the road under study to transport the goods of your business 1= Yes 2=No		
viii	If 'No' why? *Now*…………………………............................ *Before the intervention*.......……………………………….....................		
ix	Length of road under study from your business centre(**in km and hour**)		
x	What type of road is found alongside of your business centre? 1=Asphalt ; 2= Gravel ; 3= Dry weather; 4= Coble		
xi	Based on the Q vii, what do you think the positive and negative impacts of such kinds of road type? a) Positive impacts: *After the intervention* ………………………………………………………………………………………… *Before the intervention* ……………………………………………………………………………………… b) Negative impacts: *After the intervention* ………………………………………………………………………………………… *Before the intervention* …………………………………………………………………………………………		
xii	How many years is your enterprise since its establishment ……………………………		
xiii	What are the major items of your business activities? …………………………………………		
xiv	What is your initial capital of investment?................................		
xv	What is your current total capital(fixed and variable)...		

5. Impact of Transport on Market

5.1	**Which option best opened due to road intervention for your market? Use cods:** ***1=Strongly agree; 2=Agree; 3=Un decided; 4=Disagree; 5= Strongly disagree***	**Now**	**Before intervention**
i	Shorten the distance of the trip		
ii	Easy access		
iii	Better price of products		
iv	Better cost of transport		
v	More access to buyers		
vi	Others		
5.2 i	Do you sell your product in the market**?** 1= Yes 2=No		
ii	If 'Yes' where do you sell your produce?		
iii	Distance of the market from your residence(**in km and hour**)	………	…………
iv	Distance of the market from your farm place(**in km and hour**)		
v	Is the market inside the village? 1= Yes 2=No		
vi	Are you using the road under study to sell your products 1= Yes 2=No		
vii	If 'No' why? *Now*…………………………............................ *Before the intervention*......………………………………................		
viii	Average distance of the farm place from the road under study(**in km and hour**)		
5.3	**How do you carry your produce to the market? Give the journey time, cost, means of transport, and the condition you use**		
i	**Human head & back** load:1= Yes 2=No		
ii	*If 'Yes' for Q i, who is dominantly doing this? 1=wife 2=husband 3=other ……*		
iii	**Animal back**: 1= Yes 2=No		
iv	*If 'Yes' for Qv, which type t? 1=donkey 2=horse 3=mule; 4=camel; 5=other*		
v	Animal drawn **cart: 1**= Yes 2=No		
vi	*If 'Yes' which type cart? 1=donkey 2=horse 3=mule; 4=camel; 5= other*		
vii	**Public bus**; 1= Yes 2=No		
viii	*If 'Yes' which type bus? 1=maxi; 2=midi 3=mini; 4= other……..*		
ix	**Bajaj**: 1= Yes 2=No		
x	*If 'Yes' which type bajaj 1=big capacity 2=small capacity; 3= other……..*		
xi	**Truck:** 1= Yes 2=No		
xii	*If 'Yes' which type truck (put according to its capacity[quintal])*		
xiii	From **Q iii, v, vii, ix, xi** do you have your own means of transport (Beast of Burdon such as: **donkey**, **horse, mule, camel; Animal carts; Public bus; Bajaj** and/or **trucks**)? 1= Yes 2=No		
xiv	*If 'Yes' which one/type is your own means of transport? Please write*		
xv	From the means of transport mentioned (**iii, v, vii, ix, xi)** do you use **hired** *means of transport*? 1= Yes 2=No		
xvi	*If 'Yes' please write **each name and transport cost(Birr/Qt)***		
xvii	What produce do you transport by the means of transport of your own or rented? Name them		
xviii	*As per Q xvii what is the annual average transport cost estimation of travel performed?*		
5.4	**If your answer for Q5.2 is 'No' why?** *Now*……………………………........ *Before the intervention*......……………………		

6. Household Expenditure and Income

6.1	From which market place do you buy your daily/monthly consumer good (other than agricultural products)?	**Now**	**Before intervention**
i	Is it the same, where you sell your products? 1= Yes 2=No		
ii	How often do you buy your needs?1= Daily; 2= Once a week; 3= Bi weekly; 4= Monthly; 5= Occasionally; 6= Any other; …….		
iii	Do you use the road under study to transport your purchased consumer goods 1=Yes 2=No		
iv	**If 'No' why?** *Now*……………………………........ *Before the intervention*......………………………………................		

	Item	Unit	6.2A Yearly HH Expenditure Now				6.2B Yearly HH Expenditure Before			
			Own Source		Purchased		Own Source		Purchased	
			Quantity	Amount (Birr)	Quantity	Amount (Birr)	Quantity	Amount (Birr)	Quantity	Amount (Birr)
a)	**Food from Cereals**									
i	Teff									
ii	Sorghum									
iii	Sesame									
iv	Maize									
v	Millet									
vi	Wheat									
vii	Barley									
vii	Cost for Grinding									
viii	Other									
b)	**Cost for watt**									
i	Pease prepared									
ii	Bean									
iii	Lentil									
iv	Oil									
v	Red Onion									
vi	White Onion									
vii	Pepper									
viii	Salt									
ix	Tomato									
x	Other									
c)	**Energy**									
i	Wood									
ii	Electric									
iii	Gas and Related									
iv	Others									
d)	**Others Needs**									
i	Clothing									
ii	Transport Cost									
iii	Health Care									
iv	Education									
v	Lighting and utilities									
vi	Agricultural Laborers									
vii	Seeds									
viii	Fertilizer and Herbicides etc...									
ix	Others (specify)									

6.3	**Ceremonial expenses incurred during one year at an average**	**Now**	**Before intervention**
i	Expenses incurred for *religious* practices/contributions in the year at an average		
ii	Expenses incurred for *marriage* practices/ contributions in the year at an average		
iii	Expenses incurred for *funeral* practices/ contributions in the year at an average		
iv	Others (specify)……………………………………. Per *year* (Birr)?		

6. Revenue

7.1	**What is your annual income in Birr?**	Now	Before intervention
i	From farming		
ii	From other activities		
7.2 i	**Are there other earning members in the family?** 1= Yes 2=No		
ii	If yes what is the annual income of other earning members in the family		
7.3 i	**Do you receive any remittance?** 1= Yes 2=No		
ii	What is the amount of remittance per year (Birr)?		

