



**ST MARY'S UNIVERSITY**  
**SCHOOL OF GRADUATE STUDIES**

**A COMPARATIVE STUDY OF LABOR INTENSIVE VERSUS  
CAPITAL INTENSIVE TECHNOLOGY IN CONSTRUCTION  
INDUSTRY**

**BY**  
**ENDALE SHIFERAW DENBI**

**JUNE 2017**  
**ADDIS ABABA, ETHIOPIA**

**A COMPARATIVE STUDY OF LABOR INTENSIVE VERSUS  
CAPITAL INTENSIVE TECHNOLOGY IN CONSTRUCTION  
INDUSTRY**

**BY  
ENDALE SHIFERAW DENBI**

**A THESIS SUBMITTED TO ST. MARY'S UNIVERSITY, SCHOOL OF  
GRADUATE STUDIES IN PARTIAL FULFILMENT OF THE  
REQUIREMENTS FOR THE DEGREE OF MASTER OF BUSINESS  
ADMINSTRATION (PROJECT MANAGEMENT CONCENTRATION)**

**JUNE 2017  
ADDIS ABABA, ETHIOPIA**

**ST MARY'S UNIVERSITY  
SCHOOL OF GRADUATE STUDIES  
FACULTY OF BUSINESS**

**A COMPARATIVE STUDY OF LABOR INTENSIVE VERSUS  
CAPITAL INTENSIVE TECHNOLOGY IN CONSTRUCTION  
INDUSTRY**

**BY**

**ENDALE SHIFERAW DENBI**

**APPROVED BY BOARD OF EXAMINERS**

---

**Dean, Graduate Studies**

---

**Signature**

---

**Advisor**

---

**Signature**

---

**External Examiner**

---

**Signature**

---

**Internal Examiner**

---

**Signature**

## **DECLARATION**

I the undersigned declare that this Thesis is my original work, prepared under the guidance of Tiruneh Legesse (Ass. Professor). All sources of materials used for this Thesis have been duly acknowledged. I further confirm that the thesis has not been submitted either in part or in full to any other higher learning institution for the purpose of earning any degree.

---

Name

St. Mary's University , Addis Ababa

---

Signature

June, 2017

**ENDORSEMENT**

This Thesis has been submitted to ST Mary's University, School of Graduate Studies for examination with my approval as a University Advisor.

---

Advisor

---

Signature

---

# TABLE OF CONTENTS

Table of contents.....	I
Acknowledgements.....	III
List of tables.....	IV
Acronyms.....	V
Abstract.....	VI
<b>CHAPTER ONE.....</b>	<b>1</b>
<b>INTRODUCTION.....</b>	<b>1</b>
1.1 Back ground of the study.....	1
1.2 Statement of the problem.....	2
1.3 Basic research question.....	3
1.4 Objective of the study.....	3
1.5 Significance of the study.....	4
1.6 Scope of the study.....	4
1.7 Limitation of the study.....	5
1.8 Organization of the study.....	5
1.9 Definition of operationalization of terms.....	5
<b>CHAPTER TWO.....</b>	<b>6</b>
<b>REVIEW OF RELATED LITERATURE.....</b>	<b>6</b>
2.1 Introduction.....	6
2.2 Construction industry.....	6
2.3 Technology.....	8
2.4 Productivity.....	8
2.5 Production technology.....	12
2.5.1 Labor intensive production.....;	12
2.5.2 Capital intensive production.....;	14
2.6 The construction industry framework in Ethiopia.....;	15
2.7 The role of the construction sector in Ethiopia.....;	16
2.8 The current state of the construction industry.....;	16
2.9 The future of the construction industry in Ethiopia.....	17
2.10 Factors that influence the performance of the construction industry.....	17
2.11 Choice of construction technology.....	17

---

<b>CHAPTER THREE.....</b>	<b>18</b>
<b>RESEARCH DESIGN AND METODOLOGY.....</b>	<b>18</b>
3.1 Research design.....	18
3.2 Study area.....	18
3.3 Population and sampling techniques.....	18
3.4 Instruments of data collection.....	20
3.5 Procedure of data collection.....	20
3.6 Method of data analysis.....	21
3.7 Validity Test.....	21
3.8 Reliability Test.....	21
3.9 Ethical Consideration.....	21
<b>CHAPTER FOUR.....</b>	<b>22</b>
<b>RESULTS AND DISCUSSIONS.....</b>	<b>22</b>
4.1 Findings of the study.....	22
4.2 Discussion.....	25
<b>CHAPTER FIVE.....</b>	<b>35</b>
<b>CONCLUSIONS AND RECOMMENDATIONS.....</b>	<b>35</b>
5.1 Conclusions.....	35
5.2 Limitations of the study.....	36
5.3 Recommendations.....	37
References.....	39
Appendices.....	42

---

## **ACKNOWLEDGMENTS**

Above all, I would like to thank the Almighty GOD for being with me and helping me from the start to the end. Next, I would like to thank my advisor Tiruneh Legesse (Ass. Prof) for his friendly and prudent guidance and support during the research work of this thesis.

My great gratitude reaches to Addis Ababa City Akaki Kality Housing Project Office for helping me to contact Project Managers working in the project without any reservation. And also I respect all the Project Managers taking their precious time in filling the questionnaires.

And finally I would like to thank my friends who helped me in different ways.



---

<b>List of tables</b>	<b>Page</b>
Table 1: Demographic data and Work experience.....	22
Table 2: Number of employees, Grade category and Work Position.....	23
Table 3: Labor vs. Capital Intensive Technology for Job Opportunity.....	23
Table 4: Labor vs. Capital intensive technology for cost of Production.....	25
Table 5: Labor intensive Vs. Capital intensive technology for quality of works.....	27
Table 6: Labor intensive Vs. Capital intensive technology for production time.....	28
Table 7: Labor intensive Vs. Capital intensive technology impact on income equality.....	29
Table 8: Labor intensive Vs. Capital intensive technology and global competitiveness.....	30
Table 9: Labor intensive Vs. Capital Intensive Technology and Knowledge transfer.....	31
Table 10: Technology contribution to community empowerment.....	32
Table 11: Labor intensive Vs. Capital intensive technology impact on Political stability....	33
Table 12: Labor intensive Vs. Capital intensive technology and social stability.....	34

---

## **Acronyms**

GDP	Gross Domestic Product
NBA	National Bank of Ethiopia
GTP	Growth and Transformation Plan
TVET	Technical and Vocational Education Training
GNP	Gross National Product
CII	Construction Industry Institute
ILO	International Labor Organization
WEP	World Employment Program
ROA	Return on Asset
MOWUD	Ministry of Works and Urban Development
FDRE	Federal Democratic Republic of Ethiopia
CIOB	Chartered Institute of Building
CSA –	Central Statistical Agency

---

## **Abstract**

*The objective of this study is to find out, compare and contrast the contribution of labor intensive and capital intensive construction technologies to the construction industry, taking in to consideration the benefit they bring to the majority of the people and at the same time find out if the technologies are well applied so that they contribute to industry growth so that future development and global competitiveness is secured. The research problem is approached by conducting descriptive survey on key actors of the industry, in this case construction project managers working on building construction projects; and review of related literature is made to collect sufficient secondary data for the analysis. The key findings from the study shows that Labor intensive construction technology is better in terms of creating employment opportunity, stabilizing social and political environment in the country and most of all bringing income equality among the beneficiaries of the industry, and on the other hand, Capital Intensive technology has got the better advantage in terms of product quality, reduction of production cost and time, global competitiveness and knowledge transfer. The study shows that each technology is not properly used as it should be, and tried to recommend that in depth study has to be done towards choosing the right construction technology, an appropriate technology, that combines both technologies which fit to the current development stage, that will absorb the abundant labor force and support future policy of the country, and most of all, which brings income equality among the construction industry performers.*

**Key words:** Labor intensive; Capital intensive; Technology; Income inequality; Job opportunity;

## **CHAPTER ONE**

### **INTRODUCTION**

#### **1.1 Background of the Study**

Ethiopia is one of the developing country among those countries showing a great economic boom, besides other sectors the construction industry is one of the nation's largest industries, it contributed more than half (56.1%) to industrial sector growth and accounted for 8.5% of the nation's GDP which is 59 billion birr in 2015 (NBE, 2015). And it is playing crucial role for the growth by creating job opportunities. But currently the productivity is becoming more capital intensive because firms chose investing on modern construction equipment to be more productive instead of enhancing the production efficiency of the abundant labor force through training and capacity building. This trend is creating its own trouble by decreasing the employment opportunity.

A major objective of development policy is not only the creation and expansion of production capacity but also the generation of employment opportunities to accommodate the growing labor force of the country. Literatures showed that for the developing countries (Third World Countries) an appropriate technology which benefits the mass and advance innovation is preferable because there is abundant cheap labor and also it creates more employment opportunities and make sustainable development (Akube, 2000). Even if the government is trying to create job opportunities by implementing some construction technologies that have the tendency of benefiting labors like Cobble stone production and installation, the effort is not seen in the private sector and some government enterprises.

