



ADDIS ABABA INSTITUTE OF TECHNOLOGY
SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING

**IDENTIFICATION AND COMPARATIVE ANALYSIS OF KEY
PARAMETERS INFLUENCING CONSTRUCTION LABOR
PRODUCTIVITY OF BUILDING PROJECTS IN ADDIS ABABA**

By

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Identification and Comparative Analysis of Key Parameters Influencing Construction labour productivity of Building Projects in Addis Ababa.

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DECLARATION

I, the undersigned, declare that this study entitled “Identification and comparative analysis of key parameters influencing construction labour productivity of building projects in Addis Ababa” is my own work. I have undertaken the research work independently with the guidance and support of the research advisor. This study has not been submitted for any degree or diploma program in any other institutions and that all resources of materials used for the thesis have been duly acknowledged.

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LIST OF ABBREVIATIONS

AACE.....	Association for the Advancement of Cost Engineering
BOOT.....	Build Own Operate Transfer
CII.....	Construction Industry Institute
CLP.....	Construction Labour Productivity
EEA.....	Ethiopian Economic Association
ES.....	Evaluation Score
F _R	Frequency Rating
GDP.....	Gross Domestic Product
I _P	Positive Impact
I _N	Negative Impact
OEEC.....	Organization for European Economic Cooperation
PFP.....	Partial Factor Productivity
PM.....	Project Managements
QC.....	Quality Control
R _A	Level of Agreement
R.....	Level of Disagreement
SS.....	Survey Sample
TF.....	Total Factor Productivity
U.S.....	United States of America

ABSTRACT

Construction labour productivity (CLP) is dominant subject matter in the construction sector; essential cost savings and efficient usage of resources are achieved through high level of labour productivity. CLP is influenced by various factors and practices (parameters) which are multi-faceted and project dependent. Various studies have been performed to determine the parameters that influence the CLP in developed countries, but much has not been done in the developing countries. As a result, this study focuses on the identification of the key parameters influencing CLP from micro to macro level in building projects in Addis Ababa.

The study relies on survey data collected to project managements and trade workers' respondents from building constructions in Addis Ababa. Respondents from 14 different grade I contractors which are actively engaged in building construction in Addis Ababa were involved in data collection process. A total of 100 surveys, 42 from the project managements and 58 from the trade group, have been collected.

The results from the study have shown that “National”, “Engineering” & “Project Complexity” from the PM survey and “Location Property”, “Equipment & Tools” & “Materials and Consumables” from the trade survey categories have been ranked from first to third respectively as negatively influencing categories. Whereas “Foreman Related”, “Labour and Crew Related” and “Project Management Practices” from the PM survey and “Foreman Related”, “Labour and Crew Related” and “Equipments and Tools” from the trade survey have been ranked from first to third respectively as positively influencing categories.

The identified top three parameters in negatively influencing CLP are “Public unrest due to political, economical or other issues”, “There is high inflation rate in Ethiopia” & “Drawings and specifications are often not complete and require updates” from the PM survey respectively and “Remunerations (salary, benefits) are satisfactory”, “Remuneration (salary, bonus and incentives) are fairly set” & “Materials are not delivered on time to task location” from the trade survey respectively. Whereas the identified top three positively influencing parameters are “Ethiopia has more young population”, “Work operation strategies and system increase performance of the organization”, “Clear goals are given to foreman and crafts” from the PM survey respectively and “There is a really good cooperation between craftsmen in a crew”,

“Craftsmen use alcohol and drugs during work hours”, “Foreman has the required experience” from the trade survey respectively.

The result from the perspective difference analysis have shown that “There is a shortage of good transportation equipment (cranes, forklifts)”, “Available drawings and specifications are not readable”, “Materials are not delivered on time to task location” have been the top three parameters showing difference in perspective between the two survey groups in negatively influencing parameters. Whereas “Crew is experienced and has the necessary competence”, “Craftsmen trust in the skills and judgment of their supervisors” and “There is a really good cooperation between craftsmen in a crew” have been the top three in positively influencing parameters showing difference in perspective.

Key Words: Construction Labour Productivity, Influencing Parameters, Project Management (PM), Trade (crafts) workers.

CHAPTER ONE

1. INTRODUCTION

1.1 Background

The Ethiopian construction industry is one of the major back bones for the development of the nation's economy. The roles of construction industry for the nation's economy are providing physical and social needs through buildings and infrastructure, employment creation, income generation and redistribution and revenue generation. It contributes about 8.5% of the GDP in 2015 (Tsehayae 2017).

The construction industry employs large unskilled labour. Throughout the developing world, the majority of employees in the industry are unskilled. For instance, from the total employed population in the country of 31.4 million, 1.4 percent was estimated to be in the construction industry. It contributes to the national output and stimulates the growth of other sectors through a complex system of linkages (EEA 2008). It deploys many labour forces which need to be managed. In management of labour in construction, construction labour productivity is the basic means of measuring the performance of the labour force. Productivity is defined as the ratio of what is produced to what is required to produce it (Dozzi and AbouRizk 1993). Productivity measures the relationship between outputs such as goods and services produced, and inputs that include labour, capital, material and other resources. A study on productivity of labour in construction is essential, specially for countries which have labour intensive construction industry and which have expensive labour cost.

Researchers and practitioners around the world have computed several contributions on areas related to construction labour productivity. In addition, the result of different researches indicated that productivity is a complex issue as many factors influence productivity such as labor, capital, material, equipment, tools and equipment's are some of the factors that affect productivity (Amanuel 2016).

In general, there are various factors and practices or what we call parameters, which have an effect for CLP (Tsehayae and Fayek 2014). Those are made up of various objective (e.g. crew size) and subjective (e.g. foreman skill in planning) factors and practices and those parameters can have either positive or negative impact. Since the parameters occur at different level (e.g. at activity level, project level, organizational level and etc.) (Tsehayae and Fayek 2014) It is

essential to categorize for clearly identifying and comparing each factors and practices in studying the CLP.

1.2 Research Problem

Construction labour productivity has a huge impact for the successful completion of a construction project. Productivity is associated with the performance of the workers and this is considered most important factor that has a significant impact on the growth of the construction industry. However, productivity has been affected by many factors and variables. Such variable factors or parameters are related to labours, materials, tools, equipments, construction methods, political factors, finance and other internal and external factors (Khaleel and Nassar 2017).

Construction projects are mostly labour-based with basic hand tools and equipment, as labour costs comprise 30 to 50 % of overall projects costs (Guhathakurta and Yates 2007). The success of a construction project in today's competitive market largely depends on accurate estimation of productivity, and a reasonably correct assessment of the labour cost is fundamental to the accuracy of any estimate might be obtained. In addition, the effect of the factors on productivity may vary from task to task. Although some factors could have similar influences on the productivity of a number of tasks, their rate of impact on productivity may be different (Karim, et al. 2012).

Studies have shown that CLP has been low in building projects in Addis Ababa (Alemu 2006). Though, numerous construction labour productivity research studies have been undertaken, only a few have addressed the productivity issue in developing countries (Enshassi, Mohamed, et al. 2007). The parameters which affect the CLP are not well identified in well-organized manner for the industry (Tsehayae and Fayek 2014). As a result, it has become one of the main factors in difficulties to estimate the project completion period and cost in contract document preparation stage. Due to those reasons projects are facing delays and cost overrun and many projects are facing contractual disputes between stakeholders. Studies have been carried out regarding identification of the factors of CLP, but since the results were not specific and not categorized into different levels of a project. It is necessary to produce results with such a manner that will benefit the industry.

1.3 Research Objectives

1.3.1 General Objective

The main objective of this study is to identify and compare the key parameters that will affect positively and negatively construction labour productivity.

1.3.2 Specific Objectives

- To present the rankings of the parameters that influence CLP.
- Identify the top ten key parameters that influence CLP.

1.4 Research questions

- 1) What are the key parameters that will influence labour productivity? And which parameter influence CLP negatively and positively?
- 2) Which of the major parameters influence CLP significantly?
- 3) What is the difference in perspective between the project managers and trade respondents in relation with CLP?

1.5 Scope and Limitation of the research

The research will focus on identifying the factors and practices that influence CLP in public building projects in Addis Ababa. Since many construction works are executed in well-organized manner by grade 1 contractors, those populations will be considered in the research.

The major limitation of the research encountered is unorganized and incomplete project teams in the sample projects. There was also unwillingness of respondents in filling the survey in the well organized and complete projects sites as well. This is due to lack of understanding in the importance of research. In addition, due to limitation of time and budget the scope of the survey is limited to 14 contractors. This results a shallow sample size from the study population.

1.6 Structure of the research

The study is organized with five parts. The first chapter gives an introduction part of the research, the second chapter discuss on the various literatures that has been done, the third chapter focused on stating the methodologies used in conducting the study, the fourth chapter

covers the analysis and discussion on the output of the results obtained and the fifth chapter gives conclusions and recommendations. The contents of each part of the study are listed here under:

Chapter one: Introduction

This chapter includes background, research problem, research objectives, research questions, scope and limitation of the research.

Chapter two: Literature review

This chapter contains definitions on productivity, measurement of productivity, importance of studying productivity, dimensions of construction productivity, different factors affecting labour productivity and review of studies on identification factors affecting construction labour productivity.

Chapter three: Methodology

This chapter contains the research approach method, the sample size and the sampling method used and the data analysis method adopted.

Chapter four: Analysis and discussions

This chapter includes the results obtained from the study analysis and in addition discussion is given for the results obtained.

Chapter five: Conclusions and recommendations

In this chapter conclusions and recommendations are given from the results obtained and from the discussions given. In addition future research areas are put under.

