JIMMA UNIVRSITY

COLLEGE OF SOCIAL SCIENCE AND HUMANITIES

SCHOOL OF GRADUATE STUDIES

DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL STUDIES

ACCESS AND QUALITY OF COBBLESTONE ROAD IN ENHANCING URBAN DEVELOPMENT, THE CASE OF JIMMA TOWN

A Thesis submitted to School of Graduate Studies, Jimma University in partial fulfillment of the requirement for the Degree of Master of Arts in Geography, specialization in Urban and Regional Development Planning

OCTOBER, 2016
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A THESIS SUBMMITED TO THE GEOGRAPHY AND ENVIRONMENTAL STUDIES SCHOOL OF GRADUATE STUDENTS ,OF JIMMA UNIVERSITY IN PARTIAL FULFILLMENTS OF THE REQUIREMENTS FOR MASTERS OF ART (M.A) IN GEOGRAPH, SPECIALIZINIG IN URDP

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DECLARATION

I undersign declare that is my original work and has not been presented for a degree in any other university, and all of the materials that used for this study have been properly acknowledged.

Candidates

Name _____signature_____Date_____

CONFIRMATION

This thesis has been submitted for examination with my approval as a thesis advisor.

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BOARD OF EXAMNATIONS

As member of the Board of examiners of the M.A thesis opened examination we certify that, we have read and evaluated the thesis that prepared by Wondimagegn Wolde and examined the candidate. We recommend that, the thesis accepted as a fulfillment of requirement for the Degree of masters of Urban and Regional Development planning/URDP/.

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Acknowledgement

First and for most I would like to express my deepest gratitude to my Advisor Dr. Kenate Worku for his patiently treatment since this program began. Then, my co-advisor Ato- Emnet Yitna for his invaluable comment, suggestion and feedback. Without their constructive comments the study would not have been successful.

I am very much indebted to thank Dr.Kidane Koyas, for his fatherly advice and encourage me for everything including material support and constructive idea.

My gratitude also goes to Mitiku, who helped me by taking the cobblestone roads picture voluntarily. My friends Kidist ,Melaku, Mesfin.Getinet ,Tariku and Gitme are also thankful for their moral and material supports throughout my study.

Finally, I really grateful to, Abdul Hafis Ahmed, Tigistu and ,Ato Bedasa for their heart fully support by providing general information about cobblestone roads paving procedures, both challenges and limitation that faces on the sector during interview.

Abstract

The aim of this study was to investigate the access and quality of cobble stone road to enhance urban development, the case of Jimma town. The study employed a cross-sectional research design .The primary data was collected by using questionnaire interview and field observation Quantitative data was analyzed by using mean, frequency distribution and percentage. The results of each point that obtain in both primary and secondary data were discussed. The ideas of each tables, figures and pictures these listed in this paper were interpreted in order to make the information brief and meaningful. Through process the roads of the town both in type and length to some extent were employed as secondary data that was current inventory data gathered by municipality .The main finding of this study concerning accessibility was obtained by calculating of the given roads to total household and population of the study areas and the gap was clearly identified. The questionnaire was employed the systematic sampling method. Because the numerical data of households in the study area was available. Accordingly 360 households were taken as the sample size from the three kebeles. In addition to this, roads map of the town was employed to show the access gaps. The quality issue was interpreted based on result of community response by means of questionnaire and the statistics methods. The result shows that, absence of drainage, lack of the stone selection, absence of traffic sign, lack of community awareness, absence of municipality follow up, construction bid acceptance issues and other factors were listed as the major finding of cobblestone roads quality parameters that results deterioration of roads in the town. In addition to the above accessibility issues in the town, cobblestone roads were paved in the center of the city and peripheral or the outer kebeles were not equally benefited from the sector. This shows that, inner city was enhanced in accessible than the outer or peripheral parts .Which means, the cobblestone technology was very recent in the town. This was other finding of the research in cases of accessibility of the cobblestone roads in the study area .Finally the research tried to conclude and gave the directions of the problem solving mechanisms as a recommendation. In the recommendation part; municipality higher officials, communities and organized pavers were suggested as the responsible bodies in every activities to keep access and quality of cobblestone roads.

Acronyms /Abbreviations

BASMAA	Bay Area Storm water Management Agencies Association
CBO	Community Based Organizations
CIPs	Capital Investment Plans
CPCO	Cobblestone Project Coordination Office
CSCBP	Construction Sector Capacity Building Program
CPDO	Community Participation Development Office
DFID	Department For International Development
DTTS	Department of Transport, Tourism and Sport
DTTP	Development Team Training program
DECLG	Department of Environment, Community and Local government
ERA	Ethiopian Roads Authority
FDRE	Federal Democratic Republic Ethiopia
GIZ	Gesellschaft für International Zusammenarbeit
GMF	German Marshal Fund of the United States
IBRD	International Bank for Reconstruction and Development
I LO	International Labor Organization
LDC	Local Development Committee
MOFED	Ministry of Finance and Economic Development
MOE	Ministry of Education
MSE	Micro and Small Enterprise
MUDC	Ministry of Urban Development and Construct
NGO	Non-Governmental Organization
SPSS	Statistical Package for the Social Science
TVETA	Technical and Vocational Education and Training Agency
ULG	Urban Local Government
ULGDP	Urban Local Government Development Project
UN	United Nations
UNCDF	United Nations Capital Development Fund
WB	World Bank

Definition of Terms

Access :- The coverage of roads to the given community**.**

Chiseling :- Shaping of stones for street/road/ pavement**.**

Kebele :- The smallest administrative unit in cities/ Jimma town**.**

Paving :- Covering of roads and other Building by curved rocks**.**

Quarrying : Dig up/extract the rock materials for building purpose**.**

Town :- The small city which has it's own municipality.

Transporting: - Taking materials and people from one place to another places.

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CHAPTER ONE

1. Introduction

1.1Background of the Study

Urban development process has taken place in the 19th century due to industrial revolution in the Western Europe. This results an increasing of urban population and needs of infrastructure. Since that period, street construction and other facility fulfillment was began in order to satisfy utility of the urban community (Z.Ljubimir, 1989).Urban development has been characterized by an alternation between systematic planning and innovative strategies to implement an integrated urban development .This helps to ensuring effective allocation of scares resources and fulfill needs to the local community *(*Weldegebriel M,2012).In the urban development process infrastructure planning plays a great role. These infrastructures consists of, roads, /cobblestone ,asphalt ,gravel roads/, drainage, solid waste landfills, housing, net working, urban business development and others can strength cities capacity to self-govern and necessary to create conditions for economic development (Tegegne, Clacey and Godden,2011).Thus roads are engine for other infrastructure development. For instance cobblestone pavement as any infrastructure has been contributing to solve urban road problems for a century in western world. *(*Schmidt, 1966).

Historically, Cobblestone roads construction was the earliest experience of many cities in Europe, United States of America and other advanced parts of the world. Cobblestones like any infrastructure played a central role in the urban environmental development at the turn of the 20th century. Hence using stones for paving streets is not a new idea in the world (Treskon,2006).For instance the development of cobblestone architecture and it's prevalence in western world is remarkable example of the interplay between the area's 19th-century in human history.

During that period, the granite shaped rock was used for wall pavement in addition to streets pavement and building of house (Swartou,1981).In the first half of 19th century the carved rock such as cobblestone provide the multipurpose use like street pavement ,building of house and canals by masonry or stone workers. Masons played great roles to build cobblestone structures in western world. Then, they advertised for other parts of the world. At that period the canals like Eric canal was the practical evidence of cobblestone technology in New York City. After the canal was

completed many of these imported masons purchased farms and made Western New York their home. They needed masonry work to supplement their farm incomes. This is probably the principal reason for so many cobblestone houses on or near edge Road and the area paralleling Canal east and west of Rochester in the present New York City (Schmidt, 1966).

In the third world countries particularly in Africa, the provision of proper infrastructure like cobblestone and other roads access and their quality issue consider as challenges for urban municipality to enhance urban development and create well designed urban environment (World Bank, 2005).In Ethiopian cobblestone technology is the newly emerging practices. The Construction Sector Capacity Building Program (CSCBP) started the Cobblestone Project in 2005 in a dual effort to create job opportunities and income for youth, and to provide attractive and long-lasting road and pavement in Ethiopian Ministry of Education (MOE, 2014). According to Ministry of Urban Development and Construction (MUDC, 2012) "one of the priority services selected by urban local government /ULG/ for improvement is improved road access through the construction of Cobblestone roads in the cities.

All participating Urban Local Government (ULG) have included Cobblestone road construction as part of the prioritized Capital Investment Plans (CIPs).Cobblestone road construction is comprehensively labor intensive **jobs** like quarrying, chiseling, transporting, and paving, as well as the production of tools needed and requires skilled labor. According to, Ministry of finance and Economic development, (MOFED,2010), Construction of road and cobblestone pavement strategies within the cities was one of the strategic direction of Ethiopian government since GTPI and coming GTPII programs. In addition to other infrastructure, paving cobblestones both in cities and towns is the strategic intervention in Ethiopia micro economic plan. This is given more attention including Addis Ababa and other towns of the country. In this regard, a huge skilled labor pull is being developed in the country (MOFED , 2010)

Road infrastructure is one of the problems observed in many urban areas of developing countries and especially in Ethiopia in general and jimma in particular. Lack of roads in urban and cities results negative impact for people living in surrounding. Because transportation is one of the important urban services, which influences and has an impacts on communities these living in cities

and towns (Sum. M, 2008).When the roads are constructing the access and quality issues must be considered. For instant the accessibility of cobblestone road has to meet social benefits from the radius of the city center to out ward On the other hand the quality of paved road is one of the important measurements to create qualified urban environment. But in Africa the provision of proper infrastructure like cobblestone road access and their quality issue consider as challenges for urban municipality to create well designed urban environment (World Bank, 2005).

1.2 Statement of the problem

In many cities in the developing world, Africa in particular, the provision of proper infrastructure such as road access, sanitation, drainage ,water supply and others lags behind the growth of the built-up area (Kalimba, 2007). In order to improve urban infrastructure development or to build well planned urban area, the most important and primary conditions was fulfilling urban amenities. But most of developing world it failed under the problems (UN, Habitat, 2007).Since the establishment of cobblestone project in Ethiopia, the quality and access issues were seriously observed as problems. Jimma as a town, cobblestone technology practiced for the last seven years. Since it's implementation in 2001 the access and quality problem issue were clearly observed by the communities and sector professionals of the town. One of the kebele official explained the problem of as follows;-"At the beginning the cobblestone pavement was standardized but gradually due to lack of eligible material ,contractors, community awareness ,trained pavers and paving technical situation, the roads are deteriorating , Ato bedasa, Hermata kebele administrator. According to the information the quality and access related problems were also pointed out as follow.

The cobblestone paved roads are less durable and lacks long-lasting to meet objective of the sector. As everywhere observes the paved roads are deteriorating from time to time by different reasons. The absence of traffic sign in order to control load was one of the problem that faced on the sector within the town. There are also materials selection related issues during the period of pavement such as stone type and size, sands, soil selection, contractors, drainage, etc.

The cobblestone roads were paved only in the limited kebeles out of the seventeen kebeles within the town. The peripheral areas of the town or kebeles didn't benefited from the sector and the population of the peripheral areas are less access of cobblestone project as compared to the central town .This confirm that, the cobblestone roads were paved with in the short distance from the center. In Some kebeles, the coverage of cobblestone roads is high and in another kebeles the

cobblestone paved roads are very low or completely unpaved. For example the peripheral kebeles such as, Hora gibe,Ifabula,Bore and Kito furdisa are still no cobblestone roads at all . In addition to this, most kebeles of the town, were minimum or no cobblestone access. This information generalized there is unbalance proportion between population size and cobblestone roads accessibility in the town. Consequently, there is access gap of cobblestone pavement within the kebeles by different reasons. That is why the research believes as a problem and tried to identify and show directions for solving mechanism.

1.3 Objectives of the Study

1, 3.1 General Objective

The study attempted to assess the access and quality of Cobblestone roads in enhancing urban development in jimma town.