The purpose of this paper is to find out, compare and contrast the contribution, explain the advantages and disadvantages of labor intensive and capital intensive technologies in the Ethiopian construction Industryt and recommend the best option by targeting on the creation of more employment opportunity for the abundant labor market and ensure that they are properly benefiting from it and also open the door for more research and study in this area.

## **1.2 Statement of the Problem**

The growth of the economy and the recent boom of the construction industry in Ethiopia is playing vital role for the development of the country and the growth of GDP. Many are involving in the construction industry and getting their share of profit and building their capacity and contribute to the GTP. By building capacity means they are investing a lot of capital on the purchase of construction equipment that increase productivity. Even if this has a positive impact on the industry growth its effect in negatively affecting the creation of job opportunities that reduced the number of labors involved in the process is not considered and also unfair distribution of wealth is seen because most profit share is taken by the company owners.

It is clear that if production is more capital intensive, it has a positive impact in in reducing cost, contribute to technology advancement, but it does not consume more labors, and for the developing countries like Ethiopia which is struggling to create more job opportunities this condition is not right. On the other hand labor intensive technology is better in creating job opportunities, but it is weak in terms quality and productivity because it is not systematic and well applied.

The country is producing skillful labors from its Universities, colleges and TVET Institutes who are trained in different skills, but there outside in the real environment more capital intensive production technology which does not require the involvement of many labor input is becoming a trend, . Where will be the place for these skilled labors if the activities are performed like this? In addition advanced technologies, capital intensive technologies are important for the industry growth but they are creating great income disparity because the profit generated due to the increased productivity goes to the company owners. It has to be ensured that the gain from development are within people's reach that benefits the majority. This condition shows that there is a knowledge gap in choosing and implementing the right technology that creates satisfactory employment opportunity.

### **1.3 Basic Research Questions**

The study attempted to answer the following questions:

1. Is the current construction technology creating satisfactory employment opportunity for the abundant labor of the country?
2. Is there even distribution of wealth among the beneficiaries of the construction industry?
3. Which technology is best in creating more employment opportunity, capital Intensive or Labor intensive?
4. Which technology is better in reducing production cost, increasing quality of product and minimalizing production time?
5. Do contractors provide skill upgrading trainings, favorable work place and appropriate tools for their labors?
6. Which construction technology plays vital role in knowledge transfer and global competitiveness, Labor intensive or Capital intensive construction technology?
7. Which construction production technology is best in sustaining political and social stability in the country?

### **1.4 Objective of the Study**

#### **1.4.1. General Objective**

To find out if the current construction technology applied is allowing citizens get proper benefit from the booming construction industry and recommend the best technology that fit in fulfilling this objective and forward the result as input to the construction policy development and improvement process.

#### **1.4.2. Specific objectives**

- i. To find out if the current construction technology is creating satisfactory employment opportunity
- ii. To find out if the applied technology is contributing to even distribution of wealth among the performers of the construction industry (Contractors, Engineer, Labors, etc.....)
- iii. To find out which construction production technology is best in creating satisfactory job opportunity.
- iv. To examine the contribution of the labor intensive and capital intensive construction technologies in terms of increasing productivity, enhancing quality and reducing cost and time.
- v. To find out if contractors are providing skill upgrading trainings, favorable work place and appropriate tools for their labors.
- vi. To find out if the current construction technology is contributing to knowledge transfer and as the same time creating the opportunity for global competitiveness and point out which technology is best in achieving this object.
- vii. To examine if the current construction production technology is contributing to political and social stability of the country.

#### **1.5 Significance of the Study**

The important of this study is to identify whether labor intensive or capital intensive production Technology is useful for the country and its people and based on the findings to recommend the best solution for the welfare of the society. It is visualized that the study will be beneficial to all relevant parties that involved in the construction industry ranging from those involved in academic research, student, practitioners of construction industry and the professionals, policy makers and concerned government bodies.

#### **1.6 Scope of the Study**

This research examines if the currently implemented construction technologies, labor intensive and capital intensive technologies are contributing to the industry properly, review related literatures to find out and recommend best approaches that will help in choosing the proper construction technology that has to be applied within the Ethiopian construction industry, taking in to consideration the current unemployment issues, unequal distribution of wealth and other related issues.

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

The construction industry is operating in wider area and the research issue is extensive and crucial but due to time and cost constraints the scope of the study is limited and focus only on one project, Akaki- Kality Housing project Koye Feche site, which is a branch of Addis Ababa City Housing Development Project. This is with the assumption that addressing the problem well with data on this selected project will help solving problems on other projects. As a result, the expected research findings might not reflect the actual scenario and further in depth research is needed for inclusion of other project.

### **1.8 Organization of the study**

This research work is structured as, chapter one is the introduction of the study which concerns on the choice of construction production technology and deals about statement of the problems, objectives, scope, significance and etc. of the study; Literatures is reviewed and discussed in chapter two; chapter three assess about productivity, technology, labor intensive technology, capital intensive technology in the Ethiopian construction industry. In chapter four data were collected, analyzed and discussed, and based on the result obtained from the analysis an appropriate technology that benefit the citizens was recommended; and finally conclusions and recommendations are presented in chapter five.

### **1.9 Definitions of Terms**

#### **Productivity:**

- ‘Productivity’ refers to the ability to generate outputs from a set of inputs ( Richardson, 2014)

#### **Labor Intensive:**

- Labor-intensive production means that the way that a good or service is produced depends more heavily on labor than the other factors of production, such as capital (Tasrif, 1995).

#### **Capital Intensive:**

- Capital-intensive processes are those that require a relatively high level of capital investment compared to the labor cost (Tasrif, 1995).



## **CHAPTER TWO**

### **REVIEW OF RELATED LITERATURE**

#### **2.1 Introduction**

Growth in one sector of the economy will not automatically translate into benefits for the poor: much will depend on the profile of growth (its employment - or productivity - intensity), the sectorial location of the poor, and the extent of mobility across sectors. For employment-intensive growth to translate into poverty reduction it must occur in a “more productive” sector, while “less productive” sectors may require productivity-intensive growth to ensure a decline in headcount poverty.

Country-specific quantitative and qualitative analysis is required to identify constraints to job creation, productivity and mobility and to ensure that the poor are able to participate in more and better job opportunities (Hull, 2009).

This chapter presents reviews of various literatures on Construction, Productivity, Labor Intensity and Capital Intensity in the Construction industry. Different works on the choice of technology for better productivity will be reviewed to better understand both the theoretical and practical frameworks as well as aspects that contribute in determining the best construction technology that boosts productivity.

#### **2.2 Construction Industry**

The construction industry is a sector of the economy that transforms various resources into constructed physical economic and social infrastructure necessary for socio-economic development. It embraces the process by which the said physical infrastructure are planned, designed, procured, constructed or produced, altered, repaired, maintained, and demolished. The constructed infrastructures include:

- Buildings
- Transportation systems and facilities which are airports, harbors, highways, subways, bridges, railroads, transit systems, pipelines and transmission and power lines.
- Structures for fluid containment, control and distribution such as water treatment and distribution, sewage collection and treatment distribution systems, sedimentation lagoons, dams, and irrigation and canal systems.
- Underground structures, such as tunnels and mines. (MOUDC, 2012)

The industry comprises of organizations and persons who include companies, firms and individuals working as consultants, main contractors and sub-contractors, material and component producers, plant and equipment suppliers, builders and merchants. The industry has a close relationship with clients and financiers. The government is involved in the industry as purchaser (client), financier, regulator and operator. (MOUDC, 2012)

### **2.2.1. Construction Industry in the Developing Countries**

The construction industry in the developing countries is beset by serious difficulties including shortages of semi-skilled and skilled labor, inadequate production of construction materials, lack of capital and poor management. These countries, for the most part, depend on large international contractors from countries like China, Germany, Turkey, United States, France and United Kingdom for construction of the major infrastructures and large scale projects that are needed in the economy. (UWAKWEH, 2000).

It is generally believed that most developing countries are characterized by abundant supplies of labor. However, they are waded with scarcity of skilled construction workers. Training of construction craft workers is not very common in these countries, and when they are available, they may not be adequate. To intensify the situation, informal on-the-job training are not well developed and not common. The lack of serious craft training can be attributed to the fact that constructors even in the developed countries take a short-term view of craft training. Another reason is the fluctuations in construction projects. Construction craft workers, once they complete their task on a project are laid off, and hence, must move to another project. As a result, construction workers tend to identify more with their trade than with a construction firm. Also, constructors keep workers on their payroll only when they have projects. The culture of contractor organizations or even constructors being involved in formal training of the various skills required in the industry is non-existent. (UWAKWE, 2000).

The significance of the construction industry as an important factor in economic growth cannot be overemphasized. It is an important contributor to any country's gross national product (GNP), and a major source of employment. Because the industry is labor-intensive, investment in construction will provide greater number of jobs than will investment in less labor-intensive industries. (UWAKWEH, 2000).

It is not uncommon to see abandoned projects in the developing countries. These projects are abandoned not only because of inadequate funding, but also due to inadequate supply of skilled labor. Because of this phenomenon, there is a lack of continuity of work, resulting in casual labor. As a consequence, there is little long-term employment, and this inhibits the emergence of a skilled and experienced labor force. (UWAKWEH, 2000).