CHAPTER TWO

2. LITERATURE REVIEW

2.1 Construction productivity

2.1.1 Defining Productivity

The origin of the word productivity can be traced back to 1766 when it was first mentioned in an article by Quesnay. More than a century later, in 1883, Littré defined productivity as the “faculty to produce”, that is, the desire to produce. In the early twentieth century, a more precise definition, “the relationship between output and the means employed to produce that output” was developed. In 1950, the Organization for European Economic Cooperation (OEEC) introduced a formal definition of productivity as “a quotient obtained by dividing output by one of the production factors”. Consequently, it became possible to speak of the productivity of capital, investment, or raw materials according to whether the output is being considered in relation to capital, investment, or raw materials (Jarkas and Bitar 2012).

Depending on the measurement objectives and the availability of data, several productivity definitions are encountered. The United States department of commerce defines productivity as “dollars of output per person-hour of labor input” (Adrian 1987). Peles (1987) interpreted productivity as “the performance accomplished by operatives,” whereas Handa and Adballa (1989) defined productivity as “the ratio of outputs of goods and/or services to inputs of basic resources, e.g., labor, capital, technology, materials and energy.” Finke (1998) defined productivity as “the quantity of work produced per man-hour, equipment-hour, or crew-hour.”

The American association of cost engineers, moreover, defines productivity as a “relative measure of labor efficiency, either good or bad, when compared to an established base or norm” (Allmon, et al. 2000). While Arditi and Mochtar (2000) referred to productivity as “the ratio between total outputs expressed in Dollars and total inputs expressed in Dollars as well,” Horner and Duff (2001) expressed productivity as “how much is produced per unit input.”

Labour productivity has been defined by many researches as performance factors, production rate, and unit of person per hour (p-h). It is described as the traditional term of a physical work which progresses in p-hours to achieve certain output. This term could be translated mathematically by the ratio of input resource /output production units. (Maarof and Easeph 2017)

Another definition of labour productivity concerning construction industry refers to units of work produced per staff-hour which is an activity measuring dominated model of productivity. While Organization for Economic Cooperation and Development defines labour productivity as it is an amount of service a labourer produces in a given amount of time “the ratio of a volume measure of output of GDP to a volume measure of input of work hours” (Maarof and Easeph 2017).

The focus on labour productivity in this research was mainly on micro level which covers the management and operation on both the project and task-based levels. As such there was an inevitable need to search for researchers’ argument to look for how this productivity proceeds forward. Also, to look at what implications this productivity has in construction project’s progress about value and non-value-added activities. (Josephson & Saukkoriipi, 2007) have illustrated significant values of waste indexes which construction projects were suffered from on the firm level. Traditionally, research studies have defined productivity to suit a specific purpose for the construction industry, at either, the industry, project, or activity level (Thomas, et al. 1990). In this study productivity can be generally defined as the “amount of goods and services produced by a productive factor in a unit of time” (Drewin 1982).

2.1.2 Measurement of productivity

While each contractor or owner is free to use its own system to measure labor productivity at a site, it is a good practice to set up a system which can be used to track productivity trends over time and in varied locations. Considerable efforts are required to collect information regionally or nationally over a number of years to produce such results. The productivity indices compiled from statistical data should include parameters such as the performance of major crafts, effects of project size, type and location, and other major project influences (Amanuel 2016).

In order to develop industry-wide standards of performance, there must be a general agreement on the measures to be useful for compiling data. Then, the job site productivity data collected by various contractors and owners can be correlated and analyzed to develop certain measures for each of the major segment of the construction industry. Thus, a contractor or owner can compare its performance with that of the industry average (Hendricken 2000).

2.1.2.1 Approaches of Productivity Measurement

On the basis of the preceding review, it is obvious that the general consensus among the various researchers is to define productivity as the ratio of output to input. Consequently, construction productivity can be regarded as a measure of outputs that are obtained by a combination of inputs. In view of this, two measures of construction productivity emerge: (1) total factor productivity (TFP), where all outputs and inputs are considered; and (2) partial factor productivity (PFP), often referred to as single factor productivity, where outputs and single or selected inputs are considered (Talhouni 1990; Rakhra 1991). Choosing between them usually depends on the purpose of the productivity measurement and the availability of data (Amanuel 2016).

Total Factor Productivity Measures

Total/Multi factor productivity measures use a weighted average of all inputs in the denominator. The weights usually correspond to each input's share of total expenditures. Multifactor measures reflect the joint impact of all inputs on productivity more accurately than single factor measures because the quantities of all inputs are in effect held constant, whereas only one input is held constant in the single factor approach. Multifactor measures do not seem to be widely used in construction. An increase in total factor productivity implies more output can be produced for a given level of inputs (Amanuel 2016).

Total factor productivity is defined as the ratio of outputs to the summation of all inputs, and is expressed as shown in Eq. (1) (Jarkas and Bitar 2012):

$$TFP = \frac{\text{Total output}}{\Sigma \text{ of all input resources}} \dots \dots \dots (1)$$

All input resources may include, but are not limited to, labour, material, energy, capital, and plant. Total productivity is a comprehensive measure that accounts for all outputs and inputs whether tangible or intangible. To get a meaningful total factor productivity index, however, outputs and inputs should bear a common base measurement unit (Jarkas and Bitar 2012). As suggested by (Thomas, et al. 1990), a monetary value base unit is appropriate, and thus TFP is quantified as shown in Eq. (2):

$$TFP = \frac{\text{Pound value of output}}{\text{pound value of input}} \dots \dots \dots (2)$$

Single/ Partial Factor Measures

Single/Partial factor measures use only one input in the denominator. Most commonly used single factor measure of productivity is the labor productivity, the ratio of output to either employment rate or labor hours (Amanuel 2016).

Partial factor productivity (PFP) establishes a relationship between outputs and a single or selected set of inputs. The definition is best exemplified by the term labor productivity, where only the input of labor is considered. Account also needs to be taken of changes in the quality of labour. Educational attainment is the usual criterion for quality measurement. In construction, this criterion is less reliable, since many skills are acquired through experience (Amanuel 2016).

Other single or partial factor productivity measures include capital, plant, and equipment productivity (Jarkas and Bitar 2012). Therefore, PFP can be defined as shown in Eqs. (3a)– (3c).

$$\text{Labour productivity} = \frac{\text{Output quantity}}{\text{Labour Hours}} \dots \dots \dots (3a)$$

$$\text{Capital productivity} = \frac{\text{Profit}}{\text{invested capital}} \dots \dots \dots (3b)$$

$$\text{Equipment (plant) productivity} = \frac{\text{Output quantity}}{\text{Equipment or plant hours}} \dots \dots \dots (3c)$$

The disadvantages of total factor productivity measure are twofold. First, it is difficult to accurately determine and measure all the input resources utilized to achieve the output, and second, it is often impractical, especially for researchers, to monitor or assess the effects of selected individual factors on the output. To the contrary the advantages of the partial factor productivity are many. By focusing on a selected factor, e.g., labor input, the measurement process becomes easier and more controllable. As a result, reliable and accurate data can be obtained. The complex nature of the construction process and the interaction of its activities, moreover, make the partial factor productivity measure the popular option because effective control systems monitor each input separately (Jarkas and Bitar 2012).

2.1.3 Importance of Studying Productivity

Construction labor productivity has become such a buzz word and one of the most frequently researched topics (Jarkas and Bitar 2012). In most developed countries, labor cost comprises 30 to 50% of the overall project's cost and thus is regarded as a true reflection of the economic success of the operation (Yates 1993, McTague 2002). Horner et al. (1989) indicated that a 10% increase in construction labor productivity would yield annual savings of approximately billion to the British economy; a similar conclusion was echoed by Stoekel and Quirke (1992). Because construction is a labor-intensive industry, the significance of this effect not only justifies the concern over its labor productivity, but it can also be argued that labor power is one of the productive resources; hence construction productivity is mainly dependent upon human effort and performance (Jarkas and Bitar 2012).

Because of its significance to project performance, CLP has been well studied (Tsehayae and Fayek 2014). Productivity enables an organization to be competitive, achieve set goals, meet stakeholder value propositions and maintain strategic and financial health. At the industry level, productivity enables the sector to maintain satisfied client, attract investment, remain viable and contribute to the economic growth and well-being of the nation. For instance, the department of housing in New Zealand observes that the level of activity and the productivity of the building and construction sector underpins New Zealand's economic recovery and growth, adding that "what happens in the building and construction sector has a multiplier effect" on the wider economy" (Durdyev and Jasper Mbachu 2011).

2.2 Three Dimensions of Construction Productivity: Task, Project, and Industry Level

According to (Huang, Chapman and Butry 2009), the nature of the construction process points to a need for measures of construction productivity at three levels: (1) task; (2) project; and (3) industry. Tasks refer to specific construction activities such as concrete placement or structural steel erection. Projects are the collection of tasks required for the construction of a new facility (e.g., the construction of a new commercial office building) or renovation (i.e., additions, alterations, and major replacements) of an existing constructed facility. Industry measures are for the construction sector and represent the total range portfolio of projects (Amanuel 2016).

The basic concept underlying construction industry productivity measures is a comparison of the output of a task, project, or industry with the corresponding factors of production (inputs) required to generate that output. The output and inputs of production thus constitute the basic components of every productivity measure. Typically, productivity measures are formulated as a ratio of output to one or more inputs. If only one of the inputs is used, then the ratio is a single factor productivity measure. A common example of this type of measure is output per labor hour. If all of the inputs are used, then the ratio is a multifactor productivity measure (Huang, Chapman and Butry 2009).

2.2.1 Task Level Productivity Measures

Task-level measures are widely used within the construction industry. Most task-level metrics are single factor measures and focus on labor productivity. Typical task level productivity measures published by (Means 2009) estimate how much a given output is produced by a designated crew in a normal 8-hour day. In this case, the denominator is the number of hours associated with a designated “crew day.” Thus, for a designated crew day, higher output is better. In this case higher output equates to higher task labor productivity. For some tasks, equipment may be involved, in such cases, R.S. Means provides estimates of output that is produced by a designated crew in an 8-hour day along with the equipment they use, and these measures can be considered multifactor (Amanuel 2016).