1.3.2 Specific Objectives

- To describe the role of the cobblestone roads for urban development in the study area.
- To show the gap between cobblestone and another roads accessibility among kebeles.
- To identify the quality parameters /main reasons for deterioration /of the cobblestone paved roads.
- To identify the role and responsibility of municipality, the community and other stakeholders in order to keep and managing the quality of cobblestone roads.

1.4 Research Questions

To address or to meet the research objectives, the research focused on the following basic questions:

1. What is the role of Cobblestone roads construction for urban development?

2. What looks like the access of cobblestone roads among kebeles?

3. What are the parameters and main reasons for the deterioration of the Cobblestone roads?

4. What should be the roles and responsibilities of the municipality and the participation of the

community in order to keep the quality of Cobblestone roads?

1.5 Significance of the study

The researcher believes that, this thesis can show direction about factors that affect quality and accessibility of cobblestone roads in the town .Cobblestone paved roads can enhance access of transportation and reduce the transportation cost. The study assessed the major factors that affect the durability of cobblestone roads in the town. Then the gap of every roads and their accessibility in person per-km was other significance of this study to identify the coverage. The study was tried to show the gaps of cobblestone pavement among the kebeles and identify the reason.

To enhance urban development roads infrastructure plays a great roles if it fulfilled both quality and access. There for, the study could motivate the stakeholders (municipality, community and others) and created awareness for further reduce the problems. In the study, contribution of cobblestone roads in enhancing urban development was confirmed.

This is fact that, Cobblestone road construction sector is a new emerging practice applied in some selected cities of Ethiopia including jimma and other towns recently .So researches were not further done on this related issues. There for the study can shows direction to further studies.

1.6 The Scope of the Study

Jimma town is suffering from immense and complicated infrastructural problems. For instance urban street/road infrastructure is the dominant one. As integral parts of the town, reflected problems that are seen in similar cities and towns are mainly infrastructural problems. This research was limited more on the Cobblestone and other roads relatively in the Jimma town in each kebeles particularly Hermata, Awetu Mendera and Ginjo Guduru purposely. The reason for selecting these kebeles is it's relatively high pavement of cobblestone roads as compare to other kebeles or the peripheral kebele. The study focused on how the Cobblestone roads are constructed and issues related with the access and quality in terms of rock type, service period or duration vehicle traffic, paving standard, drainage and total coverage. As a case study, the research delimited Jimma town. The three kebeles that taken as a sample size was the main focused area of the study.

1.7 Limitation of the Study

The drawback of this study is mainly availability of data, which was mostly expected to gather necessary information about accessibility and quality parameter of the cobble stone from municipality and kebeles. But these data were not available for the expected time and even the very important data this research need was un fulfilled. For instance the numerical data of roads, in type and their length in each kebeles were the important one for this study to show the gaps among them and accessibility of these roads to the community. This research was tried to identify the quality parameters that municipality believed .Based on these quality parameters, the questionnaires was prepared and distributed to the community Cobblestone as the recent technology quality measurements were not well known. As a result, some member of the community were not interested to list down or give the common problems that cobblestone faced .It may be political related issues. On the other hand time and materials restriction themselves were factors those affected for the study.

1.8 Organization of the thesis

This paper consisted of five chapters. The first chapter is an introductory part of the study. Thus in this chapter the background, statement of the problem, objectives, research questions, significance, Scope of the study and limitation are discussed. The second chapter reviewed the literature in which the frame works of Cobblestone pavement, road access and quality issues, and others were dealt with. The third chapter described the research design and methodology. The fourth chapter is more focuses on discussion of the issues (access, quality parameters and cobblestone roads and their contribution in enhancing urban development) in detail or it is analysis part of the research. Finally the fifth topic focuses on summary findings and Recommendation related issues.

CHAPTER TWO

2. REVIEW OF RELATED LITERATURE

2.1. Conceptual and Operational framework

A conceptual framework is a set of concepts that carry out the research in a structured manner and adequately explain the study**.** This research relies upon the structure of conceptual model as follows.

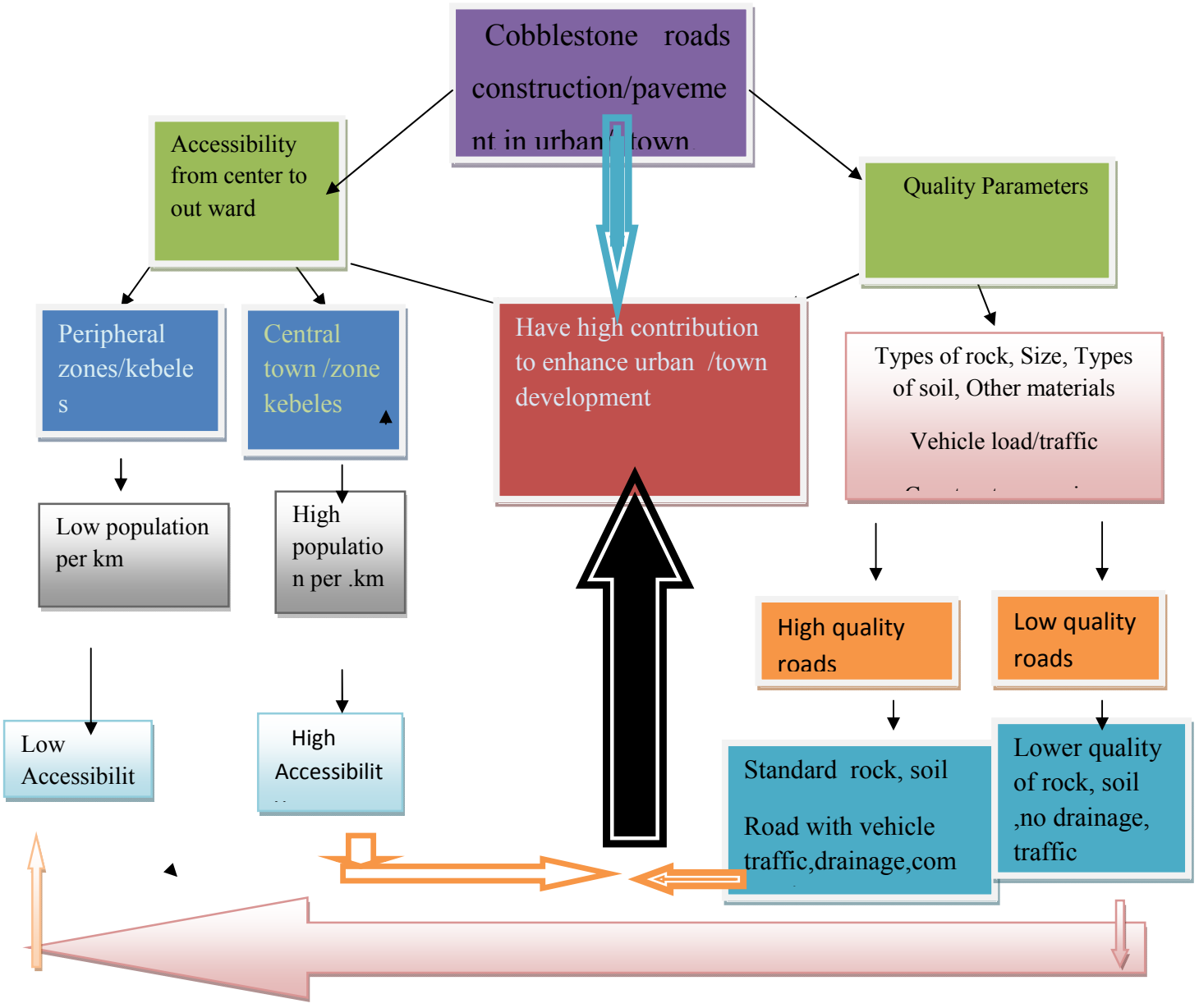


Figure 2. 1. Conceptual framework ; -Source; the Author survey, 2016).

The above fig2.1, conceptual framework reflects that, to enhance urban development, construction of cobblestone road is necessary if it fulfills the basic parameters of quality measurements and encompasses high accessibility to the local community. But due to the absence of adequate quality measurements or dependent variables such as rocks, soil, road trafficking and other factors, the quality might be reducing the urban development. Other dependent variables were location of an area.

This indicates that, as we go far away from inner city to peripheral areas, accessibility of the cobblestone roads became very low despite its distance from the radius of central town. Which means the paved roads in the central town is better accessible than the peripheral kebeles in the study area. The black and large upward arrow shows that, using the standardized parameters and highly accessibility of cobblestone roads within the town has higher contribution to enhance urban development. The thickness of horizontally drawn arrow at the fig (2.1) bottom indicates that, low quality parameters reduce to enhance urban development and cobblestone roads in the town has lower access in the peripheral area as contrast to the inner city.Which means the roads were built within the short radius from inner city.

2.1.1 Definitions and concepts of cobblestone

- **Encyclopedia Britannica** cited in (Tiwari**,** 2011), **Cobblestones** are stones that are frequently used in the pavement of early streets.
- **Treskon, 2006**) **Cobblestone:-**is refers to a rounded water-worn stone used for paving streets . It is larger family of paving stones or the mental construct of stone blocks.
- **Kalimba**, 2007) **Cobblestone**;- is a kind of concrete block that used to pave the streets in order to solve urban roads problem in slum area .
- **Swartout**,1980) **Cobblestone:-** Are simply fist-sized rocks. Fieldstone" and "lake-washed." Fieldstone cobbles are sub angular to rounded rocks that vary in average dimension from approximately 10 to 20 cm. These cobbles are derived from glacial till and outwash deposits and many litho logy are represented in a typical fieldstone wall: sandstone, limestone, quartzite, gneisses, and coarse and fine-grained igneous and metamorphic rocks
- According to **Bay Area Storm water Management Agencies (BASMAA**, 1999) Cobbles are larger granular materials and their sizes generally range from approximately 6" to 24" diameter and are available in a variety of stones and colors Cobbles are useful as a permeable pavement in areas where little traffic is desired.

- **Ethiopian Roads Authority (ERA,2011)** defined Cobble Stone (Dressed stone) as Cubic pieces of stone larger than sets, usually shaped by hand and built into a road surface layer or surface protection.
- **Operational definition or term: Cobblestone;-** is a stone that carved from hard igneous rock (basalt ,obsidian ,and granite)which formed after cooling of the magma on the surface of earth that cannot broken easily and used for paving street in order to solve road problems within urban short paths .

2.2. Theoretical framework of the study

It is fact that, cobblestone is recent technology that require theories on these related issues. However there are two theories that hold up the founding of Micro and Small Enterprise and their contribution in development process. These are the classical and the Modern theories. The Classical theory states that poverty and the importance of MSE development correlate positively. This theory focused on the relationship between levels of income and the growth of MSE. The theory hold up in highly populated country, economic development, be able to solve through the economic share of MSE. In other words, the higher proportion of people living in poverty, the more could contribute by MSE in reducing poverty. The foundation of MSE is to reduce poverty by creating jobs for youth like cobblestone paving, chiseling and others. The modern Theory postulates that, high level of commutative innovation, high level of corporation, flexible and specialization rather than MSE like cobblestone projects (Tambunan, 2006).

Theoretically cobblestone pavement technology had taken place as early as nineteenth century in west Europe and North America .According to this theory cobblestone is available as either roughly squared, unfinished blocks or as uniformly trimmed, highly polished tiles, Common cut stone, used for paving include blue or flagstone, marble, slate, granite blocks that considered as street pavement'(Jim Gibbons, 1999). Cobblestone had emerged as best suited to urban traffic throughout North America and Europe. The technology determined to solve urban roads problems and improve access, reliability and safety and to lower negative effects of transport on people and environment (Treskon, 2006).