8. Asset Ownership

8.1	Immovable Assets	Now		Before intervention	
		Area (in ha or km^2)	Estimation of the Property (Birr)	Area (in ha or km^2)	Estimation of the Property (Birr)
i	Total **landed property** owned by the HH				
ii	Your own **agricultural production area** (ha)				
iii	Your own **grazing** land (other than community land) (ha)				
iv	Own area under **backyard** production (ha) (if you have)				
v	Own area **under tree** (other than community land) (if you have)				
vi	Your own additional **House in the town**(if you have)				
vii	**Ggrain grinder** (if you have)				
viii	**Water pump**(if you have)				
ix	Estimated value of any other asset…………….				

8.2 Moveable Assets:

	Moveable Assets:	**Now**		**Before intervention**	
		Qty	**Value (Birr)**	**Qty**	**Value (Birr)**
i	Oxen				
ii	Bull				
iii	Cow				
iv	Heifer				
v	Mule				
vi	Horse				
vii	Camel				
viii	Donkey				
ix	Sheep				
x	Goat				
xi	Animal drawn cart,karo, specify				
xii	Bees in hive				
xiii	Hens				
xiv	Television (TV)				

	Moveable Assets:	**Now**		**Before intervention**	
		Qty	**Value (Birr)**	**Qty**	**Value (Birr)**
xv	Radio/Transistor				
xvi	Watch/clock				
xvii	Mobile				
xviii	Bicycle				
xix	Bed/mattress (wood or steel and foam)				
xx	Kerosene lamp with glass chimney				
xxi	Car				
xxii	Truck…….Qt				
xxiii	Passenger vehicle…seat				
xxiv	Tractor				
xxv	Combiner				
xxvi	Others				

Any suggestion:…………………………………………………………
………………………………………………………………………

9. Women Specific Household Activities, Other than the Main Occupation (for Women Head of the Family) at an Average

S/N	Activities	Now	Before intervention
i	Purchasing household items (weekly) from market	……hours/min….. km	……hours/min….. km
ii	Fetching drinking water(per day)	……hours/min….. km	……hours/min….. km
iii	Fuel wood collection (per week)	……hours/min…. .km	……hours/min…. .km
iv	Medical assistance(per month)	……hours/min…. .km	……hours/min…. .km
v	Any other activity …………………………	……hours/min….. km	……hours/min…. .km

10. Household Savings

		Now	Before intervention
i	**Are you a member of a saving group?** 1= Yes 2=No		
ii	*If Yes in which of the following you save? 1=Amhara Micro-finance; 2= Equib; 3= Rural bank; 4= Urban bank; 5= Afar Micro-finance; 6= Oromia Micro-finance; 7=Any other; …….8. Equb and Micro-finance*		
iii	For what purpose do you use your savings? 1=Festivities; 2= Consumption ; 3= Repay debts 4= For agriculture 5=Others (specify)		
iv	How much is your saving per month (Birr)		

11.Household Indebtedness: Indicate household borrowings:

		Now	Before intervention			Now	Before interv.
11.1	Have you ever borrowed the following? a. In cash 1= Yes 2=No b. In Material 1= Yes 2=No	……… ………	………… …………	11.6	How is the status of returning the debt? Use cods shown below* 1= I am returning 2= I have returned all 3= I didn't start returning a. In cash b. In material	……… ………	……… ………
11.2	If 'Yes' what is the amount borrowed? a. In cash b. In material	……… ………	………… …………	11.7	What is amount returned? a. In cash b. In material	……… ………	……… ………
11.3	If 'Yes' what is the purpose of borrowing ? a. In cash b. In material	a……. ……… b……… ………	a……… ………… b……… …………	11.8	If you returned, when? a. In cash b. In material	……… ………	……… ………
11.4	When did you borrowed? a. In cash b. In material	………	………	11.9	What is the amount at outstanding)?a. In cash b. In material	……… ………	……… ………
11.5	From where is your source of borrowing? a. In cash b. In material	……… ………	……… ………	11.10	Any suggestion about the borrowing *Before intervention* …………………………………...... *After intervention* ………………………………….......		

**NB for Q 11.5 fill cods; 1= Ministry of Agriculture 2= Rural bank; 3= Urban bank ; 4= Amhara Micro-finance; 5= Cooperatives 6=Unregistered money borrower 7=Afar Micro-finance; 8=Oromia Micro-finance;; 9=Equb; 10=Any other (specify) ………*

12. Health Centre Accessibility for Households

		Now	Before the intervention
12.1	Do you have access to medical services? 1= Yes 2=No		
12.2	*If 'Yes' **which type of health facility access do you have**? (you can answer more than once); use the cods:1= Health post; 2=Clinic; 3=Health centre; 4=Hospital*		

12.3 **At the Current time:** How far is the nearest health centre from your house? Type of means of transport used, cost between origin and destination?

a)Health facility	**b)Name/ place**	**c) Owner 1=Govt 2=Private**	**d) Is a road connected to this health centre?** 1= Yes 2=No	**e)Distance from the house**		**f)Travel**			**g)Frequency per year**
				Time	**Km**	Means of transport	**Time**	**Cost/trip (Birr)**	
Health post									
Clinic									
Health centre									
Hospital									

12.4 Before the Road Intervention: How far is the nearest health centre from your house? Type of means of transport used, cost between origin and destination?

a)Health facility	**b)Name/ place**	**c) Owner 1=Govt 2=Private**	**d) Is a road connected to this health centre?** 1= Yes 2=No	**e)Distance from the house**		**f)Travel**			**f)Frequency per year**
				Time	**Km**	Means of transport	**Time**	**Cost/trip (Birr)**	
Health post									
Clinic									
Health centre									
Hospital									

		Now	**Before intervention**
12.5	Is medical aid free or paid by you? 1=Free; 2=Paid		
12.6	Was any member of your family affected by any major illness? 1= Yes 2=No		

If 'Yes' for Q 12.6 indicate the details in Q12. 7 and use cods for Q c* 1=very good; 2=good;3=medium;4=bad;5=very bad; 6=No treatment