(Goodrum and Haas 2002) examined productivity measures for 200 construction activities over a 22-year period in the U.S.A. They found that average activity productivity has increased. Furthermore, studies by (Goodrum and Haas 2002) show that activities that experienced a significant change in equipment technology (i.e., hand tools and machinery) generally also witnessed substantially greater long term productivity improvements. Activities that experienced a significant change in material technology in terms of modularization, reduction in unit weight, or installation flexibility, also experienced greater productivity improvements.

2.2.2 Project Level Productivity Measures

Since a project is a collection of tasks, project level productivity measures are more complicated as compared to task level productivity measurement. The inputs and outputs for a given task, say concrete placement, differ from any other tasks, and say structural steel erection. Thus, it is not

possible to aggregate the individual raw task productivity metrics into project productivity metric unless adjustments are made (Amanuel 2016).

One way to make these adjustments is to use a reference data set to calculate baseline values for each task. Information is still needed, however, to calculate a meaningful project level productivity metric. For instance, information yielding the task weight (share that it represents to the overall project) is required, as is an understanding of the task flows. Because some tasks are completed in parallel, while other in series, the composition of the task flows affects overall project productivity. Therefore, each component of the project productivity metric contains: (1) the task weight; (2) the raw task productivity baseline value in the denominator; (3) the raw task productivity value for that project in the numerator; and (4) a measure of the task mix (in parallel versus in series task flows). The project productivity index value is a function of the individual components (Huang, Chapman and Butry 2009).

The project level productivity metric just described is useful in measuring how an individual project compares to the overall average in the reference data set. In addition, data from all projects can be compiled into a distribution. Further analyses can then be conducted to identify characteristics associated with the best performing or worst performing projects.

A project level productivity index can also be used to track changes in project productivity over time. In this case, the reference data set corresponds to time zero. For each index component, the values for the task weights and the task baseline values appearing in the denominator are equal to values computed in the reference data set. The numerator in each index component then becomes the average value of the corresponding task productivity in the future data set. As noted earlier, an index can also include a deflator to adjust for changes in relative prices over time (Huang, Chapman and Butry 2009).

An alternative project level productivity index can be produced as follows. We can create an index which is the quotient of two ratios, in each ratio the numerator is the value of construction put in place and the denominator is the number of field work hours. As noted earlier, a reference data set can be used to fix a baseline value for the ratio of value put in place to field work hours. The baseline value for the ratio is then used as the denominator in the index calculation. How an individual project compares to the baseline is determined by inserting its ratio of value put in place to field work hours in the numerator of the index. Alternatively, this project level

productivity index can be used to track changes in productivity over time by following the process described in the previous paragraph (Huang, Chapman and Butry 2009).

A related measure of productivity on project level is cost per square footage data for a particular type of building. R.S. Means produces a square footage model that requires limited inputs, such as building type, exterior wall type, structural system, square footage and yields rough estimates for the overall cost of a project (Amanuel 2016).

2.2.3 Industry Level Productivity Measures

At the industry level productivity, the amount (or value) of output produced per unit of input provides a measure of industrial efficiency. Industry level productivity measures can be developed for different building types or infrastructure types. For each building or infrastructure type, productivity measures can be created, and these productivity measures can serve as benchmarks for practitioners who engage in such projects.

Industry level productivity measures can be either single factor (labor) productivity or multifactor productivity. Increases in labor productivity may be due to increases in labor quality or labor efforts. However, it can also increase simply due to other factors such as technology, even when labor quality and worker efforts are held constant.

Multifactor productivity is often a preferred measure compared to labor productivity. This is because labor productivity measures are more open to misinterpretation. Increases in labor productivity may reflect increases in the capital-labor ratio, rather than increases in labor quality and efforts. Additionally, a unit of production may achieve high levels of labor productivity, but the overall productivity may be compromised because the underlying capital-labor ratio may not be optimal. Similarly, low labor productivity might be efficient in the sense that low wages induce contractors to adopt more labor intensive practices and save on capital costs. Labor productivity measures are limited in the sense that they do not reveal a complete picture and are prone to misinterpretation. While labor productivity is often a less preferred measure of productivity compared to multifactor productivity, it is calculated with much more precision with fewer assumptions. Obviously, the data requirement for labor productivity calculation is also significantly less compared to multifactor productivity calculation (Hendrickson 2000).

Multifactor productivity (total factor productivity) is the ability to produce more output with the same inputs. It represents a shift in production function. Changes in multifactor productivity reflect changes in output that cannot be attributed to changes in capital inputs, labor inputs, and intermediate inputs. Changes in multifactor productivity reflect technological change, changes in capacity utilization, economies of scale, changes in managerial skills, changes in the organization of production, changes in the resource allocation, and measurement error (Huang, Chapman and Butry 2009).

Productivity represents the residual between output and inputs, and it also represents the residual between output prices and input prices. It is the ability to mitigate input price increases without increasing the price of output. Or it is the ability to gain a competitive edge without input price reductions. In the growth accounting framework, multifactor productivity growth is the growth in output minus weighted growth rates in capital, labor, and intermediate inputs. It is the residual, which is not accounted for by growth in labor and capital. The weights are the average value shares of the respective inputs in the value of the output between the two periods of consideration. In the equation form, the multifactor productivity growth is (Huang, Chapman and Butry 2009):

$$A = Q - S_K * K - S_L * L - S_X * X \dots \dots \dots (4)$$

where A is multifactor productivity, Q is output, K is capital, L is labor, X is intermediate input, S_K, S_L, and S_X are cost shares of capital, labor, and intermediate input, respectively, assuming competitive factor markets and constant returns to scale. That is (Huang, Chapman and Butry 2009),

$$S_i = \frac{p_i * i_i}{\sum(p_i * i_i)} \dots \dots \dots (5)$$

Where p_i is the price of input i, and i is the quantity of input i.

2.2.4 Does Task-Level Productivity Reflect Industry-Level Productivity?

Construction projects tend to be unique and are increasingly more complex. Task-level productivity does not capture project-level uniqueness and complexity. High productivity at the task level also does not necessarily translate into high productivity at the project level. A project level success depends on managerial coordination and planning, which task-level productivity

does not capture. For instance, idle time is not included in task-level productivity measurement, but it certainly can hinder progress and productivity at the project level. Regulation is sometimes cited as one reason for low productivity in the construction industry. Regulation does not generally apply to task-level productivity, but it does affect project-level and therefore industry-level productivity.

Task/Lower-level measures are more useful for monitoring individual activities, while higher level measures may be more convenient for developing industry-wide standards of performance (Hendrickson 2000). By measuring productivity and its changes during construction projects, you can identify problem areas and resolve them more quickly, resulting in better productivity on job sites. In measuring productivity at all level, there are different factors or parameters that may decrease or increase the output. And it is crucial to study those parameters in order to increase productivity rate in a sustainable manner. Therefore, in this study those parameters are well interpreted.

2.3 Different Factors Affecting Labor Productivity

Productivity is the outcome of several interrelated factors. Discussed below are various factors affecting labor productivity and are reviewed from past studies.

I. Time: During construction projects, there are many tasks which cause a loss of productivity. Past study shows productivity decreases with working overtime. The most frequently stated reasons are fatigue; increased absenteeism; decreased morale; reduced supervision effectiveness; poor workmanship, resulting in higher rework; increased accidents (Horner and Talhouni, 1995). Working overtime initially result in increased output, but continuing overtime may lead to increased costs and reduced productivity (Hinze, 1999 as cited in (Gundecha 2012)).

Time used by a construction laborer on productive activities averages about 30% of the total time available (Gundecha 2012). An employee in the field only works effectively for 3.5 hours of his 8-hour shift and spends 20% of his time on direct value-adding activities (Alinaitwe et al., 2005).

ii. Schedule Compression: When there are early delays in a project, compressions of the overall time frame for a later activity are often the way to compensate interruptions and to complete the assigned task on schedule. From a professional scheduling perspective, schedule compression may be possible without accelerating individual work activities by utilizing float in the project's

overall schedule. However, on many projects, schedules are not fully resource loaded. As a consequence, a properly updated schedule reflecting the delays may show the project finishing on time without shortening individual activities. Schedule compression may result to force extra labors for the desired task by the contractor because of shortening the overall duration, allowing the contractor to complete the total remaining work. Schedule compression, when linked with overtime, often results in major productivity losses due to shortages of materials, tools or equipment to support the extra labor's, resulting in difficulties for planning and coordinating the task, and unavailability of experienced labors (Gundecha 2012)

iii. Type of Project: To accomplish substantial productivity, every member of a crew requires adequate space to perform task without being affected with/by the other crew members. When more labors are allotted to perform particular task, in a fixed amount of space, it is probable that interference may occur, thus decreasing productivity. Additionally, when multiple trades are assigned to work in the same area, the probability of interference rises and productivity may be decreased. Interference among the various crews and labourers is due to mismanagement on construction sites. For example, a steel-fixtured crew has to wait before fixing the reinforcement rods if the carpenter's framework is incomplete. The types of activities and construction methods also influence labor productivity (Sanders and Thomas, 1991 as cited in (Gundecha 2012).

iv. Safety: Accidents have high impacts on labour productivity. Various accident types occur at the site, such as an accident causing death and resulting in a total work stoppage for a number of days. An accident that causes an injured person to be hospitalized results in a work decrease of the crew for which the injured employee worked. Small accidents resulting from nails and steel wires can stop work and, thus, decrease productivity (Sanders and Thomas, 1991). Even insufficient lighting shows decreased productivity because sufficient lighting is required to work efficiently and because insufficient lighting has negative effects. Employing a safety officer helps labors to recognize the required safety regulations and to follow them, which can reduce the number of accidents, thus increasing productivity (Gundecha 2012).

