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Building Capacities in the public Service



COLLEGE OF URBAN DEVELOPMENT AND ENGINEERING

DEPARTMENT OF URBAN INFRASTRUCTURE AND TRANSPORT

PLANNING & MANAGEMENT

PROGRAM URBAN INFRASTRUCTURE PLANNING & MANAGEMENT

URBAN ROAD INFRASTRUCTURE SUSTAINABILITY AND CHALLENGES THE  
CASE OF WOLITA SODDO CITY

BY

ANDARGE BELAYNEH

ID NO, ECSU2101558

ADVISOR ELENI G/MESKEL

A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES OF URBAN INFRASTRUCTURE PLANNING AND MANAGEMENT PROGRAM, COLLEGE OF URBAN DEVELOPMENT AND ENGINEERING, ETHIOPIAN CIVIL SERVICE UNIVERSITY, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF A MASTER'S DEGREE OF SCIENCE(M.Sc.) IN URBAN INFRASTRUCTURE PLANNING AND MANAGEMENT.

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ADDIS ABABA, ETHIOPIA

## DECLARATION

I, Registration Number/I.D. Number **ECSU2101558**, do hereby declare that this thesis is my original work and that it has not been submitted partially; or in full, by any other person for an award of a degree in any other university/institution.

Nam **Andarge Belayneh**

Signature.....

Date **20/06/ 2022**

This Thesis has been submitted for examination with my approval as College supervisor.

Name of Advisor **Elene G/meskel**

Signature.....

Date **20/06/ 2022**

## **DEDICATION**

I dedicate this thesis to my wife Elsabeth Alenko, my children Adonit, and Ethubi as well as my mother W/o Aster Godana.

## APPROVALS

The undersigned certify that they have read and hereby recommend to the Ethiopian Civil Service University to accept the Thesis submitted by Andarge Belayneh, and entitled “ Urban road infrastructure sustainability and challenges”, in partial fulfillment of the requirements for the award of a Master’s Degree in urban infrastructure planning and management.

Name of Supervisor                      Elene G/meskel                      Signature.....

Date    20/06/ 2022

Name of Internal Examiner            Dr. Ranavijai Bahadur Singh            Signature.....

Date    20/06/ 2022

Name of External Examiner           Dr. Tilahun Derib                      Signature.....

Date    20/06/ 2022

Name of Head of Department        Dr.Belete Ejigu                      Signature.....

Date    20/06/ 2022

## ABSTRACT

Road infrastructure is considered a large and vital public asset that requires careful upkeep throughout its lifetime. Demand for road construction often leads to the development of other infrastructure and significantly outnumbers the supply. Designing, constructing, operating, maintaining, and deconstructing road infrastructure in a way that balances the sociological, economic, and environmental considerations. The study's objective was to identify and examine the city of *Wolita Sodo's* road infrastructure's sustainability and challenges. The study used a qualitative and quantitative research approach, primary and secondary data were used and it was a descriptive and mixed research design. The data collection instrument was questionnaires, interviews, focus group discussion, and document review. Primary and secondary data sources were used in the study. The findings of this study revealed that major economic, social, and environmental sustainability dimension of road infrastructure development was trouble and the major challenges identified were: the disintegration of road and utility infrastructure; road design, construction, and maintenance; weak institutional integration and coordination; topography of the city contribute traffic accidents to happen; land development plan problem to implement road design as required standards and less accountability of professionals as well as an administrative body. Due to all these and other factors, the road infrastructure in the city was not satisfactorily sustainable; because the concept of sustainability is broad in dimension. The prospects of the analysis indicate that road infrastructure sustainability remains to be more challenging shortly.

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# TABLE OF CONTENTS

## Pages

|                                                     |     |
|-----------------------------------------------------|-----|
| <b>DECLARATION</b> .....                            | i   |
| <b>DEDICATION</b> .....                             | ii  |
| <b>APPROVALS</b> .....                              | iii |
| <b>ABSTRACT</b> .....                               | iv  |
| <b>ACKNOWLEDGMENT</b> .....                         | v   |
| TABLE OF CONTENTS.....                              | vi  |
| LIST OF TABLES.....                                 | ix  |
| LIST OF FIGURES.....                                | x   |
| APPENDICES.....                                     | xi  |
| ACRONYMS/ABBREVIATIONS.....                         | xii |
| <b>CHAPTER ONE</b> .....                            | 1   |
| <b>INTRODUCTION</b> .....                           | 1   |
| 1.1 Background of the study.....                    | 1   |
| 1.2 Problem Statement.....                          | 3   |
| 1.3 Objective .....                                 | 5   |
| 1.3.1 Main objective .....                          | 5   |
| 1.3.2 Specific Objectives .....                     | 5   |
| 1.3.3 Research Questions.....                       | 5   |
| 1.4 Significance of the Study.....                  | 5   |
| 1.5 Scope of the study .....                        | 6   |
| 1.5.1 Thematic scope .....                          | 6   |
| 1.5.2 Spatial scope .....                           | 6   |
| 1.5.3 Temporal scope.....                           | 6   |
| 1.6 Description of the study area.....              | 6   |
| 1.6.1 Location, Area, and Climate of the town ..... | 7   |
| 1.6.2 Population Size of the city .....             | 8   |
| 1.6.3 Local Economic Activity.....                  | 8   |
| 1.6.4 Physical Infrastructure .....                 | 9   |

|                                                                            |    |
|----------------------------------------------------------------------------|----|
| 1.6.5 Social Infrastructures .....                                         | 9  |
| 1.6.6 Financial Institutions .....                                         | 10 |
| 1.7 Limitation of the study.....                                           | 10 |
| 1.8 Organization of the research .....                                     | 10 |
| CHAPTER TWO .....                                                          | 11 |
| LITERATURE REVIEW .....                                                    | 11 |
| 2.1 Introduction .....                                                     | 11 |
| 2.2 Theoretical literature review .....                                    | 11 |
| 2.2.1 The Concept of Sustainability .....                                  | 11 |
| 2.2.2 Sustainable Road Infrastructure Development (SRID) Concept .....     | 11 |
| 2.2.3. Conceptual framework .....                                          | 13 |
| 2.2.4 Sustainability criteria for road infrastructure .....                | 17 |
| 2.2.5 Factors in the construction of sustainable road infrastructure ..... | 18 |
| 2.2.6 Definition.....                                                      | 19 |
| 2.3 Empirical literature review.....                                       | 20 |
| 2.4 Research Gaps.....                                                     | 28 |
| CHAPTER THREE .....                                                        | 30 |
| METHODOLOGIES .....                                                        | 30 |
| 3.1 Introduction .....                                                     | 30 |
| 3.2 Research Design .....                                                  | 30 |
| 3.3 Research approach.....                                                 | 30 |
| 3.4 Sample Design.....                                                     | 31 |
| 3.4.1 Total Population.....                                                | 31 |
| 3.4.2 Sampling Frame .....                                                 | 31 |
| 3.4.3 Sampling Unit.....                                                   | 32 |
| 3.4.4 Sampling Technique .....                                             | 32 |
| 3.4.5 Sampling Size .....                                                  | 33 |
| 3.5 Data Sources .....                                                     | 35 |
| 3.6 Method of Data Collection method .....                                 | 35 |
| 3.6.1 Primary data collection method .....                                 | 35 |
| 3.6.2 Secondary data collection method .....                               | 35 |
| 3.7 Data Analysis and Interpretation .....                                 | 35 |

|                                                                                                                                                |    |
|------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 3.7.1 Data Analysis .....                                                                                                                      | 35 |
| 3.7.2 Data presentation .....                                                                                                                  | 36 |
| 3.8 Ethical Considerations.....                                                                                                                | 37 |
| CHAPTER FOUR .....                                                                                                                             | 38 |
| RESULT AND DISCUSSION .....                                                                                                                    | 38 |
| 4.1 Introduction .....                                                                                                                         | 38 |
| 4.2 Response Rate.....                                                                                                                         | 38 |
| 4.3 Demographic data.....                                                                                                                      | 39 |
| 4.3.1. Gender .....                                                                                                                            | 39 |
| 4.3.2 Age Distribution .....                                                                                                                   | 40 |
| 4.3.3 Educational Status.....                                                                                                                  | 41 |
| 4.3.4 Employment Condition .....                                                                                                               | 42 |
| 4.4 Main Findings.....                                                                                                                         | 43 |
| 4.4.1 Existing condition of the city road .....                                                                                                | 43 |
| 4.4.2 The city residents/community were consulted during road project selection and participated in the construction of the road project. .... | 44 |
| 4.4.3 Major problems of the city road infrastructure.....                                                                                      | 45 |
| 4.4.4 why did road and utility infrastructure disintegrate? .....                                                                              | 46 |
| 4.4.5 Economic well-being of road infrastructure .....                                                                                         | 48 |
| 4.4.6 The constructed road has a drainage system and pedestrian walkway .....                                                                  | 49 |
| 4.4.7 Road problems related to the transportation .....                                                                                        | 50 |
| 4.4.8 The environmental impacts/problems of road.....                                                                                          | 51 |
| 4.4.9 The constructed roads contribute to traffic accidents that frequently happen.....                                                        | 53 |
| 4.4.10 the city road maintenance condition.....                                                                                                | 57 |
| CHAPTER FIVE .....                                                                                                                             | 62 |
| CONCLUSION AND RECOMMENDATION .....                                                                                                            | 62 |
| 5.1 Conclusions .....                                                                                                                          | 62 |
| 5.2 Recommendations .....                                                                                                                      | 63 |
| REFERENCES.....                                                                                                                                | 66 |

## LIST OF TABLES

| <u>Lists</u>                                                                                        | <u>page</u> |
|-----------------------------------------------------------------------------------------------------|-------------|
| Table 2.1 sustainable development in five sustainability dimensions.....                            | 16          |
| Table 2.2 sustainability criteria for road infrastructure projects.....                             | 17          |
| Table 3.1 operationalization framework.....                                                         | 36          |
| Table 4.1: Return/response Rate of Questionnaires/ Interview/<br>Focus group discussion.....        | 39          |
| Table 4.2 Educational status of respondents.....                                                    | 42          |
| Table 4.3 Existing condition of the city road .....                                                 | 43          |
| Table 4.4 community was consulted and participated in the construction of<br>the road project ..... | 44          |
| Table 4.5 Major Problems of the city road .....                                                     | 45          |
| Table 4.6 road infrastructure contributes economic well-being of<br>the residences.....             | 48          |
| Table 4.7 the contribution of the road to the economic wellbeing<br>of the community.....           | 48          |
| Table 4.8 road problems related to the transportation.....                                          | 50          |
| Table 4.9 possible policy objectives for transport infrastructure sustainability.....               | 52          |
| Table 4.10 the constructed roads contribute to traffic<br>accidents frequently happen.....          | 53          |
| Table 4.11 Reason for road transport accident .....                                                 | 53          |
| Table 4.12 road maintenance condition .....                                                         | 57          |

## LIST OF FIGURES

| <b><u>Figures</u></b>                                  | <b><u>page</u></b> |
|--------------------------------------------------------|--------------------|
| Figure 1.1 location map wolita soddo city.....         | 8                  |
| Figure 2.1 Conceptual framework.....                   | 15                 |
| Figure 4.1: Gender characteristics of respondents..... | 40                 |
| Figure 4.2: Age characteristics of respondents.....    | 41                 |
| Figure 4.3: the occupation of respondents.....         | 43                 |
| Figure 4.4 poor road construction.....                 | 54                 |
| Figure.4.5 road user's problem.....                    | 55                 |
| Figure 4.6 topography.....                             | 56                 |
| Figure 4.7 maintenance problem.....                    | 59                 |

## APPENDICES

|                                                                        |       |
|------------------------------------------------------------------------|-------|
| Annex.....                                                             | xvi   |
| General Background Information.....                                    | xviii |
| Questioners translated to Amharic.....                                 | xix   |
| Questionnaires for respondents.....                                    | xxv   |
| Interview Questions for municipality and road sectors/authorities..... | xxvi  |

## ACRONYMS/ABBREVIATIONS

|        |                                                                   |
|--------|-------------------------------------------------------------------|
| AACRA  | Addis Ababa city road authority                                   |
| AAWSA  | Addis Ababa water supply agency                                   |
| AHP    | Analytical Hierarchy Process                                      |
| CBA    | cost-benefit analysis                                             |
| CSA    | Central statistical agency                                        |
| ERA    | Ethiopian road authority                                          |
| ESA    | Ethiopian statistical agency                                      |
| EEPCO  | Ethiopian Electric corporation organization                       |
| ETC    | Ethiopia Telecommunication Corporation                            |
| FIIDCA | Federal Integrated Infrastructure Development Coordinating Agency |
| FGD    | Focus Group Discussion                                            |
| GIS    | Geographic information system                                     |
| GHG    | Greenhouse gas                                                    |
| GRDP   | Gross Regional Domestic Product                                   |
| IUISP  | Integrated urban infrastructure service planning                  |
| Km     | Kilometer                                                         |
| MCDA   | Multi-criteria decision analysis                                  |
| ORS    | Organizational Research Services                                  |
| OECD   | Organization for Economic Cooperation and Development             |
| PLC    | Privatization limited corporation                                 |
| ROW    | Right Of Way                                                      |
| RSDP   | Road sector development project                                   |
| S.C    | Standard chartered                                                |
| SPSS   | Statistical package for social science                            |
| SNNPRS | South nation nationality peoples regional state                   |
| TOC    | Theory of change                                                  |
| UN     | United nation                                                     |
| USEPA  | United state environmental protection agency                      |





# CHAPTER ONE

## INTRODUCTION

### 1.1 Background of the study

Given unprecedented levels of urbanization and motorization in developing countries, as well as deteriorating infrastructure in developed countries, countries all over the world have faced enormous challenges in delivering sustainable infrastructure with limited resources. Infrastructure is critical to the growth and development of a region. One issue that has received attention in encouraging regional growth is the provision of transportation infrastructure, particularly road infrastructure. Road infrastructure is a regional necessity that also helps other areas of the economy thrive (Ridwan et al., 2019).

Roads are seen as a tool of socio-economic growth since they connect areas, places, people, and economic activities. Extending, and improving a road network would increase accessibility and mobility while reducing travel distance, costs, and time (Dagnew Bogale, 2016). The developing world, and especially the African continent, has a very poorly developed infrastructure, compared to middle- and high-income countries. On average, Sub-Saharan Africa has a road density of only approximately 200 meters of paved roads per km<sup>2</sup> compared to 1400 meters in high-income OECD countries (S. Bekele & Ferede, 2016).

Because of the importance of road infrastructure in economic development and poverty reduction, Ethiopia's government has been significantly developing the country's road infrastructure since 1997, thanks to the Road Sector Development Program (RSDP). The government has invested a significant amount of money, with the help of international donors, to build all-weather roads to increase regional connections (ERA, 2014). The number and hierarchy of urban centers; the infrastructure demands that support them, such as power, water, information, and transportation; and how to deliver these in a national urban system that is competitive, socially and economically inclusive, climate-resilient, and environmentally friendly are all important decisions.

Roads are critical for economic development both nationally and locally. In this setting, major road links and motorways are being constructed to speed up development and growth. In locations and provinces where no apparent gain is expected, roads, on the other hand, are crucial for social well-being. Road construction projects with a limitless rate of return are challenging to finance, especially in developing countries (Mouratidis, 2020).

The demand for road construction, which usually leads to the construction of other infrastructure, exceeds the supply. While most developing countries are making deliberate efforts to build road infrastructure, this critical activity will become increasingly beneficial and significant when it is carried out following the theory of sustainability standards; this incorporation not only results in economic benefits but also societal and ecological benefits (Ametepey et al., 2020). This necessitates a stronger emphasis on sustainable road infrastructure development (SRID) throughout the process.

Road infrastructure, therefore, is a part of the structure; material, or economic base of a society or an organization. It is a basic structure that fosters the good performance of cities', states', or countries' essential services. In this sense, for a country to have a good logistics infrastructural system in the different modes of transportation, constant investment from both the public and private sectors is needed.

Sustainable road infrastructure should improve the environment and use fewer resources throughout its existence, while also meeting the functional needs of societal advancement and economic expansion. When planning, designing, building, operating and maintaining a road infrastructure or roadway project, the sustainability factors should be evaluated and taken into account.

The road is sustainable “if able to reach, during the phases of construction, operation, maintenance, the objectives underlying the design (regulations observance, safety, fluidity of movement, maintenance, energy efficiency, transport capacity...)” in a self-sufficient way so that the system “road” is self-sustaining, and then it can use effectively and efficient resources, and non-renewable materials for its needs and ensure reproducibility while maintaining.