12.7 Major Illnesses

	Now			**Before intervention**		
	a)Type of disease/illness	**b)No. of cases per year**	**c)Status of treatment undertaken***	**a)Type of disease/illness**	**b)No. of cases per year**	**c) Status treatment undertaken***
i						
ii						
iii						

12.8	**If treatment *is very bad* or *no treatment*, is it because of: Use cods: *1=Strongly agree; 2=Agree; 3=Un decided; 4=Disagree; 5= Strongly disagree***	**Now**	**Before intervention**
i	Non-availability of health facility:		
ii	High cost of treatment		
iii	No appropriate transport facility:		
iv	Very far to reach health centre:		
v	Any other please specify…………………………….		
12.9	**Where do women go for child delivery? Use codes: *1=Strongly agree; 2=Agree; 3=Un decided; 4=Disagree; 5= Strongly disagree***		
i	Stay at home		
ii	Use traditional treatment;		
iii	Use midwives;		
iv	Go to health centre		
12.10	Do you use the road under study to commute for health service? 1= Yes 2=No		
12.11	If 'No' why? *Now*……………………………....... *Before the intervention*.......………………………………................		

If you ***strongly agree*** or ***agree on*** "stay at home" give reasons………………………………………..
……
……

13. Accessibility of Education for Household

		Now	**Before inter.**
13.1	**Is there school in/around your village?** 1= Yes 2=No		
13.2	If 'Yes' which type of school? (*you can answer more than once*); **use cods**: *1= 1st cycle(1-4); 2= 2nd cycle(5-8); 3= 3rd cycle(9-10); 4= Preparatory(11-12); 5= College/TVET 6= University; 7= Adult education 8=Integrated functional literacy 9=Non formal education; 10=Any other*		

If 'Yes' for Q 13.1 answer questions 13. 3 and 13.4

13.3At this time: How far is the nearest school from your house? Which means of transport is used and cost between origin and destination?

	School and Standard	**Name/ place**	**Owner (Got/Pr)**	**Is a road connected to this school?** 1= Yes 2=No	**Distance from the house**		**Transport mode type**	**Travel cost (Birr)**
					Time	**Km**		
i	1st cycle(1-4)							
ii	2nd cycle(5-8)							
iii	3rd cycle(9-10)							
iv	Preparatory (11-12)							
v	College/TVET							
vi	University;							
vii	Adult education							
viii	Fun. literacy education;							

13**.4 Before road intervention:** How far is the nearest school from your house? Which means of transport is used and cost between origin and destination?

	School and Standard	Name/ place	Owner (Got/Pr)	Is a road connected to this school? 1= Yes 2=No	Distance from the house		Transport mode type	Travel cost (Birr)
					Time	Km		
i	1st cycle(1-4)							
ii	2nd cycle(5-8)							
iii	3rd cycle(9-10)							
iv	Preparatory (11-12)							
v	College/TVET							
vi	University;							
vii	Adult education							
viii	Fun. literacy school;							

		Now	Before int
13.5	Do you have your children or family members going to school? 1= Yes; 2= No		
13.6	If 'Yes' how many? ***Use cods 1=male; 0=female***	1… 0….	1… 0….
13.7	If you have a school-going child (or children), at age of 5 to 14, by which means of transport do they commute? (you can answer more than once); use the cods: *1= Walking; 2= Animal drawn carts; 3= Donkey/horse back;4= Bicycle; 5= Own automobile; 6= Rented vehicle;7= School service; 8= Any other………*		
13.8	If 'No 'for Q 13.5, why? **Use cods: *1=Strongly agree; 2=Agree; 3=Un decided; 4=Disagree; 5= Strongly disagree*** for Q i-v below		
i	Education is not considered as important		
ii	The school is too far from the house		
iii	Transportation service is costly		
iv	Children help in household economy		
v	Any other please specify...............................		
13.9	Do you use the road under study to commute to school for any purpose? 1= Yes 2=No		
12.10	If 'No' why? *Now……………………………........ Before the intervention......……………………………................*		
13.11	How many members of your family in age group 15-24 are educated		
13.12	State the level of education for each of them		

14. Road Use and Impact of Road Development

14.1. What benefits do you envisage from road improvement? **Use cods: *1=Strongly agree; 2=Agree; 3=Un decided; 4=Disagree; 5= Strongly disagree***

	Impact variables	Now	Before interv.
i	Purchase of better products at better price		
ii	Purchase of better products at lower price		
iii	Sale of products at better price		
iv	Sale of products at lower price		
v	Get consumable goods easily		
vi	Easy access to health care		
vii	Easy access to schooling		
viii	Easy access to Government offices to promote economic activities		
ix	Easy access to physical communications		
x	Easy access to visit relatives, friends etc		
xi	Easy access to pleasure trip		
xii	Enhanced the living standard of the community		
xiii	Increased the commuting of the community to cities		

	Impact variables	Now	Before interv.
xiv	Decreased women's work burden		
xv	Created additional work opportunities		
xvi	Created off- agriculture work opportunities		
xvii	Influenced the HHs to build their houses near to the road side		
xviii	Influenced the HHs to change the thatched houses to tin roofs		
xix	Influenced the community to use new technologies and innovations		
xx	Influenced the attitude of the community through enhanced innovations		
xxi	Other please specify		

14.2 Please give any explanations related to the above (i-xxi) opportunities ……………………………
………

14.3.: What are the places mostly visited by you, purpose and means of transport *after the intervention?*

S/n	Places	Name of Nearest Place/ Destination	Purpose of travel	Road nature			Mode of Transport and cost		
				Gravel	Asphalt	Dry weather	Mode	Time	Co st
i	Market town								
ii	*Kebele* Office								
iii	*Wereda* Office								
iv	Hospital/Health centre								
v	School								
vi	Agricultural extension office								
vii	Police station/Court								
viii	Church/Mosque								
ix	Cooperative offices								
x	Peasant associations								
xi	Normal job place								
xii	Others, specify……………								

xii. Any explanations related to the above *after the intervention*

…………………………………………..………………………………………………………..