v. Quality: Inefficiency of equipment and poor quality of the raw material are factors which cause low productivity. The productivity rate of inefficient equipment is low. Old equipment is subject to a great number of breakdowns, and it takes a long time for the laborers to complete the work, thus reducing productivity. Poor-quality material used for work is the other factor because

poor materials generally lead to unsatisfactory work and can be rejected by supervisors, thus reducing the productivity (Gundecha 2012).

vi. Managerial Factors: Managers' skill and attitudes have a crucial bearing on productivity. In many organizations, productivity is low even though the latest technology and trained manpower are made available. Low productivity is because of inefficient and indifferent management. Experienced and committed managers can obtain surprising results from average people. Employees' job performance depends on their ability and willingness to work. Management is the catalyst to create both. Advanced technology requires knowledgeable laborers who, in turn, work productively under professionally qualified managers. It is only through sound management that optimum utilization of human and technical resources can be secured (Gundecha 2012).

vii. Manpower Group: Literature shows that a lack of labour experience is the factor which negatively affects labour productivity and proves that, to achieve good productivity, labour plays a significant role. Contractors should have sufficiently skilled laborers employed to be productive. If skilled labor is unavailable and a contractor is required to complete specific task with less-skilled labor, it is possible that productivity will be affected. The absence of any crew member may impact the crew's production rate because workers will typically be unable to accomplish the same production rate with fewer resources and with a different crew member. Misunderstanding among labourers creates disagreements about responsibilities and the work bounds of each labourer, which leads to a lot of work mistakes and decreases labour productivity. Lack of compensation and increased labourer age negatively affect labor productivity because labour speed, agility, and strength decline over time and reduce productivity (Heizer and Render, 1990as cited in (Gundecha 2012)).

viii. Motivation: Motivation is one of the important factors affecting construction labour productivity. Motivation can best be accomplished when labours personal ambitions are similar to those of the company. Factors such as payment delays, a lack of a financial motivation system, non-provision of proper transportation, and a lack of training sessions are grouped in this topic (DeCenzo and Holoviak, 1990as cited in (Gundecha 2012)).

ix. Supervision: Generally, projects come across some design, drawings and specification changes during construction. If drawings or specifications are with errors and unclear

productivity is expected to decrease since labourers in the field are uncertain about what needs to be done. As a result, task may be delayed, or have to be completely stopped and postpone it until clear instruction. There is a 30% loss of productivity when work changes are being performed (Thomas et al., 1999). Work inspection by the supervisor is an essential process to proceed. For example, the contractor cannot cast concrete before an inspection of the formwork and steel work, thus affecting labor productivity (Zakeri et al., 1996). With noncompeting of the required work according to the specifications and drawings, supervisors may ask for the rework of a specific task. Supervisors' absenteeism stops the work totally for activities that require their attendance, such as casting concrete and backfilling, further delaying inspection of the completed work which, in turn, leads to delays in starting new work (Gundecha 2012).

x. Material/Tools: Material management is one of the most important factors in construction industry. Productivity can be affected if required materials, tools, or construction equipment for the specific are not available at the correct location and time. Selection of the appropriate type and size of construction equipment often affects the required amount of time it is, therefore, essential for site managers to be familiar with the characteristics of the major types of equipment most commonly used in construction. In order to increase job-site productivity, it is beneficial to select equipment with the proper characteristics and a size most suitable for the work conditions at a construction site. Labourers require a minimum number of tools and equipment to work effectively to complete the assigned task. If the improper tools or equipment is provided, productivity may be affected (Alum and Lim, 1995; Guhathakurta and Yates, 1993). The size of the construction site and the material storage location has a significant impact on productivity because labourers require extra time to move required materials from inappropriate storage locations, thus resulting in productivity loss (Sanders and Thomas, 1991).

xi. Project Management Factors: Improper scheduling of work, shortage of critical construction equipment or labour, may result in loss of productivity. Improper planning of project-initiation procedures generally leads to lost labour productivity. Additionally, poor site layout can contribute to a loss of productivity. Labourers have to walk or drive a long way to lunch rooms, rest areas, washrooms, entrances, and exits, affecting overall productivity (Association for the Advancement of Cost Engineering (AACE) International Recommended Practice No. 25R-03, 2004).

xii. Natural Factors: Various natural factors affecting labor productivity collected from previous study are weather conditions of the job-site and geographical conditions. Others factors such as fuel, water, and minerals also affect productivity to certain extent. Productivity is found to be highly affected if weather recorded is too being extreme (too cold, heavy rainfall, too hot (Gundecha 2012).

xiii. External Factors: Weather conditions are significant factor to consider for completion of any construction project. Adverse winter weather, such as winds and rains, reduces productivity, particularly for external work such as formwork, T-shape work, concrete casting, external plastering, external painting, and external tiling. Adverse weather sometimes stops the work totally (Sanders and Thomas, 1991).

xiv. Political Factors: Law and order, stability of government, etc. are essential for high productivity in the construction industry. The government's taxation policies influence willingness to work and expansion of plants. (A. Kumar, as cited in Desai, 2004).

2.3.1 Review of studies on Identification of Factors Affecting Construction Labour Productivity

The vital and starting point of any Construction Labour Productivity (CLP) analysis study involves the quantification of input parameters (factors and practices) influencing CLP. However, the parameters affecting labour productivity are numerous, complex, interlinked and dynamic thus making quantification and data collection a challenging task. Additionally, quantification of the parameters is complicated as the factors and practices are a mix of subjective and objective concepts and require the development of an appropriate measurement scheme (Thomas, et al. 1990). Parameters having subjective concepts like fairness of foreman in work assignment or uniformity of safety procedures require detailing of the parameter to a level that accurate data can be collected. Though measurement of objective parameters, such as temperature and crew size, has been easy to carry out, measurement of subjective parameters like supervision skill of superintendent has presented challenges that researchers have attempted to address through the use of simple rating scales without calibration of each measurement scale (Oduba 2002; Thomas et al. 1990). As a result, past CLP studies have tried to first identify the critical parameters based on expert knowledge before completing detailed measurements so as to simplify the data collection process (Thomas et al. 1990; AbouRizk et al.2001; Chan et al.2004;

Dai et al. 2009). unfortunately, this deductive approach has not improved understanding of the parameters and their impact on the complex construction process (Tsehayae 2015).

Additionally, in rare cases where detailed parameter quantification and documentation was carried out together with documentation of the output parameter (achieved labour productivity), data driven method could be employed to identify critical parameters; as data-driven methods like correlation analysis, feature reduction and principal component analysis have been useful in identifying critical parameters, resulting in better prediction ability (Gray and MacDonell 1997; Jang et al. 2011; Moselhi and Khan 2012). Unfortunately, quantifying and documenting the number of parameters known to affect labour productivity is not an easy task so it has rarely been tried let alone achieved to a level at which the actual parameters could be determined using data-driven techniques (Tsehayae 2015).

As a Result Construction labor productivity has been the subject of numerous research studies. (Olomolaiye, Wahab and Price 1987) investigated factors influencing labor productivity in Nigeria and concluded that output quantities need to be established through time study techniques and that the results obtained should be imparted to a wide range of construction firms to utilize the most productive working method without resorting to additional strenuous physical effort (Jarkas and Bitar 2012).

(Horner, Talhouni and Thomas 1989), in a questionnaire survey to a wide section of British constructors, have identified the 13 significant factors shown in Table 2.1.

Table 2.1 (Horner, Talhouni and Thomas 1989) Findings on factors affecting CLP

Factor	Rank
Skill of Labor	1
Build ability	2
Quality of Supervision	3
Method of Working	4
Incentive Scheme	5
Site Layout	6
Complexity of Construction Information	7
Crew size and Composition	8
Length of Working Day	9
Availability of power tools	10
Absenteeism	11
Total number of operatives on site	12
Proportion of Work subcontracted	13

Talhouni (1990) classified four categories responsible for affecting productivity on construction sites: (1) management; (2) site; (3) design; and (4) weather, whereas Herbsman and Ellis (1990) reported two-group main divisions of influencing factors: (1) technological and (2) administrative. Management-related or administrative-related factors include inadequate supervision, improper selection of construction methods, sequencing problems, crew size and composition, working overtime, shortage of materials and the unavailability of suitable equipment. Site-related factors are caused by site restricted access, stringent control procedures, confinement of working space, site layout and congestion. Technological or design-related factors are the direct result of constructability or the lack of it. It includes uncoordinated, incomplete and illegible drawings; complex designs of unusual shapes and heights; unclear or out-dated technical specifications; and stringent inspection procedure. Weather-related factors are ascribed to cold or hot temperatures, high humidity, high wind, rain and snow (Jarkas and Bitar 2012).

Lim and Alum (1995) explored various factors impacting the construction productivity in Singapore and shortlisted the followings as most significant: lack of qualified supervisors, shortage of skilled labor, high rate of labor turnover, labor absenteeism and communications with foreign laborers (Jarkas and Bitar 2012).

Heizer and Render (1996) sorted productivity factors into three major groups: (1) labor characteristics; (2) project conditions; and (3) nonproductive activities. Labor characteristics include skills, experience, satisfaction and motivation. Project conditions are related to the type, design, material and location factors. Nonproductive activities are those that are either counterproductive or don't contribute directly to the progress of tasks at hand, e.g., unscheduled breaks, frequent relaxation, late starts and early quits, waiting idle, engagement of operatives in personal discussions and the simultaneous involvement of labor in several tasks (Jarkas and Bitar 2012).

In a survey geared toward identifying the constraints on Iranian construction productivity, Zakeri et al. (1996), using the relative index ranking technique, ranked the five following factors as major determinants of operatives' efficiency: (1) materials shortage; (2) weather and site conditions; (3) equipment breakdown; (4) drawing deficiencies/change orders; and (5) lack of proper tools and equipment. Kaming et al. (1997) studied factors affecting the productivity of

craftsmen in Indonesia and concluded that lack of materials, rework, absenteeism of operatives and lack of suitable tools are among the most influential (Jarkas and Bitar 2012).