### **2.3. Technology**

Technology has different meanings and definitions. In manufacturing, technology has often been used interchangeably with the production system. Daft (2004) defines technology as the tools, techniques, machines, and actions used to transform organizational input (materials and information) into output (products and services). Slack et al. (1995) also see production as a transformation process. In addition to the transformation process, (Koskela, 2000) sees the production as a flow to reduce waste and a value generation process to meet customer needs.

Technology includes hard machinery and soft work procedures. Most literature of technology emphasizes the hardware aspect such as machine and techniques but neglects the software aspect such as methods of working and managing. Technology influences performance and achievement of strategic objectives. The software of the transformation process is like tacit knowledge that is worth exploring in depth to supplement hardware to achieve better performance (Chang & Lee, 2004).

### **2.4. Productivity**

Productivity is the ultimate engine of growth in the global economy. Raising productivity is therefore a fundamental challenge for countries going forward

In general, literature shows that there are two kinds of productivity definitions: **verbal** and **mathematical**. Verbal definitions of productivity aim to explain what the term means while mathematical definitions are used as a basis of measurement that is intended to improve productivity (Tangen, 2005)

#### **2.4.1. Verbal Definitions of Productivity**

The European Association of National Productivity Centres (EANPC, 2005) defines productivity as how efficiently and effectively products and services are being produced. In this context, efficiency refers to “doing things right” or utilizing resources to accomplish desired results (Grunberg, 2004) and effectiveness described as “doing the right things” or meeting the customer requirements (Neely, Gregory, & Platts, 1995).

Bernolak (1997) defined productivity as “how much and how good we produce from the resources used.” Generally, productivity is often defined as the ratio of output to input (Rojas & Aramvareekul, 2003). Output, in this context, can be seen as any outcome of the process, whether a product or service, while input factors consist of any human and physical resources used in a process (Pekuri et al., 2011).

In contrast, it has also been defined traditionally as the ratio of input to output, where input refers as an associated resource (usually, but not necessarily, expressed in person hours) and output as real output in creating economic value (Dozzi & AbouRizk 1993).

Because of these contradicting definitions of productivity there is lack of standard definition (Thomas & Mathews, 1986). In 2006, Hee-Sung Park explained the two forms of productivity: the first form i.e., output/input has been widely used in the construction industry and the existing literature, and the second form i.e., input/output has been usually used for estimating (Park, 2006).

One can easily get confused with the terms productivity and profitability because, like productivity, profitability is also seen as a relationship between output and input. This relationship is monetary thus the influence of price factors is included (Tangen, 2005).

According to Pekuri et al. (2011), the difference between these concepts is that profitability takes into account monetary effects, while productivity relates to a real process that takes place among purely physical phenomena. Similarly, productivity is often confused with performance; however, performance is a broader concept that covers both the economic and operational aspects of an industry (Pekuri et al., 2011). Construction Industry Institute (CII, 2006) reports productivity as “one of the most frequently used performance indicators to assess the success of a construction project because it is the most crucial and flexible resource used in such assessments.”(Krishna, 2015)

### **2.4.2. Output/Work hours**

The measure of the rate at which work is performed is called “productivity”. It is a ratio of production output to what is required to produce it. The measure of productivity is defined as a total output per one unit of a total input like productivity, profitability is also seen as a relationship between output and input (Tangen, 2005).

This relationship is monetary thus the influence of price factors is included (Tangen, 2005). According to Pekuri et al. (2011), the difference between these concepts is that profitability takes into account monetary effects, while productivity relates to a real process that takes place among purely physical phenomena.

Similarly, productivity is often confused with performance; however, performance is a broader concept that covers both the economic and operational aspects of an industry (Pekuri et al., 2011). Construction Industry Institute (CII, 2006) reports productivity as “one of the most frequently used performance indicators to assess the success of a construction project because it is the most crucial and flexible resource used in such assessments.”(Krishna, 2015)

### **2.4.3. Productivity in Construction**

The primary concern of constructors in developed and developing nations is with craft workers and how to increase their productivity. Although, this is of interest to constructors, there has not been significant research on how to improve construction worker productivity. Existing research on productivity view workers simply as labor, and therefore, one of the factors of production. The implication of this assumption is that management’s objective is to maximize the efficiency with which these workers are utilized. Thus, one unit of labor is perceived as interchangeable with another. This view of interchangeability of labor leads management to focus on the work and the environment instead of the worker. (UWAKWEH, 2000)

The assumption of this “engineering view of worker” is that the worker possesses the necessary abilities (mental and physical) to successfully perform a given task. Thus, management can enhance worker performance by providing the necessary equipment, materials, tools, instructions and the environment that is conducive for expected level of performance. As a result, performance is indicative of the effort expended by the worker due to resources provided by management.

The duration of effort the worker is willing to exert in the task, the intensity of the workers effort, the effectiveness with which the worker's effort is combined with technology and other resources, and the efficiency of the workers effort. The proportion of time that the worker is engaged in productive work during work period is the duration of the worker's effort. This time may be influenced by the availability of resources and the worker's motivation. Similarly, it may also provide an insight on a worker's ability. (UWAKWEH, 2000).

The effectiveness with which a worker's effort is combined with technology and other resources is a measure of the degree to which the productive potential of technology and other resources has been utilized. As an illustration, a worker can move bricks by either a wheel barrow or a forklift. In the latter case, the worker's effort has been combined much more effectively with the available modern technology.

The efficiency of a worker's effort is a measure of the quantity of acceptable quality output provided by a worker as a result of effort expended. It is possible for a worker to expend effort very intensely over a period of time, but if the quality of work is poor, then the worker's efficiency and performance will be low. On the other hand, a worker may take extreme care to produce high quality product, but, because of time expended in producing this high quality product, not enough quantity is produced. In this case, the worker's efficiency and performance are low. This is true if the quality of the individual's work is far more superior than is required by the task. Using rough carpentry as an illustration, it is not necessary to measure a piece of lumber to the same tolerance as we would in finish carpentry. (UWAKWEH, 2000).

Productivity is perhaps one of the most important and influential basic variables governing economic production activities (Singh, Motwani & Kumar, 2000; Tangen, 2006). Higher productivity levels allow constructors to simultaneously increase profitability, improve competitiveness, and pay higher wages to workers while completing activities sooner (Rojas, 2008). It is a commonly used but often poorly defined term that is often confused with profitability and performance (Pekuri, Haapasalo, & Herrala, 2011). Pekuri et.al. (2011) also defined productivity as an ambiguous concept that seems to be dependent on the reviewer's point of view and the context in which it is used.

Therefore the definition of productivity should be clear within the context described to provide proper meaning. In order to be able to understand how productivity is defined in a context, it is very necessary to explore the definitions of productivity and how they are being used in the construction industry. (UWAKWEH, 2000)

## **2.5. Production Technologies**

Production technology is the technology used to produce goods, services or works. It can vary from the most sophisticated that uses automation and IT to the primitive one that use labor force and small hand tools, for this study divide the technology in to two major category, Labor intensive production Technology and Capital Intensive Production Technology.

### **2.5.1. Labor Intensive Productivity (Production Technology)**

Labor-intensive production means that the way that a good or service is produced depends more heavily on labor than the other factors of production, such as capital. The degree of labor use is measured in proportion to the amount of capital required to produce the goods/services; the higher the proportion of labor costs required, the more labor intensive the business (Tsegaye, 2014).

#### **2.5.1.1. Labor Intensive Production Technology in Construction**

Labor-intensive construction may be defined as the economically efficient employment of as great a proportion of labor as is technically feasible, ideally throughout the construction process including the production of materials, to produce as high a standard of construction as demanded by the specification and allowed by the funding available; labor-intensive construction results in the generation of a significant increase in employment opportunities per unit of expenditure by comparison with conventional capital-intensive methods(Robert, 2008).

There are several stages of employment intensity depending upon the type of project and the parameters used to define economic efficiencies. The first stage of labor intensity is cost-competitive with conventional capital-intensive methods. This is achieved partly through the creation of individual, community and institutional capacities by the establishment of large, carefully planned, long-term national programmers (Robert, 2008).

A consequence to this definition is what it is *not*: It is not the use of large numbers of people on relatively unplanned emergency or relief projects to construct something of ill-defined quality and value; that is labor-*extensive* (Robert, 2008).

Since the 1970s, “labor-intensive” has been the term used in the major research and field studies carried out by the World Bank and the International Labor Organization. A serious problem with the phrase “labor-intensive” is that decision makers tend to focus upon “labor” and its negative meanings of “picks and shovels” (and “slave-”). This ignores, as we will see below, the array of factors which need to be in place long before any labor can be productively employed. These factors include: appropriate policy, legislation, institution, suitability of project, contract documentation, sanction, quality and efficiency, organization and training at site and managerial levels, including that required for proper contractor and sub-contractor development (Robert, 2008).

The South African National Productivity Institute found that management is responsible for 85 per cent of the improvement in labor productivity; labor for only 15 per cent. For these reasons the authors now prefer to use the term “employment-intensive” (Robert, 2008).