…..…………………………………………………………….. ……………………………………

14.4.: What are the places generally visited, purpose and means of transport *before the intervention?*

S/n	Places	Name of Nearest Place/ Destination	Purpose of travel	Road nature			Means of Transport and cost		
				Gravel	Asphalt	Dry weather	Means of Transport	Time	Cost
i	Market town								
ii	*Kebele* Office								
iii	*Wereda* Office								
iv	Hospital/Health centre								
v	School								
vi	Agricultural extension office								
vii	Police station/Court								
viii	Church/Mosque								
ix	Cooperative offices								
x	Peasant associations								
xi	Normal job place								
xii	Others, specify……………								

xii. Any explanations related to the above *Before the intervention* ……………………………………………

……

14.5	Mobility outside the village and *wereda*	Now	Before int.
i	What means of transport do you use to travel to the boundaries of your village?		
ii	Have you ever traveled outside your ***wereda***? 1= Yes; 2= No		
iii	If 'Yes' how often do you travel to places outside your ***wereda***? **Use cods:** *1= Daily; 2= Weekly; 3= Monthly; 4= Twice a year; 5= Once a year; 6= Occasionally;*		
iv	If 'Yes' at which month of the year is more dominant travel? Please specify.		
v	For what purpose do you frequent outside your *wereda*? Use Cods: 1= for social; 2= for market; 3= for trade; 4= for meeting; 5= for others …………		
14.6 i	**Have you ever encountered traffic accident on you or on your family along the route under study? 1= Yes; 2= No**		
ii	If 'Yes' where?		
iii	If 'Yes' When?		
iv	If 'Yes' which type of vehicle encountered accident?		
v	Type of the Accident(1=Fatality, 2= Heavy injury; 3= Light injury, 4= Property damage)		
vi	If there was property damage please put the estimated cost(Birr)		
vii	For the accident happened, were you used third party insurance? 1= Yes; 2= No		
viii	If 'No' Why? Use cods:1= I don't have any knowledge about insurance rule that time,2=The case was harmonized informally between the victim and the victimizer; 3= Harmonized with negotiation of traffic police; 4= Other…		
14.7	**Do you know *a person* affected due to road development and vehicles' mobility along the road under study? 1= Yes; 2= No**		
14.8 **i** **ii**	**If 'Yes' for Q 14.7, please specify the detail** *After the intervention* ……………………………………………………………………………………………… *Before the intervention* ………………………………………………………………………………………………		
14.9	**Do you know *an environment/a place* affected due to road development and vehicles' mobility along the road under study?** **1= Yes; 2= No**		
14.10 **i** **ii**	**If 'Yes' for Q 14.9, please specify the detail** *After the intervention* ……………………………………………………………………………………………… *Before the intervention* ……………………………………………………………………………………………..		

15. Poverty Indicators

		Now	Before intervention
15.1	Your family members get how many meals a day?1= Once; 2= Twice; 3= Three times; 3= Four times		
15.2	You are using variety of food types: **Use cods: *1=Strongly agree; 2=Agree; 3= Un decided; 4=Disagree; 5= Strongly disagree***		
15.3	Do children in your family get full diet of milk, eggs required for nourishment? **1= Yes; 2= No**		
15.4	Have you a pair of Shoes? **1= Yes; 2= No**		
15.5	How many family members have a pair of shoes?		
15.6	Do you and your family members have proper clothes to wear and protect from heat and cold? **1= Yes; 2= No**		
15.7	What is your monthly income(Birr)		
15.8	What is the total estimation of monthly income(Birr) of your family		

16. Community Development Activities on Road Development

		Now	Before intervention
16.1	Have you ever been consulted/invited in the planning and implementation of road development projects in your area? 1= Yes; 2= No		
16.2	Have you been associated with the local road development plan? 1= Yes; 2= No		
16.3	Do you make any contribution in terms of cash for road development? 1= Yes; 2= No		
16.4	Do you make any contribution in terms of labor for road development? 1= Yes; 2= No		
16.5	Have you ever been invited to participated in the training or workshop of traffic safety issues? 1= Yes; 2= No		
16.6	If 'Yes' which institution invited you?		
16.7	When did you been invited?		
16.8	During your walking, which direction do you follow from the highway? 1= Left side; 2= Right side; 3= Both; 4= I don't Know		
16.9	Do you believe that you know well about traffic safety? **Use cods: *1=Strongly agree; 2=Agree; 3= Un decided 4=Disagree; 5= Strongly disagree***		

17. What major impacts have you gained or lost due to road development?

……
……
……

18.What are the major impacts the village/ local area, *wereda* and the region gained or lost due to road development?

……
……
……

19. What are the overall challenges in road transport development in the village/local area, *wereda* and the region?

……
……
……

20. What are the overall solutions for the challenges mentioned above in the village/local area, *wereda* and the region?

……
……
……

Name of Enumerator: …………………… Date of Survey: …………… Signature …………………

Name of the Supervisor…………………………… Date : …………… Signature ……………

NB: Use cods: 66= None; 77= Not applicable; 88= Do not know; 99= Refusal

Annex B2 Interview Questions

The key informants are composed of different sectors as indicated below: They are guided by questions related to the socioeconomic impacts of road development. In this regard, this technique was used to embed the data the researcher has got from survey methods. The impact questions are indicated in the following page:.

S/N	Key informants	S/N	Key informants
1	Education Sector	6	Road transport Infrastructure
2	Health Sector	7	Drivers
3	*Wereda* Administration	8	Passengers
4	Businessmen	9	Traffic police
5	Agricultural Sector		

Name of the interviewer………………….................**Date**………..............S**tarted at(hr)** ……........
Completed at……........................**(hr); Signature**……………...................

The name of the investigator is Belew Dagnew from Ethiopian Civil Service University, Transport Management Masters Programme, Addis Ababa. He is conducting PhD study on the title *Socioeconomic Impacts of Road Development in Ethiopia: Case Studies of Weldiya-Mile, Gelago-Shehedi and Ginchi-Kachise Roads* in the University of South Africa (UNISA).The purpose of this interview is to capture firsthand information to assess the socio economic impacts of road infrastructure development. All Questions you are going to be asked are purely for academic purpose. So you are thoughtfully requested to respond honestly to all items stated in the questionnaire. Be sure that the information you provide will be kept confidential.

Thank you in advance for your heartfelt cooperation.