(Makulsawatudom, Emsley and Sinthawanarong 2004) researched the influence of 23 factors on the productivity of the construction industry in Thailand and deduced that lack of material, incomplete drawings, incompetent supervisors, lack of tools and equipment, labor absenteeism, poor communication, instruction time, poor site layout, inspection delay and rework are the most critical. Abdul Kadir et al. (2005), in addition, surveyed the perceived effects of 50 productivity factors on Malaysian residential projects and identified the followings five as most important to labor efficiency: (1) shortage of material; (2) nonpayment to suppliers causing stoppage of materials delivery to sites; (3) change orders by consultants; (4) late issuance of construction drawings by consultants; and (5) the incapability of site management. According to their recognized impacts on the productivity of craftsmen in Uganda, (Alinaitwe, Mwakali and Hanson 2007) further ranked the following five factors as being most significant: (1) incompetent supervisors; (2) lack of skills; (3) rework; (4) lack of tools/equipment; and (5) poor construction methods (Jarkas and Bitar 2012).

In an effort to classify the factors affecting construction labor productivity into global main groups, which can best encompass and relate to the various corresponding factors, several approaches have been adopted; however, a consensus among research on the classification schemes of such groups is yet to be reached (Jarkas and Bitar 2012).

Sugiharto (2003) further allocated the key factors impinging upon construction productivity in Indonesia into the following categories: (1) characteristics of contractors; (2) inadequate management strategy; and (3) organization's focus. The characteristics of contractors include ownership type, qualifications, accumulated experience, classifications and the caliber of staff employed. Management strategy refers to the tools and managerial approaches adopted to minimize waste and unproductive activities, hence promote lean, efficient, and cost-effective operations, whereas organization's focus relates to the client objectives and motivations, project goal and the active involvement of all construction personnel (Jarkas and Bitar 2012).

(Liberda, Ruwanpura and Jergeas 2003) identified 51 factors grouped under three categories human, external and management and carried out an interview survey with 20 project

management experts from Alberta, Canada to identify the relative importance of the identified 51 factors and establish the top 15 critical factors.

CII (2006) identified 83 influencing factors grouped under 11 categories: supervisor direction, communication, safety, tools and consumables, materials, engineering drawing management, labour, foreman, superintendent, project management and construction equipment.

(Enshassi, Mohamed, et al. 2007), moreover, surveyed 45 factors affecting labor productivity of building projects in Gaza Strip, and distributed such factors under the following 10 major groups: (1) materials/tools; (2) supervision; (3) leadership; (4) quality; (5) time; (6) manpower; (7) project; (8) external; (9) motivation; and (10) safety (Jarkas and Bitar 2012).

In the most extensive and detailed existing study of factors influencing CLP, (Dai, Goodrum and Maloney 2009) carried out a factor survey based on an identified 83 factors with 1,996 craftspeople on 28 U.S. industrial construction projects to identify the top 10 critical factors and the relationship between these factors. Detailed investigation of differences in perception between the different generations of craft workers (Dai and Goodrum 2012), foremen and craft workers (Dai et al. 2007), union and non-union craft workers, and trades (Dai et al. 2009) was carried out using the same survey data; significant differences were observed between the compared groups.

Durdyev and Mbachu (2011) identified 56 influencing factors grouped under two main categories and carried out surveys with 37 respondents from project management consultants, contractors, and subcontractor in New Zealand to identify the relative importance of the identified 56 factors and establish the top eight critical factors.

Jarkas and Bitar (2012) identified 45 influencing factors grouped under four categories and conducted a questionnaire survey with 157 respondents from civil engineering and buildings construction firms in Kuwait to identify the relative importance of the identified 45 factors and establish the top five critical factors.

Eslamdoost and Heravi (2013) identified 15 factors grouped under five categories and carried out a survey with 106 site and office staff in thermal power plant construction projects in Iran; they were able to establish the relative importance of the identified 15 factors and five factor categories.

Tsehayae and Fayek (2014) identified key parameters influencing labour productivity using context sensitive surveys that reveal contextual differences between key parameters. The study relies on data collected through 141 surveys administered to project management and trade respondents from six Canadian projects in either of two contexts: building and industrial. In the building context, “adequate and quality work tools” in the “equipment and tools” category was identified as the top parameter positively influencing CLP; “aging of Canadian population” in the “national” category was identified as the top parameter negatively influencing CLP. The perspective analysis indicated that PM and trade workers in the building context perceived some parameters’ influences on CLP differently, such as the positive influence of “crew experience and competence” and the negative impact of “harshness of weather”. In the industrial context, the parameter “daily job hazards assessment system” in the “health, safety, and environment” category was identified as the top parameter positively influencing CLP; “presence of many competing projects within the province” in the “provincial” category was identified as the top parameter negatively influencing CLP. The perspective analysis indicated that PM and trade workers in the industrial context perceived some parameters’ influences on CLP differently, such as the positive influence of “good cooperation between craftsmen in a crew” and the negative impact of “workers not getting required hand tools to do their jobs”.

Amanuel (2016) also identified factors affecting labour productivity on building construction projects in Addis Ababa, Ethiopia. And the study result indicates that the performances of building construction projects are influenced by the effect of poor labour productivity; and The top ten labour productivity influencing factors rated by their level of effect and frequency of occurrence are rated and ranked as; 1) Shortage of material, 2) Delays in decisions making, 3) Incomplete and Inaccurate drawings, 4) Lack of follow up the work progress, 5) Financial difficulties of the owner/Payment delay , 6) Incomplete facilities (water & power supply, and sanitary facilities), 7) Inspection and Instruction delay, 8) Lack of Motivation, 9) Frequent damage of equipment’s and 10) Change of work order/Variation. The result indicates that among the top ten ranked critical factors five (50%), four (40%) and 1 (10%) of them lies under the responsibility of Contractors, Consultants and Clients respectively.

Despite extensive research in the area, consensus on the classification of parameters, development of context-specific key parameters, and generalization of common parameters is yet to be achieved (Panas and Pantouvakis 2010). Past studies ranked factors irrespective of positive

or negative influence and mainly focused on factors negatively influencing CLP, while failing to comprehensively address the factors positively influencing CLP.

Research into CLP has been conducted from different perspectives such as industry, project, or activity levels. However, a mechanism that allows the mutual enhancement of CLP at these different levels does have not been thoroughly discussed (Yi and P.C.Chan 2014). They considered the perspective of either PM or trade level respondents without addressing differences in perspective between the two groups, thereby misrepresenting the multilevel and context-specific nature of productivity factors. Furthermore, past studies did not investigate practices as key factors influencing CLP. Therefore, in this study, parameters made up of factors (all factors influencing CLP except for project practices) and practices (practices related to the management of the project based on Project Management Institute 2000, and identified best practices based on Construction Industry Institute 2011), which are discussed in the following section, are investigated. The study methodology will be based on Tsehayae and Fayek (2014) findings.

Table 2.2 Summary for some of the previous studies that identified key input parameters.

Study Details	Key Parameters Ranked in Chronological Ascending Order of Influence
Horner et al. (1989) 13 Key factors	Skill of labor, Build ability, quality of supervision, method of working, Incentive Scheme, Site layout, Complexity of Construction information, Crew size and composition, length of working day, Availability of power tools, Absenteeism, Total number of operatives on site and proportion of work subcontracted.
Lim and Alum (1995) 5 Key factors	lack of qualified supervisors, shortage of skilled labor, high rate of labor turnover, labor absenteeism and communications with foreign laborers
Makulsawatudom et al. (2004) 23 Key factors	Lack of material, incomplete drawings, incompetent supervisors, lack of tools and equipment, labor absenteeism, poor communication, instruction time, poor site layout, inspection delay and rework are the most critical.
Jarkas and Bitar (2012) 10 Key factors	Clarity of technical Specifications, the extent of variation/change orders during execution, coordination level among design disciplines, lack of labour supervision, proportion of work subcontracted, design complexity level, lack of incentive scheme, lack of construction manager's leadership, stringent inspection by the engineer and delay in responding to request for information.
Tsehayae and Fayek (2014) 10 Key Factors	Canada's population is aging, Global economy still faces uncertainty of facing another slow down, Drawings and specification are of then not complete and require updates, Natural gas prices (Dollar/ GJ) are currently low and construction projects in Alberta is not adequate. Has been ranked influencing negatively
Amanuel (2016) 10 Key factors	Shortage of material, Delays in decisions making, Incomplete and Inaccurate drawings, Lack of follow up the work progress, Financial difficulties of the owner/Payment delay , Incomplete facilities (water & power supply, and sanitary facilities), Inspection and Instruction delay, Lack of Motivation, Frequent damage of equipment's and Change of work order/Variation

CHAPTER THREE

3. METHODOLOGY

3.1 Introduction

3.1.1 Research Approach

The main objective of this research is to identify and compare the critical parameters affecting construction labour productivity (CLP) in building projects. The research is observational study where quantitative approach is used. In the observational study, the researchers stand apart from events taking place in the study. They simply observe and record. The research focused on building projects in Addis Ababa which are under construction with grade one contractors. The research methodology is adopted from the research finding of Tsehayae and Fayek (2014) on CLP in Canada. This methodology is selected because a new methodology for evaluating and ranking the positive and the negative influence of each distinct parameter on CLP is developed, thereby enabling the identification of enablers as well as barriers to better CLP. The methodology thus improves the limitations of past approaches that either ranked factors based only on a severity index (negative influence) or a relative importance index (regardless of positive or negative influence). The methodology also provides a means to capture the expertise of construction workers from all levels within a project, while allowing for an investigation of the differences in perspectives between PM and trade level respondents, both within and between different project contexts. Tsehayae and Fayek (2014) identify 169 parameters with different categories as shown in the Table 3.1. Those parameters have been contextualized into Ethiopia's context as shown in the Table 3.1. In addition, 23 parameters are included from Amanuel's (2016) finding and other factors which are most commonly observed in Ethiopian construction industry have been included. A total of 191 parameters are sorted in the research study. In this study the influence factors for construction labour productivity at different levels of participating construction companies executing the projects are studied. The factors are presented based on their influence in different hierarchy as shown in the table 3.1. This shows the multi-level nature of parameters influencing CLP at different level.