This study was therefore conceptualized to identify and assess the road infrastructure sustainability and challenges in *wolita soddo* city. Moreover, international practices were reviewed from available literature and a comparison has been made with the Ethiopian practice.

Having considered the identified gaps and findings of comparison; improvements and/or intervention actions were recommended to strengthen the decision-making process on the sustainability of road infrastructure development in the city.

## **1.2 Problem Statement**

The governments spend on infrastructure to boom city productiveness and shopping power. Infrastructure funding has accelerated considerably inside the whole, and especially in city regions. The inventory of the street community is gradually rising (Ibrahim, 2011 cited in Assefa L, 2018). The Ethiopian authorities have been running to enhance city dwellers' fine of existence and lift the productiveness of city economies to make sure that city facilities make contributions to the financial progress. The importance of an included infrastructure improvement plan in guiding and selling city improvement is critical (Assefa L, 2018). But city infrastructure is frequently issued to haphazard making plans; disjoint implementation and negative setup management. Moreover, the availability of infrastructure is insufficient and negative in the maximum the city facilities and its improvement is lagging at the back of the populace increase rate. Poor provision of infrastructures can result in the exposition of city populations to fitness risks, restricting productiveness via carrier cuts, the boom in family and investor fees via belongings damage, and growing manufacturing fees via congestion, accidents, and site visitors jams (Werner & Than, 2007 cited in Admasu, 2012). Sustainability of city infrastructure and integration in making plans and implementation of the infrastructure is an assignment in maximum city facilities.

Roads are vital transportation and communication linkages, but their sustainability has been questioned. While roads provide economic and social benefits, their influence on the natural environment is a source of concern. The primary environmental concerns with highways are greenhouse gas emissions from the traffic they transport (Thorpe, 2012).

Implementation issues plague the creation and rehabilitation of significant road infrastructure in Western countries. This results in cost and schedule overruns, as well as concerns with quality and legitimacy, as well as low stakeholder satisfaction (Heeres et al., 2016). These implementation issues, according to Heeres, might be traced in part to a contradiction between

functional interconnectedness and institutional fragmentation. Due to several circumstances, the interconnectedness of land uses has become more apparent.

The concept of integrated planning is distinct from rational, all-encompassing planning. One of the most important criteria for a healthy economy is the successful operation of roads and transportation operations, as it enhances connectivity and accessibility and provides intermediary services to promote interactions between production facilities and consumer centers (Mouratidis, 2020).

Some scholars have attempted to develop standards and approaches for infrastructure sustainability, but they do not focus on a specific type of infrastructure (Ametepey et al., 2020). Although there are certain rules and frameworks for implementing sustainable roads, their use is limited and ambiguous. Even though these frameworks are focused on assessing the outcomes, they do not distinguish and address issues that affect the gap between sustainable development efforts and actual project deliverables during project implementation.

Roads serve an important role in lowering transportation costs, reducing physical weariness, and promoting economic growth in the country. Many studies, however, have focused on infrastructure sustainability in general, rather than specific infrastructure, such as road infrastructure. Even if they were focused on road infrastructure sustainability with road construction projects; some were design and road integration with drainage and utility infrastructure; others were incorporating intra-sectoral integration in utility infrastructures.

In *Wolita soddò* city, there was weak institutional integration and coordination, negligence of integrated urban infrastructure planning implementation, Uncertainty in design, and construction, lack of maintenance, improper land use development plan, and scarcity of available funds were identified problems to road infrastructure sustainability. These all were manifested by cutting off-road sections with respective sectors, and the re-design and reconstruction of road and utility infrastructures resulting in the wastage of scarce resources. For this reason, road infrastructure sustainability was under problem.

This study is an attempt to fill the cognitive gap for the above issues of sustainability in road infrastructure in the city. The sustainable road infrastructure concept is that road construction consists of social, economic, and environmental dimensions. Therefore many of the studies were

incorporated into the road infrastructure development in different aspects but did not properly address road infrastructure sustainability and its challenges in detail.

## 1.3 Objective

### 1.3.1 Main objective

The main objective of this study is to assess road infrastructure sustainability and major challenges in *wolita sodd* city.

### 1.3.2 Specific Objectives

The specific objectives are to:

- ❖ Assess the physical defects and operation of existing road infrastructure
- ❖ Examine the existing road infrastructure integrated with utility infrastructures
- ❖ Analyzing sustainability in road infrastructure social, economic, and environmental dimensions
- ❖ Come up with contextual possible solutions and recommendations.

### 1.3.3 Research Questions

- ❖ What is the physical condition of road infrastructure in the city?
- ❖ What are the major problems/challenges of existing road infrastructure related to the sustainability of infrastructure in the city?
- ❖ What is the contribution of land use development plan to road infrastructure planning in the city
- ❖ How do the road infrastructure meet sustainability and the role of the city administration in ensuring sustainability?

## 1.4 Significance of the Study

Urban infrastructure and its long-term viability were critical in achieving Sustainable Development Goals. To achieve rapid, sustainable, and equitable economic growth, city infrastructure supports and facilitates economic, social, and environmental development. The quality of road infrastructure in metropolitan areas has a direct impact on residents' quality of life, including their health, safety, economic opportunities, and working and leisure conditions.

As a result, because it is very intricate and socially sensitive, every action must be carefully planned.

To address such issues, municipal governments frequently face significant challenges during the planning process, when it is vital to find a solution that meets the needs of all stakeholders while also being consistent with the planned development idea. The project's sustainability emerges as one of the most essential and challenging issues to resolve in the public decision-making process since they are constrained by specific annual budgets for construction, maintenance, and remedial actions.

The relevance of this study is that it will help to reduce the waste of scarce resources during the planning, design, building, operation, and maintenance stages of road infrastructure to ensure the city's long-term viability. Infrastructure and its sustainability have played a vital role, even though infrastructure project management is a complicated process that necessitates adequate organizational capability and collaboration among multiple stakeholders.

## **1.5 Scope of the study**

The scope of the project shall be limited in space, theme, and time.

### **1.5.1 Thematic scope**

This study is delimited to assess road infrastructure sustainability and challenges that covers all the theoretical principles to emphasize the stated objectives, due to limited availability of resources and time,

### **1.5.2 Spatial scope**

The study is geographically delimited to cover road infrastructure sustainability and challenges in *wolita soddo* city with an area coverage of 16,500 hectares.

### **1.5.3 Temporal scope**

The expected proposal is going to be finalized in the first semester of the 2021/22 academic year.

## **1.6 Description of the study area**

*Wolaita Soddo* city was founded in 1952 EC as a municipal governing city. *Soddo* is currently one of the leading reform towns in the SNNPRS, with a second-grade status comparable to *Dilla* and *Arba Minch*. The city serves as the administrative seat of the *Wolaita Zone* and as a location for many of the zone's public and commercial organizations. Furthermore, the city serves as a

market center for the neighboring zones and rural areas. It also serves as a key transportation hub, as it is located at the intersection of six national and regional inland transit lines.

#### **1.6.1 Location, Area, and Climate of the town**

The city is 383 kilometers and 167 kilometers south and west of Addis Ababa, the country's capital, and Hawassa, the regional capital, respectively, and 332 kilometers from Addis Ababa through *Butajira Alaba soddo*. The city lies within the coordinates from 6° 46' 00" North to 6° 54' 00" North Latitude and 37° 42' 00" East to 37° 50' 00" East Longitude. The spatial coverage of built-up area increased from 8.9% in 1985 to 32% in 2016 and increased by 216.8% (8.4ha yr<sup>-1</sup>) between 1985 and 2016. According to the municipality's five-year strategic plan, the city's entire territory is around 16,500 hectares, divided into seven new Kebele administrations (woreda) and 19 *ketas* (including newly added rural kebeles). The city is situated at the foot of *Mount Damota*, whose altitude drops in all directions. Mountains, gorges, and plain areas dominate the city's terrain, notably in the south. The city's highest and lowest points are between 1600 and 2100 meters above sea level. As a result, the city's average altitude is 1,800 meters above sea level. The town's average annual temperature is 20°C, and its average annual rainfall is 1,212mm.

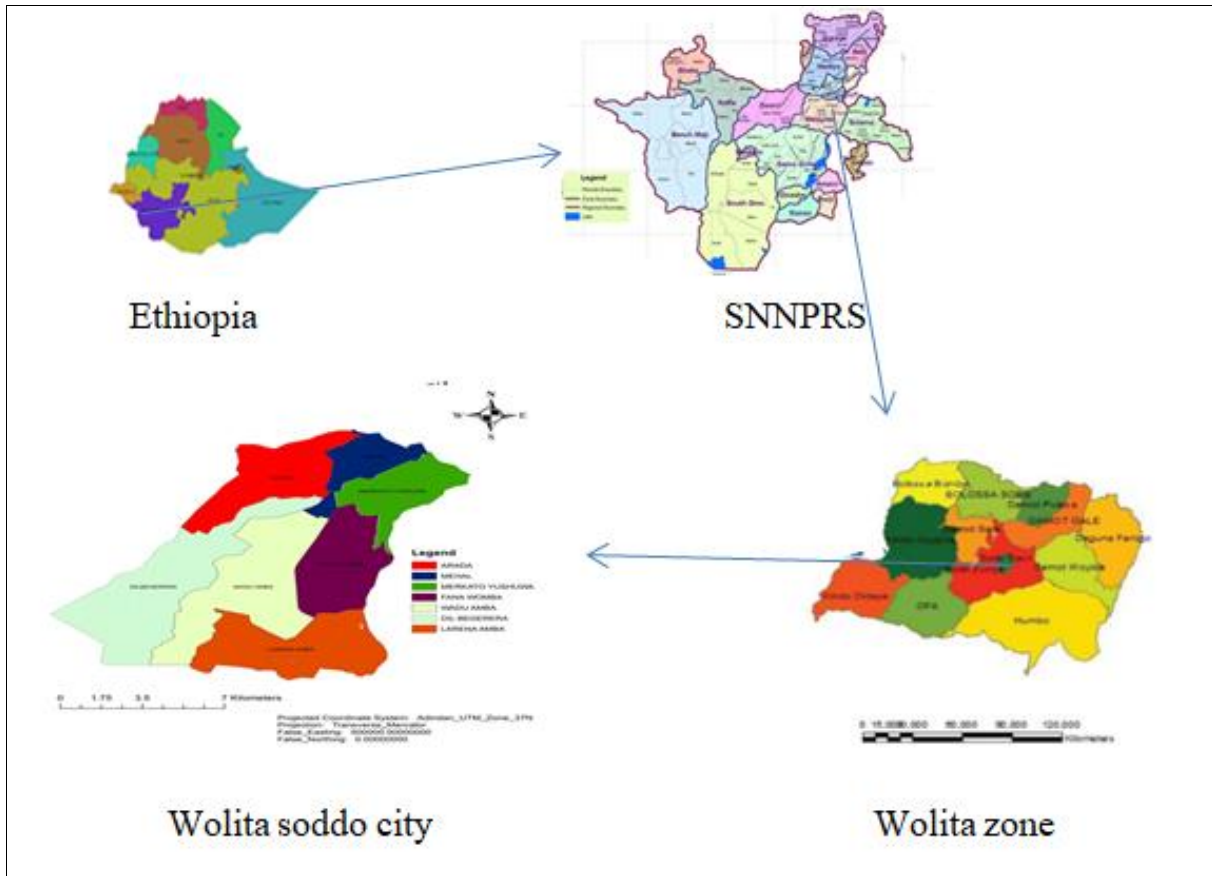


Fig. 1.1 location map wolita soddo city

### 1.6.2 Population Size of the city

Due to a lack of in-migration data, it is difficult to obtain an exact population figure for the city, as the city experiences a high rate of rural-urban migration from surrounding rural villages, as well as the inclusion of rural population into the town as a result of the town's expansion into rural areas. According to CSA projections based on data from last year, the town's current population is over 268,400, with an annual growth rate of 5.7 percent, which is higher than the area's average urban population growth rate (5.13 percent).

### 1.6.3 Local Economic Activity

Soddo- Addis Ababa via Shashemene, Soddo - Arba Minch, Soddo - Addis Ababa via Hosanna, Soddo -Waka - Jima, Soddo- Gofa/Sawla, Soddo - Badessa - Hawassa, Soddo- Hobicha - Dilla are the seven routes that connect the city As a result, the city serves as a land transit and trade hub for the region's and beyond neighboring zones. Furthermore, the city functions as a social

and economic hub for the surrounding area. Petty trade, cereal trade, livestock trade, spice trade, and other trades are important to the city's economy.

Others, such as hotels and small-scale enterprises, are becoming significant occupants of the labor force and economic stay in the town, while others with educational status are working in the service and development sectors of governmental and non-governmental organizations. There are no large-scale industries in the city when it comes to industrial activities. Over the last five years, some flour mills have been built. The number of existing small-scale companies, such as grain mills, wood and metal workshops, and block and hollow concrete manufacturing, is limited, which does not qualify the city's current economic vigor.

#### **1.6.4 Physical Infrastructure**

Since 1985 E.C., the city has had a hydropower supply system from the National Grid on Wolaita Soddo Substation, which comes from *Gilgel Ghibe* and *Melka Wakena* hydropower facilities. 84 transformers have been installed in the town's power distribution system, with a total capacity of 16000 KVA. Since the year 2000 E.C., *Soddo* has had access to digital communications. 15CC/ Cable Cabinet/ has divided and distributed the telephone network at this point. Each cable cabinet has its coverage area network map and skeletal map with general and detailed maps. Their spatial distribution is equitable, reaching all parts of town, and even new cable cabinets can be placed and mapped for expansion areas. *Soddo* has 173 km of roads, with asphalt (60.5 km), gravel (25.2 km), cobblestone (87.3 km), and compacted earth (98.4 kilometers). There are about 13 transport institutions that organize the transport arrangement into different routes away from Soddo city and transit transport vehicles.

#### **1.6.5 Social Infrastructures**

*Wolaita Soddo* city contains eighteen kinder gardens, seventeen primary schools, and five secondary schools, according to data from the local administration. Ten colleges, three universities, and two technical and vocational schools, all of which are privately and publicly owned, make up the 15 higher education institutions (city finance and economy development 2021 report). The city has two hospitals (one private and one public), three health facilities, 24 private clinics, 14 private pharmacies, 16 rural drug dealers, and five private laboratories for health care. A Broadband network, postal service, internet access, appropriate hotels, and a pleasant environment and tranquility are among the town's additional social services.

#### **1.6.6 Financial Institutions**

*Soddo* is a city with a high rate of investment due to its position, the availability of various resources in the area, and its stability. Commercial Bank of Ethiopia, *Development Bank of Ethiopia*, United Bank, *Dashen Banks S.C*, Debu Global Bank S.C., Nib International Bank, Bank of Abyssinia, and Birhan International Bank are among the financial institutions that assist business transactions. They are the town's most important financial institutions. There are also three microfinance institutions in addition to these (Omo microfinance & wisdom micro finance S.C, Metemamen Credit & saving fund PLC). Ethiopian Insurance Corporation, Nile Insurance Corporation, and Nyala Insurance Corporation are three insurance businesses among several financial institutions.

#### **1.7 Limitation of the study**

Apart from the funding constraints, it was difficult to review previously conducted studies, particularly empirical findings in Ethiopia, due to a lack of reference materials. The main problems encountered during the research were the lack of experts and the willingness of respondents from the target institutions to participate in the interviews.

#### **1.8 Organization of the research**

The paper is organized into five chapters; Chapter one provides an introductory overview of the full study comprising the background, statement of the problem, objectives of the study, research questions, significance of the study, the scope of the study, description of the study area, and limitation. The second chapter is a theoretical and empirical review. Chapter three presents the methodology used for the study and gives a detailed overview of the research design, research approach, sample design, population of the study, research sample selection, data analysis, and presentation. Chapter four focuses on the data analysis, results in presentation, and discussions. Chapter five summarizes, concludes, and offers recommendations for the study.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

This study's literature review aims to find out what information is accessible regarding the research issue. The literature review gives important context on the similarities and differences between the current study and previous research. For the extra relevant study, lists of references from original research articles or reports were also reviewed.