Location explanation…………………………………………………………Road Corridor………………

i. **Interviewees' Background**

1.1	Sex: 1= male 0= female	1.2	Age:……………
1.3	Ethnic affiliation: ………………..	1.4	Marital status: ……………
1.5	Religion………………..	1.6	Occupation: …………….
1.7	Position: ………………………		
1.9	**Residence address, family and education:**	**Now**	**Before road intervention**
i	Region:		
ii	Zone:		
iii	*Wereda*:		
iv	*Kebele*:		
v	Town:		
vi	Village:		
vii	Number of family members		
viii	Education status		

S/N	**Opinion Questions Interviewed on the Impacts of Road Development for:** **a)*Before Road Intervention Periods*** **b)*After Road Intervention Periods* (explanations are given under each key informants by hand writing on separate sheet)**	**Key informants from different sectors**								
		Education Sector	**Health Sector**	***Wereda* Administration**	**Agricultural Sector**	**Road transport/ Infrastructure**	**Drivers**	**Passengers**	**Traffic Police**	**Businessmen***
1	How are the changes related to institutional facilities of road intervention?	x	x							
2	What is your suggestion on the implementation of traffic rules and regulations before and after road intervention in the study areas?	x	x	x	x	x	x	x	x	
3	How are the governance issues in road infrastructure before and after road intervention in the study area?	x	x	x	x	x	x	x	x	
4	How are the governance issues in traffic management before and after road intervention in the study area?	x	x	x	x	x	x	x	x	
5	What do you think the impact of road construction / improvement on:									
6	Education?	x								
7	Health?		x							
8	Women, young girls, young boys, adult men?		x	x	x	x	x	x	x	
9	Population growth/ change and distribution status in the *wereda*			x						
10	Does the road development under study attracted investment?			x						
11	Does road investment contributed to agricultural development?				x					
12	Are there agricultural activities opened due to road investment?				x					
13	How is the historical development of the road corridor under study?					x	x	x	x	
14	Do you believe that this road meets good road standard at this moment?					x	x	x	x	
15	What do you think the benefits you gained from the road investment as compared to before intervention?					x	x	x	x	
16	What do you think the opportunities you missed due to the road investment before and after intervention?					x	x	x	x	
17	Among direct impacts (changes), were there frequent closure of the road under study during the rainy season **after intervention**?					x	x	x	x	
18	What economic, social, environmental impacts (positive/negative) do road development brought about?					x	x	x	x	
19	Is traffic count executed along the corridor?					x			x	
20	You think the road network coverage of the town is sufficient for the existing population and number of vehicles						x		x	
21	How do you evaluate traffic mobility change before and after intervention? If it has been due to intervention which types of vehicles dominate after intervention?						x		x	
22	How is the time, labour, and money cost saving before and after intervention?					x	x	x	x	
23	What are the main challenges of road provision and maintenance in your *wereda*?					x	x	x	x	
24	How is the vehicle accident rate along the corridor?					x			x	
25	How are the financing options for road development in the study area?					x			x	
26	Is there involvement of local communities and other stakeholders in the management and maintenance to sustain and improve the road network?					x				
27	Do you measure the level of community participation, in planning construction, management and maintenance of road infrastructure in the study area?					x				
28	How is integration with other sectors in road planning, management and financing?					x				

29	Does the monitoring and evaluation system undertaken for the road under study?					x				
30	Do you think the road network coverage of this *wereda* is sufficient for the existing population and number of vehicles?						x		x	
31	At which time does high vehicle traffic mobility dominate? …………hours; ……….months ……………………………						x	x	x	
32	Have you ever encountered traffic accident along the route under study If yes where ………………………. when? .... Which type of vehicle						x	x	x	
33	Do you think that there is environmental effect due to the road development If yes in what way it affects the environment?						x	x	x	
34	Do you know a person affected by road development and vehicles' along the road under study? If Yes please specify the detail						x	x	x	
35	*Fuel cost:*						x			
36	Vehicle speed before intervention at an average						x			
37	What are the main challenges of road provision and maintenance before and after intervention in your *Wereda*?						x	x	x	
38	Have you ever participated in the contribution for road development in the study area *If yes specify and explain the level of your participation*						x	x	x	
39	Were you ever involved with local communities and other stakeholders in the management and maintenance to sustain and improve the road network? *If yes specify and explain the level of your participation*						x	x	x	
40	Are you volunteer to participate in the road development? *Yes, what type contribution? a) Money; b) labor; c) both: d) any other*					x	x	x	x	
41	How long have you used the high way under study						x			
42	What is the name of your common origin and destination?						x			
43	While you are walking along the highway which direction do you follow? right/left							x		
44	How is your geographical coverage of traffic administration and scope at this moment?								x	
45	Your traffic control origin and destination?								x	
46	What do you think the benefits the community gained from the road investment as compared to before intervention?								x	
47	What do you think the opportunities the community missed due to the road investment before and after intervention?								x	
48	Do the walkers follow/respect traffic rules and regulations (walking directions, zebra line etc) along the highway during their movement?								x	

**Business questions are included in HH survey questionnaires (Questionnaire number 4.6)*

Annex B3 Focus Group Discussion and Consultation Check List

A focus group discussion allows a group of 8 - 12 informants. The researcher selected purposively mixed participants of different sectors as indicated below. The participants were invited for free discussion guided by questions related to the socioeconomic impacts of road development. In this regard this technique was used to embed the data the researcher has got from survey methods. The impact questions are indicated below.

S/N	Participants in FGD	S/N	Participants in FGD
1	Village heads	6	Investors and Businessmen/traders
2	Women affairs	7	Agricultural sector
3	Youth association	8	Education sector
4	Development agents	9	Health sector
5	Religion leaders	10	Road infrastructure
6	Investors and Businessmen/traders	11	Traffic police
7	Agricultural sector		

Checklist No: **………**

Village Name ……………………., Woreda ……………., Road corridor ………………

Name of the interviewer……………………........**Date**………............**Started at(hr)** ……........;

Completed at……..........**(hr); Signature**………….........

The name of the investigator is Belew Dagnew from Ethiopian Civil Service University, Transport Management Masters Programme, Addis Ababa. He is conducting PhD study on the title *Socioeconomic Impacts of Road Development in Ethiopia: Case Studies of Weldiya-Mile, Gelago-Shehedi and Ginchi-Kachise Roads* in the University of South Africa (UNISA).The purpose of this **Focus Group Discussion** is to capture first hand information to assess the socioeconomic impacts of road infrastructure development. The discussions are purely for academic purpose. So you are thoughtfully requested to discuss openly and honestly to all discussion items presented by the investigator. Be sure that the information you provide will be kept confidential.