Primary sources of data are collected for the study. Surveys are used to gather the data's. Whereas, secondary data from literatures described above are used in preparation of surveys. Therefore, questionnaire surveys are developed to gather both the quantitative and qualitative

primary data's. Previous studies on factors affecting CLP have been gathering data from the management level of organizations only. But it is essential to identify the opinion of skilled and unskilled (crafts) workers since the operation of each activity are performed by those trade workers. Therefore, it is necessary to identify the influences of the parameters at different level of a given project. Though, it is necessary to develop two types of surveys. The first one is Crafts Workers survey consisting of 103 parameters which address parameters related with Foreman's, carpenters, masons and other crafts workers. And the second one is the project management (PM) survey consisting of 155 parameters which address project managers, construction & site engineers, office engineers & other top and middle level managers. The crafts survey focuses on only in activity & project level parameters whereas the PM survey focuses on all levels of parameters. The samples of the questioners for both PM survey and crafts survey can be seen in the appendix.

In addition to identification of parameters in different level, a comparative analysis of perspective difference between crafts survey and PM survey is done. 34 Common parameters were selected in the survey for both crafts and PM survey. Those parameters are selected because those parameters have mutual influence in construction labour productivity in each of the survey groups then the rest. Using those common parameters, the difference in the perspective of the two is determined. Agreement on perspective helps as an input for improvement strategies to CLP whereas; difference in perspective of parameters will need further investigation of the result.

The survey includes two sections; the first one covers the background of the respondents. It includes the trade or occupation of the respondents, the demography, educational status and other related issues. And the second main section of the survey is classified into two 1) Agreement or Frequency questions and 2) Impact questions types. The agreement questions type are for all levels of parameters. Those types of question are usually happening parameters (e.g. the work tools provided are not of the required quality). And the frequency types are parameters which rarely occur (e.g. Electrical power gets disconnected during operation). The parameters are written both positively and negatively worded in order to make the respondent conscious in filling the questioner. Unlike from previous researches in factors affecting CLP in Ethiopia, in this research parameters which influence both positively and negatively are determined. In each questions of the survey both the negative and the positive rankings are put under each parameter.

Therefore, by making sure of the respondents understanding on each question, the positively and negatively influencing parameters can easily be differentiated.

Table 3.1 Parameters (factors and practices) influencing construction labour productivity

Parameter category	Activity level parameters
Labour and crew	Crew size, crew experience and competence, crew balance between journeymen and apprentices, work assignment to different crews, crowding, crew team spirit, cooperation between craftsmen, cooperation between the different crews, crew turnover, craftsmen treatment by foreman, number of consecutive days on job, craftsmen positive attitude towards the task, craftsmen physical fitness, craftsmen learning speed, craftsmen boredom and fatigue, craftsmen flexibility in accommodating task changes, job site orientation program, craftsmen trust in the skills and judgment of their supervisors, craftsmen participation in decision making process, level of job security, absenteeism of craftsmen, craftsmen's labour union status, craftsmen's skill utilization, feedback on performance to craftsmen, provision of clear goals, remunerations (salary, benefits)
Materials and consumable	Materials delivery to task location, material quality, shortage of consumables, correction work on prefabricated products, temporary material storage location, unloading of materials, vertical movement materials, horizontal material movement, material order tracking system
Equipment and tools	Transportation equipment (cranes, forklifts), electrical power connection during operation, waiting time for man lifts, adequacy of hand tools, adequacy of power tools, quality of work tools, efficiency of tool crib attendant, misplacement of tools
Task property	Tasks repetitiveness, tasks nature (challenging and interesting), total work volume, rework sources (vendor or contractor), rework frequency, change orders frequency, interruption and disruption frequency, most of the tasks in this project have repetitive nature, change orders frequency
Location property	Weather (temperature, wind, humidity, precipitation), location of work scope (distance and elevation), work area congestion, cleanness of work area, temporary electrical service provision, work conditions (noise, dust, and fumes), work area protection from weather effect, washrooms location, adequacy and location of lunchrooms, adequacy of camp facilities (residences, recreation, and shops), site access
Foreman	Foreman experience, foreman training for leadership, foreman's management style, frequency of change of foremen, span of control, fairness in performance reviews of craft workers, foreman skill in proper resource allocation, clear goals provision by project managers, feedback on performance, uniformity of work rules
Engineering and instructions	Availability of drawings and specifications, readability of drawings and specifications, drawings and specification's frequency of updates, response time for drawing questions, adequacy of job instructions
Parameter category	Project level parameter
Project delivery and contract	Delivery system (design bid build, design build, BOOT), contract type (lump sum, unit rate, cost plus)
Health, safety, and environment	Health and safety training, daily project briefing and debriefing practice, daily job hazard assessment system practice, tailgate safety meetings, stringency of project site safety rules, accidents and injury frequency, efficiency of safety incident investigations, planning of safety inspections and audits, sorting of waste materials practice, frequency of corrective actions to meet environmental requirements, planning

Identification and Comparative Analysis of Key Parameters Influencing Construction labour productivity of Building Projects in Addis Ababa.

	of environmental inspections and audits
Project management practices	Integration, scope, cost (identification and documentation of the estimation stages), cost (monitoring status of project to update project budget and manage changes), cost (reporting system for the identification of cost overruns), quality (identifying quality requirements and (or) standards), quality (process for monitoring and recording results of quality activities, QC), human resource (trainings, workshops, seminars), human resource (overall participation of HR in the formulation and realization of competitive strategies), procurement (project procurement plan), procurement (evaluation criterion to select bidders), procurement (documentation of procurement process and follow up), risk (use of risk assessment tool), risk (process for tracking, monitoring, and mitigation of risks), change (documentation process), change (monitoring and controlling changes), communication (availability of procedures), communication (documentation and tracking systems), business development (development of a time scaled business plan)
Project best practices	Detailed front end planning, alignment in front end planning stage, constructability reviews, formal team building process, material management practices (planning and controlling of materials), zero accident techniques implementation, use of automation and integration technologies, planning for startup, productivity measurement and improvement practices, efficiency of work permit process
Project owner nature	Owner's primary driver (schedule, cost, quality, safety), the project site is transferred timely to the contractor, owner team competence and knowledge, owner team decision provision, owner's project team adoption of project risk management practices, frequency of change requests, suspension of projects (frequency)
Parameter category	Organization level parameters
Organizational	Diversity of organization's principal construction project type (industrial, commercial, infrastructure), successful years in industry, number of divisions, number of employees, annual turnover in dollars, organizational structure system (matrix, project based, mixed), number of projects awarded per year, annual turnover of employees, execution of work approach (subcontracting, self-performing, both)
Parameter category	Provincial level parameters
Provincial	Provincial economy, competing projects within the province, provincial codes and regulations, quality of labour, adequacy of available labour, labour strikes, quality of supervisors, adequacy of available supervisors, taxes (income tax, provincial GST), construction material price fluctuations, unemployment rate for construction workers, balance of expenditure towards energy-related and non-energy related projects, increase of prices for outputs (project completion costs)
Parameter category	National level parameters
National	Stability of political system, competition from international firms, adequacy of available labour, recruitment of foreign workers, quality of labour, interest rates, unemployment rate for construction workers, population, aging of population, competing projects among provinces, inflation rate
Parameter category	Global level parameters
Global	Global economy forecast, recession effect of global economy, global energy supply and demand balance, oil price, oil price volatility, natural gas price, natural gas price volatility

Table 3.2 Additional Parameters included in this research

Parameter category	Activity level parameters
Labour and crew	Craftsmen are well disciplined in early start & Late finish time of work, Quality of work is higher which avoid rework & Craftsmen use alcohol and drugs during work hours.
Materials and consumable	Material order tracking system is too long for operation & required quantity of material is not delivered on time.
Equipment and tools	Appropriate Equipment type is provided for each type of work, Service time for Equipments and machineries are during non-working days(time)
Location property	The distance between the toilets and the work place is near
Foreman	Follow up and control of crews by foremen are Adequate
Engineering and instructions	Timely submission of material approvals from supervisors, Frequently change in drawings and specification, frequent Change of supervisor, Incompetence of supervisors and Supervisors absenteeism
Parameter category	Project level parameter
Project delivery and contract	Labour contract type as compared to contracts including material are ineffective in improving the site performance
Health, safety, and environment	Safety clothing's and tools are well provided & Safety sign boards and materials are well provided.
Project management practices	There is a lack of task & project follow up from managers.
Project owner nature	Owners don't have sufficient budget in financing projects & Owners don't pay to contractors in timely manner.
Parameter category	Organization level parameters
Organizational	Work Operation strategies and system increase performance of the organization & Marketing(Bidding) strategy compared with competitors decreases performance

3.2 Sample Size and Sampling Method

The sample size of the research is determined from a population of local grade one contractors which have ongoing building construction projects in Addis Ababa. Grade one contractors are selected because those contractors have a better organized company structure which satisfies the professionals, equipments and other experience requirements than the lower grade contractors. Therefore, since the survey is conducted to identify the parameter influencing CLP at different hierarchal level of a project and organization, those contractors are selected as a research population.

Using purposive sampling 14 projects of different contractors which are actively engaged in building construction in Addis Ababa were involved in data collection process. Among those 10 are engaged in public building projects. The remaining 4 are engaged in private building projects. From 14 contractors, 4 survey processes were conducted in the head office, 11 survey processes were at the projects. The projects from each contractor have been varying location, complexity, project size, project status and other variables. Since the study is done at all level of personnel's involved in execution of the projects. It is necessary to determine a sample size from a given project. Therefore, stratified random sampling method is used to determine the sample from the population. First the population of the project is classified into two, project management and crafts men. Then after determination of the population of each group, random sampling method is used to determine the number of sample required to have higher accuracy level. The study aims to achieve 90% confidence interval and 10% margin of error.