2.3 Empirical data

2.3.1 Historical Background of Cobblestone

The historical foundation stone pavement take us back to 4000 BC in ancient Mesopotamia and by 2000 BC, flagstones were being used to pave village streets. Cobblestones were the traditional method of stone paving, being uncut and often water-worn stones or large pebbles about 150mm in size. Later hand-cut stone blocks were introduced. This paper takes and analyzes a certain type of cobblestone road, or stone block road. More specifically, it tries to analyze the cobblestone itself: its genesis, development, obsolescence, and occasional reuse. As the quote above indicates, the development of a specific form of road stone could (and would) be cited as an exemplar of rational Positivistic progress (Treskon, 2006).

Cobblestones techniques show a progressive refinement over the cobblestone era. This is Early, 1825-1835 according to (Schmidt, 1966). At that period the New York's regional architecture used this stones not for only road pavement but also for wall construction technology. The development of cobblestone architecture and its prevalence in America and West Europe counties is remarkable example of the interplay between the area's 19th century in human history and the bedrock and sacrificial geology of the area. These continents used the terms for the small pieces of the stone like sand which is available for building houses, Canal and the economic development projects .These countries used building cobblestone house as it's comparative advantage with building frame house .In order to reduce labor cost for wood and reduced, a particularly important factor in the inflationary labor markets that followed the Civil War during the periods they preferred cobblestone (Tenney, 1987).

This paper takes and analyzes a certain type of cobblestone road or stone block road. More specifically, it tries to analyze the cobblestone itself: its genesis, development, obsolescence, and occasional reuse. As the quote above indicates, the development of a specific form of road stone could (and would) be cited as an exemplar of rational Positivistic progress. However, these roads lost their primacy in the urban environment at about the same time the automobile overtook the horse as the primary means of conveying people and goods.

As the practices and concepts related to Cobblestones roads which were experienced in early nineteenth and late twentieth century in different cities of Europe, United States of America and Latin America, there is a lack of literature review for this topic. And how the Cobblestone road

construction was started in Ethiopia will discussed in detail as a review under this title even though there is also a lack of related literatures. There is some that Cobblestone Pavement is not really a new concept, even for Ethiopia, this technology was used over a century according to cited in (Azeb, 2011). This document described that Cobblestone in Ethiopia was first introduced by the French experts some 100 years ago during the construction of Ethio-Djibouti rail way. Beyond this fact however, this construction could not show any progress for a long period of time, and recently, the idea of Cobblestone has started again in different areas of the country in collaboration with the German Technical Cooperation of Engineering Capacity Building program.The Construction Sector Capacity Building Program (CSCBP) started the Cobblestone Project in 2005 in a dual effort to create job opportunities for youth, and to provide attractive and long-lasting road pavement in Ethiopian cities. Cobblestone projects include labor-intensive jobs like quarrying, chiseling, transporting, and paving, as well as the production of tools needed Ministry Of Education (MOE, 2014).As (UN-Habitat, 2013) described in its document, Cobblestones technology was introduced in Ethiopia by the France visitor who called Mayor, in Dire Dewa town. It is only recently (2008) that paving streets with Cobblestone was introduced to the rest of Ethiopian cities. In 2008 the initiative was started in Adama town as a pilot and up scaled to 19 World Bank supported (ULGDP second edition, 2011) and further spread to 140 regional cities and towns (Mulaw, 2015). And in terms of roads constructed or paved (as per the World Bank standard of meter width) between 2008-2012/13 more than 2,202 km of Cobblestone roads, taxi terminal, feeder roads and public squares have been built Addis Ababa, as a capital city of the country, is also the one which is implementing the Cobblestone road construction in its all Sub-Cities. And Addis is also the one which is covering almost most of the earthed roads with cobblestone.

the different researcher treated the cobblestone in different ways. This is obvious that, cobblestone road has socio-economic and political benefits for the local community. But due to lack of awareness within the stakeholders and other related issues, it deteriorates from time to time. The main factor for deterioration is, lack of management and maintenance problems in development country (Mulaw,2015) experience of Addis Ababa sub, city. Another research shows, that how the newly development of this technology has cost effective and fasten urban development in the 20th century (Treskon, 2006). Subsequently another searchers also treated the

low standard/low volume road and it's negative consequence for development in Ethiopia (zaid, 2011). Other researcher also realized that, positive impacts of cobblestone project in order to create jobs for youth plus women and for food security,(Azeb N,2011).

This research supports most of the ideas of the above Autos .Especially the statements that listed as a benefits of cobblestone project by Azeb N, factors for deterioration of cobblestone roads by Mulaw and impacts of low volume roads sited by (zaid,2011) above were major contributors of this study. But the particular difference of this thesis was focusing on the various parameters that determine quality and accessibility gaps or coverage of cobblestone roads to the community of the study area. For instance the quality that explained by (zaid,2011) was more gave attention on technical aspect of the road but this thesis highly determine the absence of quality in terms of rock type ,soil selection ,drainage ,contractor issues due to limited fund, huge vehicles and paving quality. There is also another research that done by (Mulaw B., 2015) in the experience of Addis Ababa sub city which was more depends on the management and maintenance, issues that related with budge allocation and farther shows how the community lacks in order to use this social over head capital properly. His thesis also supports factors that affect the quality of cobble stone which has partial similarity to this study.

But he more focused on management and maintenance issues. The quality of rock, materials and contractors related issues that affects the paved cobblestone roads were not further raised and discussed more. However this research included other factors that affect the roads quality and the access rate which is related to coverage of the cobblestone road with in the town. Which means the research focused on accessibility of cobble stone roads and the gaps of pavements among kebeles. In addition to this, the stone type, size, awareness of community, vehicle load and management related issues are considered under the study.

2.3.2. The Cobblestones Construction process

The nature of the Cobblestone roads normally depends on the preparation of road; such as cleaning and avoiding the upper soil, size, types of stone, the status, paving quality, side drainages position of laying the stones and fulfilling other materials are common procedures. If a single Cobblestone is displaced (scattered) from the normal position it is put, there is a possibility for the whole Cobblestones to displace. It's nature enables it to simply deteriorate or destruct if it is not constructed in quality as the stability of one Cobblestone in its place depends on the stability of the other. The edge or the end of the roads which has a connection or a join

with asphalt or earthen road can simply be destroyed unless strongly fixed with a cement or concrete as sited by (ERA , 2011).).

The curve stones should also be properly erected, stuck or fixed by cement and other materials in order for it to hold the Cobbles. If the joint area between the end of the Cobblestone roads and either asphalt or earthed road is not constructed with the help of big stone and cement, it will simply deteriorate and makes other Cobblestones to scatter as practically observed in the field.

2.3.3 The Quality and Status of the Cobblestone Roads

In developing country, every infrastructure has problems which are related in access, quality, and quantity and other. When these roads were constructed, the quality must be considered as a major deal because of the aim to reduce the number of Unemployment and to cover all the intra urban earthen roads with cobblestones. At the beginning people may not have any awareness about the characteristics of the cobblestone roads, their benefits and advantages to create wealth.

There for the government needs to give clear orientation about their responsibility. Because absence of awareness can bring great quality problems cited by (Mulaw ,2015). This research tried to investigate human related factors that affect cobblestone quality within the urban areas. These factors are vehicle controlling and Management, constructers or organized pavers, Materials types of rocks and others are expected finding of this research concerning quality through the data collected and the field observation.

2.3.4. The importance of cobblestone sector for urban development

Cobblestone paving has labor-intensive, creates jobs opportunities for construction entrepreneurs; uses natural and local materials and does not require imported machinery; does not depend on imported oil, as asphalt does; is cost-effective as compared to concrete or asphalt and this road can easily maintain than the asphalt road and has high durability. The road makes towns and cities more beautiful, have benefits residents and encourages tourism; is easy to maintain and has a much longer lifespan than asphalt roads (Tiwari,2011). Described the economic advantage of Cobblestone in his article as, “in asphalt road projects, maximum jobs are

given to foreigners because it is based on imported technology, and in Ethiopia, only Chinese companies are constructing asphalted roads.

CHAPTER THREE

3. RESEARCH DESIGN AND METHODOLOGY

3.1 .Description of study Area

3.1.1 The physical setting

Location:-Jimma town is located relatively North of Dedo ,south of Mana(yebu),West of Qersa and East of Seqa woreda as and the absolutelocation of the town is7°40′60″ N latitude and 36°60′00″E longitude(DTTP project of URDP and GIS Students,2015/16).

Climate and topography;- . The town has the average annual temperature of 16.2 °C and the average rainfall is 1099 mm (climate profile of the town, 2002). The town lies at the foot of mount Abajifar 2020m to the lowest of 1700m around Becho bore kebele above sea level. The town is commonly known by moderate climate which is sometimes called woinedega .The town is surrounded by highlands and can get rain fall in each seasons. The presence of rain and vegetation coverage makes the town as preferable for coffee production and makes greener to the town.

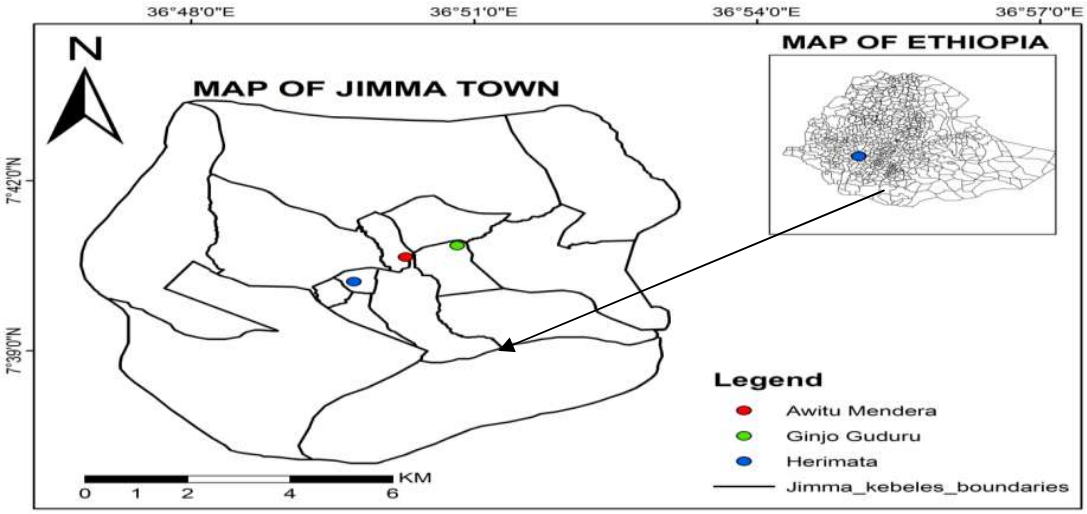


Figure 2: Location map of the study Area. Source ;(Ethio GIS data, 2016)

3.1.2 Demographic and Socio- economic profile of the town

Based on data obtain from construction and business office of the town, population of the tow is estimated to be 189,732 in 2007 E.C).The town is known by home of different nation nationalities and which is one of the popular town of the region. These people live together with

their varieties of believers and culture by tolerating one another. The economy of the community is based on commerce and different stakeholders' activities both in government and privet sectors. The town is center of commerce due to its coffee production and distribution.

3.2. Study Design and Strategy

The necessary data were collected during the field work and prepared to make suitable for analysis. Finally, analysis at different levels was carried out. Existing situation analysis was done to assess the performance of the existing system. Based on analysis result conclusion and recommendation for the study were drawn.

The research design that used for this study was across-sectional research design Thus; the required data was collected from municipality, kebele leaders and communities. These required data obtained by using various tools such as questioner, interview, observation and the analysis follows both qualitative and quantitatively (i.e.) through the use of statistical tools for data analysis, such frequency distribution.

3.3. Types and Source of Data

The data source of this study was both primary and secondary. Regarding primary source of data was obtained from the municipality, through questionnaire, semi structured interview and observation to obtain the necessary information about the access and quality related issues. Then secondary source of data was gathered from books, published and unpublished journals, magazines, bulleting and internet etc regarding on the same issues.

3.4. Target Population and Sample size

The target population of this study was permanent resident of the jimma town. According to municipality construction and business office, the town has currently seventeen (17) kebeles. As source from municipality, since development of cobblestone in the town, the paved road was accounted 30.1k.m .These roads are concentrated around central towns within a few radiuses rather than the peripheral kebeles.