Thank you in advance for your heartfelt cooperation.

	Does the road development under study shown significant change in the following components?	**Suggestions based on *1= Strongly agree; 2=Agree; 3=Un decided; 4=Disagree; 5= Strongly disagree***
Economic impact variables	Does the road development under study attracted investment? If so please list the types by **ranking** according to their dominance before and after intervention	
	Land value	
	House rent	
	Property values and development	
	Purchase of better products at better price	
	Purchase of better products at lower price	
	Sale of products at better price	
	Sale of products at lower price	
	Distribution of shops along the road	
	Distribution of MSEs along the road	
	Trade	
	Wealth accumulation	
	Affordability on the community	
	Enhanced the living standard of the community	
	The access of consumable goods easily	
	Consumer expenditures	
	Economic efficiency: More outputs (benefits) per unit of input (costs)	
	Productivity: More goods and services produced	
	Progress toward economic objectives such as employment	
	Access to government offices to promote economic and social activities	
	Privet employment	
	On- farm employment	
	Off-farm employment	
	High valued agricultural products	
	Fertilizer utilization	
	Individual income	
	Household income	
	Any other	
	Challenges	
	Solutions for the future development	

	Social impacts	
	History of road under study	
	Population change from before intervention to after intervention	
Impacts on education	School accessibility	
	School availability	
	Students' attitude	
	Communities' attitude	
	Any other	
	Challenges	
	Solutions for the future development	
Impacts on Health variables	Health service accessibility	
	Health service availability	
	Health service affordability	
	Communities' attitude on the importance of health care	
	Quality of treatment	
	Availability of physicians	
	Availability of trained midwives	
	Availability of nurses	
	Access of health laboratory	
	Mothers' care	
	Child care	
	Reduced malaria	
	Reduced tuberculosis	
	HIV AIDS	
	Traffic accidents	
	Environmental degradation	
	Any other	
	Challenges	
	Solutions for the future development	
Other Impacts	Access to physical communications	
	Access to visit relatives, friends etc	
	Access to pleasure trip	
	The commuting of the community to cities	
	Reduced women's work burden	
	Influenced the HHs to build their houses near to the road side	
	Influenced the HHs to change the thatched houses to tin roofs	
	Influenced the community to use new technologies and innovations	
	Influenced the attitude of the community through enhanced innovations	
	Other please specify	
	Challenges	
	Solutions for the future development	

Annex B4 Checklist /Format Prepared for Road Observation

Check list ………..

Region…………………….Woreda ……………………….., Road corridor …………………….
Study Centre………………………….Village Name ……………………………..

1.Road condition and type in the selected study centre.

Road condition	asphalt		gravel		Total(km)	**Justification**
	km	percent	km	percent		
Good						
Faire						
Poor						
Total						

1.2 Length of asphalt road provided with sidewalks……………km…………% of the total road
8.3 Length of gravel road provided with sidewalks……………..km…………% of the total road
8.4. Road component/furniture condition in the selected study centre

Road type	Main road component types*	Length (km)	% of Total road	Condition of the component (%)			**Not xisting at all**	**Remark**
				Good	Fair	poor		
Paved/ Gravel	1.Drainage							
	Open earth ditch							
	Open paved ditch							
	Concrete pipes							
	2.Street lights							
	3.Side walkway**							
	4.Carriage way							
	5.Parking							
	6.Plantations							
	7.Median strip/centre divider strip/							
Total								

***Road components:** *The main are: carriage way, side walkway, parking, plantations, median strip/centre divider strip/, street lights, pedestrian over or under pass, intersection and interchanges. They are generally parts of road furniture*

****Sidewalk**: a path for pedestrians alongside a street*

Annex B5 Traffic Count Format

UNIVERSITY OF SOUTH AFRICA

Saterday market day morning

ROAD VEHICLE COUNT FORM

Saterday market day mor D M Y

LOCATION : _Kachise # ENUMERATOR: Initial ______ 1 3 6 2 0 1 4

DIRECTION Kachisi - Shibute ENUMERATOR : 2. ______________ Initial ______ Cycle No.

Day

Night

Hour Beginning	Pack animal	Carts	Other slows	M. Bicycle	Bajaj	Car	L/Rover	Mini bus	Midi bus	Maxi bus	S/Truck < 3.5 Tons	M/Truck 3.5 - 7.5 Tons	H/Truck 7.5 - 12 Tons	Truck & Trailer ≥ 12 Tons	Total
6-7															
7-8															
8-9															
9-10															0
10-11															
11-12															
Sub-Total															

UNIVERSITY OF SOUTH AFRICA

ROAD VEHICLE COUNT FORM

Saterday market day aaf D M Y

LOCATION : ______________ # ENUMERATOR : 1.Frehiwot Abate Initial ______

DIRECTION :Kachisi - Shibute ENUMERATOR : 2. ______________ Initial ______ Cycle No.

Day

Night

Hour Beginning	Pack animal	Carts	Other slows	M. Bicycle	Bajaj	Car	L/Rover	Mini/Bus	Midi/Bus	Maxi bus	S/Truck < 3.5 Tons	M/Truck 3.5 - 7.5 Tons	H/Truck 7.5 - 12 Tons	Truck & Trailer ≥ 12 Tons	Total
12-1															
1-2															
2-3															
3-4															
4-5															
5-6															
Sub-Total															
TOTAL															

Source: Modified by the Author Based on ERA, and Kadiyali, 2006

ANNEX- C: CONSENT LETTERS

የአማራ የገጠር መንገዶች ባለሥልጣን
Amhara Rural Roads Authority

Ref no ARRA/Gm/307/04

Date 20/02/2012

To Metema Wereda Administration Office
To Quara Wereda Administration Office
To Gonder Road Maintenance and Cluster Office
To Wollo Road Maintenance and Cluster Office
To Gubalafto Wereda Administration Office

As per the letter of February 27, 2012 numbered SGS/oo1o/2012, from Ethiopian Civil Service University, Ato Belew Dagnew Bogale is preparing PhD proposal on the Topic **Socioeconomic Impacts of Road Transport Development in Ethiopia: Case studies of Weldiya-Mile, Galegu-Shehidi and Ginchi_Kachsie.**

The PhD research envisaged by Ato Belew is a comprehensive one that will be conduced at road corridors an household levels in Amahara, Oromia and Afar regions, which would involve several institutions: Federal, Regional, Zonal, Wereda and local levels where by empirical data would be collected from various sources including informants, discussants and institutional sources.