Using the Cochran formula Eq. (3.1) for determining survey sample size and for a 10% margin of error and 90% confidence interval, the sample size for the infinite population is 96. It is observed from the samples of populations that the number of head office and project management employees to be 43. Whereas an average of 120 temporary and permanent trade workers employees were recorded at the project. Therefore, by taking 43 population for project management (both at head office and project level) and 120 for crafts workers, the required numbers of samples for the study are 30 and 54 for PM survey and crafts survey respectively. As a result, 42 PM survey and 58 Crafts survey was managed to be collected which is adequate for further analysis. And a total of 100 surveys were collected in the research.

$$Valid\ Response_{perstrata} = \frac{SS_{ip}}{1 + \frac{SS_{ip}-1}{Populationo\ fStrata}} \dots \dots (3.1)$$

Table 3.3 Expected and Collected survey results

Type of Survey	Expected Survey	Collected Survey
PM Survey	30	42
Crafts Survey	54	58
Total	84	100

3.3 Data Analysis Method

The analysis method used is also adopted from Tsehayae and Fayek, 2014 findings. This finding enables for identification of the positively and negatively influencing parameters as it is clearly put in the survey. In addition, the perspective difference between the PM survey and Crafts survey can be analyzed.

For agreement-type parameters, which are presented in either positive or negative parameter statements, first, the level of agreement (R_A) or disagreement (R_D) with a given parameter statement by a number of respondents was computed using equations (3.2) and (3.3), where the maximum possible weighted percentage of agreement or disagreement is equal to 50:

$$R_A = \frac{(A \times 1 + B \times 2 + C \times 3)}{6} \times 100 \dots \dots \dots (3.2)$$

$$R_D = \frac{(D \times 1 + E \times 2 + F \times 3)}{6} \times 100 \dots \dots \dots (3.3)$$

- Where A= percentage of respondents rating the positively worded parameter as 5 (slightly agree);
- B= percentage of respondents rating the positively worded parameter as 6 (agree);
- C= percentage of respondents rating the positively worded parameter as 7 (strongly agree);
- D= percentage of respondents rating the negatively worded parameter as 3 (slightly disagree);
- E= percentage of respondents rating the negatively worded parameter as 2 (disagree) and
- F= percentage of respondents rating the negatively worded parameter as 1 (strongly disagree)

The impact in terms of positive (I_P) or negative (I_N) impact of a given agreement-type parameter statement by a number of respondents was computed using equations (3.4) and (3.5), where the maximum possible weighted percentage of positive or negative impact is equal to 50:

$$I_p = \frac{(X \times 1 + Y \times 2 + Z \times 3)}{6} \times 100 \dots \dots \dots (3.4)$$

$$I_N = \frac{(U \times 1 + V \times 2 + W \times 3)}{6} \times 100 \dots \dots \dots (3.5)$$

Where X= percentage of respondents rating the impact of the parameter as 5 (slightly positive);

Y= percentage of respondents rating the impact of the parameter as 6 (positive);

Z= percentage of respondents rating the impact of the parameter as 7 (strongly positive);

U= percentage of respondents rating the impact of the parameter as 3 (slightly negative);

V= percentage of respondents rating the impact of the parameter as 2 (negative); and

W= percentage of respondents rating the impact of the parameter as 1 (strongly negative).

After determining the level of agreement and impact on each parameter, the positive and negative effects of each parameter is evaluated. For the positive effect of a positively worded parameter the evaluation index and evaluation score was computed using equations (3.6) and (3.7); similarly, equations (3.8) and (3.9) were used to calculate the positive effect of a negatively worded parameter. First, the evaluation index based on the product of the agreement/disagreement and impact scores was computed. Then, the evaluation score was computed by dividing the evaluation index of a given parameter by the maximum possible evaluation score. The maximum possible evaluation score is equal to 2500—the product of the maximum values of agreement/disagreement (50) and impact (50).

Positively worded parameters and positive effect:

$$Evaluation\ Index_{AP(+ve)} = R_A \times I_P \dots \dots \dots (3.6)$$

$$Evaluation\ Score_{AP(+ve)} = \frac{Evaluation\ Index_{AP(+ve)}}{2500} \times 100 \dots \dots \dots (3.7)$$

Negatively worded parameters and positive effect:

$$Evaluation\ Index_{AN(+ve)} = R_D \times I_P \dots \dots \dots (3.8)$$

$$Evaluation\ Score_{AN(+ve)} = \frac{Evaluation\ Index_{AN(+ve)}}{2500} \times 100 \dots \dots \dots (3.9)$$

For the negative effect of a positively worded parameter, the evaluation index and evaluation score were computed using equations (3.10) and (3.11); similarly, equations (3.12) and (3.13) were used to calculate the negative effect of a negatively worded parameter.

Positively worded parameters and negative effect:

$$Evaluation\ Index_{AP(-ve)} = R_D \times I_N \dots \dots \dots (3.10)$$

$$Evaluation\ Score_{AP(-ve)} = \frac{Evaluation\ Index_{AP(-ve)}}{2500} \times 100 \dots \dots \dots (3.11)$$

Negatively worded parameters and negative effect:

$$Evaluation\ Index_{AN(-ve)} = R_A \times I_N \dots \dots \dots (3.12)$$

$$Evaluation\ Score_{AN(-ve)} = \frac{Evaluation\ Index_{AN(-ve)}}{2500} \times 100 \dots \dots \dots (3.13)$$

The frequency type parameters were only used for activity level parameters under the “material and consumables” and “equipments and tools” categories for the crafts survey. The parameters were all negatively worded and the evaluation index and scores were calculated as follows. First, the frequency rating of a parameter by a number of respondents (F_R) was computed using the weighted percentage of respondents rating the parameter’s frequency based on the seven-point Likert scale, as shown in equation (3.14), where the maximum possible weighted frequency rating is equal to 100:

$$F_R = \frac{(H \times 1 + I \times 2 + J \times 3 + K \times 4 + L \times 5 + M \times 6 + N \times 7)}{7} \times 100 \dots (3.14)$$

Where H = percentage of respondents rating the parameter frequency as 1 (never);

I = percentage of respondents rating the parameter frequency as 2 (very rarely);

J = percentage of respondents rating the parameter frequency as 3 (rarely);

K = percentage of respondents rating the parameter frequency as 4 (sometimes);

L = percentage of respondents rating the parameter frequency as 5 (often);

M = percentage of respondents rating the parameter frequency as 6 (very often); and

N = percentage of respondents rating the parameter frequency as 7 (constantly).

Then, the effect in terms of positive or negative impact of a given frequency parameter-type statement by a number of respondents was computed using equations (3.4) and (3.5). Finally, the evaluation index and score was computed for positive effect of the parameter using equations (3.15) and (3.16), and for negative effect using equation (3.17) and (3.18). The evaluation index was based on the product of frequency rating and impact score, and the evaluation score was computed by dividing the evaluation index of a given parameter by the maximum possible evaluation score. The maximum possible evaluation score is equal to 5000 the product of the maximum values of frequency rating (100) and impact (50).

Positive effect:

$$Evaluation\ Index_{F(+ve)} = F_R \times I_p \dots \dots \dots (3.15)$$

$$Evaluation\ Score_{F(+ve)} = \frac{Evaluation\ Index_{F(+ve)}}{5000} \times 100 \dots \dots \dots (3.16)$$

Negative effect:

$$Evaluation\ Index_{F(-ve)} = F_R \times I_N \dots \dots \dots (3.17)$$

$$Evaluation\ core_{F(-ve)} = \frac{Evaluation\ Index_{F(-ve)}}{5000} \times 100 \dots \dots \dots (3.18)$$

The level of ranking of each parameter is based on the data on evaluation scores of each parameter. The values obtained from evaluation scores is first normalized to a scale from 0 to 100. And a higher value indicates greater influence both positively and negatively. Each group categories are also ranked by taking the average of each parameter under the categories.

CHAPTER FOUR

4. ANALYSIS AND DISCUSSIONS

4.1 Introduction

In quantitative research, the reliability and validity of the data collected should be checked for its internal consistency before proceeding into the analysis. Among the many types of data reliability checking methods, Cronbach's alpha method is the most commonly used method by different scholars.

Alpha was developed by Lee Cronbach in 1951 to provide a measure of the internal consistency of a test or scale; it is expressed as a number between 0 and 1. Internal consistency describes the extent to which all the items in a test measure the same concept or construct and hence connected to the inter-relatedness of the items within the test (Dennick 2011).

As it is described in Chapter 3 the parameters in the survey are both negatively and positively worded in order to make the respondent concise in ranking the parameters. But in determination of the Cronbach's alpha value it is necessary first to decode the negatively worded parameters ranking. Therefore, after decoding (reversing) the values of ranking of the negatively worded parameters into positive the Cronbach's alpha value of the PM survey and Crafts workers survey was determined by Microsoft excel sheet and determined to be 0.86 for PM survey and 0.92 for crafts workers survey which is between 0.7- 0.95 the allowable range (Dennick 2011).

Since the data is reliable for conducting analysis, the collected survey both at PM survey and Trade survey is analyzed by the method described in Chapter 3. And the results have been presented as follows: The first part will discuss on the ranking of the parameters in each of the category influencing both negatively and positively in PM survey and Crafts workers Survey has been discussed separately. Then ranking the categories in each of the survey groups has been presented. Then top ten parameters in each of the survey groups separately and combined is discussed consecutively. The last part of the discussion will present the analysis on the perspective difference between the two survey groups which are PM survey and Crafts or Trade survey which will give an important input for formulating mitigating strategy for the parameters which have same perspective between the two survey groups whereas the parameters with different perspective will need further investigation.