The definition has already been given. Its intellectual base began with the recognition that the conditions regarding the factors of production were different in developing countries from those in the industrialized world. A major thrust of the development policies of the 1950s and 1960s was the growth of Gross National Product and the promotion of rapid urbanization and industrialization, the latter involving the transfer of technology from industrialized countries. (Robert, 2008).

Government policies promoted the use of machinery. Yet by the late 1960s unemployment were increasing. "Takeoff" into self-sustained economic growth, as predicted by Rostow, for example, had simply not taken place. Technology transfer became problematic. Much later it was recognized that there was a need for a local technological.



In 1969, as mentioned above, the ILO set up its World Employment Program (WEP), which was devoted to seeking ways of creating employment opportunities not only through economic growth but also in its absence. Research was carried out into the employment potential within the existing economy. One of the concepts explored seemed bizarre in the context of the late 20th Century: the reverse substitution of labor for equipment. (Robert, 2008).

Civil construction was identified as worthy of attention. Firstly, it formed a definable portion of the economy and thus employed a significant proportion of the work force. Secondly, in the industrialized countries and the modern sector of developing countries, the civil engineering industry was capital-intensive (building by comparison was labor-intensive) thus the opportunity existed to substitute people for machines. Thirdly, 50 to 60 per cent of most countries' capital formation is in construction as a whole and the civil portion plays a key part in the infrastructure of the economy (roads, railways, dams, ports, power stations, irrigation, and air ports). Fourthly, 60-70 per cent of civil construction in developing countries is carried out through the public sector and should, therefore, be amenable to influence by government policy (Robert, 2008).

## **2.5.2. Capital Intensive Production Technology**

Capital-intensive processes are those that require a relatively high level of capital investment compared to the labor cost (Robert, 2008).

### **2.5.2.1. What does 'Capital Intensive' mean?**

Capital intensive refers to a business process or an industry that requires large amounts of money and other financial resources to produce a good or service. Once the upfront investments are made, there may be economies of scale with regards to ongoing expenses and sales growth, but the initial hurdle to get into the business tends to keep the list of competitors small, creating high barriers to entry. Companies in capital-intensive industries are often marked by high levels of depreciation and fixed assets on the balance sheets.

### **2.5.2.3. Measures of Capital Intensity**

There are several ways to measure and compare capital intensity. One way to measure a firm's capital intensity is compare capital expenses to labor expenses. For example, if a company spends Birr100000 on capital expenditures and Birr 30,000 on labor, it means the company is most likely capital-intensive. Likewise, if a company spends Birr300000 on labor and only Birr 10,000 on capital expenditures, it means the company is more service- or labor-oriented.

A company that needs more assets to produce a dollar of sales has a higher capital intensity than a company that needs fewer assets to produce the same dollar. As a result, analysts like to measure capital intensity by looking at a variation of return on assets (ROA) calculated by dividing total assets by sales. (Robert, 2008).

Instead of looking at the level of net income created by each dollar of assets, which is what ROA measures, it looks at the level of revenue created by each dollar of assets. In this way, it is a measure of asset efficiency rather than management's efficient use of assets (Robert, 2008).

## **2.6. The Construction Policy Framework in Ethiopia**

The National Construction Industry Policy takes into account of the fact that the realization of the objectives and goals of the identified priority sectors such as education, health, water, agriculture, manufacturing, tourism, mining, energy, construction, land and good governance operates on the availability of reliable, strong and competitive local construction industry which is capable of delivering quality services to its stakeholders. New investments in the construction and rehabilitation of infrastructure will be given priority parallel with the maintenance of the existing constructed facilities so as to enable speedy development of the other sectors which depend upon the performance of the local construction industry. The interim policy is anticipated to provide guidance towards the increased involvement of the local construction industry in construction activities. (MOUDC, 2012).

The Construction Industry Policy emphasizes the development of an efficient and self-sustaining roads network that is capable of meeting the diverse needs for construction, rehabilitation and maintenance of civil works for trunk, regional, districts and feeder roads network through the involvement of private sector. Public sector involvement in the enhancement of housing, infrastructure and other constructed facilities to assist in the mobilization of financial resources as well as capital investment will be emphasized. (MOUDC, 2012).

The pursuance of all the above general goals will be carried out in tandem with all the other key national sectorial policies, e.g. agricultural policy, land policy, investment policy, industry and trade policy, energy policy, housing policy, health, education and all other sectorial policies which have direct or indirect impact on the construction sector. (MOUDC, 2012).

## **2.7 The Role of the Construction Sector in Ethiopia**

The construction industry in Ethiopia is the major sector where public and private sectors are investing huge amount of fund. The percentage share of the construction sector to GDP at constant basic price has increased from 4.3% in 1993 E.C to 5.8% by 2002 E.C.

Expansion of economic infrastructure (railways, roads, telecom, power, irrigation) being critical towards achieving the country's Growth and Transformation Plan (GTP). Significant amount of the country's budget is allocated to economic development through financing infrastructures for development of educational and power projects, construction of railways and road projects which increased road network density, construction of health projects to increase access for water and sanitation infrastructure. Share of the Private sector in the value add of construction is also significant. (MOUDC, 2012).

The private sector is investing its capital for acquisition of various fixed assets such as acquiring new machinery and equipment and construction of new buildings and building maintenance activities. The construction industry of Ethiopia has contributed much in reduction of poverty, in increasing employment expansion through small and medium enterprise development and job creation through the construction of low cost houses in Addis Ababa which was subsequently replicated to other regions. Ethiopia has also issued successive public procurement reforms to adhere good governance principles, reform efforts were made in order to promote competitive tendering for the selection of suppliers and for effective deliver of projects with predictable cost and time (MOUDC, 2012).

## **2.8. The current State of The Construction Industry**

Currently the construction industry is making a huge contribution in creating job opportunities. In recent years, in addition to government funded projects, private investors are spending money on the construction of multipurpose buildings, business complex and real estate.

## **2.9. The Future of the Construction Sector in Ethiopia**

The construction industry has bright future, with the help of advanced technology. The government of Ethiopia is giving priority to the industry, the next 20 years the industry will be create enormous employment opportunity and pave the road to be globally competitive.

## **2.10 Factors that influence the performance of the construction Industry**

The inefficient and deteriorated state of the construction industry with poor performance has detrimental effects to the development of the industry. Weaknesses, problems and constraints hampering the performance and development of the industry include (MOUDC, 2012):

- Low capacity and capability of the local contractors and consultants due to weak resource base and inadequate experience.
- Inadequate and erratic work opportunities, inappropriate contract packaging of works which favor foreign firms in donor funded projects, low public investment in infrastructure projects and over dependence on donor funding.
- Inefficient and non - transparent procurement Systems Corruption and financial mismanagement in public/private sectors.
- Lack of supportive institutional mechanisms in terms of financial credit facilities, equipment for hire and professional development.

## **2.11. Choice of Construction Technology**

Hiring more productive workers or Adopt more advanced production Technology? Which one is better for a developing country like Ethiopia, taking in to consideration the current development path and development policies of the Country? Different literatures argue in these issues, the choice of technology for sustainable development. What shall it be?

In this paper both labor intensive and capital intensive technology will be discussed, compared and analyzed based on the benefit that brings to the country and its people.

## **CHAPTER THREE**

### **RESEARCH DESIGN AND METHODOLOGY**

#### **3.1 Research Design**

The Research is descriptive in which Opinion survey is used for data collection, and the research adopted a mixed method analytical approach. Mixed method includes the collection and analysis of both qualitative and quantitative data in a single study in which the data are collected concurrently or sequentially [and which] involve the integration of data at one or more stages in the process of research (Creswell et al. 2003: 212). Bak (2011) cites three advantages of mixed method research, namely: convergence and integration of findings; shrinkage of other possible explanations for conclusions; and clarifying different aspects of the phenomenon under investigation. In the study described here, the data are collected concurrently using a structured questionnaire to assesses the opinion of construction project Managers regarding the construction industry trend with respect to the technology used and describes various factors that would have significant impact on the implementation of Labor Intensive and Capital Intensive Construction Technology that support the realization of growth, competitiveness and poverty reduction strategy and policy of the country.

#### **3.2. Study area**

The study area was Addis Ababa City housing development Akaki Kality Housing Project, Koye Feche Project Site.

#### **3.3. Population and Sampling Techniques**

##### **3.3.1. Population of the Study**

Population of the study were 250 Project Managers working for Construction Contractors Registered by Ministry of Works and Urban Development of Ethiopia and which are currently participating in the construction of Low Cost Housing at Addis Ababa City Housing project, Akaki Kality Sub-city. The Sub-city is chosen because it is accessible with reasonable time and minimum cost.

### **3.3.2 Sampling technique**

The objective of the study was to investigate the opinions of Project Managers in choosing the right technology, labor intensive or capital intensive technology is better for the construction industry, in terms of the welfare of the people, equal division of wealth, the country's Sustainable development, quality of work and cost of work and keeping in consideration that quality standards has to be met in order to be competitive in the global market.