#### **2.2 Theoretical literature review**

##### **2.2.1 The Concept of Sustainability**

The term "sustainability" was coined at the United Nations (UN) Conference on the Human Environment in Stockholm in 1972, the first international symposium solely dedicated to environmental issues. "Sustainable development," according to the Brundtland Commission, is "development that meets current needs without jeopardizing future generations' ability to meet their own needs" (Brundtland World Commission on Environment and Development, 1987, p.1). The first sustainability conferences, with an emphasis on environmental issues, were held in 1992. Environmental, social, and economic improvement has all been prioritized since that time.

There are various definitions of sustainability in the literature, but the majority of them focus on specific areas such as economics, ecology, and the environment. Because each discipline has its explanation and semantic features, "no single reference presented a feasible definition of sustainable development that could incorporate all aspects of the concept commission's report under investigation, and provide no ideal understanding of this concept," according to the report (Ciegis, Ramanauskiene, & Martinkus, 2009, p. 30 cited in(Dagnew B, 2016)). The concept of sustainability has given the appraisal of road infrastructure investments a whole new dimension. It stresses examining a facility's whole life cycle from environmental, social, and economic aspects (List, 2007, Djalante et al., 2020).

##### **2.2.2 Sustainable Road Infrastructure Development (SRID) Concept**

Even though studies in the field of SRID implementation have been carried out, there is presently

no widely accepted SRID idea or construct. Scholars have differing perspectives on the SRID theory, making it a contentious and ambiguous topic (Brandon, P. S., 2000, & Dovers, S. R., Handmer, J. H., 1993). In terms of infrastructure development, different people have varied perspectives on sustainability (Brandon, P. S. 2000, Pearce, D. Markandya, A. & Babier, E., 1989).

Designing, building, operating, maintaining, and deconstructing road infrastructure members in a way that balances the societal, economic, and environmental concerns required to maintain human justice, diversity, and the functionality of the natural environment could thus be defined as sustainable road infrastructure development. In general, sustainable development entails meeting the needs of current generations without jeopardizing future generations' ability to meet their own (Instruments et al., n.d.).

This has three dimensions to it:

- ❖ **Economic sustainability (economic efficiency):** even though the public debate on sustainability frequently focuses on economic goals, sustainable development cannot be realized without taking into account the consequences on the economy, employment, and the provision of products;
- ❖ **Environmental sustainability (ecological stability):** to ensure the functional stability of current ecosystems, both on a local and global scale, the environmental balance must not be overwhelmed by human emissions and resource usage.
- ❖ **Social sustainability (distributional/social equity):** ensure a fair allocation of resources, poverty reduction, stable human development, public engagement, and democratic policy creation to meet social and distributional demands. Access to facilities and services.
- ❖ **Technical sustainability:** roles and responsibilities, procurement & production, capacity building, local affordability, and informed choice

The concept of sustainability is composed of three pillars: environmental, social, and economic also known informally as profits, planet, and people. The effectiveness of the three main principles as a whole, and in particular, a balanced approach to all three, is evaluated to determine sustainability. Although the Triple Bottom Line's three guiding principles lack a measurement system of their own, more recent approaches to assessing sustainability have made

an effort to do so. Although there is no standardized method for measuring sustainability, numerous organizations are creating industry-specific tools and procedures to assess how social, environmental, and economic values operate within an organization.

To successfully attain a better and more sustainable future, the UN has released The Sustainable Development Goals. They deal with issues of sustainability on a worldwide scale. The 17 Goals, which are hoped to be accomplished by 2030, include sustainable economic growth, ending poverty and hunger, providing access to clean water and sanitation, affordable and reliable energy, and responsible consumption and production.

The three primary principles' performance is evaluated as a whole, with a focus on how well each is handled. Although the Triple Bottom Line's three guiding principles do not offer a measurement methodology by themselves, more recent approaches to assessing sustainability have made an effort to do so. Though there is no standardized method for measuring sustainability, numerous organizations are creating industry-specific tools and procedures to assess how social, environmental, and economic values operate within an organization.

### **2.2.3. Conceptual framework**

Economic, social, and environmental aspects can all be used to examine the notion of sustainable road infrastructure development. In road construction, sustainable roads are a technique for balancing these three goals. In light of the stated problems and the new sustainable development strategy, the infrastructure development sector, as well as every area of society, has a key role to play in achieving a sustainable society (Jarmin, J. C., 2008). As a result, it becomes clear that, regardless of project scale, sustainability must be considered throughout the design, construction, operation, maintenance, and deconstruction phases of infrastructure development projects. Policies such as sustainable procurement, sustainable monitoring, and sustainability reporting with appropriate standards are projected to eventually become pertinent specifications required by customers and key stakeholders for certain sectors to gain work or stay competitive (Olteanu-Dumbrava, C., Watts, G., and Miah, A., 2014).

Provide access to sound, affordable, accessible, and sustainable transportation systems, such as infrastructure for all, improving road safety, especially by expanding public transportation, and paying special attention to the needs of those in vulnerable situations, such as women, children,

people with disabilities, and the elderly. Thus, the road infrastructure industry cannot be left out of the sustainability agenda since it forms a significant part of infrastructure development. Stakeholders in the road infrastructure industry are under enormous pressure to find project outcomes or procedures that are economically sustainable, socially viable, and environmentally responsible to achieve Sustainable Road Infrastructure Development (SRID). This will necessitate not only the adoption of sustainability criteria across the life cycles of projects but also the evaluation of outcomes and the consideration of accountability during project implementation. Although in an ideal world, sustainability principles should drive road infrastructure construction, numerous stakeholders are involved in the process, which appears to complicate the situation. Stakeholders have different concerns, key goals, and interests when it comes to road infrastructure development projects, resulting in different project delivery targets. Professionals have a similar issue in recognizing and translating strategic sustainability goals into project-specific action (Ugwu, O.O., and Haupt, T.C., 2007).

The lack of a well-designed decision-making technique and accumulating information at multiple classified levels in road infrastructure project development, as well as the diverse vested interests of project stakeholders and the multi-dimensional viewpoints of sustainability, are further impediments.

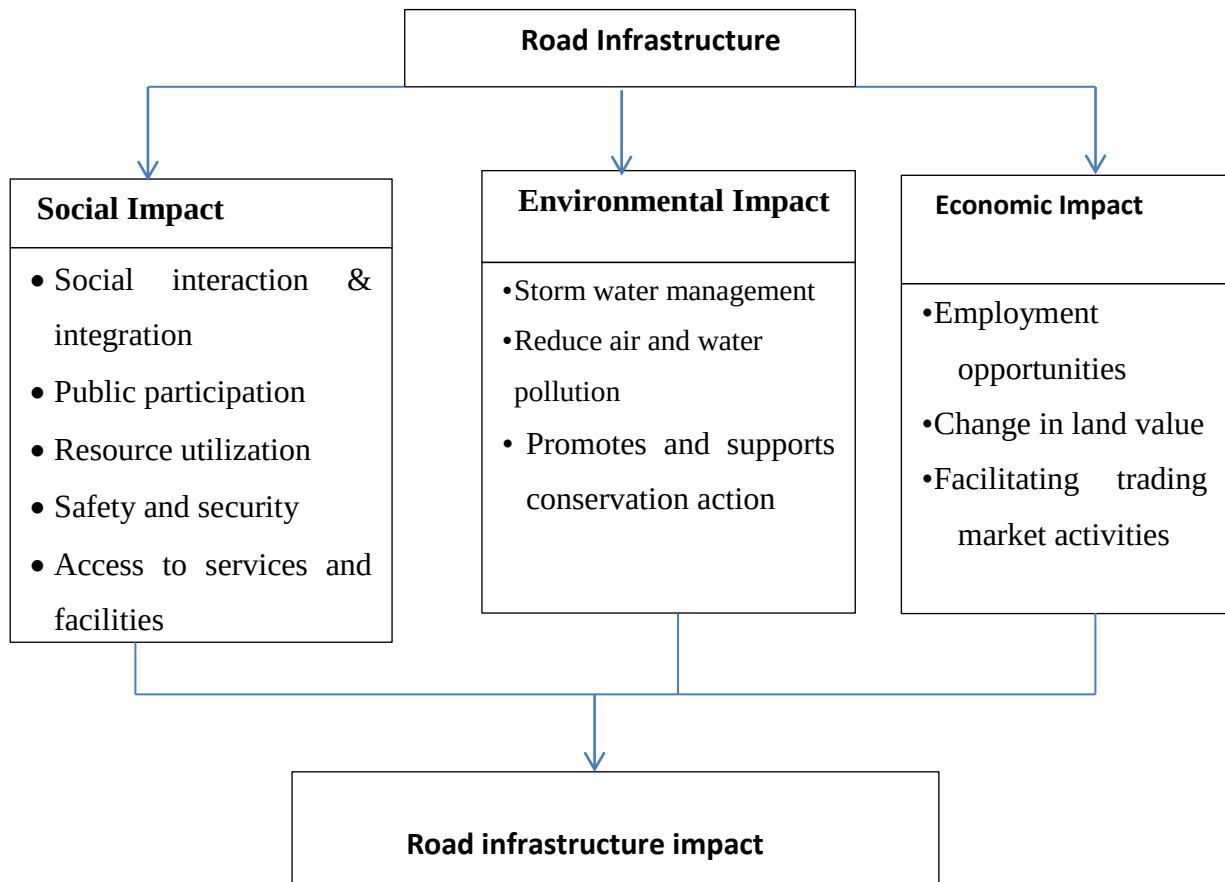


Fig. 2.1 Conceptual framework

Based on the arguments from the literature on these theories, I develop a conceptual framework where certain dimensions, relevant to the context of my studies, and their relations are depicted as shown in Figure 1.1. The dimensions used to measure the possible impacts of road infrastructure projects in the studied communities which may inform the community wellbeing of different social groups.

Infrastructure sustainability has attracted great attention. It is rife with propaganda, but it needs a lot more practical solutions. Because the greatest prospects for sustainability exist during the planning stage, sustainable design can be a major success element. All of these objectives lead to more sustainable infrastructure solutions and can be realized via building information modeling.

A sustainable city is one in which residents enjoy a high quality of life while avoiding the spread of socioeconomic, environmental, or health problems to other areas or future generations.

Sustainable construction is a construction method that incorporates the key concepts of sustainable development (Chaharbaghi & Willis, 1999; Parkin, 2000). These practices should aim for environmental responsibility, social awareness, and economic viability (Shelbourn et al., 2006).

Sustainable development aims to deliver essential environmental, social, and economic benefits to all members of a community while preserving the natural, constructed, and social systems on which these services are based. Public infrastructure is crucial to long-term growth because of its ability to give both direct and indirect economic, social, and environmental benefits to society.

Table 2.1 sustainable development in five sustainability dimensions

| Dimension                            | Main components                                                                                                                                                                                                                                                                                                                                             | Objective                                                                                                       |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Social sustainability                | Job creation that provides sufficient individual income, and improved living conditions                                                                                                                                                                                                                                                                     | Reducing social inequality                                                                                      |
| Economic sustainability              | A continuous flow of public and private capital (the latter with special emphasis on cooperation).<br>Efficient management of resources.<br>Absorption by the company of environmental costs.<br>Endogenization: rely on your strengths.                                                                                                                    | Increased production and social wealth, without external dependence                                             |
| Ecological sustainability            | Produce respecting the ecological cycles of ecosystems.<br>Prudence in the use of non-renewable resources.<br>Priority to the production of biomass and the industrialization of renewable natural inputs.<br>Reduction of energy intensity and energy conservation.<br>Technologies and production processes with a low waste rate.<br>Environmental care. | Quality of the environment and preservation of sources of energy and natural resources for the next generations |
| Spatial or geographic Sustainability | Spatial decentralization (of activity, population).<br>De-concentration - local and regional democratization of power.<br>Balanced city-country relationship (centripetal benefits).                                                                                                                                                                        | Avoid excess agglomerations                                                                                     |

|                         |                                                                                       |                                                       |
|-------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------|
| Cultural sustainability | Solutions are adapted to each ecosystem.<br>Respect for community cultural formation. | Avoid cultural conflicts with potential<br>Regressive |
|-------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------|

Sachs (1993) apud Filho (1993, p.134), own translation

#### 2.2.4 Sustainability criteria for road infrastructure

Sustainability criteria for Road infrastructure projects throughout their life cycle according to (Bueno et al., 2015) are:

Table 2.2 sustainability criteria for road infrastructure projects

| <b>Economic</b>                                                                                                                                                      | <b>Environmental</b>                                                                                                                                                               | <b>Social</b>                                                                                                                                                                                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Infrastructure costs<br>(construction/ operating / maintenance)<br>Travel time cost/saving<br>Vehicle operating cost<br>Accident cost/saving<br>Macroeconomic impact | Energy consumption, resource use, and CO2 emissions<br>Habitat fragmentation and negative effects on species<br>Air pollution<br>Landscape degradation and negative visual impacts | Community disruption<br>Impacts on businesses and community services<br>Employment and labor standards<br>Distributive effects of the project<br>Occupational and community health and safety |

There is no single, best strategy for dealing with a particular case study; numerous approaches might be used. Many factors influence technique selection, including material and financial resources as well as employee skills (Heeres et al., 2016). The complexity and number of indicators used in the above-mentioned methodologies for assessing sustainability vary greatly. The challenge most often encountered during the transfer from theory to reality is reducing the number of sustainability indicators included in the assessment. This is critical for making a method practiced in practice and increasing the method's acceptance by local stakeholders

involved in the planning and decision-making of urban infrastructure projects (Heeres et al., 2016). Current methods and techniques for the assessment of road infrastructure project how they address sustainability do?

The two most frequently used criteria are socio-ecological system integrity and livelihood security and opportunity. The criterion socio-ecological system integrity is often used to develop indicators that refer to project effects across scales from climate change and ozone layer depletion at a global scale, to soil and local water quality at a fine spatial scale. The criterion socio-ecological system integrity is associated with the indicators concerning the mitigation of species habitat fragmentation, land use management, and pollution prevention. The criteria livelihood security and opportunity are adopted to construct indicators related to the socio-economic effects of projects. These indicators can be grouped into mobility and accessibility improvement, community livability, and societal wellbeing and equity. Several indicators concern intergenerational equity (e.g., direct and indirect effects on employment), and transportation costs are also derived from the criterion (Krajangsari, T., & Pongpeng, J. 2018).

#### **2.2.5 Factors in the construction of sustainable road infrastructure**

As a result, consideration of various variables related to both regulatory requirements and excellent sustainable management practices is required while building and managing sustainable road infrastructure (Thorpe, 2012). The components involved in this process as they relate to road building and management are listed below.

##### **Road Material Selection and Use**

Reduced embodied energy in road construction and maintenance materials, as well as in buildings, is crucial (Sattary and Thorpe, 2011). Consider using locally available materials for aggregates, subject to their compatibility, to reduce the embodied energy of the transportation effort of importing material into the construction site, for example.

##### **Road Construction Processes**

Construction activities have a significant impact on waste, energy use, and greenhouse gas emissions, so sustainability has become increasingly important from a project delivery aspect (Wallace, 2005). As a result, the construction industry has been pressed to take greater responsibility for its social and environmental consequences. The International Roads Federation, which understands the importance of sustainability, supports green public

procurement, which aims to acquire products and services with a reduced environmental impact throughout their life cycle (Thorpe, 2012).

## **Planning and Design**

The parameters for road construction and development are established during the planning and design process. Sustainable planning and design can result in lower energy consumption, better resource management, and waste management (Sinclair Knight Merz, 2009). The design has an impact on material choices and pavement design. Water-sensitive urban design, for example, which can be addressed with innovations like permeable concrete pavements, is predicted to influence both construction and material selection and placement (Thorpe and Zhuge, 2010).

Finally, in both design and construction, ensuring the quality of materials and construction techniques is critical. Controlling variability (such as in material properties) will, for example, help the road achieve better and more predictable results over its lifetime (Thorpe, 1998, pp. 116-124).

### **2.2.6 Definition**

Urban sustainability is defined as a composite notion made up of various concepts, levels, tactics, and actors: A city's potential to achieve formal, functional, social, economic, and cultural requirements that enable its population to live well and develop without negatively harming global environmental, social, and economic conditions on a global scale is characterized as urban sustainability (in terms of goals and objectives). Locally (strategically), urban sustainability can be characterized as the facilitation and coordination of formal and functional approaches such as sustainable land use (compactness, intensity, and density), sustainable transportation and its integration, and cycle resource management.

Infrastructure sustainability: It is defined as "the development and responsible administration of a healthy built environment based on judicious use of resources and environmental values," according to Sustainable Infrastructure Development (Kibert, C.J., 1994) and a slew of other terms focusing on the environmental aspect of sustainability.