There is mismatch of cobblestone accessibility among each kebeles due to wide extent of the town and newly practiced technology of this sector. This research focused on three (3) kebeles that are taken as an sample size. These kebeles are Aweto mendera, Gingo Guduru and hermata purposely. The total population of these three kebeles is 32491. which means Awetu mendera 13,217 , Ginjo Guduru 10,106 and Hermata 8, 951 respectively. In the level of household

Hermata 1089, Ginjo guduru, 1120 and Awetu mender 1400 according to the information obtained from the kebeles . The total number of house hold in the three kebeles was 3609**.** This research identified the parameters of cobblestone quality from municipality professionals. Then questionnaire was distributed for the community in household level as above indicated. The following formula was used to calculate sample size of households at 0.05 level of precision (Yamane, 1967).

That is , $n = \frac{N}{1+N(e)^2}$,

Where;- n. is sample size,

N. is total population and

e. is the level of precision.

Using the above formula the sample size of the household can be :

$$n = \frac{3609}{1+3609(0.05)^2}$$

This is approximately $n = 360.$

360; was the sampled household of the three kebeles. These, three selected kebeles were the purposely focused area. The reason that this research focused these kebeles was due to better cobblestone pavement as compared to the rest. For instance Mendera kebele is one of highly accessible than others.

3.5. Instrument of Data collection

Among the various instrument that can be used for data collection, that preferred by researcher was; questionnaire, interview/ semi-structured interview and observation to obtain necessary data's.

3.5.1 Questionnaire

Questionnaire was one of the instruments that used for data collection in some cases; this research believes that, the questionnaire has an option. Because, it was obvious that, the users of this infrastructure or the community can easily observes through their way in their locality about the quality of cobblestone and factors for deterioration. So that they had answer what they have

observed about the access and the quality of cobblestone in their surroundings. It is fact that, after quality parameters identified by municipality experts on the issues, the questionnaire was distributed to 360 households in systematic technique. It was very important to check the reality of the problem. They could gave comparative explanation of the project by comparing other towns in similar way. In this regard the relevant questions were preferred.

3.5.2 Semi-structured Interview

Another tool that was used in this study was semi- structured interview. This is a kind of interview for which question was partially designed and the interviewer was asked additional question while the interview is taking place and was enable the research to gather data in face to face manner. The researcher have used this interview for the municipality expert of the sectors and kebeles high officials in order to identify quality parameters and access issues before the questionnaire taken place. There for the research had the opportunity to ask other related question that help to obtain additional information on the issue.

3.5.3 Field Observation

The third instrument which has been used for this study to gather appropriate information was field observation. This also provides a better opportunity for researcher to obtain reliable data and to observe whether stakeholder are facing challenges in order to enhance the access and to keep quality of cobblestone roads to solve such urban social amenity problems. During the field observation the organized pavers were input for this study. Through field observation the necessary picture of cobblestone roads was taken.

3.6. Procedures of Data Collection

It is fact that data, collection consider as pre problem identification when research takes place. Accordingly the necessary letters were written from the department in order to make the study reliable and official. Then the letter was approved and the data obtain through tools for data collection particularly; questionnaire, semi-structured interview and observation checklist were designed. The data collection process has gone through different stake holders by the given schedule.

3.7. Methods of Data Analysis

After the required data was collected, through different methods, data organization follows. Then data analysis and interpretation was conducted. Thus, the data which collected from the

different bodies was analyzed using frequency distribution, mean and percent in order to explain the major determinant, variables more extensively. Different data analyzing methods was used as much as possible to meet the variables. For instance data regarding quality was collected through interview and questionnaire from the stakeholders. SPSS software was used to analyses quantitative data. The results of data were presented in form of tables, graphs, map and figures. In this research the quantitative method were used to analyses the data.

3.8. Validity, Reliability and Triangulation

How do we know that what the participant is telling us is true? And if it is true for this participant, is it true for anyone else? And if another person were doing the interview, would we get a different meaning? Or if we were to do the interview at a different time of year, would the participant reconstruct his or her experience differently? Or if we had picked different participants to interview, would we get an entirely dissimilar and perhaps contradictory sense of the issue at hand? These are some of the questions underlying the issues of validity, reliability, and generalize ability that researchers confront (Seidman,2006).

Validity

The validity of findings or data is traditionally understood to refer to the 'correctness' or 'precision' of a research reading (Ritchie and Lewis, 2003). Although the validity of 'measurement' is seen as a primary concern of quantitative research, and of positivist research more broadly, it is widely recognized that it is an equally significant issue for qualitative research. But the questions posed are different ones and relate more to the validity of representation, understanding and interpretation. In order to meet validity criterion, this research has used different combinations of data gathering tools.

Reliability

Reliability is generally understood to concern the reception of research findings and whether or not they would be repeated if another study, using the same or similar methods, was undertaken (Ritchie and Lewis, 2003). The possibility of another researcher in the future obtaining similar findings could slightly be different as it depends more on the type of issues, time, purpose, changes and processes used. Similar or repeated findings or results arrived at by another researchers will be an argument because problems like the change of respondents' opinion on issues, the time lap between the researchers, new regulations of the local government, the

response given by the government or other stakeholders to solve or bridge the problems or gaps found in the study may have influence on the result arrived at by other researchers.

Triangulation

Triangulation may take several forms, but commonly refers to the employs of multiple data sources, data collection methods, or investigators. In general, the purpose of this would be to reduce the disadvantages inherent in the use of any single source, method or investigator (Longand Johnson, 2000). Triangulation may involve the use of different methods, especially observation, focus groups and individual interviews, which form the major data collection strategies for much qualitative research (Shenton , 2004). So based on the above justification the researcher for this paper has used different types of data collection instruments such as interview, focused group discussion and observation in order to triangulate the research results. Triangulation is more a direct check on the validity of observations by crosschecking them with other sources of data. If a researcher's conclusion is supported by data from other sources, then we can be more confident of its validity. Triangulation can involve comparing data on the same behavior from different researchers (as in reliability checks in more-structured observation) who possibly adopt different roles in the field.

3.9. Ethical Considerations

Research ethics deals with how far somebody treats those who participate in our studies and how he/she handles the data after he/she collected them (Vanderstoep and Johnston, 2009) Ethical considerations are very important for every research or study. Because it is honesties issues that researcher consider during data collection. Interviewees were informed that this work is purely for academic purposes and not for other reasons. Therefore, respondents of this study were assured of confidentiality in respect of all information that they provided.In every case, names was be keep confidential thus collective names like 'the respondents or the informants. All documents used have also been properly acknowledged and documented to avoid issues of plagiarism.

CHAPTR FOUR

RESULT AND DISCUSSION

This chapter presents the results and discussion of cobblestone accessibility and quality of the roads. Specifically, the study is mainly concerned with cobblestone road accessibility in the town in general, cobblestone convenience in each kebeles, cobblestone accessibility rate in the three selected kebeles, Quality parameters of cobblestone or major variables of the cobblestones based on the quality determinants and the awareness / the believe of the community or the out looking of the respondents concerning of the durability of the paved roads to enhance the urban development,

4.1 An Overview of Cobblestone Project

Through interview, the researcher tried to investigate general information about cobblestone project, particularly aims, procedures of implementation, stakeholders, source of funds, quality parameters and other necessary information from municipality higher officials. Thus, the general foreman of the project said that, cobblestone project was started in this town lately in 2002 E.C by the strategy of government under the Small and Micro Enterprise (SME). The purpose of the project was to solve urban road tribulations, and to enhance urban infrastructure development in order to reduce urban transportation problem. In addition, it is important to create job opportunities for youth to benefiting the community and to meet GTP I and GTP II plans of the government. Hence these youth expected to take training from recognize collages/TVET/and come with official documents.

As the philosophy of the sector, the organized members for this project must be eleven in number in order to give approval for the groups''. According to the professional of the sector, the type and size of the rock that selected for the cobblestone is internationally constant. For instance, igneous rock (granite) is considered as the best and selective rock for cobblestone pavement (Treskon, 2006).Concerning the size, international standard for cobblestone is ($10cm^3$).The funding procedure is taken place by the three stakeholders. According to Abdulhafiz Ahmed, general foreman of the project, (April,2008), the source of fund for the cobblestone project are :World Bank ,Local government(Municipality) and Pavers by themselves. The expected budget for the project by each stakeholders is shown as follow; .

4.1.2 Financial Source of Cobblestone project

According to secondary data that obtained from the sector professionals, financial source for the cobblestone project implementation was not owned by one or individual stakeholder .As municipality, cobblestone project budget system implements by the three stakeholders. These are the local government (Municipality), organized pavers and World Bank respectively.

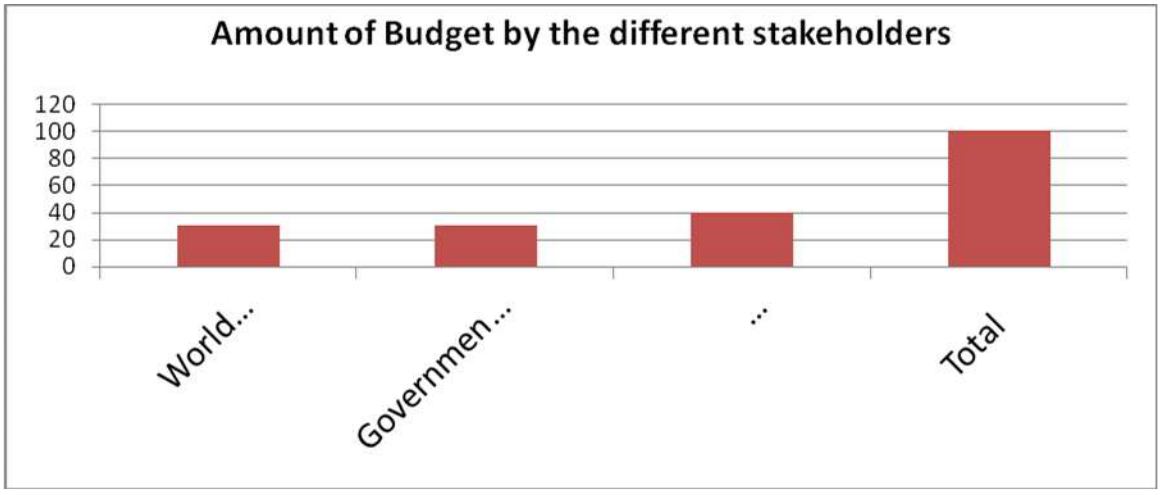
Table 1 The financial source and budget allocation for cobblestone projects

No	Source and stakeholders of the budget	Expected fund in%
1	World Bank	30%
2	Government/Municipality	30%
3	Organized pavers	40%
Total		100%

Source; (Municipality Construction Office, 2016)

As it is shown in table (4.1) above, the financial source for the cobblestone project was obtained from the three stakeholders. Here, 30% of the cobblestone fund is to be paid by World Bank, then 30% of the budget is covered by Urban Local Government/Municipality/ and finally 40% of the financial source is facilitated by organized pavers.

Graph 4.1 the financial source and stakeholders for the cobblestone project



Source;- (Municipality,2016).

Similarly the graph on figure 4.1 above represent that, from the expected 100% budget for the cobblestone project in the town, three stakeholders are shared different amounts of money.

4.2 The Respondents information on the Role of cobblestone roads

According to the response during the interview, cobblestone has played social, economical and environmental roles for the road sector and other infrastructure development in the town. As a data collected from the respondents, the different social sectors (schools, clinics, police stations, government offices, other public institutions, taxi parking, pedestrians, vehicles , condominium 'and residents areas), this streets have brought social changes. On the other hand, the sector created job opportunity for youth in order to minimize the number of unemployed in the town. It is obvious that "Cobblestone road construction is comprehensively labor intensive and requires skilled labor. In this regard, a huge skilled labor is developing in the town. There has been extensive training program launched across cities targeting women, unemployed youth, and the disadvantaged groups of local communities. The training program is specifically focusing on skills required for construction of Cobblestone roads.