Using a sound judgment, stratified purposive sampling technique is used to choose samples that represent the population to participate in the study. The Researcher believed that the samples chosen in this technique can properly represent the population and help in saving time and money In the year 2016, from 6665 Contractors registered by FDRE MOWUD, 100 high grade contractors (Grade 1 to Grade 3) and 150 Medium grade contractors (Grade 4 to 6) are participating in the construction of low cost houses in Akaki Kality Sub-city, lower grade contractors (Grade 7-10) are not participating because of their capacity, so they are excluded from this study.

For this study Project Managers working in the specified project were approached. Since the project managers are all professionals who have the required education and work experience and have the real exposure of the actual working environment their response is accurately represent the population, so stratified purposive sampling were applied by picking equal number of project managers from each category.

The contractors are categorized based on their capacity, the high grade contractors use capital intensive technology( Cranes, Concrete pumps, Truck Mixers, etc.) that does not need the inclusion of many labor force, while the medium grade contractors use more of labor with help of small tools and equipment( Mobile mixers, hand tools).

Depending on sound judgment and ease of access, 25 Project Managers from the Higher grade Contractors and the same 25 Project Managers from the Medium grade contractors were approached.

### **3.4 Instruments of Data Collection**

A sectioned opinion survey questionnaire instrument which contains quantitative and qualitative questions were designed. The strength of respondents' opinions was elicited by using 5 point Likert scale of agreement or importance. The survey questionnaire sought demographic, cultural and professional background information from respondents; investigate the effects in increasing or decreasing employment opportunities, affect quality of works, affects the business, affect the productivity, social and political stability of the country.

### **3.5 Procedure of Data Collection**

In statistical investigations, collection of data occupies the important place and the data collected are the foundation of the whole structure. The whole statistical analysis is based on the way the data have been collected or obtained, because the data provide a raw material to statistical analysis and interpretation.

For this research two types of data were gathered and used. The first is the primary data, the data which are obtained for the first time for the statistical investigation, collected by providing Structured questionnaires and distributed in person to the sample population and were collected after filled by the respondents. The secondary data were obtained from research journals, related literatures, publications and websites.

### **3.6 Method of Data Analysis**

Quantitative data analysis is used in this study by compiling in tables the frequency and percentage of the respondents. After collecting all questionnaire during the onsite visit the questionnaire report are scrutinized and relevant statement in each questionnaire report are categorized according to sub evaluation questions.

### **3.7 Reliability**

Reliability is defined as be fundamentally concerned with issues of consistency of measures (Bryman and Bell, 2003). In general we can say that reliability of a study is a pre-requirement for the result to be interpretable and help for generalization (Ghiselli, 1981). Internal consistency reliability is used to assess the consistency of results across items within a test and the method for assessing reliability of the current study. This is done by using Cronbach's alpha. The alphas for the current study were presented together with the research result in order to make the presentation more logical.

### **3.8 Validity**

Based on the researcher opinion the instrument has a good Content Validity that provides adequate coverage of the topics under consideration, because the statements have been generated from an extensive review of literature and it contains a representative sample of the universe of subject matter of interest. For the content validity the researcher had a discussion with some project managers working in the study area. The comments were taken in to consideration for developing the final version of the instrument, so its content validity is good.

### **3.9 Ethical Consideration**

The necessary permissions was requested prior to distributing the questionnaires for the selected candidates. And participants have the awareness from the research questionnaire that no information will be made public and the study will be utilized for academic purposes only.



## CHAPTER FOUR

### RESULTS AND DISCUSSIONS

#### 4.1 Findings of the study

Respondents were asked general demographic questions regarding their age, gender, location, job level, job sector, and the number of employees within their organization. There were both qualitative and quantitative questions in the survey, allowing respondents the opportunity to openly express their opinions. From the survey response out of a total of 50 invitations 39 usable responses were received by the cut-off date, these represented 78% usable response rate. When we come to the age, 52% are from 36 to 40 years old and 25% are above 40 years old. 45% of the respondents work for High grade contractors employing over 100 staff, 55% work for Low grade contractors that employ less than 100 staff. From the respondents 75% are degree holders, 5% are Certificate holders, 15% diploma holders, and the rest 5% are Master's degree holders.

#### Characteristics of respondents

**Table 1: Age, Gender, Educational Level and Work experience of the respondents**

		Frequency	Percentage	Commutative %
Age	21-25	4	10%	10%
	26-35	6	14%	24%
	36-40	20	52%	76%
	>40	9	24%	100%
	<b>Total</b>	<b>39</b>	<b>100%</b>	<b>100%</b>
Gender	Male	30	77%	77%
	Female	9	23%	100%
	<b>Total</b>	<b>39</b>	<b>100%</b>	<b>100%</b>
Educational Level	2 <sup>nd</sup> Degree	2	5%	5%
	1 <sup>st</sup> Degree	29	75%	80%
	Diploma	6	15%	95%
	Certificate	2	5%	100%
	<b>Total</b>	<b>39</b>	<b>100%</b>	<b>100%</b>
Work Experience	1-5 years	14	35%	35%
	6-10 years	14	35%	70%
	>10 years	11	30%	100%
	<b>Total</b>	<b>39</b>	<b>100%</b>	<b>100%</b>

Source: Own Survey, 2017

**Table 2: Number of employees, Grade category and Work Position**

		Frequency	Percentage (Rounded)	Commutative %
Number of employees under the management	<20	4	5%	5%
	21-50	6	35%	40%
	51-100	20	45%	85%
	>100	9	15%	100%
Grade Category	High Grade(1-3)	18	45%	45%
	Medium Grade(4-6)	21	55%	100%
Work Position	Company Owner	2	5%	5%
	Project Manager	29	75%	80%
	Both	6	20%	100%

Source: Own Survey, 2016/17

**Table 3 Choice of technology**

	Technology	Grade Category	Frequency	Percentage (Rounded)	Commutative %
Choice of technology, Labor intensive Vs. Capital Intensive	Labor	High Grade	6	15.38%	15.38%
		Medium Grade	8	20.51%	35.89%
	Capital	High Grade	12	30.77%	66.36%
		Medium Grade	8	20.51%	87.17%
	Both	High Grade	5	12.82%	100%
		Medium Grade	0	0%	100%

Source: Own Survey, 2017

### 4.3 Discussions

As it is observed in Table 1 above most of the respondents are well matured, well-educated and are project managers with long years of experience and their response is based on practical experience and real environment exposure. And one can conclude that majority of the respondents are well knowledgeable and have the information to understand the research problem and can provide valid and logical answers to the inquiry.

Among the respondents 15.38% of the high grade contractors chose implementing Labor intensive technology while 20.51% of Medium grade contractors chose the same. And when it comes to capital intensive technology 30.77% of High grade contractors made their choice and 20.51% of Medium grade contractors also chose this technology and 12.82% of High grade contractors chose both technology. This implies that the choice of technology vary depending on the availability of capital and also the contractors interest.

#### Job opportunity

Literature (CASEY, 2007) reveals that one of the main goal of development policy in developing countries like Ethiopia is the creation of enormous employment opportunity that can absorb the abundant labor force.

**Table 4: Labor vs. Capital Intensive Technology for Job Opportunity**

		S.D	D	I	A	S.A	
The technologies are creating adequate job opportunities	Labor	Frequency	5	16	7	4	7
		Percentage	12.82%	41.03%	17.95%	10.26%	17.95%
	Capital	Frequency	3	23	8	4	1
		Percentage	7.69%	58.97%	20.51%	10.26%	2.56%

Source: Own Survey, 2017

On the basis of this existing fact 39 respondents were asked that implementation of Labor intensive technology in the construction industry is creating satisfactory employment opportunities, and

responded, 12% strongly disagree, 41.03% disagree, and this implies that labor intensive technology is not generating job opportunity satisfactorily. The same respondents were asked that implementation of capital intensive technology in the construction industry is creating job opportunities satisfactorily And responded, 8% strongly disagree, 58.97% disagree, 8% Indifferent, 10.26% agree, 2.56% strongly agree. This implies that capital intensive technology is not generating enough job opportunity. And when comparing the two, labor intensive technology generates more employment opportunity than capital intensive technology, but in both cases the creation of employment opportunity is not enough to absorb the abundant labor resource of the country.

### Cost of production

Literature (Krishna, 2015) shows that applying new work methods, new technology have the effect of reducing production cost if properly implemented. Utilization of automated equipment, adaptation of wastage minimization techniques, efficiency and time management, skill up grading trainings leads to reduction of production cost and hence optimize profit and also favorable work environment enables workers to produce more.

**Table 4: Labor vs. Capital intensive technology for cost of Production**

			S.D	D	I	A	S.A
Training is provided	Labor	Frequency	3	23	8	4	1
		Percentage	7.69%	58.97%	20.51%	10.26%	2.56%
Proper working tools are provided	Labor	Frequency	5	16	7	4	7
		Percentage	12.82%	1.03%	7.95%	0.26%	17.95%
Favorable work place	Labor	Frequency	15	11	6	4	3
		Percentage	38.46%	28.21	15.38%	10.26%	7.69%
Invest on automated equipment	Capital	Frequency	10	4	15	4	6
		Percentage	25.64%	10.26%	38.46%	10.26%	15.38%
Reduces production cost	Capital	Frequency	2	6	3	18	10
		Percentage	5.13%	15.38%	7.69%	46.15%	25.64%

Source: Own Survey, 2017

Respondents were invited to give their opinion if their company give proper training for the workers so that they can be efficient and productive so that cost of production will reduce. 58.97% of the respondents disagree with the idea and none of the respondents show their agreement on the idea, this implies that most of the contractors are not providing proper training for their labor to facilitate the production process and avoid unnecessary wastage of useful energy.