Sustainable Infrastructure Development is defined as the process of designing, building, and using a final product in a way that balances the social, economic, and environmental principles required to maintain human fairness, variety, and natural system functionality (Ceres, 2012).

A sustainable Infrastructure is a group of products, strategies, and practices that use natural processes to improve environmental quality and deliver useful services.

Sustainable infrastructure is defined by the US Environmental Protection Agency as "strategies, procedures, and investments that dependably deliver active systems over a long period with sufficient utilization, repairs, and replacement" (USEPA).

Utility infrastructure refers to the set of 'hard' infrastructure services which is provided by utility organizations consumed by the public hence it is commonly named public utility. Here, utilities are the 'conduits' or 'technological systems' which support the rapid movement of waste, water, energy, and information on which their integration together into economic and social structure depends (Gebreegziabher, 2014).

### **2.3 Empirical literature review**

As indicated in the theoretical review part, there are challenges with urban road infrastructure sustainability. Unfortunately, several concerns with sustainability have been highlighted by academics and researchers. As a result, numerous studies on this topic have been conducted. Among the many types of research, those with important issues in the field of urban road infrastructure sustainability are examined in this section.

The majority of study on road infrastructure focuses on engineering problems such as construction materials, measurement, safety, and cost (e.g. ASCE, 2018; Federal Highway Administration, 2013). Some studies (e.g., Flyvbjerg, 2009; Garemo et al., 2018) look at the political and economic factors that influence investment decisions (Ahmed, 2013).

Ridwan(2019) Examines the influential factors in the development of Sustainable Road infrastructure: (A Case Study in Buol Regency of Central Sulawesi Province): The concept of sustainable road infrastructure development can be assessed from economic, social, and environmental criteria. A sustainable road is a process of balancing the three criteria in its implementation.

The purpose of the observation is to determine the impact of various factors on the development of sustainable road infrastructure in Buol Regency and to generate recommendations for improving sustainable road infrastructure. The investigations evolved into a descriptive observation, utilizing qualitative methodologies and photographing stakeholder evaluations using the Analytical Hierarchy Process (AHP), a quantitative approach used to establish a path for long-term infrastructure improvement. The findings demonstrated that social and economic considerations, as well as safety, creation guarantees, quality preservation, health, reforestation, and flood avoidance, all had an impact and that optimizing those priority factors was the most promising way to progress. To assess the perception of long-term road infrastructure improvement, economic, social, and environmental standards might be employed. Sustainable roads refer to the process of balancing the requirements for their development. At the local level, long-term progress involves financial and social improvements that can improve people's lives while also utilizing local resources. If the blessings of financial and social development are to be disbursed at some stage in time, one of the methods to pursue is environmental safety to keep away from ecological damage.

Khanani (2021) examined the impact of road infrastructure development projects on local communities in Peri-Urban Areas: the Case of Kisumu, Kenya, and Accra, Ghana. The purpose was to look at how road infrastructure projects influenced socio-spatial landscapes and economic development, as well as how they influenced social companies in the peri- Urban regions of Kisumu (Kenya) and Accra (Ghana), with a focus on network effects.

To explore such socio-spatial and monetary improvement dynamics, the researchers used a case observation strategy and used qualitative, quantitative, and spatial techniques. On the one hand, road infrastructure improvements accelerated residential development in both Kisumu and Accra, as the roads increased housing rentals and land prices, making peri-urban communities more appealing to real estate investors. Access to facilities and services was also improved. In addition, the road improvements in both cities boosted job prospects. In contrast, road construction improvements in both cities resulted in gentrification and, as a result, the migration of poor citizens towards the hinterlands, which altered the social fabric and integration to some extent. The wealthy who own land benefited from the road infrastructure developments at the expense of the poor.

The findings that the effects of road infrastructure vary depending on the locational context and socioeconomic status of individuals in peri-urban areas lead us to believe that place-based and people-based strategies should be coupled to address the consequences of road infrastructure projects. Cities in the Global South have been increasingly interested in large-scale spatial planning and urban development projects. These projects are being used to improve connectivity, increase the competitiveness of cities, and attract investment. However, while road expansion alters peri-urban landscapes in Global South cities, the consequences of road infrastructure in those places receive little attention.

Thorpe (2012) Evaluating factors in sustainable road construction and management - a life cycle approach. Roads serve as a vital component of the community's connectivity. However, from a sustainability aspect, their design, construction, and operation aren't necessarily sustainable. Initiatives such as good environmental management, water-sensitive city design, the use of superior and recycled resources, and environmentally responsible venture control and production are essential to accomplish sustainability in this way. When compared to other possibilities for constructing and operating the street, the contribution of such variables to a particular road endeavor may be distinctive. This could make weighing those alternatives difficult.

To address this issue, a strategy is given that involves generating a weighted evaluation of the sustainability-related economic, environmental, and social factors for each choice, as well as using an existence cycle control technique that takes stakeholder needs into account. Because the variables in this way tend to be measured in a variety of devices and can be both quantitative and qualitative, each variable in a given road creation choice is given a weight and also given an appropriate comparative rating obtained through the calculation for quantitative variables or the use of an application technique for qualitative variables. The estimated overall weighted rankings for various roadway construction and control options can then be compared when determining the best option. There is an example computation that compares the weighted sustainability of different road construction options. The method described is adaptable and can be used in conjunction with a variety of methodologies. It can also be developed into a useful computer-based modeling tool.

Assefa L. (2018) Examined Challenges in urban infrastructure service provision: The case of water, power and road sub-sector in Hossana town, SNNPRS. The observation is focused on analyzing the city infrastructure's demanding scenarios as well as the water, strength, and road sub-sectors possibilities. The findings are based entirely on cross-phase data gathered from 212 randomly selected families from five kebeles throughout the city. The records received were also boosted by interaction with the recognized organizations and the assistance of secondary assets from the institutions. The findings suggest that the infrastructure provided by the three subsectors up to this time has been inadequate.

The water subsector was rated as more progressive, even though roughly half of the respondent families had no household degree. It becomes clear that 95 percent of the respondents must gain access to various types of roads. In comparison to the other sub-sectors, the road sub-sector is significantly trailing, even though it is rated for trendy asphalt and cobble-type road. Even though 87 percent of respondents need to have access to strength in some form, the strength available is insufficient for use with traditional strength cutting.

Furthermore, the degree of coordination in a few areas becomes fragile, and efforts to ensure network participation in presenting infrastructure become constricted. Loss of infrastructure finance, limited technical capability, scarcity of sufficient supply assets, topographic challenges, fairness, transparency, and responsibility issues, difficulty following the master plan of the city, out-of-control enlargement of the city size, and increased demand for infrastructure due to increased complexity of financial and social offerings with within the city are all recognized as major challenges. According to the possibilities analysis, the water subsector will likely get more problematic shortly. The strength subsector is enlarging, although it moves extremely slowly through the process. The road area became reliant on external financial assets, and it was necessary to mobilize infrastructure funds through network involvement, increased openness, and responsibility.

B. Dagnew (2016) study on socioeconomic impacts of road development in Ethiopia case studies of gendewuha-gelago, mile-weldiya, and ginchi-kachisi roads: He investigates how highways are seen as a means of socioeconomic development since they connect areas, locations, people, and economic activities. The expansion and development of a specific street community may

contribute to an increase in accessibility and mobility while also reducing the area required to reach destinations, tour prices, and tour duration. Despite its social and financial benefits, roadway networks are viewed as cultural creations that have disastrous environmental consequences. He used a combined studies design and quantitative studies method to examine the effects of roadway infrastructure improvement on the monetary, social, and environmental levels. With the help of combined techniques of statistics series thinking about quasi-experimental layout, the investigation focused on number one statistics on selected variables that describe socioeconomic conditions both before and after the intervention (QED). Descriptive and inferential statistics are the most commonly used evaluation methodologies. The Random version approach and double-distinction regression were employed in the models. The research used several types of effect analyses (temporal and spatial) to assess the data, as well as paired pattern t-tests to examine the results. The research is primarily based on data gathered from 392 family heads, 77 key informants, 69 FGD participants from seven different locations, traffic counts from seven different points, bodily observations, GIS evaluation outputs using satellite tv for pc imageries, and a large amount of secondary data.

The data show that using the three corridors generates more positive and less negative temporal and spatial socio-economic benefits, but there are differences in the various special sites. The investigation was also carried out with the help of Dagneu (2016), who considered both natural and artificial limits. The former, which includes weather, climate, and relief, is considered outside and more difficult to reduce, while the latter is considered inside. Man-made issues, on the other hand, are well-entrenched, particularly in developing countries like Ethiopia, even though they are no longer difficult to address.

For example, there are no effective institutions in place to monitor and assess the positive and negative effects of street development in all three locations studied, as well as to test the execution of street and street delivery-related norms and laws. Furthermore, prior attempts in terms of encouraging network engagement in street development and raising awareness about site visitor safety had been mostly limited, resulting in unfavorable street improvement outcomes. Such unfavorable outcomes, which include street visitor accidents, are caused by a variety of factors, including poor street designs (as seen alongside the toll road at Hara), the use

of less environmentally friendly delivery equipment (such as antique vehicles), and the use of vans for passenger delivery.

M. Gebreegziabher (2014) study on the Causes and Effects of Poor Inter-Sectoral Linkage in Infrastructure Development Works: The Case of Road and Light Rail Construction Projects in Addis Ababa. Her research looked into the process of city infrastructure improvement projects to determine the scale and root causes of the lack of inter-sectoral integration among city service providers, as well as the potential economic, social, and environmental consequences of the problem, with a focus on specific light rail and avenue improvement initiatives in Addis Ababa. Each qualitative and quantitative technique was applied in the observation, and relevant information was gathered from number one as well as secondary assets via questionnaires, interviews, area observation, and record reviews.

The data was examined using an exploratory, descriptive methodology in conjunction with a story methodological approach. The studies found that the institutional and administrative structure, as well as the degree of responsibility of institutions, as well as the different assets of the price range, is all factors that contribute to poor inter-sectoral integration. In addition, one of the primary causes is a lack of communication at some point during layout arrangements, as well as peculiar position needs and pointers for all carrier providers. Because of uncoordinated planning and layout and fragile institutional systems, M. Gebreegziabher (2014) confirmed that repeating defective designs and modifying software traces has wasted a large number of resources. The beauty of the environment and the efficiency of the local transportation system were severely impacted as a result of the widespread reduction of municipal streets by several software companies. This has resulted in the internal reduction and destruction of several infrastructural traces that were before operating in good condition.

It has also slowed the execution of projects on the inside, putting a strain on the city's basic infrastructure and service delivery. The research aimed to assist decision-makers in deciding on the most appropriate road infrastructure architecture from a sustainability standpoint. Its goal is to keep in mind the limitations and constraints imposed by using surrounding planning systems, layout criteria, and exercise regulations as much as possible. When deciding on the layout

requirements for road infrastructure, understanding the complexity of sustainability principles may be required.

According to experts, the most common cause of poor coordination is a lack of regulatory power. The four main infrastructure sectors of Addis Ababa, namely water and sewerage, electricity, telecommunications, and roads, were identified as major factors with strong relationships and significant influence on the process of infrastructure development and service provision, as well as the level of inter-sect, in the study. The Federal regulatory agency for integrated infrastructure development, construction permits, and control was established with the Proclamation (Ethiopian Federal House of Public Representatives, 2014). According to this page, the Agency's main purpose is to coordinate the implementation of integrated infrastructure development projects under the roadway master plan, as well as to design a formula for determining compensation for demolished homes.

The Agency can draft a national integrated infrastructure development works plan and master plan in collaboration with other relevant implementing organs. The city of Addis Ababa has lately established a new agency with similar powers to the Federal Integrated Infrastructure Development Coordinating Agency (FIIDCA). The Authority was founded when the city council issued a proclamation approving its foundation. The authority has the authority to revoke the utilities' owners' licenses to fail to meet the permit's conditions. Although there are a variety of methods for assessing the socio-financial and environmental viability of ground transportation projects such as roads and railway infrastructure, there is currently no standardized or widely accepted method for ensuring the long-term profitability of avenue projects. Cost-benefit analysis (CBA), multi-criteria decision analysis (MCDA), and other traditional selection-making tools; avenue layout process, which includes requirements and rules; Sustainability score systems, and fashions for reading the sustainability of infrastructure layout and construction are three types of current strategies that can be identified.

Hailmareyam M, (2011) study on the case of Addis Ababa's inner city: intra- and inter-sectoral integration of urban services planning, with a focus on the road, water and sewerage, telecommunications, and power supply. The goal of the research was to evaluate every intra and inter-sectoral integration of City Company planning within Addis Ababa's inner city, with a focus on the four institutions that have a correct away relationship with this take a look at.

Furthermore, four departments with a direct relationship to the crisis drowned deliberately. 68 respondents were chosen at random from the entire human population to represent the entire group. In addition, an in-depth interview is conducted with the virtual committee and special officials. Information has been gathered from personal observation, TV talk shows, and secondary sources. Even though humans were aware of the present fame's integration, the research found that a large number of humans ranked the intra-level integration as a medium.

Unique elements were identified as the top reasons for the low level of integration in the assessment, including institutional arrangements, a lack of a strong controlling body, proper governance, a lack of finance, asset issuance, and a short plan year, as well as the not uncommon occurrence of plan changes. Furthermore, this has a significant impact on the overall performance of all sectors as individuals and as a group. Even though the suggestions placed less emphasis on the problem even though the effect is considerable, the research found that the attempt made with the resource of the use of utility groups and road authorities can be very very much less.

Ethiopia has made some efforts at city infrastructure and business development, but they are not well-developed at this time. Almost every infrastructure and company (water, transportation, drainage, power, and telecommunications) has tried to combine its plans with a gift and planned networks in the past. Nonetheless, the initiative is no longer able to benefit from the popular outcomes due to a lack of frequent follow-up (Matewos, 2006). This is controversial; unique information claims that none of the responsible corporate organizations attempted it.

Three research efforts were made, but they were collapsing. It is hard to mix the try into the hold close plan because of the reality each company's plan is carried out one after the alternative for the one and unique reason. As a result, drainage and utilities have been considered while growing the Addis Ababa holds close to plan.

Some utility workers question the existence of the municipal master plan, stating that their involvement was either unlawful or minimal throughout the planning process, which is to blame for the inconvenience and lack of infrastructure integration. Following the reform of the City Administration in 2003, the Addis Ababa Infrastructure and Construction Authority (AAICA) was established. The Authority was given the power to oversee and coordinate infrastructure

institutions and projects. Under the leadership of AAICA, two committees comprising members from infrastructure institutions have been formed. The Addis Ababa regulatory design and management was formed in 2009, according to the IUIISP manual, which primarily focuses on design and construction requirements. The design regulatory and capacity-building authority of the Addis Ababa municipal administration's development bureau met with stakeholders to discuss a draft regulation for infrastructure integration. The legislation was evaluated by representatives of infrastructure businesses and tested on Ethiopian telecommunication corporation experimental projects, according to the deputy head bureau, with positive results (News Addis 2010).

## **2.4 Research Gaps**

To summarize this chapter examines both the theoretical and empirical components of existing literature reviews. Summarize topics linked to the research problems provided and discussed in a theoretical literature study. From a sustainability viewpoint, those principles are the role of sustainable road infrastructure development for sustainable development, as well as the features of sustainable road infrastructure design, construction, operation, and maintenance.

Under the empirical literature review, some past studies connected to the research concerns are provided. Different industries implement utility infrastructure design and development at different times to provide integration, resulting in resource waste and road infrastructure sustainability issues. Several cities and municipalities have taken responsibility for the design, construction, operation, and upkeep of their road and utility infrastructure in this way. As a result, there is a large increase in the waste of valuable resources, as well as a loss of urban aesthetic value.

There was no obvious void that could be attributed to a responsible entity or industry. The problem was not solved since, as shown in the studies above, laws and regulations were stated and prepared from time to time but never implemented.

Most previous studies focused on issues such as road infrastructure sustainability in conjunction with other utility infrastructures due to infrastructure integration, weak inter-sectoral integration, design and construction, economic effect, and road infrastructure provision. To identify the difficulties, a quantitative research approach was employed to collect data. They were able to generalize the results since they lacked detailed information. However, the focus of this study

was on issues of road infrastructure sustainability in terms of social, environmental, and economic factors, as well as major concerns. Using mixed approach research methods, the data gathering system was created. Because it allows the researcher to obtain more information and identify problems and challenges related to sustainability.