The other economic importance of these roads is also the fact that the materials for the construction are locally produced materials that enable the town, cities and country to save the foreign currency that might be spent for any foreign materials that imported from abroad. Environmentally, Cobblestone roads are important in contributing that the soil is not degraded by water or flood and not wiped by a wind. These are generally eco- friendly designed type of roads important to cope with the challenges produced by climate changes.

4.3 Road Accessibility in Jimma town

It is obvious that, the access of roads infrastructure fulfillment in urban area is the primary condition while urban planning employed in order to bring regular and sustainable development. Because roads are core of social amenity that helps for the mobility of people, goods and services in the given geographic regions.

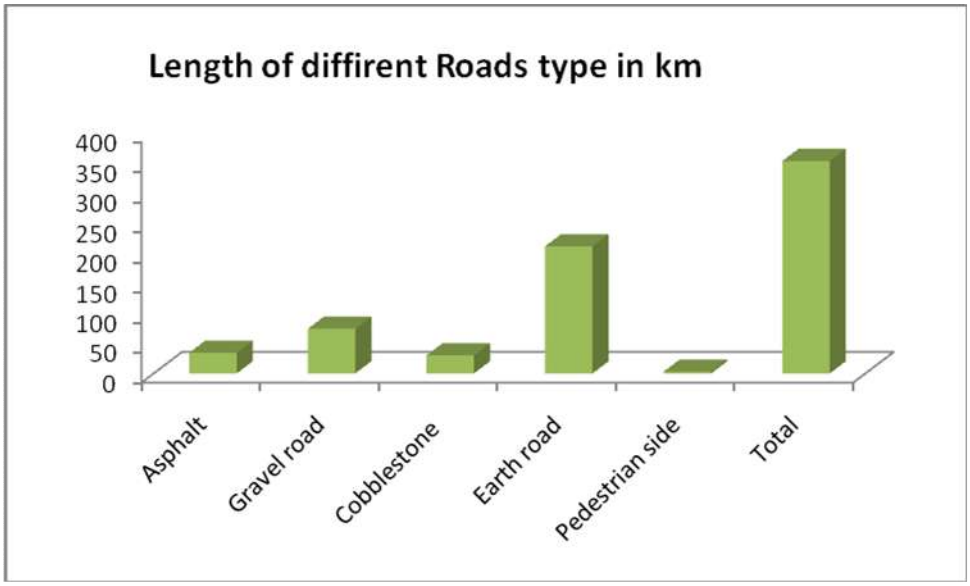
According to the source of information from municipality, the town is suffering by the road problems .Even if the different road types are built in the town, the accessibility of these roads were not proportionally addressed to the communities in the locality. The accessibility of these roads for the communities within the town is listed down as the following

Table 4. 2. Accessibility of Roads in Jimma Town

No	Types of Roads	Distance in km /Length/	Total population of the town	Accessibility of roads in dividable per –km
1	Asphalt	34.5	189732	0.0002
2	Gravel	74.25	189,732	0.0004
3	Cobblestone roads	30.11	189,732	0.000158
4	Earth Road	211.37	189,732	0.001114
5	Pedestrian side	3.0	189,732	0.000015
Total		353.22/m	189,732	0.00186 person per-km

Source; - Jimma town Municipality, 2007 E.C)

According to table (4.2.) revealed above, various types of roads that built in the town. For instance asphalt road is 34.5km with the accessibility of 0.0002km.This means, the coverage of asphalt roads to the total population of the town (189,732), is only 0.0002 km per- individual. On the other hand, gravels, 0.004 km, cobblestone roads 0.00013 km, earth roads 0.0011km and pedestrian side, 0.000015km per individuals in the town. In general the accessibility of each road in the town is very low. As compared the cobblestone with another roads, it is relatively better. Because it was established very recent (2002 E.C) in this small city. Table 4.2.1 above fig is clearly shows the gap between the different roads type and inadequacy of the quality roads like asphalt and cobblestone roads within the town.



Graph 4.3.1 The roads infrastructure type and coverage in (km)

The above graph (4.3) is also shows that, the different road types and their coverage in km. For instance, as seems clearly on the graph, except earth road, the rest roads are low accessible within the town. But to enhance the urban development, the earth roads are not preferable even if it has better coverage.Because it do not have quality and selective to enhance urban development. The cobblestone road is at the fourth stage according to the graph. But as it's recently implementation; it seems better progress than other roads in the town.

4.3.1 The Access of cobblestone road in the town

The Cobblestone road construction project in the town is a type of local development project in which the municipality interfered in the implementation process. As it's recently achievement, the project takes place in the center of the town rather than peripheral. The following three kebeles (Hermata, Awetu Mendera and Ginjo Guduru) observed as improved cobblestone roads pavement due to their location in the central town.

Table 4. 3. The Accessibility of cobblestone roads in the three selected kebeles

S.No	Name of kebeles	Population			Roads		Accessibility of roads per-person
		M	F	T	Types	Length in km	
1	Hermata				1	2.8	0.00031km

		4386	4565	8,951	2	2.1	0.00023k.m
					3	2.00	0.00022km
					4	0.2	0.00002km
2	Awetu Mendera	6476	6741	13,217	1	3.396	0.00025km
					2	4.553	0.00034km
					3	0.985	0.00007k m
					4	1.625	0,00012km
3	Ginjo Guduru	5058	5265	10,323	1	2.264	0.00026km
					2	5.220	0.00050km.
					3	1.2	0.00011km
					4	2.5	0.00024km
Total		15,920	16,571	32,491		28.843	0.000887km

Types of roads: Asphalt=1 cobblestone=2 Gravel=3 Earth roads=4

Source: Municipality road network Inventory, 2007 E.C)

According to table(4.3.) above detail information about accessibility of cobblestone roads within the three selected kebeles and their comparative analysis based on present inventory results of road data from municipality office of construction, accessibility of cobblestone roads within the kebele is found to be very poor. As the data shows, the coverage of cobblestone roads is restricted to be accessed for the local community .For example the accessibility of asphalt road in Hermata is 0.00031km per-individual .Which means the asphalt roads that pass through the kebele is very low when it divided by the total population of the kebele. Similarly in this kebele, the accessibility of the cobblestone road is 0.00023km.As compared to asphalt road in this kebele, just about the same accessibility. But cobblestone as the recent technology, it has better progress. On the other hand, the accessibility of Earth road is 0.00002km.

Assume that, on the table (4.3.1) the earth road was 211.37km that has accessibility of 0.001114km per-individuals. This is the highest coverage of the town. But in this kebele, the earth roads has less accessibility than cobblestones roads. This shows the degree of cobblestone accessibility in this kebele is high as compared to other roads. In Awetu Mendera accessibility of the asphalt roads is 0.00025km per individual and the cobblestone road is 0,00034km per-

individual. As this number shows Awetu Mendera has the higher accessibility both in asphalt and cobblestone roads in the town .Ginjo Guduru is another highly accessible kebele .For instance asphalt road(0.00026) km. Cobblestone (0.00050) km ,Gravel(0.00011) km per-individuals .According to this numerical evidence, Ginjo Guduru is the highest accessibility from these kebeles. As table 4.2.2 indicates that the comparative demonstration of cobblestone roads in the three selected kebeles as the sample of study, there is variation of cobblestone roads in length within the kebeles. This realized the access variation among kebeles.

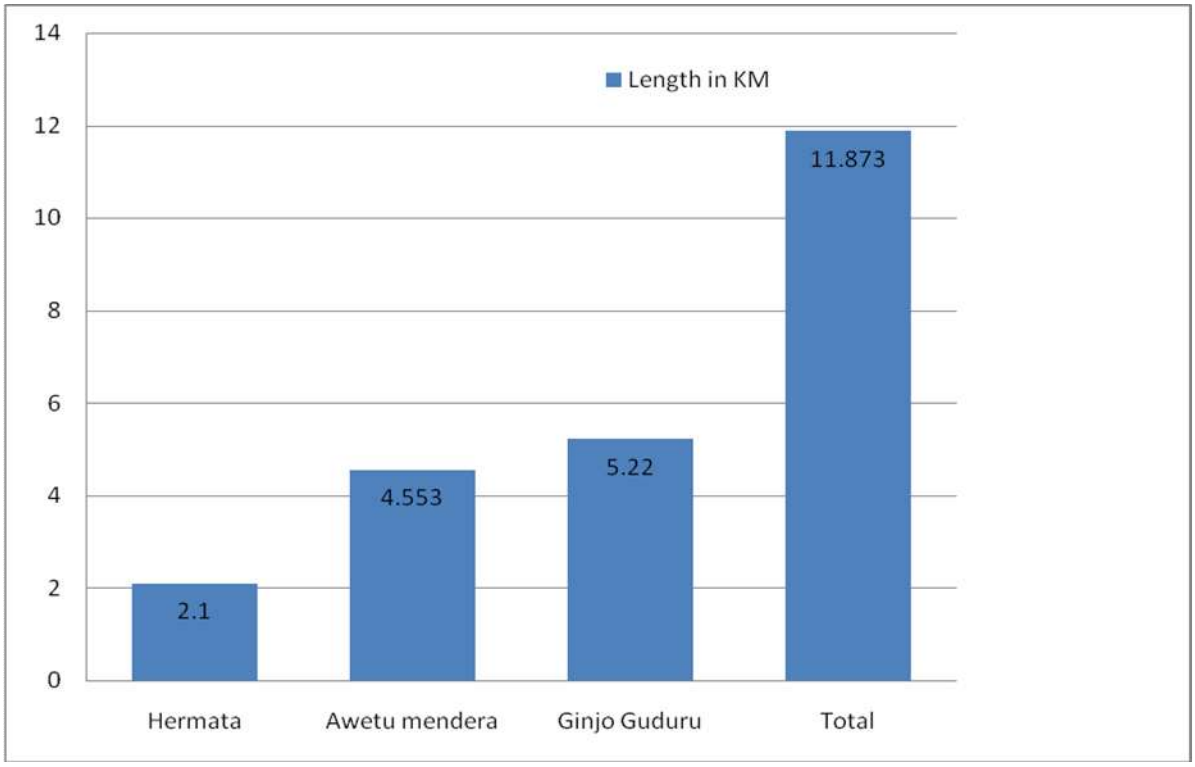
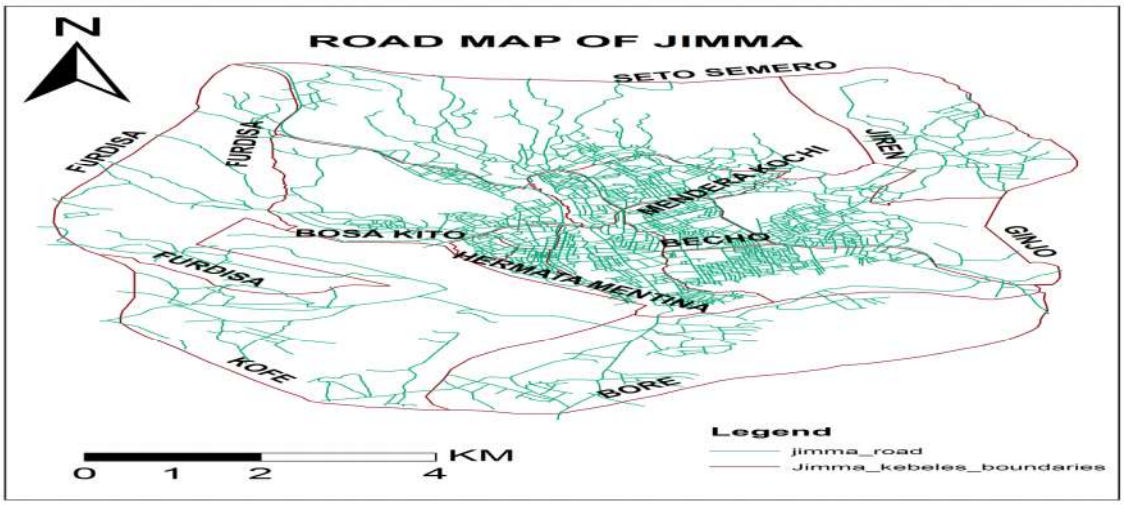


Figure 4. 3. the cobblestone roads length in km of the three kebeles

Source :-(Municipality, 2016)

As graph (4.3.2) indicates, the cobblestone paved road in Ginjo Guduru kebele is 5.22km, Awetu Mendera 4.553km and Hermata kebele 2.1km respectively. Accordingly the progress of cobblestone pavement in Ginjo Guduru is the highest as compared to others. But the numerical data of the table (4.2.2) shows, Ginjo guduru has the lowest accessibility of asphalt road than other two sample kebeles in the town.