Therefore, in order to conduct his research meaningfully, we kindly request your good office to facilitate and cooperate the following important issues:

1. Cooperate for any type of primary and secondary data collection from your office and from each individual in the Wereda.
2. While he is collecting data from different sources and the study area, allocate the responsible person up to finalization of his career

Best Regards,

Amhara National Regional State Rural Roads No. 001

CC:

- Ethiopian Civil Service University
- Ato Belew Dagnew Bogale

058 220 17 11	ፋክስ 058 222 03 21	ፖ.ሣ.ቁጥር
058 20 09 21	Fax	P.O.Box 382

UNISA university of south africa

CONSENT FORM

TITLE OF RESEARCH PROJECT

Socioeconomic Impacts of Road Development in Ethiopia: Case Studies of Weldiya-Mile, Gelagu-Shehedi and Ginchi-Kachise Roads.

Dear Mr/Mrs/Miss/Ms Wondewosen Asmamaw Date: .09/03/./2012

NATURE AND PURPOSE OF THE STUDY

The purpose of the study is to assess socioeconomic impacts of road infrastructure development (the lack thereof) on the surrounding communities and investigate the relationships between them in the study area. The thesis will report findings on major selected socioeconomic variables such as: household income, agriculture, employment, household asset, trade, education, health, gender, population and nature of housing and poverty among other things. The study makes use of questinnaires, interviews and discussions with HHs and key informants.

RESEARCH PROCESS

1 The study requires your participation in filling questionnaire and interviews to obtain primary data on impacts of road development

2 The data collection will be led by trained data collectors and a facilitator from Wereda and the Kebele representatives in the study area.

3 The questionnaire and interview offers you the opportunity to express your opinion on the subject of changes due to road intervention.

4 There is no right or wrong answers and all opinions will be valued.

5 You do not need to prepare anything in advance.

NOTIFICATION THAT PHOTOGRAPHIC MATERIAL, TAPE RECORDINGS, ETC WILL BE REQUIRED

Your attention is drawn to the fact that the interview will be tape recorded to ensure that valuable information. Following the interview and discussion, the recorded material will be transcribed. Photographing and video can be taken according to its essentiality of the data. Your residential area where you live or perform business will be locacted on the map from GPS. You may peruse the transcription of the recording of the interview/discussion in which you participated at any time.

CONFIDENTIALITY

The opinions of the respondents are viewed as strictly confidential, and once the questionnaires are gatherd and interviews recorded, it is only the researcher who will have access to the information. No data published in dissertations and journals will contain any information thorugh which respondents and interviewees may be identified.

WITHDRAWAL CLAUSE

I, the respondent/ interviwee, understand that I may withdraw from the participation in the project (to be interviewed or respond questionnaires). I therefore participate voluntarily.

POTENTIAL BENEFITS OF THE STUDY (brief as in the research proposal)

Road projects completed in the country or in the local area should have impact assessements. Newly penetrated roads in Ethiopia have no scientific impact assessement studies. There is also knowledge gap ofpositive and negative impacts of road expansion. This study will help to close such gaps. The socioeconomic baseline which will be newly established is also expected to contribute for the future studies and be used as the model for other corridors in the country. In addition, there is a knowledge gap on how investment on roads can result in multidirectional benefits to the society through direct and indirect impacts. In line with this, the present study aims to build better policy implications. Based on this, an attempt of the spatiotemporal impact analysis of road development may assist with the identification of areas or regions with specific problems, poverty, and further will lead to a better utilization of resources and consider geographically even development distribution in the country.

INFORMATION (contact information with supervisor)

If the researcher has any question concerning the study, he may contact the supervisor, Prof Bekure W/Semait, at the Department of Geography and Environmental Studies, Addis Ababa University, Email-bekurewotr@gmail.com, Cell: 251911752173, Addis Ababa, Ethiopia.

CONSENT

I, the undersigned, Ato Wondewosen Asgamaw .... have read the above information relating to the project and have also heard the verbal version, and declare that I understand it. I have been afforded the opportunity to fill the questionnaire to be interviewed and discuss on relevant aspects of the project with the project leader, and hereby declare that I agree voluntarily to participate in the project.

I indemnify the university and any employee or student of the university against any liability that I may incur during the course of the project.

I further undertake to make no claim against the university in respect of damages to my person or reputation that may be incurred as a result of the project/trial or through the fault of other participants, unless resulting from negligence on the part of the university, its employees or students.

I have received a signed copy of this consent form.

Signature of participant: .... ወንድወሰን አስማማው እንየው Wondwosen Assmamaw Eneyew

Signed at Woldia/Debregelila on May 22/2012 1:30

WITNESSES

1 Ato Getachew Muchie Assefa

2 Ato Ashagrie Ayalew

በኢትዮጵያ ፌደራላዊ ዲሞክራሲያዊ ሪፐብሊክ
የኢትዮጵያ ሲቪል ሰርቪስ ዩኒቨርሲቲ
አዲስ አበባ-ኢትዮጵያ
The Federal Democratic Republic of Ethiopia
Ethiopian Civil Service University
Addis Ababa - Ethiopia

ቀን : Feb.27/2012
Date
ቁጥር:
Ref. No 565/0110/2012

To: Oromia National Regional State,
Oromia Region Roads Authority
<u>Addis Ababa</u>

Subject: **<u>Request for Ethical Clearance for a PhD Research</u>**

Dear Sir/Madam,

Ato Belew Dagnew Bogale, who is an academic staff of the Ethiopian Civil Service University and a PhD student at the University of South Africa (UNISA) with student registration number 48771996, is currently in the final stages of completing his proposal for a PhD research on the Topic **"SOCIOECONOMIC IMPACTS OF ROAD DEVELOPMENT IN ETHIOPIA: Case Studies of Weldiya-Mile, Gelagu-Shehedi and Ginchi-Kachise Roads."**

The PhD research envisaged by Ato Belew is a comprehensive one that will be conducted at road corridor and household levels in Amhara, Oromia and Afar regions, which would involve several institutions both the Federal, Regional, Zonal, Woreda and local levels whereby empirical data would be collected from various sources including informants, discussants and institutional sources.