The study by (Assefa L., 2018) examined challenges in urban infrastructure service provision of three sub-sectors (water, power, and road). The study addresses the problem of those infrastructure services and provision-related problems and does not address road infrastructure sustainability and challenges.

As a result, the study of urban road infrastructure sustainability and challenges in *Wolita Soddo* City might fill a gap in such research at the secondary level city. To supplement the literature review, other articles will be added to the main paper.

## **CHAPTER THREE**

### **METHODOLOGIES**

#### **3.1 Introduction**

This section describes all of the procedures that are followed to meet the study's objectives. The procedures that were used, including all important information on data collection, where the data came from, and how it was obtained, are addressed. Data and information sources, research instruments, sample size, and analytic methods are also discussed.

#### **3.2 Research Design**

The research was descriptive and the data collected information from households, focus group discussions, key informant interviews, and document reviews. The data was collected from primary and secondary sources by using a combination of closed-ended and open-ended questionnaires, interviews, and focused group discussions. In addition, a review will be conducted on published documents and exploration of the reports to study the current state of road infrastructure sustainability and the associated challenges.

It is a case study based on a city with municipal and household concerns regarding the long-term viability and problems of road infrastructure. It is based on a condition survey conducted in the field and primary data gathered from the field, municipality, and community. It looks at the existing state of road infrastructure, as well as the responsibilities of community and corporate groups and major service providers, to identify obstacles and opportunities in service delivery.

#### **3.3 Research approach**

The study adopted a qualitative and quantitative research approach. Quantitative research is an objective measurement of a problem based on a theory composed of variables that can be measured in numbers, whereas qualitative research focuses on meanings, experiences, and descriptions to subjectively evaluate respondents' opinions, views, or perceptions of a particular issue. Because it is possible to obtain appropriate information from research questions relating to the respondent's attitude, opinion, and view combined with a desk study examination of actual practice, both qualitative and quantitative research methods were used in this study.

For this research, both qualitative and quantitative types of research have been implemented, because it is possible to get adequate information from research questions that are related to the respondent's attitude, opinion, and view coupled with a desk study review of actual practice.

**Questionnaire:** a questionnaire was developed and distributed to households of the sample selected Keble's in the city.

**Interviews:** An interview was made with the municipality and roads authority representatives to understand the road infrastructure sustainability issues and challenges.

**FGD:** through discussion with key informants from the municipality to get supportive information that was relevant to the study.

**Document Review:** reviewing documents from the municipality and Roads Authority were collected and reviewed thoroughly to establish an in-depth understanding of the actual practice road infrastructure project.

**Desk study:** desk study was conducted on selected case study projects to support and strengthens the questionnaire findings.

### **3.4 Sample Design**

This is a descriptive survey data-based study that uses data collection based on the probability sampling method and non-probability sampling method. The population of the study includes city dwellers and uses randomly selected sample households. The sampling procedure used is a two-stage, simple random sampling and purposive selection method. First, appropriate kebeles were selected purposively from the city to obtain appropriate information and selected organizations for document reviewing, interviewing key informants, and focus group discussants, followed by simple random sample household selection.

#### **3.4.1 Total Population**

According to ESA projection from last year's data, the current population of the city is over 268,400 with an annual growth rate of 5.7% from city finance and economy sector offices.

#### **3.4.2 Sampling Frame**

Two stages of a simple random sampling technique were employed for primary data collection. In the city, there were three sub-cities and two of the sub-cities had three kebele each, and one of

the sub-cities had four kebeles. Hence, there were a total of ten kebeles in the city. Out of the ten kebele, four kebeles were selected randomly in such a way that from the three sub-cities with four kebele every two kebeles would be selected on a random basis. From the second and third sub-city with three kebeles one kebele was selected. Hence a total of four kebeles from the ten kebeles were selected for the sample survey. From the four selected kebeles, 360 households were selected through random choice according to the proportion of kebele's respective population size and 40 experts from provider institutions. Hence the first stage was selecting the kebeles and the second stage was to choose the respondent households randomly from the kebele register. Primary data collection tools include a structured and semi-structured questionnaire on the coverage and factors challenging the provision. Qualitative information was collected through in-depth interviews and focus group discussions selected purposefully from representative community institutions, residents, and provider institutions. Secondary data was collected from the relevant office reports and policy-related documents.

The four selected kebeles of households to get information about the road in their living area, the interview of key informants, focus group discussion, and document review about the whole city road information.

### **3.4.3 Sampling Unit**

Sampling units are taken from an entire population, such as a country, customer database, or region, and put into a smaller group to form a research sample. This group of units is then used to research, analyze and draw conclusions. The sampling units are households of *wolita sodo* city selected by Kebele and key informants from the city municipality and road sector.

### **3.4.4 Sampling Technique**

By applying Probability and non-probability sample techniques; a Simple random sampling technique is employed for primary data collection techniques of structured and unstructured questioners, and non-probability sampling was a purposive selection for structured interviews of key informants and focus group discussion, and field observation.

#### **3.4.4.1 Interview Sampling**

The persons to be interviewed from the roads authorities and municipality were identified. Those individuals were selected from the planning departments of the roads authorities and

infrastructure development department of the municipality, who have direct involvement in the subject matter and are relevant to the study.

#### **3.4.4.2 Case Study Sampling**

For the questions “what are the challenges and gaps of the current road infrastructure related to sustainability”. To obtain the answer to this question, selected road segments from four selected kebeles were chosen for the case study to find out the answer to these questions. Road segments were selected to assess the road users' and stakeholders' opinions that demonstrate the effectiveness of the current road projects investment practice in the city.

#### **3.4.4.3 Questionnaire Sampling**

The questionnaire was developed for determining the road users' and stakeholders' opinions on the road project planning practice and its effectiveness to be able to identify the road projects' critical impact indicators. The participants of the study were households, key informants, and focus groups from selected kebeles, road authorities, municipality, direct road users, and different project stakeholders. This research method was conducted through a questionnaire distributed to selected road users, municipalities, and road authorities.

#### **3.4.5 Sampling Size**

To determine the appropriate sample size for the study; the researcher deals with three possible options which can provide different sample sizes. The basis for determining the sample size in each option is the level of precision or sampling error, the confidence level, and the degree of variability in the attributes being measured. In this regard, the researcher used option 2 to determine the sample size. Since the population is large the following simplified formula was applied:

To determine the sample size, using yimaneh sample size determination formula is as follows:

- ❖ To calculate the sample size (for infinite population) based on the sample required to estimate a proportion with an approximate 95% confidence level, using the following formula:
- ❖ . The formula derived by Yemane (1967) is presented as:

$$n = \frac{N}{1 + Ne^2} \quad \text{equation ..... 3.1}$$

Where:

- $N$  = The target population size
- $n$  = required sample size,
- $e$  = Margin of error or sampling error expressed as a proportion = 5 %
- $l$  = constant

So, the city household of four selected kebeles was 21,364 from each administrative

To determine the sample size we have:

Accordingly, to determine sample size the researcher assumed option 2 In this scenario the researcher assumed the confidence level, the degree of variability, and the sampling error as follows:

Confidence Level = 95%

Degree of Variability = 50% (Maximum Variability) Sampling Error =  $\pm 5\%$

By using the formula in equation 3.1 
$$n = \frac{N}{1 + Ne^2}$$

$$n = \frac{21364}{1 + 21364(0.05)^2} = 399.8 = 400$$

The method may be to take an initial estimate which may either be based on personal judgment or maybe the result of a pilot study. A personal judgment based on the expected percentage of infrastructure coverage for the households in the city is taken

Hence, the sample size of 400 is accepted for household and expert selection.

### **3.5 Data Sources**

Two main sources of data were employed in this investigation. These are primary and secondary data sources, respectively. Data from field observations, sample survey responses, pictures, etc. are the main data sources. The linked literature study, website (internet) report, documents, reviews from municipality and road authority, books, journals, and articles are the secondary data sources. The households of four selected kebeles and road infrastructure within the selected kebeles of the city serve as the main data sources. The questionnaire's primary data was drawn from samples of the population of the City that were picked at random.

### **3.6 Method of Data Collection method**

The primary and secondary data collection methods were relevant to this study. Qualitative data were collected by using the primary and secondary methods of data collection as described in the following section.

#### **3.6.1 Primary data collection method**

Primary data was collected from personal observation and experience and filed survey by using different techniques such as structured and semi-structured questioners, structured interviews, focus group discussions, and field observation.

#### **3.6.2 Secondary data collection method**

Secondary data involves information from the road authority's guidelines, reports, and different documents from the municipality that were reviewed to clearly understand the road infrastructure sustainability and challenges, and complement the primary data. In addition, published texts such as academic periodicals, research journals, government publications, dictionaries, past dissertations, and Internet resources were reviewed.

### **3.7 Data Analysis and Interpretation**

#### **3.7.1 Data Analysis**

Initially, the data cleaning process would be conducted to identify any missing value and to take corrective measures by cross-checking the corresponding questionnaires. Analysis of data would be conducted to show important relationships of variables under the study. The data collected by the questioner was going to be analyzed through descriptive methods using tables, graphs, charts, and, percentages. The data collected from the interview, FGD, and observation was analyzed by

narration. The findings and discussions would be compared with available literature and case study and therefore, the qualitative and quantitative data that was analyzed and interpreted were organized together in the study.

### 3.7.2 Data presentation

Both primary and secondary data are analyzed and presented using statistical tools in different ways, such as tabular form, SPSS table output, and graphical form to realize and supportive for the written data.

Table 3.1 operationalization framework

| Research objective                                                                         | Concepts                | Indicators/variables                                                                                                         | Methods of data collection                 | Method of Data Analysis                     |
|--------------------------------------------------------------------------------------------|-------------------------|------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|---------------------------------------------|
| To explore Social interaction , integration, Public participation and Resource utilization | Social dimension        | Change in level of Perception about Social networks (Support from friends, neighbors ,and relatives) and social interactions | Questionnaire, interview                   | Descriptive statistics<br>Thematic analysis |
| To increase access to facilities and services<br>Change in land use                        | Spatial/physical Change | Improved access to facilities and services                                                                                   | The questionnaire, deep interview, and FGD | Descriptive statistics<br>Thematic analysis |
| Environmental friendly planning, design, construction, and maintenance                     | Environmental dimension | Improved water and air quality, flood protection measures                                                                    | The questionnaire, interview, and FGD      | Descriptive statistics<br>Thematic analysis |
| To increase employment opportunities, job creation                                         | Economic dimension      | Access to employment opportunities, access to income-generating activities                                                   | The questionnaire, interview, and FGD      | Descriptive statistics<br>Thematic analysis |

|                     |  |                                                                    |  |  |
|---------------------|--|--------------------------------------------------------------------|--|--|
| Increase land value |  | Change in living<br>conditions of residents<br>Current land values |  |  |
|---------------------|--|--------------------------------------------------------------------|--|--|

### 3.8 Ethical Considerations

Questionnaires are designed with two alternatives in mind to provide some level of subject protection: anonymity or confidentiality. Confidential research participation implies that the data from the research subject(s) might be connected to a specific person. As a result, all data obtained in person (surveys, focus groups, interviews, etc.) is immediately considered confidential. This is true even if the researcher issues the subject a coding number that cannot be traced back to the subject because the researcher knows who submitted the data. As a result, the researcher's option is the second, because most impact analyses require respondents to be recognized by their names by their very nature. It's all about the changes that have occurred as a result of interventions. The respondents must be recognized by their names and the location of their residence to facilitate future impact studies with their permission.

## CHAPTER FOUR

### RESULT AND DISCUSSION

#### 4.1 Introduction

This section analyses and discusses the major findings of data collected from primary sources: key informants' interviews, focus group discussions, field observations, and survey questionnaires. Secondary source: document review and report files from public organizations stated under methodology. The return rate of responses, the profile of respondents, and presentation and analysis on issues related to the research questions are included in this chapter. It also attempts to give response to the research questions by dealing with the assessment of urban road infrastructure sustainability and challenges and many related questions. Moreover, the analysis and discussion will help to reach a major conclusion and forward a possible recommendation.

#### 4.2 Response Rate

Response rate is a percentage of the actual samples that participated in responding to the study questionnaires of the researcher after filling them to the total of the samples that the researcher intended to consult with. The researcher used the responses of the respondents for answered questionnaires. After the required numbers of respondents were determined, questionnaires were distributed more than the required number to compensate for non-return questionnaires. Out of 420 sample questionnaires, only 394 were returned and filled. Twenty-six of the questionnaires were not returned.

The researcher distributed for households extra 20 questionnaires to complement unreturned responses due to fulfilling the required sample unit. Therefore a response rate of  $394/420 \times 100\% = 93.8\%$ . And a response rate that is greater than or equal to 80% is very good. And hence this research survey has an excellent response rate.

Table 4.1: Return/response Rate of Questionnaires/ Interview/ Focus group discussion

| Data Collection Tool            | Number of Questionnaires/ Interview/ Focus group |                       |                     |                     |                  |       |
|---------------------------------|--------------------------------------------------|-----------------------|---------------------|---------------------|------------------|-------|
|                                 | Required                                         | Distributed/presented | Collected/ Returned |                     |                  | Valid |
|                                 |                                                  |                       | In Number           | As % of Distributed | As % of Required |       |
| Questionnaire for house holds   | 360                                              | 380                   | 366                 | 96.3                | 98.4             | 360   |
| Questionnaire for organizations | 40                                               | 40                    | 34                  | 85                  | 85               | 34    |
| Interview                       | 9                                                | 9                     | 9                   | 100                 | 100              | 9     |
| FGD                             | 8                                                | 7                     | 7                   | 100                 | 87.5             | 7     |

### 4.3 Demographic data

Three hundred sixty (360) respondents from the household and thirty-four (34) respondents from the municipality and road authority were given a well-structured questionnaire instrument for quantitative and qualitative data while another nine (9) (five from Municipal officials, two from road sector and two from city administrative office) were interviewed by semi-structured interview instrument, and seven (7) focus group discussion from the municipality for qualitative data participated in this study. Road sustainability shows a great variation related to differences in background and characteristics of households. In this section, the researcher tried to constitute different sample households with various demographic characteristics.

#### 4.3.1. Gender

The following Figure 4.1 shows the gender profile of the respondents and the interviewees. It shows that, from the major respondent category, more males 71.3% (281) and females 28.7% (113) respondents from a total of 394 respondents were sampled for quantitative and qualitative data. On the other hand, 77.8 % ( 7) of the total 9 interviewees were male respondents and the

rest 22.2(2) were female, and also seven (7) respondents (five male& two female) focus group discussion sampled for qualitative data.

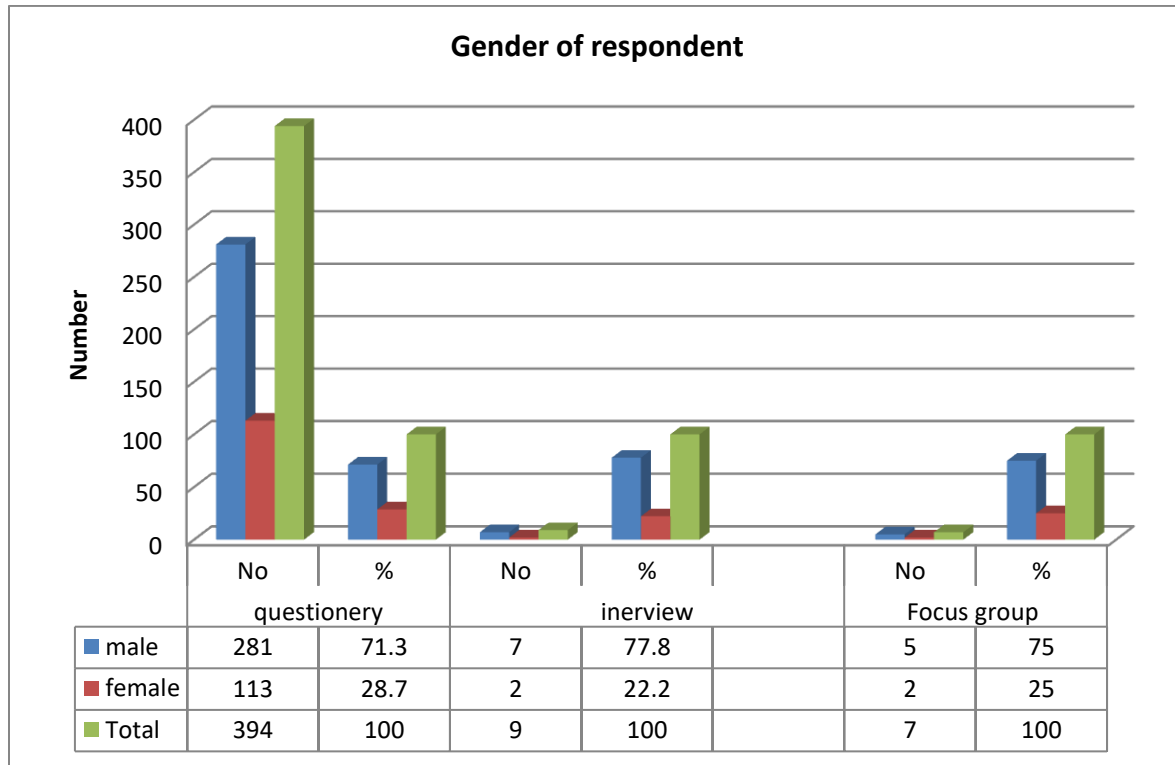


Figure 4.1: Gender characteristics of respondents

#### 4.3.2 Age Distribution

Age is one of the most important demographic indicators and biological attributes of the population that affect demographic as well as socio-economic situations. The age distribution of the household respondents is also important for determining /her ability to understand the past and present situation of road conditions in the city regarding get relevant information.