Figure 4.2.1 The Road map of jimma town.



Source ;-adapted from Google earth,2016**)**

According to the fig (4.2.1) above, roads of the jimma town are highly concentrated within the city center rather than the peripheral areas .Similarly the map confirms that, the inner kebeles of the town has somewhat higher road accessibility as compared to the peripheral kebeles. The idea of the above road map reflect that, fig (2.1) the conceptual framework .It is fact that as we go beyond from the city central kebeles to the outer kebeles,the accessibility of cobblestone roads became lower. In the same ways other roads like asphalt and gravel roads also highly covered in these areas. This is obvious that, in central town there is high economic activities, administrative center and highly popular regions. Figure (4.2.1) also clearly demonstrates, the three kebeles(Ginjo Guduru,AwetuMendera and Hermata) are included in this district .

4.3.2 The respondents Information on cobblestone Accessibility

This is fact that road are jargon for other infrastructure development .Anybody believe that without Well organized roads web other infrastructure planning is senseless **.**As the respondent of the town, the implementation of the project is really need encouragement .It is obvious that "Cobblestone road construction is comprehensively labor intensive and requires skilled labor. In this regard, a huge skilled labor are developing is being developed in the town. There has been extensive training program launched across cities targeting women, unemployed youth, and the disadvantaged groups in local communities. The training program is specifically focusing on skills required for construction of Cobblestone roads.

4.4 The Quality determinants of cobblestone roads

According to construction and infrastructure development office of municipality, the quality parameters of cobblestone roads are rock type and size, soil selection and damping, presence of drainage on both side of the roads, vehicle controlling or traffic, contractors related issues, paving quality ,other materials like sand, ground by itself, appropriate use of the community and others variables. Based on the above variables, the researcher prepared questionnaires to collect information pertaining to the quality. The questionnaires were distributed to the community by the researcher in order to ensure either the given data from the municipality and kebele leaders is accurate or not. Thus, around 360 households were selected by using systematic sampling method from the three purposive kebeles to make the data reliable particularly on the quality parameters and the standards measurement techniques. In addition to this the data was collected from the cobblestone pavers these organized to benefit the job opportunity and directly to involve in the development process.

Table 4.4 the statistical table of the Quality parameters.

s.No	Quality parameters.	No of respondents	Mean
1	Availability of drainage	360	1.9833
2	The selection of stone on cobble stone quality	360	1.1806
3	Standard of cobble stone road	360	1.9861
4	The absence of drainage on cobble stone in the locality	360	1.2139
5	Availability of vehicle load controlling traffic sign	360	1.9444
6	Impact of the absence of traffic sign on cobble stone road	360	1.2139
7	The absence of awareness of community on cobble stone road	360	1.3611
8	Awareness creation given by the municipalities.	360	1.9806
9	The degree of satisfaction by the pavement of cobble road.	360	2.6500

Yes=1 No=2 Unsatisfied =3

Source: The Author, 2016)

According to the results of descriptive statistics in table 4.4 that obtain by using SPSS version 16, the average mean (1.98) confirms the availability of drainage in the town was found to be poor. In a similar manner the average mean (1.18) shows that the selection of stone has an impact on the quality of cobble stone pavement. Then mean average (1.98) depicts that the standard of cobble stone in study area was poor. The average mean (1.21) in table 4.4 confirm that, there were no drainage in the cobble stone roads in the study area. Similarly the mean average (1.94) shows that, there is no or rare availability vehicle control sig on cobblestone road Again the table also confirms, absence of vehicle control has an impact on quality of cobble stone roads. On the other hand the absence of awareness creation for the community on the cobble stone has yet poor as the mean average (1.36) near to 1. More over the table also prevailed that the municipalities didn‘t give any awareness for the community. On the similar table, the degree of satisfaction of the community on the cobble stone roads in their surrounding was found to be to some extent rather than good or very good.

Table 4. 5 Reponses on Quality parameters

S.No	Quality parameters.	Frequency		
		Response	Number	Percent
1	Availability of drainage	Yes	17	4.7
		No	333	92.2
		Partially	11	3.1
2	The selection of stone on cobble stone quality	Yes	312	86.7
		No	31	8.7
		Partially	17	4.7
3	Standard of cobble stone road	Yes	33	9.2
		No	299	83.1
		Partially	28	7.8
4	The absence of drainage on cobble stone in the locality	Yes	303	84.2
		No	37	10.3
		Partially	20	5.6

5	Availability of vehicle load controlling traffic sign	Yes	14	3.9
		No	268	76.4
		Partially	78	19.7
6	Impact of the absence of traffic sign on cobble stone road	Yes	300	83.3
		No	43	11.9
		Partially	17	4.7
7	The absence of awareness of community on cobble stone road	Yes	244	67.8
		No	102	28.2
		Partially	14	3.9
8	Awareness creation given by the municipalities.	Yes	41	11.4
		No	285	79.2
		Partially	34	9.4
9	The degree of satisfaction by the pavement of cobble road	Yes	15	4.2
		No	96	26.7
		Partially	249	69.2

An evaluation of the data on the construction of cobblestone quality determinants in jimma town as are presented in table 4.4.(92.2%) of respondents replied that there was no availability of drainage on the side of cobblestone roads in order to protect the road in their locality. The following picture from field observation also confirms the on top records.

Figure 5 Cobblestone roads without drainage patterns

From table 4.4 , above (86.7%) of the respondents replied that the selection of stone was found to be one of the factors that determine the quality of cobble stone. In a similar table (83.1%) of the respondents agree that the standard of the cobble stone in the town was found to be poor. As depicts in table 4.4. , (84.2%) respondents' response prevailed that the absence of drainage in the town for the cobble stone was also the other influential factor for the quality of cobble stone. According to table 4.4 the (83.3%) of the respondents have the same opinion that the absence of vehicle traffic sign has an impact on the quality of cobble stone in selected site.

Figure 6.Deteriorated cobblestone roads by heavy vehicle

On the other hand table 4.4.2.(76.8%) of the respondents' replied that, absence of awareness creation by the municipalities to the local community has negative impact on the cobble stone quality. The following picture also verify how the local community require to keep cobblestone roads quality.

Figure 7.Garbage on the cobblestone roads by absence of awareness

The exceeding picture (4.4.3) realized,nonexistence of the local community fashioned carelessness on them to use this social amenity properly. The picture clearly proves garbage/rubbish materials accumulated on the cobblestone roads around Hermata kebele.On the similar table (4.4.2) 69.2% of the respondents replied that the degree of satisfaction by cobble stone quality was found to be to some extent good rather than very good or good as a result of respondents.The detail response on this issue was specifically shown as below. As this graph 4.3.3. result depict that 69.2% of respondents are satisfied to some extent, 26.7% of respondent are moderately satisfied and only 4.2% of respondents were satisfied by the cobblestone quality.

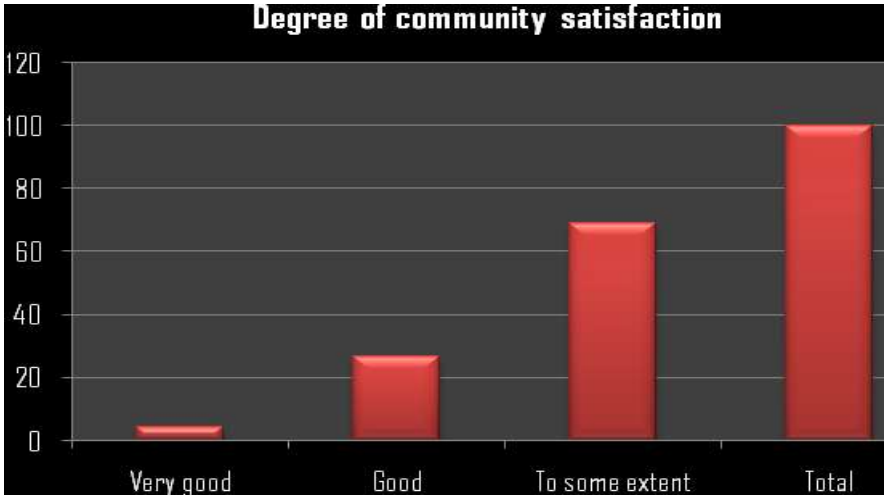


Figure 8 . Communities degree of satisfaction by cobble stone roads in their surrounding (Source;-Author, survey 2016)

4.4.1 Procedures and paving Stages of cobblestone roads

Cobble stone like any sectors of work needs and takes place procedures in order to keep its quality. The nature of the Cobblestone roads normally depends on the size of each Cobblestone, the status, and position of laying the stones on the already prepared sub base. If a single Cobblestone is displaced (scattered) from the normal position it is put, there is a possibility for the whole Cobblestones to displace. Its nature enables it to simply deteriorate or destruct if it is not constructed in quality as the stability of one Cobblestone in its place depends on the stability of the other. The edge or the end of the roads which has a connection or a join with asphalt or

earthen road can simply be destroyed unless strongly fixed with a cement or concrete. The curve stones should also be properly erected, stuck or fixed by cement and other materials in order for it to hold the Cobbles. If the joint area between the end of the Cobblestone roads and either Asphalt or earthed road is not constructed with the help of big stone and cement, it will simply deteriorate and makes other Cobblestones to scatter as practically observed in the field in

4.4.2 Stages of cobblestone road construction/pavement

The construction of cobblestone road follows a number of steps. Planning, budgeting, designing, and procurement works need to be undertaken prior to commencement of the actual construction. The earth work also takes places by; Clearing and Grubbing, Top Soil Excavation(15-20cm), Bulk Excavation(15-20 cm) and Backfill using Sub-base Material. After these activities are completed, the actual construction activity of cobblestone road will involve the following stages (ULGDP Third edition, 2012)

Stage 1: Production of cobble stones: This stage precedes production of raw material at quarry, delivery of raw material to chisellers, and chiseling of stones to the required sizes.

Stage 2: Surveying of the proposed road: This stage follows ground preparation to make the ground ready for pavement to determining location, levels and grades of road as per the design.

Stages of Ground preparation

Stage 3: *S*ub grade, Materials fulfillment / preparation: This stage involves cut and fill works to bring the raw material to the required level and facilitating for pavement grade, and

then constructing sub-base and/or base layer as necessary based on design recommendations.

Stage 4: Bedding and cobble stone laying: This stage involves constructing bedding layer that comprises either crushed stone or sand, and then putting cobblestones and the bedding layer.

Stage 5: **Finishing work**: This stage involves filling the spaces between cobblestones with crushed stone or sand, completing minor finishing works, compacting and clearing the area.

Figure 9The different stages of cobbleston pavement

Source ;-(Field observation may,2008 E.C)

complated cobblestone road

Figure 10. One of the model roads of the town which is built in Mendera Kebele

4.5. Roles and responsibility of the municipality and communities

4.5.1The roles and responsibilities of the Municipality

The Cobblestone road construction project in the town is a type of local development project and the strategic direction of the government .Hence organizing and coordinating of budget and other activities must be owned by the municipality. According to the data collected from various sources, the municipality was the key actor and plays an enabling role in any local development activity. As the respondents, in addition to facilitating the condition for every activity to the project, municipality should have, coordinating and managing responsibility to keep durability of the cobblestone roads.

4.5.2 Role of Community Participation

As collected data indicated, the community participation in the construction of Cobblestone roads is the key issue both in accelerating the project and keeping durability. This implies that community as owner and benefiters need to follow up the implementation of the project. It is obvious that the roads have multiple benefits at the national and local level. Hence, community participation plays a vital role in development program in addition to the cobblestone pavement in the town.