We therefore kindly request your good offices to provide PhD student Belew Dagnew the Ethical Clearance Letter that would enable him to meaningfully carry out his proposed PhD research.

We thank you in advance for the kind assistance you will provide to him.

Best Regards,

Tilahun Fekade,
Director, School of Graduate Studies

Cc: Ato Belew Dagnew
<u>ECSU</u>

ስልክ 0116-463006 President 0116-46 30 12 Academic Vice President 0116- 46 30 13 ፖ.ሣ.ቁ. 5648 ቴሌ ፋክስ (Tel Fax)0116- 46 30 16
Tel (PBx)011-646 30 15 Ass. V/PB&D0116- 46 23 48 External Relations Office0116- 46 23 44 P.O.Box5648 EthCSCol@excite.com

UNISA university of south africa

CONSENT FORM

TITLE OF RESEARCH PROJECT

Socioeconomic Impacts of Road Development in Ethiopia: Case Studies of Weldiya-Mile, Gelagu-Shehedi and Ginchi-Kachise Roads.

Dear Mr/Mrs/Miss/Ms Daba Garedew Date: .09/03/./2012

NATURE AND PURPOSE OF THE STUDY

The purpose of the study is to assess socioeconomic impacts of road infrastructure development (the lack thereof) on the surrounding communities and investigate the relationships between them in the study area. The thesis will report findings on major selected socioeconomic variables such as: household income, agriculture, employment, household asset, trade, education, health, gender, population and nature of housing and poverty among other things. The study makes use of questinnaires, interviews and discussions with HHs and key informants.

RESEARCH PROCESS

1 The study requires your participation in filling questionnaire and interviews to obtain primary data on impacts of road development

2 The data collection will be led by trained data collectors and a facilitator from Wereda and the Kebele representatives in the study area.

3 The questionnaire and interview offers you the opportunity to express your opinion on the subject of changes due to road intervention.

4 There is no right or wrong answers and all opinions will be valued.

5 You do not need to prepare anything in advance.

NOTIFICATION THAT PHOTOGRAPHIC MATERIAL, TAPE RECORDINGS, ETC WILL BE REQUIRED

Your attention is drawn to the fact that the interview will be tape recorded to ensure that valuable information. Following the interview and discussion, the recorded material will be transcribed. Photographing and video can be taken according to its essentiality of the data. Your residential area where you live or perform business will be locacted on the map from GPS. You may peruse the transcription of the recording of the interview/discussion in which you participated at any time.

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WITHDRAWAL CLAUSE

I, the respondent/ interviwee, understand that I may withdraw from the participation in the project (to be interviewed or respond questionnaires). I therefore participate voluntarily.

POTENTIAL BENEFITS OF THE STUDY (brief as in the research proposal)

Road projects completed in the country or in the local area should have impact assessements. Newly penetrated roads in Ethiopia have no scientific impact assessement studies. There is also knowledge gap ofpositive and negative impacts of road expansion. This study will help to close such gaps. The socioeconomic baseline which will be newly established is also expected to contribute for the future studies and be used as the model for other corridors in the country. In addition, there is a knowledge gap on how investment on roads can result in multidirectional benefits to the society through direct and indirect impacts. In line with this, the present study aims to build better policy implications. Based on this, an attempt of the spatiotemporal impact analysis of road development may assist with the identification of areas or regions with specific problems, poverty, and further will lead to a better utilization of resources and consider geographically even development distribution in the country.

INFORMATION (contact information-with supervisor)

If the researcher has any question concerning the study, he may contact the supervisor, Prof Bekure W/Semait, at the Department of Geography and Environmental Studies, Addis Ababa University, Email-bekurewotr@gmail.com, Cell: 251911752173, Addis Ababa, Ethiopia.

CONSENT

I, the undersigned,....Daba Garedew.......................... have read the above information relating to the project and have also heard the verbal version, and declare that I understand it. I have been afforded the opportunity to fill the questionnaire to be interviewed and discuss on relevant aspects of the project with the project leader, and hereby declare that I agree voluntarily to participate in the project.

I indemnify the university and any employee or student of the university against any liability that I may incur during the course of the project.

I further undertake to make no claim against the university in respect of damages to my person or reputation that may be incurred as a result of the project/trial or through the fault of other participants, unless resulting from negligence on the part of the university, its employees or students.

- I have received a signed copy of this consent form.

Signature of participant: ....

Signed at .....Kachise........... on 4.16.2012........

WITNESSES

1. Tefer Tolera
2. Adeneeh Kefle

2012-09-19

Ref. Nr.: 2012/CAES/009

To the student:
Mr BD Bogale
Department of Geography
College of Agriculture and Environmental Sciences

Student nr: 48771996

Dear Mr Bogale

Request for Ethical approval for the following research project:

Socioeconomic impacts of road development in Ethiopia: Case studies of Weldiya-Mile, Gelagu-Shehedi and Ginchi-Kachise roads

The application for ethical clearance in respect of the above mentioned research has been reviewed by the Research Ethics Review Committee of the College of Agriculture and Environmental Sciences, Unisa. Ethics clearance for the above mentioned project (Ref. Nr.: 2012/CAES/009) **is granted** after careful consideration of all documentation submitted to the CAES Ethics committee.

Please be advised that the committee needs to be informed should any part of the research methodology as outlined in the Ethics application (Ref. Nr.: 2012/CAES/009), change in any way. Should this be the case, a memo should be submitted to the Ethics Committee in which the changes are identified and fully explained.

We trust that sampling, data gathering and processing of the relevant data will be undertaken in a manner that is respectful of the rights and integrity of all participants, as stipulated in the UNISA Research Ethics Policy.

The Ethics Committee wishes you all the best with this research undertaking.

The Ethics Committee wishes you all the best with this research undertaking.

Kind regards,

Prof E Kempen,
CAES Ethics Review Committee Chair

University of South Africa
www.unisa.ac.za