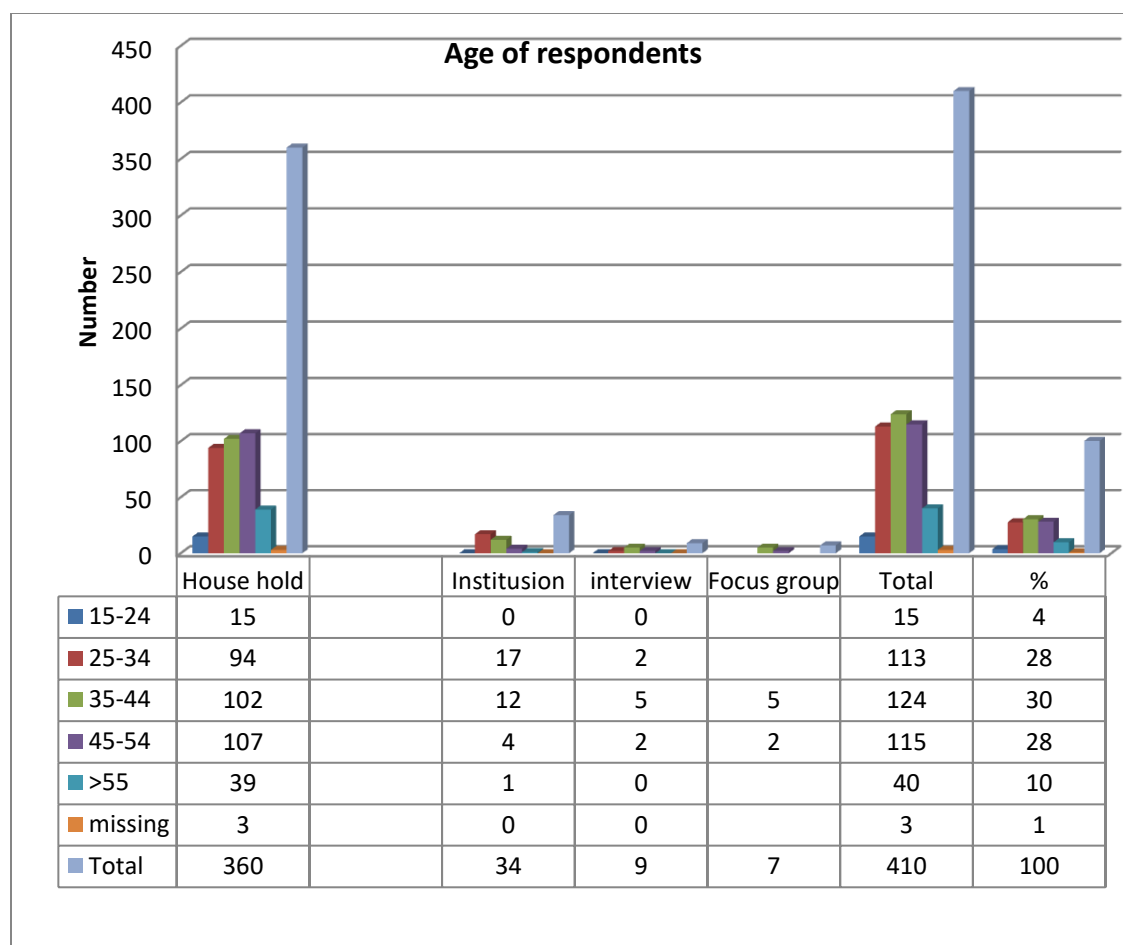


Figure 4.2: Age characteristics of respondents

#### 4.3.3 Educational Status

The majority of the households in the sub-city have different educational backgrounds. This educational background of the respondents influences their active participation in answering road project selection and following up the construction to ensure road infrastructure sustainability. Therefore to upgrade their understanding of the challenges of sustainability in road infrastructure project selection, design, construction, and maintenance organized training and awareness campaigns are needed. This problem is seen in the study area. Table 4.2 below shows the level of education completed by the respondents. It revealed that the respondents who never crossed formal education and cannot read and write properly are the smallest proportion.

Table 4.2 Educational status of respondents

| Educational status | Household |       | Institution |       | Interviewee |       | Focus group |       | Total |
|--------------------|-----------|-------|-------------|-------|-------------|-------|-------------|-------|-------|
|                    | No        | %     | No          | %     | No          | %     | No          | %     | No    |
| Illiterate         | 6         | 1.67  | -           | -     | -           | -     | -           | -     | 6     |
| 1-4                | 5         | 1.39  | -           | -     | -           | -     | -           | -     | 5     |
| 5-8                | 24        | 6.67  | -           | -     | -           | -     | -           | -     | 24    |
| 9-12               | 57        | 15.84 | -           | -     | -           | -     | -           | -     | 57    |
| certificate        | 26        | 7.22  | -           | -     | -           | -     | -           | -     | 26    |
| Diploma            | 102       | 28.33 | -           | -     | -           | -     | -           | -     | 102   |
| Degree             | 111       | 30.83 | 22          | 64.71 | 5           | 55.56 | 4           | 57.14 | 142   |
| Above degree       | 29        | 8.05  | 12          | 35.29 | 4           | 44.44 | 3           | 42.86 | 48    |
| Total              | 360       | 100   | 34          | 100   | 9           | 100   | 7           | 100   | 410   |

#### 4.3.4 Employment Condition

The employment condition of the respondents and interviewees has a relation to gathering adequate information.

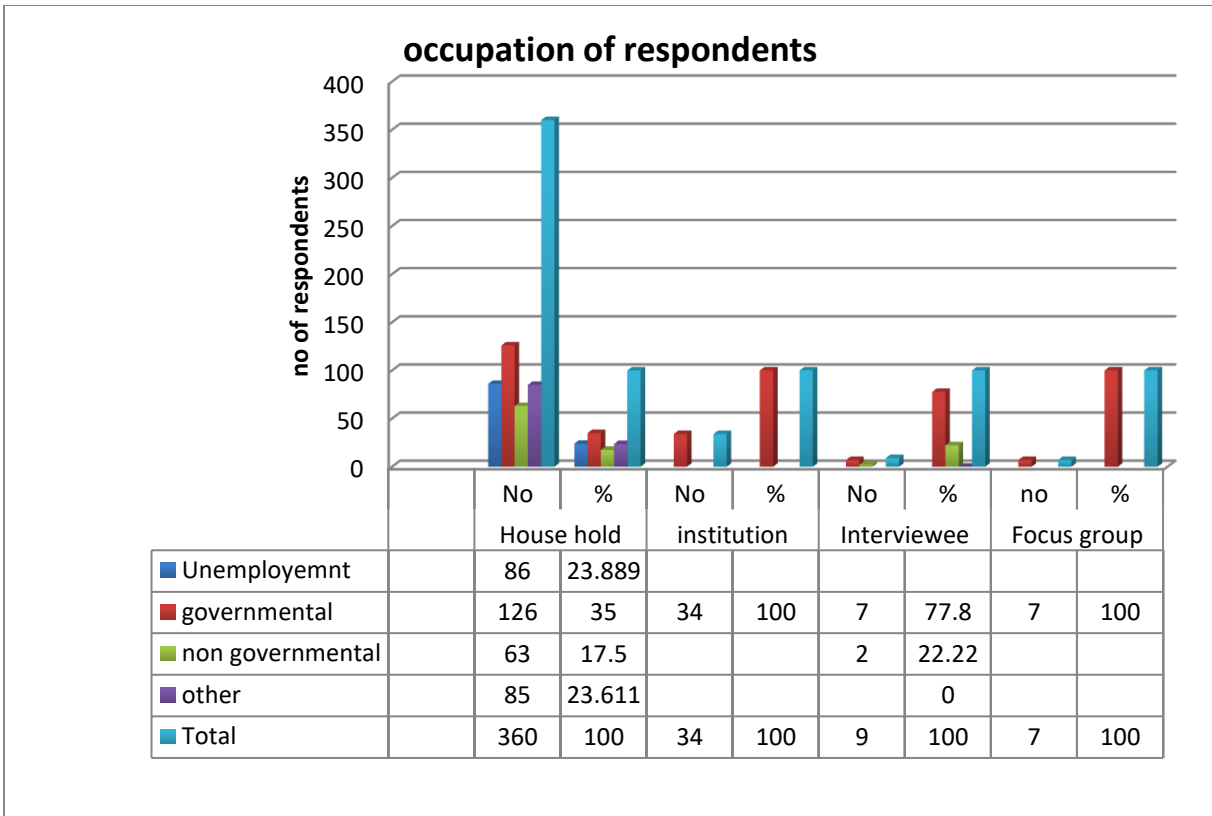


Figure 4.3: the occupation of respondents

## 4.4 Main Findings

### 4.4.1 Existing condition of the city road

Table 4.3 Existing condition of the city road

| Category       | Frequency | Percent |
|----------------|-----------|---------|
| Good           | 172       | 43.7    |
| Fair           | 137       | 34.8    |
| Poor           | 81        | 20.6    |
| Missing system | 4         | 1.0     |
| Total          | 394       | 100     |

The above Table 4.3 shows that response to a question about the existing condition of city road has categorized good 172 (43.7%), fair 137 (34.8%), and poor 81 (20.6%). This shows that the

road in the city was in better condition by aggregating a good and fair response rate. While a quarter of respondents answered city roads were in poor condition. in this regard, the city road infrastructure was improved in a better way so, the researchers acknowledge the city administration.

Some respondents revealed that the city road was poor their reason was some part road has a flood problem this was due to overflow of flood resulted from inadequate drainage capacity. The other reason was the slope problem which from the topography of the area and others revealed the poor construction of the road and drainage channels with no maintenance.

Good, fair, and poor road conditions are defined as follows by Queiroz and Gautam (1992:3) in the World Bank policy research working paper series: (a) Good: paved roads that are substantially free of defects and require only routine maintenance, or unpaved roads that require only routine upgrading and spot repairs; (b) Fair: paved roads with significant defects that require resurfacing or strengthening, or unpaved roads that require reshaping or resurfacing and drainage spot repairs; and (c) Poor: paved roads with extensive defects that require immediate rehabilitation or reconstruction, or unpaved roads that require immediate rehabilitation or reconstruction(Dagneu Bogale, 2016).

#### **4.4.2 The city residents/community were consulted during road project selection and participated in the construction of the road project.**

Table 4.4 community was consulted and participated in the construction of the road project.

| Category       | Frequency | Percent |
|----------------|-----------|---------|
| Yes            | 288       | 73.1    |
| No             | 103       | 26.1    |
| Missing system | 3         | 0.8     |
| Total          | 394       | 100     |

A question was raised for the residents who were consulted during road project selection and participated in a road construction project the response from 391 respondents by yes 288 (73.1%) and by no 103 (26.1%) from the above table 4.4. This indicates that the majority of the residents consulted and participated in road project construction. Interviewing some respondents reveals

that the community was consulted and actively participated in World Bank projects of road infrastructure and other projects such as culvert and drainage construction projects, whereas in municipal road project construction communities were not consulted. This is due to World Bank supervision and evaluation mechanism first step was a community meeting/consultation. For the matter, the majority of respondents were revealing a yes response.

Most community development work involves the participation of the communities or beneficiaries. Thus, community participation is an important component of community development. Effective community participation may lead to social and personal empowerment, economic development, and sociopolitical transformation(L. kassa, 2017).

Generally, the current study findings revealed that community participation in development activities is highly significant by stabilizing a sense of ownership, and belongingness, and assured sustainable organized performance systems. Similarly, the current study also shows that the community participation rate has gone up and promotes development works accordingly.

#### 4.4.3 Major problems of the city road infrastructure

Table 4.5 Major Problems of the city road

| Category       | Frequency | Percent |
|----------------|-----------|---------|
| Accessibility  | 104       | 26.4    |
| Mobility       | 46        | 11.7    |
| Quality        | 151       | 38.3    |
| Maintenance    | 209       | 53.0    |
| Design         | 116       | 29.4    |
| Missing system | 7         | 1.8     |
| Total          | 394       | 100     |

Based on the above Table 4.5 and data obtained from the survey the major road problems in the city were due to accessibility (26.4%), mobility (11.7%), quality (38.3%), and maintenance (53.0%) and design (29.4%). A finding from the interview and FGD why maintenance was not done question was answering the shortage of budget the major challenge. Some of the discussants during FGD revealed the negligence of the municipality and /or road sector. Quality

related to the utilization of poor local construction materials, low capacity of contractors, and sub-contractors winning the bid by the least bidder rule resulted in poor quality of construction. The design problem was the application of local standards and also missing other utility infrastructure considerations or disintegration of road, drainage, and utilities. Accessibility and mobility were also a problem for road infrastructure in the city.

Because they connect regions, locations, people, and economic activities, roads are seen as a means of socioeconomic growth. The extension and enhancement of a road network would boost accessibility and mobility while also lowering distance to destinations, travel expenses, and journey time. Despite these social and economic advantages, road networks are viewed as cultural artifacts that have detrimental environmental consequences (Heeres et al., 2016).

#### **4.4.4 why did road and utility infrastructure disintegrate?**

Understanding from the interviewee of road sector and municipality managers as well as key informants answered this question; the city road was integrated into utility infrastructure to some extent. They revealed that roads and drainage are integrated because the design construction was done by the municipality and road sector. Other utility infrastructures are integrated to some extent. The question raised is why not integrated with the required standards. The reason was provision and installation of utility infrastructure was done by their respective sectors. In this regard, the design, construction, operation, and maintenance were implemented by them. This leads to the wastage of scarce resources because the road was cut after construction by those sectors to install the utility lines, environmental problems, and poor service provision. In this regard FGD participants stated that to construct a new road or to maintain the existing road and utility infrastructure; the road sector/ municipality must get permission from the electric utility organization to lift the electric pole that was planted in inappropriate position; similarly, the municipality asks permission from water supply and sanitation office to lift water supply distribution lines inappropriately installed. Similarly, all the other utility sectors ask permission from the municipality to cut the road section to cross the utility lines. This all shows that there is less integration, coordination, and collaboration with the municipality and the respective utility sectors. Due to this reason redesign and reconstruction of road and utility infrastructures, process/time wastage to get permission from one to another, resource wastage, and service interruption to the residences. This all implies that there is no superstructure to implement

integrated infrastructure planning, design, construction, operation, and maintenance, this should minimize resource wastage, have an aesthetic value of the urban landscape, easy system to provide service for users, consideration of land value, good quality construction of infrastructure, easy to manage and sustain. In this manner road infrastructure, as well as utility infrastructures, is sustainable.

Urban areas are rapidly expanding, and as a result, urban infrastructure must keep up with the demand. The skeleton of a city is made up of technical infrastructures such as transportation, energy, water supply, sewerage, and information networks. It distributes resources, energy, and information to the final customers. On the other hand, urban infrastructure has a wide and long-term impact on the area's long-term growth (Zavrl & Zeren, 2010). The leading infrastructure development at the same time as urban growth should have skilled people/professionals and good management expertise for the given city.

Urban road infrastructure design should consider many things through design to implement design standards and criteria at the local level as well as national level. Road infrastructure projects are appraised in practice through several tools or methodological frameworks that include the concept of sustainability to a greater or lesser extent.