38.48% of the respondents agree that their company invest on modern equipment expecting that costs could be reduced and profit could be maximized. This has the implication that contractor invest on capital intensive technology to reduce cost of production and hence optimize their profit.

A skilled laborer, equipped with the proper tools and skills can perform better. The important point to consider here is the choice of the right tool. 41.03% of the respondents disagree with the idea that they provide the necessary working tools for their labor resource. This implies that the labor force could not be productive due to lack of proper tools to perform a task.

38.46% of the respondents strongly disagree and 28.21% disagree on the condition that their company provide good working environment for their labor. This is implies that there is lack of effort in providing safe work place environment which has an impact in optimizing labor productivity, because suitable work environment has a positive impact to get the most out of workers.

The last point presented for the argument was the capability of capital intensive technology in reducing production cost, 46.5% of the respondents agree and 25.64% strongly agree on the point and this implies that in addition to other advantages capital intensive technology play important role in reducing production cost.

## Quality of works

When producing service or goods quality is inevitable (Krishna, 2015), because it is a base for a company to be competitive and stay in the market consistently. Most customers do not compromise quality, especially to get a place in the global market quality is mandatory.

**Table 5: Labor intensive Vs. Capital intensive technology for quality of works**

			S.D	D	I	A	S.A
1. Application of the technology has the effect of increasing quality of works.	Labor	Frequency	9	17	7	4	1
		Percentage	23.08%	43.59	17.95%	10.26%	2.56%
	Capital	Frequency	2	3	7	18	9
		Percentage	5.13%	7.69%	17.95%	46.15%	23.08%
2. Quality program is applied	Labor	Frequency	5	25	7	2	0
		Percentage	12.82%	64.10%	17.95%	5.13%	0.0%

Source: Own Survey, 2017

If labors did not have the right skill to do a job it is clear that there is always a quality issue raised. 43.59% of the respondents disagree that labor intensive technology in the context of Ethiopian construction industry increase quality of product. And 46.15% of the respondents agree that capital intensive production increase quality of work. Literature also reveals that modern automated production technology leads to quality production. This implies that capital intensive technology has the advantage of increasing quality of product when compared to labor intensive technology

Literature (Krishna, 2015) reveals that quality needs a plan, a program to keep it, to increase it, to improve it. Many globally competitive companies have quality management plan. 64.10% of the respondents disagree that they have a quality program to enhance the product quality. This implies that majority of the contractors does not have quality plan to implement throughout the production process.

### **Production time**

When we come to the capital intensive technology, production time cannot be reduced only because of the efficiency of the machine used, it depends on how effectively it is operated, and Your company formulate and implement the required quality program to enhance product quality, the same is true that a skilled labor could not produce fast only because he acquire knowledge, there should be a method, a way to use the potential properly and in a productive way.

**Table 6: Labor intensive Vs. Capital intensive technology for production time**

			<b>S.D</b>	<b>D</b>	<b>I</b>	<b>A</b>	<b>S.A</b>
Proper training in operating equipment is given	Capital	Frequency	9	23	6	1	0
		Percentage	23.08%	58.87%	15.38%	2.56%	0%
There is proper work methodology to perform a task	Labor	Frequency	6	22	5	3	3
		Percentage	15.38%	56.41%	12.82%	7.69%	7.69%

Source: Own Survey, 2017

Even if a sophisticated and automated modern equipment is deployed, unless it operated by a skillful and experienced person the expected output will not be achieved. 58.97% of the respondents disagree with the situation that their company trains operators with the required skill, this is a contradiction to the point that capital intensive production reduce cost, it depends on how well it is deployed(used).

Work methods determine success or failure of a work process, properly designed work methods are important to do a task in reasonable time and minimum cost. 56.41% of the respondents disagree that their company have a proper work methodology to perform a task. This implies that the industry is weak in applying work methods that boost productivity by using scientific techniques of performing a task.

### **Income equality**

For a country to be stable and peaceful, it has to choose a technology that brings income equality among the beneficiaries, if this does not happen there will be uncertainty about the continuation of sustainable development. Because the situation creates chaos and strikes. (Krishna, 2015)

**Table 7: Labor intensive Vs. Capital intensive technology impact on income equality**

			S.D	D	I	A	S.A
Application of the technology play a role creating income equality.	Labor	Frequency	3	4	6	21	5
		Percentage	7.69%	10.26%	15.38%	53.85%	12.85%
	Capital	Frequency	2	18	5	8	6
		Percentage	5.13%	46.15%	12.82%	20.51%	15.38%

Source: Own Survey, 2017

46.15% of the respondents disagree that capital intensive production technology creates income equality, and the next highest number of respondents, 20.51% strongly disagree with the issue, this implies that the contribution of capital intensive technology in creating income equality is small and this in support of literature that capital intensive technology creates income inequality.



53.85% of the respondents agree that labor intensive construction technology have an impact on creating income equality, this implies that in the context of Ethiopian construction industry labor intensive technology play a better role in contributing to the creation of income equality by distributing the benefit gained among the beneficiaries.

### Global competitiveness

Global competitiveness is a long term goal for some countries and it will be a short term goal for others, especially developing countries will plan for this after building their national production capacity quality wise and quantity wise (Krishna, 2015)

**Table 8: Labor vs. Capital intensive technology and global competitiveness**

			S.D	D	I	A	S.A
Implementation of the technology helped your company to be a globally competitive	Labor	Frequency	7	29	3	0	0
		Percentage	17.95%	74.36%	7.69%	0.00%	0%
	Capital	Frequency	5	26	7	1	0
		Percentage	12.82%	66.67%	17.95%	2.56%	0.0%

Source: Own Survey, 2017

66.67% of the respondents disagree with the idea that capital intensive technology does help them to be a global competitor, most of the respondents are project managers working for high grade contractors, and this implies that even if the companies invest more capital they do not develop the capacity to compete globally. The problem may be either their weakness in building their capacity or lack of opportunity to be exposed in the global market. This needs further study and findings.

Not only the accumulation of capital and the ownership of machineries make a contractor capable of being productive, the skillfulness, efficiency and effectiveness of its labor force determine its success. And to be globally competitive a contractor has to equip its labor force with recent technology, operational skill and quality production knowledge (Krishna, 2015). 74.36% of the respondents disagree with the fact that their labor force has the quality that will help them secure a place in the global market. This implies that there is a work to be done to create globally competitive labor force through training and improvement.

### Knowledge Transfer

A technology besides its direct benefit, transferring of knowledge, new methods and skills to the beneficiaries is very important. The beneficiaries should not be always dependable on the technology or skill creator, they have to learn and do by themselves (Krishna, 2015).

**Table 9: Labor Vs. Capital Intensive Technology and Knowledge transfer**

			S.D	D	I	A	S.A
Implementation of the technology has a better contribution to knowledge transfer	Labor	Frequency	0	10	8	18	3
		Percentage	0%	25.64%	20.51%	46.15%	7.69%
	Capital	Frequency	0	0	2	22	15
		Percentage	0%	0.0%	20.51%	61.5%	10.750%

Source: Own Survey, 2017

46.15% of the respondents agree with point that Labor intensive technology is contributing to knowledge transfer, 25.64% disagree with the point. 61.5% of the respondents agree with point that Capital intensive technology is contributing to knowledge transfer, 0.0% disagree with point. This shows Capital intensive technology plays the major role in the case of knowledge transfer which helps the people get exposed to new techniques, work culture and trends.

### Community empowerment

Majority of the benefit gained from development has to reach the mass, enable them play a vital and decisive role in their lives, the country's political and economic issues. They will be decision makers, organized, confident, inclusive and cooperative.

**Table 10: Technology contribution to community empowerment**

			S.D	D	I	A	S.A
Application of the technology is crucial for empowering the community, enabling them play a decisive role.	Labor	Frequency	0	8	11	18	2
		Percentage	0.0%	20.51%	28.21%	46.15%	5.13%
	Capital	Frequency	2	24	7	6	0
		Percentage	5.13%	61.54%	17.95%	15.38%	0.0%

Source: Own Survey, 2017

As per the data in Table 10, 61.54% of the respondents disagree with the idea of capital intensive production technology empowering the people so that they will play important role in the country's social, political and economic decisions. 46.15% of the respondents agree with point that labor intensive productivity contribute to community empowerment, while 20.51% show their disagreement. This implies that labor intensive technology plays a better role in community empowering.

### Political stability

Political stability is the condition of the government of a country that precludes the possibility of open revolution because the government is governing correctly and the people are happy and benefit from the policies of the government. Choosing and implementation of a technology that benefit the community leads to political stability.