4.6. Contribution of the cobblestone roads in enhancing the urban development and challenges

4.6.1 Contribution of the cobblestone roads in enhancing the urban development

As response that obtain from the sector officer in municipality during interview, "The Cobblestone project is labor-intensive, creates jobs opportunities for construction entrepreneurs, uses natural and local materials and does not require imported machinery, does not depend on imported oil, as asphalt does; is cost-effective as compared to concrete or asphalt roads; makes towns and cities more beautiful, have benefits residents and encourages tourism; is easy to maintain and has a much longer lifespan than asphalt roads." They added, before the implementation of the project in this town, there was no readymade universally acceptable solution to the urban transport problem unless highly access and quality roads in the town.

Thanks to MSE 'for creation, providing opportunities for entrepreneurs these problems on the way of solving. It is an important sector in creating jobs in quarrying, chiseling and paving. Employment in cobblestone sectors is open to all, focuses largely on unemployed women and youth, disabled working people, TVET graduates and other vulnerable citizens. Moreover, the market oriented focus of cobblestone emphasizes on MSE's creation, providing opportunities for entrepreneurs and to transfer. Although many benefits were obtained by the construction of a cobblestone (CS) road, the main one resonates around the benefit related to the streamlined transport that came after its completion. Along with this is a reduction in transportation cost for the citizens living in the town and surrounding areas .In general the sector has reduced unemployment, added joint roads within the town and reduced transportation problem, kept the town beautiful and plays vital roles in enhancing urban development.

4.6.2. Major Challenges faced on cobblestone pavement.

As response that obtain from organized pavers during field observation, they had replied it is not secrete that, most curved cobblestone roads do not have quality and similar standard .The main reason for the absence of quality is municipality bid accepting or approvals situation. Which means the municipality accepts these who submit lower cost. After the pavers accepted the roads in this situation every materials that they use is mostly below quality. Because how can they get profits? For instance, the size of the stone was less than 10 cm×10cm×10cm($10cm^3$).If the cobblestone stone is under this size it cannot carries heavy loads. Other important factors that reduce the cobblestone roads quality are the pavers them self and absence of vehicle controlling mechanism. Cobble stone similar to any sectors of work needs procedures in order to keep its quality. In general the above factors and other were considered as main challenges during and after pavement of cobblestone road.

CHAPTER FIVE

4. Summary, finding, Conclusions and Recommendations

This chapter deals with the summary of the findings and conclusions driven from the discussions and analysis of the study. It also ends up with the recommendations on the basis of the findings of the study.

5.1 Summary

The purpose of this study is to assess the overall access and quality of cobblestone roads and their contribution to enhancing urban development in the jimma town. This means accessibility within the kebele of the town and Factors that affect the quality. Accessibility in this sense coverage of the cobblestone roads with in each kebeles by population per km and the gaps within them .In addition to this the study tried to identified other roads in the kebeles to see them relatively with cobblestone roads. The roads commonly include in addition to the cobblestone roads in this studies are;- asphalt, gravel roads , earth roads and pedestrian in a similar manner. In this situation the necessary numerical data was available to identify their gaps. Thus, the inventory data of some kebeles is collected from municipality and the accessibility results were shown in the forms of tables, and graphs through analysis. The numerical evidence of these rods in each kebeles was obtained by calculating each road to the population of the kebeles. The second dimension of this study was the quality parameters. Here, the relevant information was obtained from municipality and questionnaires were prepared. The community participated to give necessary information on the questions that raised on the quality parameters of the cobblestone roads in their surrounding and the factors that affect the durability of this road. According to this, the results for cobblestone roads deterioration are clearly identified through the results of the respondent.

5.2.Major Finding of the study

- The accessibility of cobblestone in the study area was found to be low. Which means the coverage of this road by household/population, it found minimum.
- Most of the cobblestone paved roads in the town were concentrated in the central area/CBD rather than peripheral. The peripheral communities didn't benefit from the sector.

- The paved cobblestone roads did not have quality due to inappropriate use of quality parameters and the issues that related to the different stakeholders. As results of the study, the roads are deteriorating by the quality determinants such as;-absence of drainage, traffic sign, community awareness, materials and others.

5.3. Recommendations

Taking in to consideration all the findings, the analysis and the conclusion drawn, the following points were made as recommendations:-
Through the investigation the researcher tried to observe the huge gap of roads accessibility in the town and variation among the kebeles .Thus, the local government or the municipality should have to work hard in order to reduce the gaps .

As the quality of roads depends largely on the quality of the sub base, even though it is difficult to reconstruct, it is better to focus on the construction and maintenance of some parts of the roads such as drainage to save the existing roads to minimize the cost of future maintenance. The government has not created awareness to make the community to keep the cobble stone roads and participate on the construction of the roads. There for municipality should have to work in order to increase the durability of the roads and inculcates the community in the development process.

The problem is observed on the part of the government in creating awareness, space and opportunity to the community and other stakeholders to participate and expected to mobilize the community to evaluate and monitor the roads.

During the data collection the researcher tried to observe absence of traffic Sign on the side of the roads. These roads are deteriorating due to passing huge vehicle, so the municipality should have to solve this problems to protect these roads from being damaged by different huge vehicles. And these sign posts are expected to be erected in collaboration with the concerned governmental bodies or Offices.

If any type of developmental activity is done at the local level we have to use the outcome of the development properly and there should be managing and keeping of it in order to utilize sustainably. All local actors, , the local government, the community, NGOs, community based organizations, Micro and Small Enterprises, Religious institutions should also involve in this activity and develop the sense of ownership in order to preserve, manage and maintain the development outcomes without expectations to the government or each other.

Directives or provisions that guide how to use the Cobblestone roads should be in place as a legal framework or as a policy in order to save the roads from being deteriorated by any huge vehicles with very high load. Selection of construction and pavement materials should be an important element to suit the design, construction and maintenance of the roads. So there should be a serious follow up on material delivery i.e., the quality and quantity of crushes and other materials and their proper application as it was a practical problem faced on the process

Cleaning and Sanitation activities are better to be given to the Kebele'*s* and *local* community to carry out and in exchange of this an incentive should also be given as a reward for their best performance.

As the main problem observed and concluded during the construction was the quality of the cobblestone roads, it is better for the government and the community to take the responsibility together to construct and the pavement rather than doing them separately .

Some of the prominent stakeholders such as the municipality, community , other members of the ton City Bureau of Road and Transportation are better to involve in keeping the safety of the roads. The government should either take full responsibility to take any measure on the roads or should hand over the responsibility to the community or to some other set up task force to manage and keep the roads

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APPENDIX I

JIMMA UNIVERSITY COLLEGE OF SOCIAL SCEINCE AND HUMANITEIS
DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL STUDIES

Master's Program in Urban and Regional Development Planning

Interview to be responded by key informants

Dear Respondents,

The objective of this Interview is to examine the current overall status of the cobblestone roads in Jimma town in relation to the accessibility and Quality of the roads in order o bring sustainable development. The information you provide would be very crucial and so valuable for the success of the study. Therefore, to attain this purpose your honest and genuine participation in responding these questions is very important. I, therefore, highly appreciate you for your volunteer and spending your time for the interview that will take not more than1 hr.

Thank you in advance for your Cooperation.

Wondimagegn Wolde

MA student in Urban And Regional Development planning

A) Interview Questions for key informants of the town municipality higher Officials

Position…….

1. Could you please tell me how the cobblestone roads are being constructed in Jimma town sub city?

2. Who are the participants in constructing the roads? In what way (their contribution)?

3. What is the general effect that the cobblestone roads have on development in this particular town?

4. How could you evaluate the process of construction in terms of quality of the roads?

5. What are the functions of cobblestone roads in the town and what social and economic benefits could the cobblestone paved roads bring?

6. At what condition is the status of these Cobblestone roads now?

7. Do municipality or any other bodies assess and evaluate the performance and current status of the cobblestone paved roads? If yes, what does the result look like?

8. What do you think of the reasons for the defects on, deterioration or decreasing of the quality of the roads? What can be the consequences if the cobblestone roads continue deteriorating?

9. What is the role and responsibility of the municipality in preserving and maintaining the roads? And also in creating awareness on the community to keep the safety of the roads?

10. How much is the weight of vehicles that are permeable to pass on the cobblestone roads?

11. What is the role of the community and other local development actors in constructing these cobblestone roads? In cleaning, preserving and maintaining the roads?

12 What problems do you observe to be corrected in the cobblestone roads?

13. What are your suggestions or possible solutions for these problems in order for roads to be used sustainably while they are in a good condition?

14. What types of rocks do commonly used for cobblestone pavement? And what are other quality measurements?

Appendix II

Jimma University

Collage of Social Science and Humanities

Department of Geography and Environmental studies

Masters program in Urban and Regional Development planning questionnaire for the community (Respondent).

Dear respondents:- the objective of this questionnaire is to examine the current overall status of the cobble stone road in order to bring sustainable development. The information you provide would be very cervical and so valuable for the success of the very crucial and so valuable for the success of the study.

Therefore, to attain this purpose your honest and genuine participation in responding these questionnaires is very important. There for I highly appreciate you for your volunteer and spending your time for the questionnaires.

Thank you in advance for your cooperation.

Wondimagen Wolde

M.A students in urban and Regional Development Planning.

Questionnaires for the key information to community

Read the following choice and use this sign (√)

1. Is there any drainage on the side of the cobble stone road in your locality?
   Yes ☐ No ☐ I don't know ☐
2. Does the selection of the stone has an impacts on cobble stone quality.
   Yes ☐ No ☐ I'm not sure ☐
3. Do you think that the cobble stone paved road in your surrounding is standardized?
   Yes ☐ No ☐ I don't know ☐
4. Do you think that the absence of drainage on the side of cobble stone road has an impact?

Yes ☐ No ☐ partially ☐

5. Is there any vehicle load controlling traffic sign in your surrounding?

   Yes ☐ No ☐ partially ☐

6. If your answer is yes on "No" 5 its absence has an impact on the cobble stone road?

   Yes ☐ No ☐ to some ☐ extent ☐

7. Do you think that misunderstanding of the community on the cobble stone road has negative impact?

   Yes ☐ No ☐ to some ☐ extent ☐

8. Is there any awareness creation given by the municipality?

   Yes ☐ No ☐ I don't know ☐

9. How did you satisfied by the pavement of cobble stone road in your surrounding?

   Very good ☐ good ☐ to some extent ☐

10. Is there any other quality parameters of cobblestone ?

_____

_____

_____

_____

ጅማ ዩኒቨርስቲ ॥

የድህረ ምረቃ ትምህርት ክፍል

የማህበረሰብ ሳይንስ ኮሌጅ

የጂኦግራፊና የአካባቢ ጥናት ትምህርት ክፍል

የከተማና ክልል ፕላን ለጋራ ልማት ለማስተርስ ፕሮግራም ለጥናት የቀረበ መጠይቅ

ውድ መላሾች፡- የዚህ ጥናት መጠይቅ ዋና አላማ ለጅማ ከተማ እየተከናወነ ያለው የኮብል እስቶን ግንባታ (ማንጠፍ) ተደራሽነትና ጥራትን በተመለከተ ነው፡፡ በመጠይቁ ውስጥ የተካተቱ ነጥቦች ይበልጥ ጥራትን የተመለከቱ ይሆናሉ፡፡ ከምክር ቤት የመንገድ ግንባታ ቢሮ በተገኘው መረጃ መሰረት የኮብል እስቶን መንገድን ጥራት የሚወስኑ ነገሮች፣ የውሃ መሄጃ ቦይ(drainage)፣ የድንጋይ አይነትና ቅርፅ፣ የአፈር አይነት ፣ የኮንስትራክተሮች (አንጣፊዎች) ልምድና ዕውቀት ፣ የተሽከርካሪ ክብደት መመጣጠኑን፣ የሚገነባበት የመሬት ሁኔታ እና አስፈላጊ ሌሎች ማተሪያሎች መሟላት መሆኑን በሴክተሩ እውቀት ካላቸው ሰዎች መረጋገጥ ተችሏል፡፡ በመሆኑም የእነዚህን እውነት ለማረጋገጥ በጉዳዩ ቅርበት ላላቸው የከተማ ነዋሪዎች የቀርቡ መጠይቆች፡፡

<u>ወንድማገኝ ወልዴ፡-</u> የከተማና ክልል ፕላን ለጋራ ልማት ተማሪ

<u>ለቀበሌ ነዋሪዎች የቀርቡ መጠይቆች</u>

የሚከተሉትን ጥያቄዎች በማንበብ በሚስማሙት ላይ ይህንን (√) ምልክት አድርጉ፡፡

1. በከተማ ውስጥ ያለው የኮብል እስቶን መንገድ ደረጃውን የጠበቀ ነው ይላሉ?
   አዎ ☐ አይደለም ☐ አላውቅም ☐
2. የኮብል እስቶን መንፈድን ጥራት ለማስጠበቅ የድንጋይ አመራረጥ ወሳኝ መሆኑን ያምናሉ?
   አዎ ☐ አይደለም☐ በመጠኑ☐
3. በአካባቢዎ የኮብል እስቶን መንገድ ሲገባ (ሲነጠፍ) የውሃ ወይም ጎርፍ መውረጃ በበቂ ሁኔታ ተሟልተው አይተዋል?
   ☐

አዎ ☐ አይቼ አላውቅም☐ በመጠኑ

4. በጥቁ ቁጥር “3” ላይ ባለው ሀሳብ ላይ በመመስረት የጎርፍ መውረጃ ያለመኖር የመንገድ ጥራት መጓደል ምክንያት ነው ብለው ያምናሉ?