In FGD, the participants added that the land development plan has a great challenge for the integration of road and utility infrastructure. This resulted in the reference to land development plan standards and guidelines. The discussants raised that due to this reason inadequate space of road width to provide road, drainage, and utility infrastructure. This was difficult to integrate the effort into the master plan because each service provider's plan is implemented separately.

In the Land-Use Management System (the Planning Control System) the various sectoral interests are balanced against the overall development objectives for a given location and thereby form the basis for regulation of future land use through planning permissions, building permits, and sectoral land use permits according to the various land-use laws (Sánchez et al., 2020).

All infrastructure and other services are overlaid on the land, so the land development plan should be properly implemented by the urban planning principles and laws. In this regard, a land development plan has a role in road infrastructure sustainability.

#### 4.4.5 Economic well-being of road infrastructure

Table 4.6 road infrastructure contributes economic well-being of the residences

| Category       | Frequency | Percent |
|----------------|-----------|---------|
| Significantly  | 196       | 49.7    |
| partially      | 184       | 46.7    |
| Not at all     | 12        | 3.0     |
| Missing system | 2         | 0.5     |
| Total          | 394       | 100     |

As indicated in Table 4.6, the constructed road contributes economic well-being of the community answers to be significantly 196 (49.7%), partially (46.7%), and not at all 12 (3.0%). From this survey result, we can understand that the constructed road has contributed to economic well-being. Table 4.7 as shown below the road infrastructure contributes economic well-being of the community significantly and partially in different aspects.

Table 4.7 the contribution of the road to the economic wellbeing of the community

| Category                                                            | Frequency | Percent |
|---------------------------------------------------------------------|-----------|---------|
| Provide market access                                               | 197       | 50.0    |
| Facilitate& Support trade market within the road influence area     | 232       | 58.9    |
| Increase access to schools, health centers, and other services      | 209       | 53.0    |
| Increase zonal and regional connectivity                            | 127       | 32.2    |
| Other/capacity building in construction for small-scale enterprises | 4         | 1.0     |
| Missing systems                                                     | 4         | 1.0     |
| Total                                                               | 394       | 100     |

Survey results from Table 4.7 above, according to respondents the constructed road infrastructure economic well-being of the community significantly or partially by Facilitating & Support the trade market within the road influence area 232 (58.9%), Increase access to schools, health centers, and other services 209 (53.0%), Provide market access 197 (50.0%), Increase zonal and regional connectivity 127 (32.2%), and some the respondents added capacity building

in construction for small scale enterprises. This finding indicated that most of the respondents revealed that road infrastructure was economic well-being for the city residents. Interviewing key informants revealed that road construction brings many changes that did not exist before the construction of the road. This is by increasing business activities around the area, increasing land grade; creating job opportunities, reducing travel time, and facilitating access to services and market area.

By the field observation, there was active transport, opened restaurants, boutiques, shops, and supermarkets on the main routes. Many unemployed teens got jobs in the manufacturing of wood and metal works such as housing and office furniture, block production, and local coffee sellers' restaurants were open to serving the residents.

Construction of roads, whether new or upgrading of existing ones, is presumed to have a range of impacts on the population, urban form, economic status, and environment. The impacts may be both positive and negative depending on the situated social, spatial, economic, and environmental context (Djalante et al., 2020).

#### **4.4.6 The constructed road has a drainage system and pedestrian walkway**

From site observation the constructed road to some extent with drainage channels. But the constructed drainage channels were not properly constructed and managed. Information from the interview key informant and FGD the drainage channel was a design problem. This and from the observation the drainage channel width and depth were inadequate size, due to this reason and dumping of solid waste blocks the channel flood easily flow to the roadside and the resident's house front to the road. Due to this reason, the residents are affected by the flood frequently during heavy rainy sessions.

Similarly, during the site visit, the road construction has to some extent considered a pedestrian walkway, but the road constructed by ERA which crosses the city from five directions was well designed and constructed walkway, medians, and zebra crossing. In the FGD discussants elaborated that the road width is not enough to provide the walkway. This problem was due to the land development plan. They arise in the city the land development plan was not follow planning standards. This implies there was a gap between urban planning and land development and management departments in the municipality to implement the plan standards.

#### 4.4.7 Road problems related to the transportation

Table 4.8 road problems related to the transportation

| Category                     | Frequency | Percent |
|------------------------------|-----------|---------|
| Traffic movement             | 139       | 35.3    |
| Difficulties for pedestrians | 197       | 50.0    |
| Parking difficulties         | 185       | 47.0    |
| Missing systems              | 6         | 1.5     |
| Total                        | 394       | 100     |

As is shown in Table 4.8 above, the majority of the respondents were revealed that road problems related to transportation facilities were the difficulty of pedestrians 197 (50.0%): This is due to poor road design and construction, narrow road width/ inadequacy for traffic movement and lack of safety measures for traffic management. From interviews, experts revealed that in the city the road infrastructure design is not considered a pedestrian walkway. For this reason, both the pedestrians and vehicles used the same road section. This is also discomfort for the pedestrians. The same reason as parking difficulty 185 (47.0%) in the city was another road infrastructure design problem for transportation. The households, FGD discussants, and key informants highly elaborated that there was a parking problem. The reason was land development plan problem during plan implementation inadequate road width and not reserving space for parking. Lack of parking and pedestrian walkway problems resulted in Traffic movement and congestion on the road.

Congestion, road accidents, loss of productivity, deteriorating air quality, and socio-economic inequalities are well-known aspects of urban life. Many of these problems, as well as rising energy consumption and associated greenhouse gas production, have their roots in the management of land use and transport systems(Dibaba, 2018).

Design is a highly technical process requiring highly trained staff, especially when the technology involved is complex. The basic design is apt to be successful if presented and adapted through a process of consultation and active stakeholder participation at all stages(Wasike, 2001).

Sustainable road infrastructure design and construction should consider roads with pedestrian walkways with safety measures and parking facility should in consideration.

#### **4.4.8 The environmental impacts/problems of road**

Environmental impact due to the road infrastructure respondents revealed that during construction of road causes cutting or removal of trees in some parts of the city and resettlements of people from the right of way. In an interview, some respondents elaborated that road contributes to environmental problems such as air pollution, sound pollution, and the cause of the flood. Air pollution is caused by a lack of road maintenance when the rainy session dirty water is stagnant on the road which affects public health. Drainage is part of road construction in this regard inappropriate drainage construction and dumping of wastes on drainage lines which blockage of drainage lines and flood overflow to the road, leads to an environmental problem.

Road infrastructure is always evolving to incorporate new technology breakthroughs for the benefit of passengers, drivers, and vehicles. High-quality materials, safety gadgets, and sophisticated transportation systems are all part of these new technical triumphs. Despite significant progress toward a technological and engineering boost in road construction, road authorities face new hurdles, including decarbonization, environmental limits, and electronic information (Mouratidis, 2020). (According to Mouratidis) Summarizes several possible policy objectives for transport infrastructure sustainability is:

Table 4.9 possible policy objectives for transport infrastructure sustainability According to Mouratidis

| Economic goals                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Environmental/Ecological goals                                                                                                                                                                                                                                                                                                        | Social goals                                                                                                                                                                                                                                                                                                                             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Provide infrastructure for sound economic development and employment</p> <p>Allow for cheap, fast, and high-volume transport</p> <p>Reduce congestion</p> <p>Strengthen rural-urban interlinkages</p> <p>Create a sound financial basis for public transport</p> <p>Allow for different transport options</p> <p>Raise revenue for infrastructure and transport facilities set-up, operation, and maintenance</p> <p>Still, this general approach has to be further broken down in the transport sector and adapted to the specific needs of developing countries.</p> | <p>Improve health and safety in transport</p> <p>Reduce pollution on a local, regional and global level; contribute to climate stabilization</p> <p>Reduce land take</p> <p>Integrate environmental and economic dimensions in transport planning and development</p> <p>Develop an environmentally sensitive strategic framework</p> | <p>Guarantee transport services and access for all social groups</p> <p>Focus on transport for the (urban) poor</p> <p>Improve methods of addressing transport problems of the poor</p> <p>Protect the poor against adverse changes in transport policies</p> <p>Ensure democratic participation in transport policy decision-making</p> |

#### 4.4.9 The constructed roads contribute to traffic accidents that frequently happen

Table 4.10 the roads contribute to traffic accidents that frequently happen

| Category       | Frequency | Percent |
|----------------|-----------|---------|
| Yes            | 227       | 57.6    |
| No             | 163       | 41.4    |
| Missing system | 4         | 1.0     |
| Total          | 394       | 100     |

Finding from the survey shown in the Table 4.10 above roads contribute traffic accidents to happen answer yes 227 (57.6%) and no 163 (41.4%) out of 390 respondents. Table 4.11 below indicates how the road infrastructure contributes traffic accidents to happen.

Table 4.11 Reason for road transport accident

| Category                                                         | Frequency | Percent |
|------------------------------------------------------------------|-----------|---------|
| Lack of provision of safety and another facility for pedestrians | 139       | 35.3    |
| Poor quality of the constructed road                             | 70        | 17.8    |
| Lack of routine and periodic maintenance or rehabilitation       | 81        | 20.6    |
| Lack of awareness of the road users                              | 104       | 26.4    |
| Topography                                                       | 151       | 38.3    |
| Missing system                                                   | 2         | 0.5     |
| Total                                                            | 394       | 100     |



Fig. 4.4 poor road construction

Poor road construction hinders road transport and curtails societal development and mobility. Additionally, it causes environmental issues and poorly maintained roads are a major contributor to accidents in several ways, mostly because they provide a significant risk to drivers. Many times, a driver will try to avoid a particular circumstance, such as a pothole or a body of water that could result in a major accident.



Fig.4.5 road user's problem

Every nation has made efforts to promote road safety, and it is important to understand how road users see these efforts to assess the success of road safety measures and the requirements of the local community. While many studies compare nations based on fatality rates or potential contributing causes, little is known about how road users. As shown in the above Figure the road users' problem in the city is due to no pedestrian walkway, zebra crossing, and weak traffic management.



Fig. 4.6 Slope of the road

The slope is one of the problems of road design and construction challenges because it contributes to traffic accidents and flood problems. The topography of the city slope has an impact on the residents as well as on the vehicle.

From the interview, the key informants agreed that the major road problem was maintenance. They revealed that the main reason for this was due to shortage of budget, some of them were the municipality's negligence, and lack of follow-up and supervision. In FGD the discussants revealed that some roads were in series condition, and many road segments were need maintenance but there was a shortage of budget.

The other major problem next to maintenance was the quality of road construction; this is due to the utilization of poor construction material and the contractors winning the tender at a low cost. From focus group discussions there was weak supervision and follows up leads to the quality of road construction.

The design problem was another problem with the city road, from the interview many respondents revealed that the design problem resulted from professionals due to negligence and accountability. The respondents revealed that much of the road design was done by the informally formed professionals from the municipality. There was no consultancy done by licensed professionals. Professionals should have enough skill and knowledge of road design. Otherwise, the design problem results in quality and maintenance problem that leads to resource wastage as well as not durability due to this sustainability is under problem. Also, the mobility and accessibility resulted from the design problem.

Roads perform an important connecting function for the community. At the same time their design, construction, operation, and maintenance are not always easy from the point of view of sustainability(Thorpe, 2012).

#### 4.4.10 the city road maintenance condition

Table 4.12 road maintenance condition

Does the road was maintained regularly

| Category       | Frequency | Percent |
|----------------|-----------|---------|
| Yes            | 103       | 26.1    |
| No             | 284       | 72.1    |
| Missing system | 7         | 7.4     |
| Total          | 394       | 100     |

According to the survey result from the table 4.12 above, 103 (26.1%) of the respondents were answering the question yes; the constructed road was not maintained and 284 (72.1%) answered that the road was maintained. The reason why the road was not maintained key informants from the municipality and road authority revealed that due to a shortage of budget. Other in-depth interviews answered that not an only budget shortage, but negligence, and there was no plan for maintenance. From FGD discussants revealed that in the city many road infrastructures need maintenance. But, no action was taken for this reason road deteriorated and contributes to a traffic accident. Routine or periodic maintenance was the main component of the road

infrastructure construction phase. Sustainable road infrastructure construction passed through phases of the plan, design, construction, operation, and maintenance to achieve sustainability in road infrastructure development. Any construction project passing through phases of plan, design, and after construction should need maintenance. Otherwise, sustainability is not guaranteed.





Fig. 4.7 maintenance problem

Finally, urban infrastructures are a set of engineered facilities including water, transportation, energy, and buildings. These infrastructures as a system influence the emergent performances of urban systems, and the performance affects future infrastructure decisions. Because of the unsustainable practices of developing urban infrastructures, environmental risks (e.g., resource depletion, groundwater depletion, and greenhouse gas emissions) and public health impacts are becoming significant. To change how cities and infrastructures are the built-in pursuits of sustainability, innovative infrastructure technologies and designs are emerging these days. (Worku, 2011). While roads are important transportation and communication links, there are some concerns about their sustainability aspects(Thorpe, 2012).

Sustainable Road Infrastructure Development could be designing, building, operating, maintaining, and deconstructing road infrastructure members in a way that balances the societal, economic, and environmental concerns necessary to sustain human justice, diversity, and the functionality of the natural environment.

The current study shows that to some extent applying the sustainability concepts in road infrastructure development in the city. Although there were many things lost while designing,

construction, operating, and maintenance phases of road infrastructure development from the point of sustainability.

The major challenge to sustainability in the road infrastructure of the city was land use development planning: because all activities were overlaid on the land. The study shows that the land use development plan of the city was a problem with the inadequacy of road plans to provide the integration of road, drainage, and utility infrastructure. The plan should not incorporate parking spaces, pedestrian walkways, minibuses', and bus stopping spaces. From this and others there were many negative impacts on the city residents were suffering. The other problem regarding sustainability was ineffective institutional integration and coordination of municipality and utility organizations to implement the design and construction of road and utility infrastructures in integrated infrastructure planning service standards. There was also a lack of routine and periodic maintenance of roads causing environmental problems and difficulty for road users. The topography of the city was as such difficult and caused many traffic accidents. There was no policy and standard manual or document available in the municipality to implement the required design and construction for road infrastructure as well as utility infrastructure. The study also shows that there were unavailable currently applicable survey instruments; such as total station, theodolite, and GPS as well as skilled staff as.

For any infrastructure design and construction, there were reliable guidelines and policy frameworks, strategic plans, and urban plan principles at the international, national as well as local levels. But there was a problem to implement those guidelines, policy frameworks, and principles in road infrastructure development sustainability point of view. In addition to this weak institutional integration and coordination, no accountability and negligence of professionals, as well as the regulatory body, were great challenges to achieving sustainable road infrastructure development in the municipality, utility infrastructure sectors, and road authority. The consequences of all this resulted in the cutting of off-road sections after construction to install utility infrastructures, faulty design and reconstruction of road and utility infrastructures, leads much more resources being wasted. In this regard, road infrastructure should not be attained sustainability as a required goal. Because of road infrastructure development is a prerequisite for other infrastructure development. From the above issues, the road infrastructure in the city was not satisfactorily sustainable. Because road infrastructure sustainability dimension

is very wide in concept and it comprises road infrastructure development viewed as socially, environmentally and economically.

## CHAPTER FIVE

### CONCLUSION AND RECOMMENDATION

#### 5.1 Conclusions

Roads perform an important connecting function for the community. At the same time their design, construction, and operation are not always easy from the point of view of sustainability. Achieving sustainability in this process requires the undertaking of initiatives such as sound environmental management, water-sensitive urban design, use of advanced and recycled materials, and environmentally responsible project management and construction. The contribution of such factors to a particular road project can be different from alternative options for constructing and managing the road(Thorpe, 2012). Road construction is largely done using public finance. Encouraging sustainable road construction with public funds can be done by municipalities that are in charge of overseeing road infrastructure.

This study has made an effort to assess urban road infrastructure sustainability development and challenges *wolita sodo* city. By the same token, it has assessed the roles of road infrastructure for the community, challenges, opportunities and problems, and factors affecting the effective construction of road infrastructure. The study has been undertaken with the covert intention of exploring the asset, skill, attitude, knowledge, and awareness level of participation of the community in sustainable road development.

The research finding observed that in developing sustainable road infrastructure social, economic, and environmental criteria. Especially the aspects of safety guarantee of construction, maintaining quality, health, reforestation, flood mitigation, and noise.

About the first objective, the existing or physical defects or operation of road infrastructure the finding was confirmed to be good condition, because it gives access to facility and services, and increase business activities. Many the road segments were constructed with asphalt pavement, cobblestone, and gravel to facilitate transport activities.