**Table 11: Labor vs. Capital intensive productivity the impact on Political stability**

			S.D	D	I	A	S.A
Application of the technology is playing an important role in stabilizing the political environment	Labor	Frequency	0	2	6	23	8
		Percentage	0.0%	5.13%	15.38%	58.97%	20.51%
	Capital	Frequency	4	21	11	3	0
		Percentage	10.26%	53.85%	28.21%	7.69%	0.0%

Source: Own Survey, 2017

53.85% of the respondents disagree with idea that capital intensive technology brings political stability in the country, while 28.21% of the respondents stayed neutral. 58.97% of the respondents agree with idea that labor intensive technology brings political stability in the country, 20.51% strongly agree on the point, this implies that labor intensive technology, which uses more labor input when compared to capital intensive technology, is more useful to create political stability.

### Social stability

Social stability is a sociological perspective that states a group always seeks to maintain equilibrium by forcing out ideas and individuals that disagree with popular opinion. This helps keep society in balance and promotes harmonious coexistence. A lack of social stability causes revolution and unrest in the country. One challenge that faces all societies is the maintenance of social stability. One aspect to maintaining social stability is ensuring that people are willing (or forced) to remain within the limits of the stability of the system in question. People when they are economically satisfied they will be willing to remain within the limits of the stability the system in question (Knight, 2012).

Table 12 below shows the frequency and percentage of the respondents opinion for the question raised, 64.10% of the respondents agree with the idea of labor intensive technology’s contribution to social stability, and 17.95% did not agree or disagree, they are in the middle.

**Table 12: Labor vs. Capital intensive technology and social stability**

			S.D	D	I	A	S.A
Application of the technology is playing an important role in creating social stability free of strike and turmoil	Labor	Frequency	5	2	7	25	0
		Percentage	12.82%	5.13%	17.95%	64.10%	0.0%
	Capital	Frequency	4	21	11	3	0
		Percentage	10.26%	53.85%	28.21%	7.69%	0.0%

Source: Own Survey, 2017

The respondent’s opinion about capital Intensive technology’s contribution to keep society in balance and promote harmony inclined to the disagreement, 53.85% is the share of those who did not support the idea. This has the implication that labor intensive technology is better in creating political and social stability than capital intensive technology.

## **CHAPTER FIVE**

### **CONCLUSIONS AND RECOMMENDATIONS**

#### **5.1. Summary of major findings**

In order to assure the right benefit is gained from the construction industry development that brings the right advantage to the citizens so that sufficient employment opportunities are created, income equalities are maintained, and productivity is boosted, choice of the right technology is mandatory. Based on the study undertaken to know the opinions of construction professional on the status of the currently implemented construction technology, the researcher has come up with the following findings.

- All respondents are well knowledge able to understand the research problem and can provide valid answers to the inquiry.
- The respondents believes that labor intensive technology is better in creating job opportunity when compared to capital intensive technology
- The major key actors, in this case Project Manager engaged in managing construction projects believes that the construction technology, neither labor intensive nor capital intensive technologies are generating satisfactory employment opportunity to absorb the abundant labor of the country.
- The project managers agreed that the application of capital intensive technology enhance quality of product, reduce cost of production, and boost productivity better than labor intensive technology.
- The respondents believe that implementation of capital intensive technology is creating income inequality while labor intensive technology has the advantage of reducing the inequality.
- In the case of community empowerment, majority of the respondents agree that implementation of labor intensive technology is preferable.
- The respondents agreed that each technology has a contribution in creating political and social stability, but the implementation of labor intensive technology do this best.
- In the research it is shown that implementation of either of the technologies could not create the opportunity for global competitiveness.
- Capital intensive technology has the lion's share in the case of knowledge transfer and global competitiveness.

## **5.2 Conclusions**

Based on the research findings it is concluded that both the construction technologies, Capital intensive and Labor intensive, are not well implemented to bring the appropriate benefit to the community. Labor intensive technology is better in creating job opportunity which if properly implemented and can absorb the abundant labor force of the country, and it also plays the major role in empowering the community so that they can be decision makers in political and economic issues of the country. Labor intensive technology has an advantage over capital intensive technology in the creation of political and social stability in the country so that the environment will be peaceful and free of chaos. Capital intensive technology is greater in terms of reducing production cost and time, enhancing quality of product can be achieved through the implementation of capital intensive technology. Regarding Knowledge transfer capital intensive technology is better in comparison because it brings new knowledge to the industry. It can be concluded that proper training, favorable working environment and right tools are not provided in the production process so that workers increase their potential to produce more.

### **5.3 Recommendations**

It is clear that technology simplify task, increase quality and reduce cost. All this things are important, as soon as they bring prosperity and development for the people. Whenever the industry add one step of technology advancement it may be a cause for a number of citizen to be jobless. If capital intensive technology over pass labor intensive technology currently and if the technology is owned by few private companies, it is clear that the benefit goes directly to the few individuals who owned the technology, this has the effect of pulling the mass back and pushing few forward, this definitely creates income inequality followed by political and social instability, and if these situations continue to happen the insight of future development come in to question, because, in developing Countries the realization of a development plan is dependable on the people's effort. For a short period it seems possible but through time things will have the probability of going the wrong way.

Since the construction sector is one of the few which contribute to the GDP and employment creation, it has to get proper attention by the policy makers. Of course, technology advancement is necessary to be competitive in the global market and move forward with the modern industry, but when it is chosen it has to bring benefit to the community and by taking in to consideration the country's abundant labor. A technology that both create enough job opportunity and at the same time that leads to technology advancement is best fit for a developing country like Ethiopia. On the basis of the major findings of the study, the researches directs the following points for policy makers to put it into actions.

- Improve the capacity of labors through proper training, and skill build up programs, so that they can have the right knowhow and understanding of producing in a scientific way which results in reducing production time, minimizing wastage, keeping quality and lowering cost.
- Ensure efficient and cost effective work methodologies are designed and practiced so that labors will learn the right way of doing their tasks so that they can produce efficiently.



- Promote Implementation of technologies that bring dual benefit to the country's development, an appropriate technology that build the capacity for global competition and at the same time creates enormous amount of job opportunity.
- Enhance participation of construction experts so that they can exert an effort to develop the right policy
- The sector has to make in depth study in choosing the right technology before bringing to the country technologies that reduce employment opportunity and creates income inequality.
- In order to make the majority get equal benefit from the construction sector development, automated capital intensive technologies which generate high profit, such as automated concrete batching plant has to be substituted by medium scale equipment, mobile mixer and labors which contributes in creating good job opportunity to absorb the abundant human resource of the Country.

## References

1. Anthony Akube (1995). Appropriate Technology for Socioeconomic Development in the Third World Countries.
2. Amihai Glazer and Stef Proost (2008). Capital-Intensive Projects Induce More Effort Than Labor-Intensive Projects. Department of Economics University of California and Center for Economics Studies Katholieke Universiteit Leuven Naamsestraat 69 B-3000 Leuven Belgium.
3. A. Soekiman, K. S. Pribadi, B.W. Soemardi & R.D. Wirahadikusumah (2011). Factors Relating to Labor Productivity Affecting the Project Schedule Performance in Indonesia. Science Direct.
4. Augustin Kwasi FosuGrowth (2011). Inequality, and Poverty Reduction in Developing Countries. World Institute for Development.
5. Bell, S. (2011). Engineers, society, and sustainability. California, US: Morgan & Claypool.
6. B O UWAKWEH. (2000). Conceptual Framework for Motivating Construction Workers in Developing Countries.
7. Casey Jo Kuykendail. (2007). Key Factors Affecting Labor Productivity In The Construction Industry. University of Florida.
8. Catalano, G.D (2007). Engineering, poverty, and the earth. California, US: Morgan & Claypool.
9. César Calderón & Luis Servén.(2014).Infrastructure, growth and inequality. World Bank Group.
10. Clare Vokes and Jennifer Brennan (2013). Technology and Skills in the Construction Industry. UK Commission for Employment and Skills.
11. David Pothier and Damien Puy Demand (2014). Composition and Income Distribution. International Monetary Fund.
12. D. H. MANJAPPA & M. MAHESHA (2008). “Measurement of Productivity Growth, Efficiency Change and Technical Progress Of Selected Capital-Intensive and Labor-intensive Industries During Reform. Indian Journal of Economics & Business, Vol. 7, No. 1, (2008)
13. David Richardson (2014).Productivity in the Construction Industry. The Australian Institute Research That Matters Website: [www.tai.org.au](http://www.tai.org.au)
14. Deb Kusum Das & Gunajit Kalita (2009). Do Labor Intensive Industries Generate Employment?