   አዎ ☐ አይደለም ☐ አይመስለኝም ☐

5. በአካባቢዎ ባለው የኮብል እስቶን መንገዶች የተሸከርካሪ ክብደት መቆጣጠሪያ ምልክት አለ? ☐ ☐

   አዎ የለም አልፎ አል☐

6. በጥያቄ ቁጥር “5” መልሶዎ “የለም” ከሆነ የተሸከርካሪ ክብደት መቆጣጠሪያ ያለመኖር የመንገዱ መፈራረስ ምክንያት ነው ብለው ያምናሉ?

   አዎ ☐ አይደለም ☐ አይመስለኝም ☐

7. በአንድ አንድ አካባቢዎች አካባቢው ህብረተሰብ ከግንዛቤ ማጣት የተነሳ ደረቅና ፈሳሽ ቆሻሻዎችን በኮብል እስቶን መንገድ ላይ ሲጥሉ ይታያል፡፡ ይህ የመንደጉ መፈራረስ ምክንያት ነው ብለው ያምናሉ?

   አዎ ☐ አይደለም ☐ በመጠኑ ☐

8. በጥያቄ ቁጥር “7” መልስዎ “አዎ” ከሆነ ምክር ቤቱ የኮብል እስቶን መንገድ አጠቃቀምን አስመልክቶ የግንዛቤ ማስጨበጫ ትምህርት ሰጥቶ ያውቃል

   አዎ ☐ አያውቅም ☐

<u>ክፍል ሁለት</u>

ሌሎች የኮብል እስቶን ጥራት መጓደል ምክንያቶችን ቢዘረዝሩልን

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APPENDIXIII

Descriptive Statistics

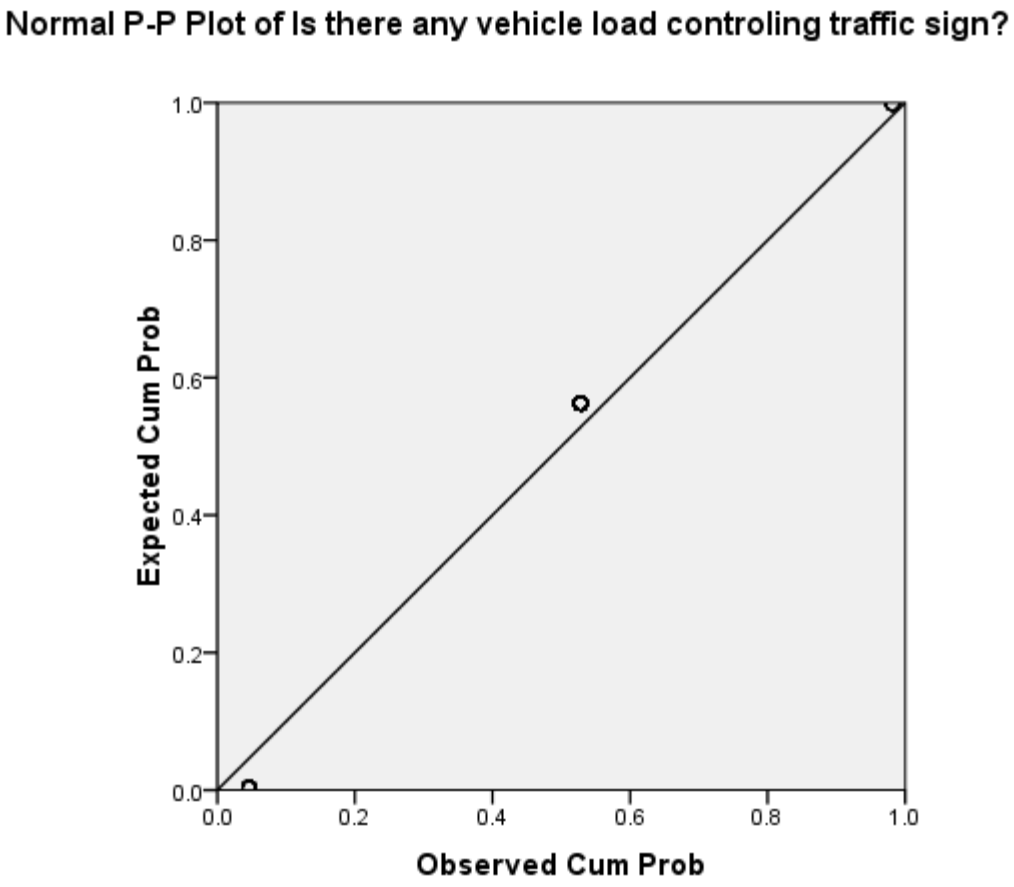
Questions that raised for the community		Range	Minimum	Maximum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
Is there any drainage in your locality?	360	2.00	1.00	3.00	1.9833	.01469	.27878	.078
Does the selection of stone has impact on cobble stone quality?	360	2.00	1.00	3.00	1.1806	.02598	.49303	.243
Is your surrounding cobble stone standardized?	360	2.00	1.00	3.00	1.9861	.02171	.41197	.170
Is the absence of drainage has an impact on cobble stone road?	360	2.00	1.00	3.00	1.2139	.02789	.52918	.280
Is there any vehicle load controlling traffic sign?	360	2.00	1.00	3.00	1.9444	.01864	.35361	.125
Is there any impact of the absence of traffic sign on cobble stone road?	360	2.00	1.00	3.00	1.2139	.02705	.51314	.263
Is the absence of awareness of community has an impact on cobble stone road?	360	2.00	1.00	3.00	1.3611	.02931	.55619	.309

Is there any awareness creation given by the municipalities?	360	2.00	1.00	3.00	1.9806	.02407	.45666	.209
How do you observe about the degree of satisfaction by the pavement of cobble in your surrounding?	360	2.00	1.00	3.00	2.6500	.02943	.55830	.312
Valid N (list wise)	360							

Statistical out put of the quality parameters

Variables	Mean	Std. Error Mean
Is there any drainage in your locality?	1.98	.01469
Does the selection of stone have impact on cobble stone quality?	1.18	.02598
Is your surrounding cobble stone standardized?	1.98	.02171
Is the absence of drainage has an impact on cobble stone road?	1.21	.02789
Is there any vehicle load controlling traffic sign?	1.94	.01864

Is there any impact of the absence of traffic sign on cobble stone road?	1.21	.02705
Is there any awareness creation given by the municipalities?	1.98	.02931
How do you observe about the degree of satisfaction by the pavement of cobble in your surrounding?	2.65	.02407
		.02943



One-Sample Test

Questions on quality determinants	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Does the selection of stone has impact on cobble stone quality?	45.433	359	.000	1.18056	1.1295	1.2317
Is your surrounding cobble stone standardized?	91.471	359	.000	1.98611	1.9434	2.0288
Is the absence of drainage has an impact on cobble stone road?	43.524	359	.000	1.21389	1.1590	1.2687
Is there any vehicle load controling traffic sign?	104.334	359	.000	1.94444	1.9078	1.9811
Is there any impact of the absence of traffic sign on cobble stone road?	44.884	359	.000	1.21389	1.1607	1.2671
Is the absence of awareness of community has an impact on cobble stone road?	46.432	359	.000	1.36111	1.3035	1.4188
Is there any awareness creation given by the municipalities?	82.290	359	.000	1.98056	1.9332	2.0279

How do you observe about the degree of satisfaction by the pavement of cobble in your surrounding?	90.059	359	.000	2.65000	2.5921	2.7079
Is there any drainage in your locality?	134.987	359	.000	1.98333	1.9544	2.0122

Data setting procedures all the way through SPSS version 16.

The following Sample of data shows that, the individual response on questionnaire.

Where;-1.0=No

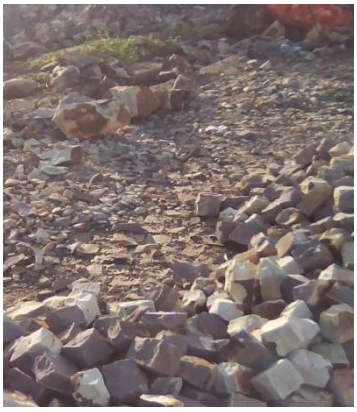
2.0=Yes

3.0=I'm not sure/I don't know/Not satisfied .

1.0	3.0	3.0	1.0	2.0	2.0	3.0	2.0	2.0	2.0
2.0	2.0	1.0	2.0	3.0	1.0	1.0	2.0	1.0	3.0
3.0	2.0	1.0	3.0	2.0	1.0	1.0	3.0	2.0	2.0
4.0	2.0	1.0	3.0	1.0	2.0	1.0	1.0	3.0	3.0
5.0	2.0	1.0	2.0	3.0	2.0	1.0	1.0	2.0	2.0
6.0	2.0	1.0	3.0	1.0	3.0	2.0	2.0	2.0	3.0
7.0	2.0	1.0	1.0	1.0	2.0	3.0	1.0	2.0	3.0
8.0	2.0	1.0	1.0	1.0	2.0	1.0	2.0	2.0	3.0
9.0	2.0	3.0	1.0	3.0	2.0	1.0	1.0	2.0	3.0
10.0	2.0	1.0	3.0	1.0	2.0	1.0	2.0	3.0	3.0
11.0	3.0	1.0	3.0	3.0	2.0	1.0	2.0	2.0	2.0
12.0	2.0	1.0	3.0	2.0	2.0	1.0	2.0	3.0	3.0

13.0	2.0	1.0	3.0	2.0	2.0	1.0	2.0	3.0	3.0
14.0	3.0	1.0	3.0	1.0	2.0	1.0	2.0	2.0	2.0
15.0	3.0	3.0	3.0	1.0	2.0	1.0	2.0	3.0	3.0
16.0	2.0	1.0	3.0	1.0	2.0	1.0	2.0	3.0	3.0
17.0	3.0	1.0	3.0	1.0	2.0	1.0	2.0	3.0	2.0
18.0	3.0	3.0	3.0	1.0	2.0	1.0	2.0	3.0	2.0
19.0	3.0	1.0	3.0	1.0	2.0	1.0	2.0	3.0	2.0
20.0	2.0	1.0	3.0	1.0	2.0	1.0	2.0	2.0	2.0
21.0	2.0	1.0	3.0	1.0	2.0	1.0	2.0	2.0	3.0

Cobblestone raw materials (inputs)



Crush sand for cobblestone building

Field observation(May,2016)