The second objective of the study was to examine whether the existing road infrastructure is integrated with other utility infrastructures. From the designing dimension, it was found that stakeholders design their projects independently and do not communicate their designs with each other unless one asks or construction is started. Moreover, there were no standards or manuals which were common to all stakeholders. Lack of clearly stated rules or regulations or any legal conditions which suggest coordination among service providers were also found to be causes for the lack of strong integration between stakeholders. The findings also confirmed that there was still loose communication during implementation due to a lack of accurate information about the location, size, and type of utility lines and negligence and carelessness of service providers in communication.

The third aim of the research was to analyze sustainability in road infrastructure from social, economic, and environmental dimensions. The findings also recognized that the road projects created some common developments such as improvement in accessibility, increase in commerce, employment opportunities, increase land value, increase in renting houses, and reduction in travel time. However, the concept of sustainable road infrastructure development is broad in its dimension, for this reason, road infrastructure in the city was not satisfactorily to decide sustainable. So, the road infrastructure development in the city was congested by many challenges. The major challenges identified were design, construction, and maintenance; inadequate road capacity for users or transportation systems; topography; financial constraint; land use development plan problem; weak intra-sectoral integration and coordination; disintegration of road and utility infrastructures; reference and implementation of structural plan problem.

This study was intended to assist decision-makers in selecting the most appropriate road infrastructure design from the standpoint of sustainability. It aims to take into account the limitations and constraints imposed by local planning systems, design standards, and codes of practice as much as possible. When choosing design requirements for road infrastructure, this will necessitate an understanding of the complexities of sustainability principles.

## **5.2 Recommendations**

The city infrastructure sustainability and challenges analysis has resulted in major conclusions as indicated above. The following recommendations are given based on the conclusions:

Various urban projects contribute to the development of urban infrastructure. They encompass a very broad group of projects, covering urban planning, urban design and architecture, transport studies, economics, ecology, geography, sociology, water management and engineering, waste management, energy engineering and economics, landscape planning, and building architecture. The municipalities need methods and tools for evaluating project sustainability(Zavrl & Zeren, 2010).

- ❖ Decision-makers at a local level need to achieve a common understanding of sustainability and related criteria for decision-making in urban planning and design dealing with infrastructure. In this regard, the city professionals, municipality, and city administration have a great role in sustainable road infrastructure construction and evaluation of infrastructure sustainability.
- ❖ Utility infrastructure is a crucial element of the spatial development framework for regions and municipal units because it facilitates the living environment, comfortability, and safety(Li & Yang, 2021). At the same time, road infrastructure is a prerequisite for other infrastructure development and should need great attention because all other infrastructure developments follow it. Therefore integration of them is a new agenda for sustainable development. Professionals, city administrators, the community, and other stakeholders should have awareness of road and utility infrastructure integration with the sustainability dimension. Due to reduce resource wastage resulting from disintegration.
- ❖ Intera-sectoral integration, coordination, and cooperation are very essential for any infrastructure development.
- ❖ Road design and construction should consider the standards and criteria from a sustainability point of view as much as possible because road infrastructure is a prerequisite for other infrastructure development.
- ❖ Routine and periodic maintenance of road infrastructure is one of the road management activities. Therefore regular maintenance should be done throughout the lifetime is good for the management of road infrastructure. At the same time budget should be allocated for road maintenance as stated standard.
- ❖ The stakeholder, as well as community consultation and participation in any infrastructure development program, are crucial to ensure sustainable development. The finding of this study revealed that community participation plays a very great role in

identifying development queries and challenges that were raised in the compliant handling of the city and working in coordination with the community and concerned bodies for resolution perspectives. Urban road infrastructure development strategies can realize their full potential through active involvement and organization of urban people at the grassroots level. Community participation aims to enhance the skills and capacity of communities by promoting their participation in their development. Therefore, it is vital and timely to seek appropriate strategies that lead to deliberate actions on the part of the public and the private sectors to properly manage the relationships between urban road infrastructure development and community participation(M. L. Bekele, 2019).

- ❖ The land development plan should follow the city structural plan because all things are performed on land. Careful planning and management of land are vital for urban development as well as sustainable road development.
- ❖ For any urban project work, there should have enough reference guidelines, policy framework documents, essential survey equipment, skilled professionals, and the commitment of the administrative body and staff are great role to ensure sustainable road infrastructure and sustainable development.
- ❖ Finally the researchers for further study on the sustainable road infrastructure construction to solve the above-stated problems of implementation putting to ground level and bring infrastructure integration to ensure sustainable road infrastructure development.

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## APPENDICES

### QUESTIONNAIRE AND INTERVIEW

#### **Part one**

##### **General Background Information**

The questions below are related to your organization and yourself. Please indicate your response by ticking (✓ or ×) the appropriate box or by filling the blank spaces provided, as appropriate.

Your Location, Age, Educational status, marital, sex, and Occupation:

- 1 Location /Keble/ woreda: .....
- 2 Sex: male ☐ female ☐
- 3 Age: 15-24 ☐ 25-34 ☐ 35-44 ☐ 45-54 ☐ above 55 ☐
- 4 Occupation  
Gov't Employee ☐ unemployed ☐ Non-gov't employee ☐ other ☐
- 5 Educational status
  - Illiterate ☐
  - Literate
    - 1-4 ☐ 5-8 ☐ 9-12 ☐ certificates ☐
    - Diploma ☐ Degree ☐ above degree ☐
- 6 Religion  
Orthodox ☐ Protestant ☐ Muslim ☐ Other ☐
- 7 Your responsibility is
  - Keble/woreda/ leader ☐
  - Keble committee ☐
  - Religious leader ☐
  - Other specify.....
  - If you are a governmental worker, organization.....
  - Governmental worker ☐
  - Resident ☐
  - Businessman ☐

## Questioners translated to Amharic

### ቃለ መጠይቅ

1 ተቋም/ማህበረሰብ የምትወክለው:

- ማዘጋጃ ቤት ☐
- ወረዳ አስ/ር ቢሮ ☐
- ከተማ አስ/ር ቢ ☐
- ነዋሪ/ህበረተሰብን ☐
- ሌላ.....

2 በከተማ/በአካባቢዉ የመንገድ ሁኔታ እንዴት ነዉ?

3 የከተማ ነዋሪ ስለ መንገድ ፕሮጀክት ግንባታ ጉዳይ ተማከሮ እና ተሳትፎ አድርጎ ያዉቃል?

አዎ ☐

አያዉቅም ☐

• መልሱ አዎ ከሆነ, በምን ይሳተፋሉ?.....

• መልሱ አይደለም ከሆነ, ለምን? .....

4 የከተማዉ ዋና የመንገድ ችግር የሚባለዉ ምንድ ነዉ?

▪ የተደራሽነት ☐

▪ የጥገና ☐

▪ የተንቀሳቃሽነት ☐

▪ የዲዛይን ☐

▪ የጥራት ☐

ሌላ ከሆነ ይገለጽ.....

5 መንገዱ ስንገባ ከሌሎች መሰረተልማቶች ጋር ቁርኝት አለዉ?

አዎ ☐ አይደለም ☐

አይደለም ከሆነ, ምንድነዉ ችግሩ ይገለጽ?

.....

6 የተገነባዉ መንግ ለህብረተሰቡ ኢኮኖሚያዊ ፋዳ አለ?

ጉልህ ሚና አለዉ ☐

በከፊል ነዉ ☐

በጭራሽ ☐

መልሱ ጉልህ እን በከፊል ከሆነ

▪ በቀላሉ የገበያ ተደራሽነት ነዉ ☐

▪ በአካባቢዉ የንግድ እንቁስቃሴን ያቀላጥፋል ☐

▪ ለትም/ት ቤት፤ለጤና ጣቢያ እና ለሎች አገልግሎቶች ተደራሽነት ☐

- የዞንና እና የክልል ግንኙነት ያጠናክራል ☐
- ሌላ ካለ፣ ይገለጽ .....

7 የመንገዱ ኢኮኖሚያዊ ጠቀሜታዊ ምንድነው?

- የንግድ እንቅስቃሴን መጨመር ☐
- የጉዞ ዋጋ ቀንሶል ☐
- ሥራ ዕድል ፈጥሯል ☐
- ተደራሽነት ☐
- የጎዞ ሰዓት ቀንሶል ☐

8 መንገዱ የእገረኛ መረማመጋ ተገንብተዋል?

አዎ ☐ አልተገነባም ☐

9 መንገዱ የጎርፍ መሄጃ ተገንብተዋል?

አዎ ☐ አልተገነባም ☐

10 መንገዱ የትራንስፖርት እንቅስቃሴን ከማቀላጠፍ ጋር ያለው ችግር ምንድነው?

የትራፍክ እንቅስቃሴ እና መጨናነቅ ☐

የህዝብ ትራንስፖርት መብዛት ☐

ለእግረኞች አስቸጋሪ መሆኑ ☐

የማቆሚያ ቦታ ችግር ☐

በአከባቢው ላይ ተጽኖ ማድረስ ☐

የአከባቢ ቢክለት ☐

ከፍተኛ ህዝብ ትራንስፖርት በሚበዛበት ጊዜ በቂ አይደለም ☐

11 መንገዱ በአከባቢው ላይ ያመጣው ችግር አለ?

አዎ ☐ የለም ☐

አዎ ከሆነ፣ ምንድነው የሆነው?

12 የተገነባው መንገድ ሁሉንም የህብረተሰብ ክፍል ምቹ ተደርጎ ነው ወይም ዲዛይኑ እና ግንባታው ህጻናትን፡አካል ጉዳተኞችን እና በትልቅ ዕድሜ ክልል ያለሁትን ታሳቢ ያደረገ ነው?

አዎ ☐ አይደለም ☐

13 በመንገድ ክልል ላይ ያለውን ንብረት የማስወገድ ህዴት ለየትኛውም መንገድ ግንባታ ትልቅ ተግዳሮት ነው :: ሰዎች የካሳ ክፍያ ወስደው ከመንገድ ክልል ያለውን ንብረታቸውን ለማንሳት ደስተኞች ናቸው?

አዎ ☐ አይደለም ☐

አዩደሉም ከሆነ ለምን? .....

14 በከተማዉ የመንገድ ግንባታ ሁሉንም የዲዛይን ስታንዳርድ እና ክራይተሪያ ታሳቢ ያደረገ ነዉ?

በትክክል ☐ በክፊል ☐ በጭራሽ ☐

መልሱ በክፊል እና በጭራሽ ከሆነ ለምን?

.....

15 የተገነባዉ መንገድ የትራፊክ አደጋ ለመከሰት መንስኤ አለ?

አዎ ☐ አይደለም ☐

አዎ ከሆነ ምንድነዉ ምክንያቱ?

ለእግረኞች ምችት እና የሚያቀላጥፉ ነገሮች ያለመዘጋጀት ☐

ጥሩ ያልሆነ የመንገድ ግንባታ ☐

መደበኛ እና ጊዚያዊ ጥገና ወይም የመልሶ ማልማት ያለመኖር ☐

የመንገድ ተጠቃሚዎች ግንዛቤ ችግር ☐

ሌላ ካለ ይገለጽ .....

ምን ዓይነት መፍትሄ ያስፈልጋል አደጋዉን ለመቀነስ?

.....

16 የመንገድ ጥገና በጊዜ ተደርጎ ያዉቃል?

አዎ ☐ አይደለም ☐

አይደለም ከሆነ ለምን?

.....

17 ለቀጣይ ምን ዓይነት ርምጃ ያስፈልጋል ብለዉ ያምናሉ ለመንገድ መሰረተ ልማት ቀጣይነት መለያ እና

ለቅድመ ሁኔታዎቼ ህዴት?

.....

## Questionnaires for respondents

1 Institution/society you are representing:

- Municipality ☐
- City administration office ☐
- City/ woreda's administrative office ☐
- Residence/community ☐
- Other.....

2 What is the condition of city constructed road?

- Good ☐
- Fair ☐
- Poor ☐

The city's residents were consulted and participated in the road project selection and construction?

Yes ☐ No ☐

- If Yes, by what? .....
- If not, why? .....

4 The major problems with the road in the city are due to?

- accessibility ☐
- mobility ☐
- quality ☐
- maintenance ☐
- design ☐

18 The constructed road is integrated with other utility infrastructures?

Yes ☐ No ☐

If no, what is the main reason?

.....

6 The constructed roads contribute to the community's economic well-being?

Significantly ☐ Partially ☐ Not at all ☐

If your response is significantly or partially

- provides easy market access to the community ☐
- Facilitate and support trade market within the road influence area ☐
- Increase access to schools, health centers, and other services ☐
- Increase zonal and regional connectivity ☐
- If any other, please specify .....

7 What is the economic input of the constructed road for you/ the community?

- Increases businesses activities ☐
- Job opportunity ☐
- Reduce travel time ☐
- Reduce travel cost ☐
- Accessibility ☐

8 T road has a pedestrian walkway

Yes ☐ No ☐

9 The road has with drainage channel

Yes ☐ No ☐

10 Road problems related to transportation facility?

- Traffic Movement and Congestion ☐
- Off-Peak Inadequacy of Public Transport ☐
- Public Transport Crowding ☐
- Difficulties for Pedestrians ☐
- Parking Difficulties ☐
- Environmental Impact ☐
- Atmospheric Pollution ☐

11 Do the constructed roads have environmental problems in the city?

Yes ☐ No ☐

If yes, what problem is happen?

- Cause of cutting the huge amount of trees and Cultural heritage damage ☐
- Cause of resettlement for a large group of peoples ☐
- Air pollution ☐
- Sound pollution ☐
- Other specify.....
- Cause flood ☐
- causes Land slide ☐

12 The constructed road is safe for all age groups of people or does the design and construction consider children, disabled and old age people?

Yes ☐ No ☐

13 The removal of right-of-way obstructions is one of the most challenging aspects of any road construction project. Are the people happy with the compensation they received for having their property removed from the road section?

Yes ☐ No ☐

If, no why? .....

14 The road construction in the city considers all the design standards and criteria?

Significantly ☐ Partially ☐ Not at all ☐

If, partially or not at all why?

.....

15 In the city constructed roads contribute to traffic accidents frequently happen?

Yes ☐ No ☐

If yes, what is the reason?

- Lack of provision of safety and other facilities for pedestrians ☐
- Poor quality of the constructed road ☐
- Lack of routine and periodic maintenance or rehabilitation ☐
- Lack of awareness of the road user ☐
- Any others, please specify .....

What measure is required to reduce traffic accidents?

.....

16 Do you believe that built roads are maintained regularly?

Yes ☐ No ☐

If no what is the main reason?

.....

17 What measures do you recommend for future road identification and prioritizing processes for road infrastructure sustainability?

.....

### Interview Questions for municipality and road sectors/authorities

1. Do the road constructed with design standards and criteria? If not what is the reason?
2. The constructed road is integrated with utility infrastructures? If not why? And what problem is happening due to disintegration?
3. The municipality is good integration, coordination, and cooperation with respective utility sectors? If not, what is the reason? What solution is needed?
4. The constructed road is in a good condition and serves the community?
5. Is the community consulted directly by the municipality or road authority when/before projects are chosen?
6. How does the municipality or the road authority ensure that the public's needs are met? Is it true that the road authority conducts its public need evaluation in terms of road demand?
7. What strategy, criteria, or procedure does the municipality/road authority employ to prioritize the road projects that have been identified?
8. Are there any gaps or obstacles that the municipality or road authorities experience while putting the standards into practice? If so, what gaps/challenges exist and how serious are they? Is there any strategy to alter the criteria so that the impact of such difficulties can be reduced or avoided?
9. What are the positive and negative impacts of the constructed road on the community?
10. Does the municipality or road authority believe that the completed road developments are having the intended economic impact? What conclusions have been reached?  
If so, how are they assessed?
11. Do newly constructed roads perform as expected to the end of their useful lives? What are the grounds behind this if not? How does the municipality or the road authority deal with such problems?
12. Does the public work with the municipality or the road authority to ensure that road-construction projects are completed successfully? If not, why?

13. Is there a mechanism for regions and road authorities to communicate with each other and integrate?
14. Are there any issues that have arisen as a result of the lack of integration?
15. Is there any intention on the part of the road authority to close these gaps?
16. Is the road authority required to re-evaluate the criterion after a certain amount of time has passed? If so, what conclusions have you reached? What kind of advancements was made?
17. Is the road authority certain that the desired goals are being met in the road projects' original plans? Why isn't this happening?
- 18 Any suggestion/recommendation regarding all the interviews or any other?