15. Ethiopian Economic Associations (2008). Report on The Ethiopian Economy (2006/2007). The Current State of the Construction Industry.
16. Fitsum Dechasa (2014). Unemployment and Labor Market in Urban Ethiopia: Trends and Current Conditions Horizon Research Publishing © 2014
17. FDRE Central Statistical Agency (2015). Statistical Report on the 2015 Urban Employment Unemployment Survey.
18. FDRE Ministry of Urban Development and Construction. (July 2012). Construction Industry Policy (First Draft).
19. François Bourguignon (2013). The Poverty-Growth-Inequality Triangle. The World Bank.
20. Fritsch, A., and Gallimore, P. (2007). Healing appalachia: Sustainable living through appropriate technology. Kentucky, USA: The University Press of Kentucky.
21. Jici Wang & Lixia Mei (2009). Dynamics of labor-intensive clusters in China: Relying on low labor costs or cultivating innovation?
22. Katy Hull (2009). Promoting Pro-Poor Growth: Employment. OECD 2009.
23. Krishna Prasad Kisi. (2015). Estimation of Optimal Productivity in Labor-Intensive Construction Operations. University of Nebraska-Lincoln, [kpkisi@gmail.com](mailto:kpkisi@gmail.com).
24. Manjappa D Hosamane (2008). Productivity Performance of Selected Capital- Intensive and Labor-Intensive Industries in India During Reform Period: An Empirical Analysis. University of Mysore.
25. Ministry of Works and Urban Development (2005)
26. Muhammad Tasrif (1995). Developing Countries Dilemma: Labor Intensive Technology or Capital Intensive Technology. Center for Research on Energy ITB
27. Müge Adalet McGowan, Dan Andrews, Chiara Criscuolo, Giuseppe Nicoletti. (2015). The Future of Productivity. Organization for Economic Co-operation and Development.
28. Nomaan Majid (2011). What has really happened to poverty and inequality during the growth process in developing countries? International Labor Organization.
29. Pedro Martins Growth (2013). Employment and Poverty in Africa: Tales of Lions and Cheetahs. Overseas Development Institute.

30. Ramesh Ramaran and Roger Hosein (2005). Growth, employment and the construction industry in Trinidad and Tobago.
31. Ravi S. Srivastava & Ajit Jha (2016). Capital and Labor Standards in the Organized Construction Industry in India. A Study Based on Fieldwork in the National Capital Region of Delhi.
32. R McCutcheon & Keynote Address (2008). The generation of productive employment opportunities for the unskilled: principles, potential and pitfalls of labor-intensive construction. Centre of Full Employment and Equity (CoffEE).
33. Robert T. McCutcheon (2008). Employment Creation in Large-Scale Public Works Programs Labor-intensive Construction and Maintenance in Sub-Saharan Africa: The World Bank played a critical role during the 1970s and 1980s; what are the prospects for the future? School of Civil and Environmental Engineering University of the Witwatersrand, South Africa.
34. Serge Shikher (2015). The Impact of Educated Labor on Technology Adoption and Comparative Advantage. U.S. International Trade Commission.
35. Tsegaye Tegen (PhD) (2014). Is Ethiopia Missing the Opportunity of Labor-intensive Industrialization? [www.aigaforum.com](http://www.aigaforum.com)
36. Wen Yi and Albert P.C. Chan (2012). Critical Review of Labor Productivity Research in Construction Journals Journal of Management in Engineering.
37. John Knight (2012). The Economic causes and consequences of Social Stability in China. China Growth Center.

## **APPENDICES**

## **QUESTIONNAIRE**

**SAINT MARRY UNIVERSITY**  
**SCHOOL OF GRADUATE STUDIES**  
**DEPARTMENT OF PROJECT MANAGEMENT**

The study on the choice of the right technology, Capital intensive vs. Labor intensive construction Technology in the case of Ethiopian Construction Industry taking in to consideration the Country's current development status and higher unemployment rate, in partial fulfillment of the requirements for the degree of masters of project management. Capital intensive technology is a technology that uses more of modern equipment and less labor in the construction process, while labor intensive technology is a technology that uses more of labor and less Equipment (Capital) in the construction process.

### **Research questionnaire**

#### **Dear respondent,**

This questionnaire is meant to collect data for a research paper targeting to study the choice of the right technology in the construction industry that is best in increasing job opportunity, guarantee equal distribution of wealth, increase community empowerment, enhance industry competitiveness in the global market, create political, social and economic stability in the country.

You have been identified as one of the respondent for this research. You are kindly requested to be honest and exhaustive in filling questionnaire. Please note that the information given is purely for research purposes and also confidential.

## **Part I. General**

**Instruction:** Please circle your response

1. Gender :     a) male            b) female
2. Age:         a) 21-25 years            b) 26- 35 years        c) 36-40 years        d) >40 years
3. Education Level: a) 2<sup>nd</sup> Degree   b) 1<sup>st</sup> Degree    c) Diploma    d) Certificate e)
4. Position :    a) Company Owner        b) Project Manager   c) Both
5. Work experience : a) 1-5 year   b) 6-10 year    c) > 10 years
6. For how many labor force you created job opportunity (Both Skilled and Unskilled)?  
   a) <20   b) 20 -50   c) 51-100   d) > 100
7. In which grade category is your company?  
   a) High grade( Grade 1 to 3)   b) Medium Grade ( Grade 4 to 6)

## **Part II. Choice of Technology**

1. Which type of construction production technology your company utilizes most?
  - a) Labor Intensive
  - b) Capital Intensive
  - c) Both
2. Do you believe that it is appropriate to invest on sophisticated construction machineries to increase productivity instead of using the available labor force by increasing their production capacity through training and proper management?
  - a) Yes
  - b) No
  - c) I don't know

**Part III. Give your opinion about the contribution of Labor Intensive and Capital Intensive construction Technology on the proceeding important points:**

**Instruction:** Using the key [where: 1-strongly disagree (SD), 2- disagree (D), 3-indifferent (I); 4-agree (A); 5-strongly agree (SA)] tick appropriately according to extent which you agree or disagree with the statement.

**A. Job Opportunity**

No	Statements	Rating				
A1	Implementation of Capital Intensive Technology in the Construction industry is creating job opportunities satisfactorily	1	2	3	4	5

No	Statements	Rating				
A2	Implementation of Labor Intensive Technology in the Construction industry is creating job opportunities satisfactorily	1	2	3	4	5



**B. Cost of Production**

No	Statements	Rating				
B1	On Implementing Labor intensive technology your company give the necessary training for its labor to boost productivity and reduces cost of production	1	2	3	4	5

No	Statements	Rating				
B2	Your company invest on automated equipment intending to reduce production costs and become profitable.	1	2	3	4	5

No	Statements	Rating				
B3	The Implementation of Capital Intensive Production technology reduces production cost when compared to Labor intensive production technology.	1	2	3	4	5

No	Statements	Rating				
B4	When applying labor Intensive Production technology your company provide the necessary tools to increase productivity and hence reduces production cost.	1	2	3	4	5

No	Statements	Rating				
B4	Your company makes a good effort to create a good working environment so that labors can produce more which in turn reduces production cost.	1	2	3	4	5

### C. Quality of Work

No	Statements	Rating				
C1	The use of Labor intensive production Technology affects quality in your company negatively	1	2	3	4	5

No	Statements	Rating				
C2	The use of Capital Intensive production Technology increases quality of works	1	2	3	4	5

No	Statements	Rating				
C3	Your company formulate and implement the required quality program to enhance product quality.	1	2	3	4	5

### D. Production Time

No	Statements	Rating				
D1	In Implementing capital intensive technology your company trains operators to make them effective and reduces production time.	1	2	3	4	5

No	Statements	Rating				
D2	In the process of implementing labor intensive technology your company made the required effort to reduce production time by developing effective work methodology.	1	2	3	4	5

### E. Income Equality

No	Statements	Rating				
E1	Implementation of capital Intensive production Technology creates income inequality among beneficiaries.	1	2	3	4	5

No	Statements	Rating				
E2	Implementation of labor Intensive production Technology narrows the income inequality among beneficiaries.	1	2	3	4	5

### F. Global Competitiveness

No	Statements	Rating				
F1	The implementation of capital intensive technology is helping your company to become globally competitive.	1	2	3	4	5

No	Statements	Rating				
F2	Your company is becoming globally competitive through the implementation of labor intensive technology.	1	2	3	4	5

### G. Knowledge Transfer

No	Statements	Rating				
G1	Labor intensive Technology has a remarkable contribution in knowledge transfer	1	2	3	4	5

No	Statements	Rating				
G2	Capital intensive construction Technology has a significant contribution in knowledge transfer	1	2	3	4	5

### H. Community Empowerment

No	Statements	Rating				
H1	Implementation of capital intensive technology has a great contribution in community empowerment, which gives financial freedom and increase the decisive power.	1	2	3	4	5

No	Statements	Rating				
H2	Implementation labor intensive technology has a great contribution in community empowerment, which gives financial freedom and increase the decisive power.	1	2	3	4	5

### I. Political Stability

No	Statements	Rating				
I1	Implementation of Capital Intensive Technology has a great contribution in creating political stability in the country.	1	2	3	4	5

No	Statements	Rating				
I2	Implementation of Labor Intensive Technology has a great contribution in creating political stability in the country.	1	2	3	4	5

### J. Social Stability

No	Statements	Rating				
J1	Implementation of labor intensive technology has a contribution for social stability, which keep society in balance and promotes harmonious coexistence.	1	2	3	4	5

No	Statements	Rating				
----	------------	--------	--	--	--	--

J2	Implementation of capital intensive technology has a remarkable contribution for social stability, which keep society in balance and promotes harmonious coexistence.	1	2	3	4	5
----	---	---	---	---	---	---