4.2 Respondents profile and opinion on CLP

From the total of 42 PM survey the occupational level of the respondents were 28.6% site engineers, 19% office Engineers, 11.9% operation managers & construction engineers each, 7.1% project manager, resident engineers & supervisors each, 4.8% contracts administrators and 2.4% of them were general forman's. An average of 6.4 years of experience of the total respondents was recorded.

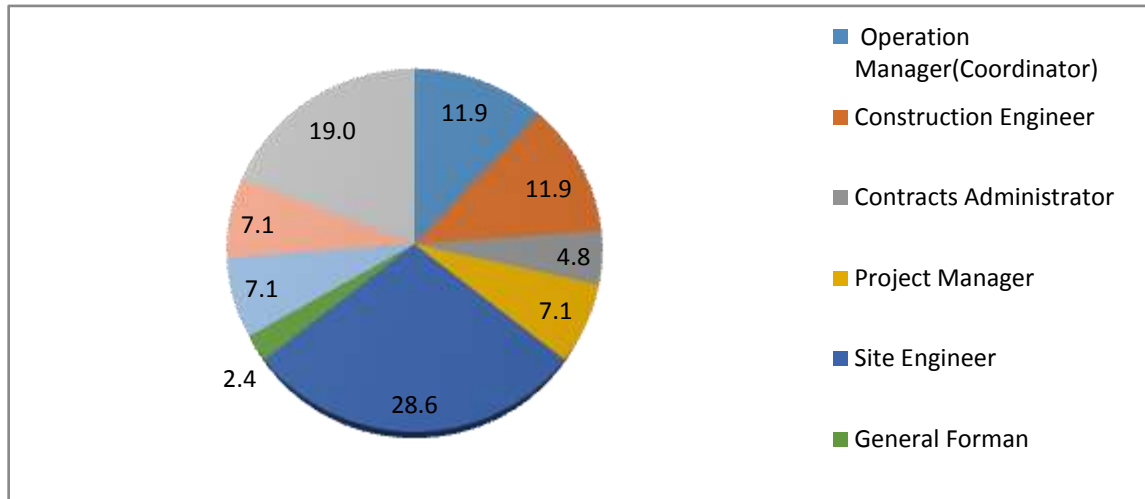


Figure 3.1 Respondents occupational statuses

Among those respondents 83.3% are having Bachelor's degree, 9.5% with a master's degree and remaining 4.8% & 2.4% with a collage diploma & vocational school level respectively. 50% of respondents think their current project is being managed "Good" and 21.4% think their current project management is "Very good". And regarding the overall productivity of their project 50% rated "Good", 19% rated "Neutral" and 11.9 % rated "Poor"& "Very Good" each.

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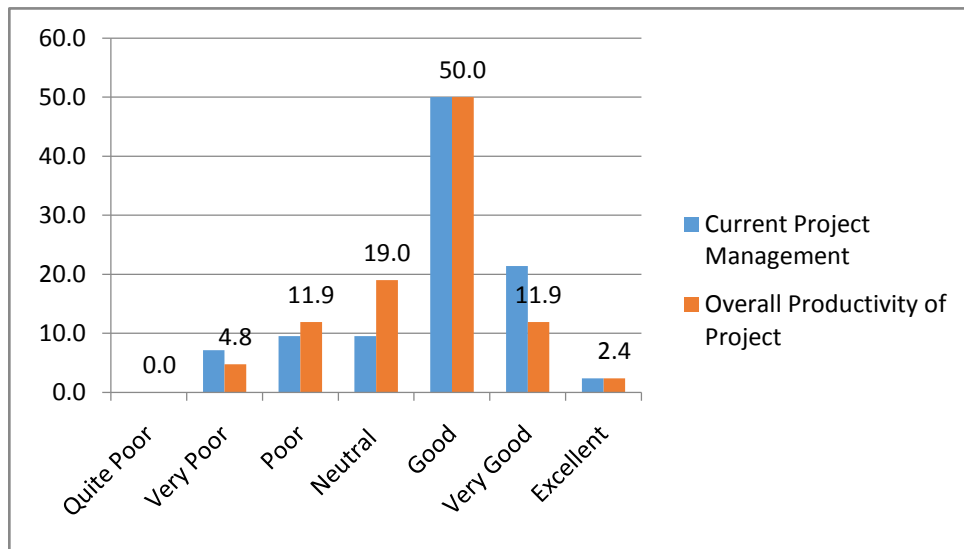


Figure 3.2 Percentage of respondents rating on their current project management and overall productivity of the project

In the crafts survey 58 questionnaires have been collected which is more than the expected 54 questionnaires. From the 58 questionnaires the percentage of trade of respondents were 19% Forman, 17.2% carpenters, 13.8% bar benders, 12.1% plasterers, 6.9% masson as shown in figure 3.3.

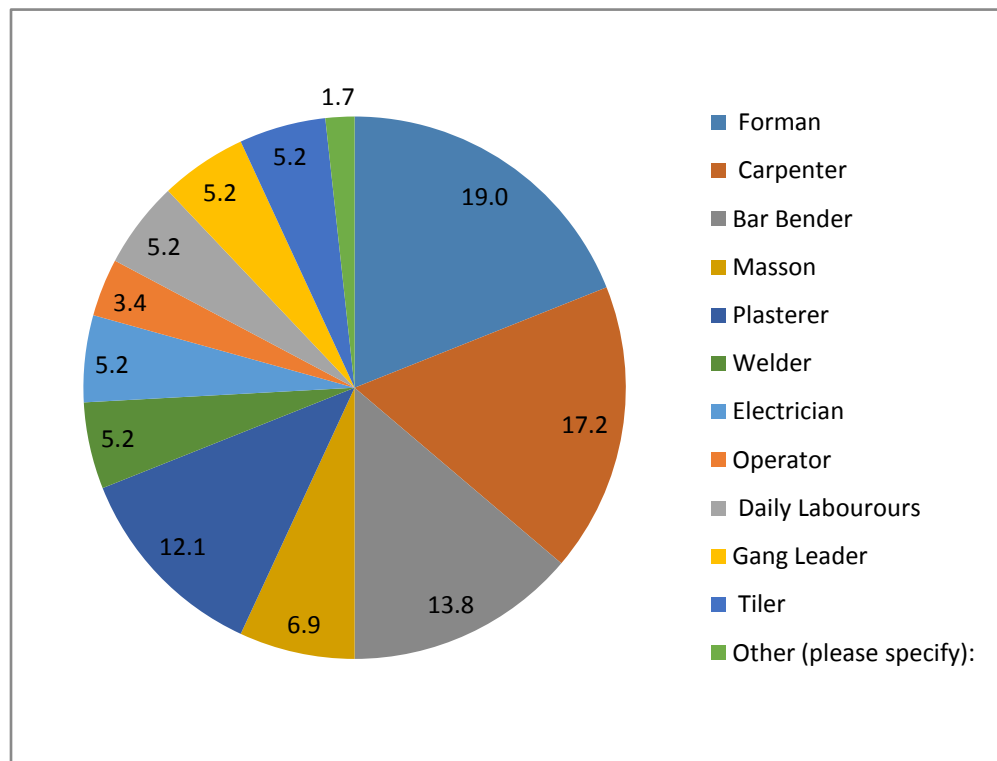


Figure 3.3 Percentage of trade position of respondents in Crafts survey

The educational level of trade workers participated in the survey were 32.8% high school graduate, 29.3% less than high school, 19% have been in vocational school and 17.2 % of them were graduated from college. Among the respondents 53.4% have taken technical training, 44.8% have taken safety training & only 17.2% of them have taken managerial training as shown in Figure 3.4.

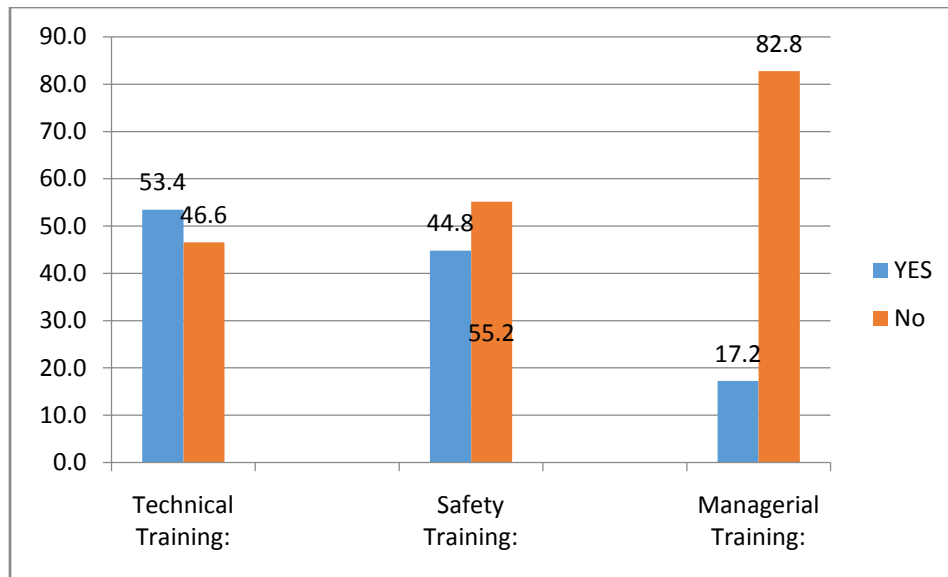


Figure 3.4 Percentage of trade workers taking technical, safety & managerial trainings

The trade workers have also ranked the current project management, overall productivity of their current project, productivity of their discipline and crew. Accordingly, 44.8% of trade workers in survey argue that their current project management is “Good”. 46.6 % of them also argue that the overall productivity rate of their project is “Good”. 46.6% of the trade workers ranked “Very Good” the management of their discipline and productivity of their own crew as shown in figure 3.5 below.

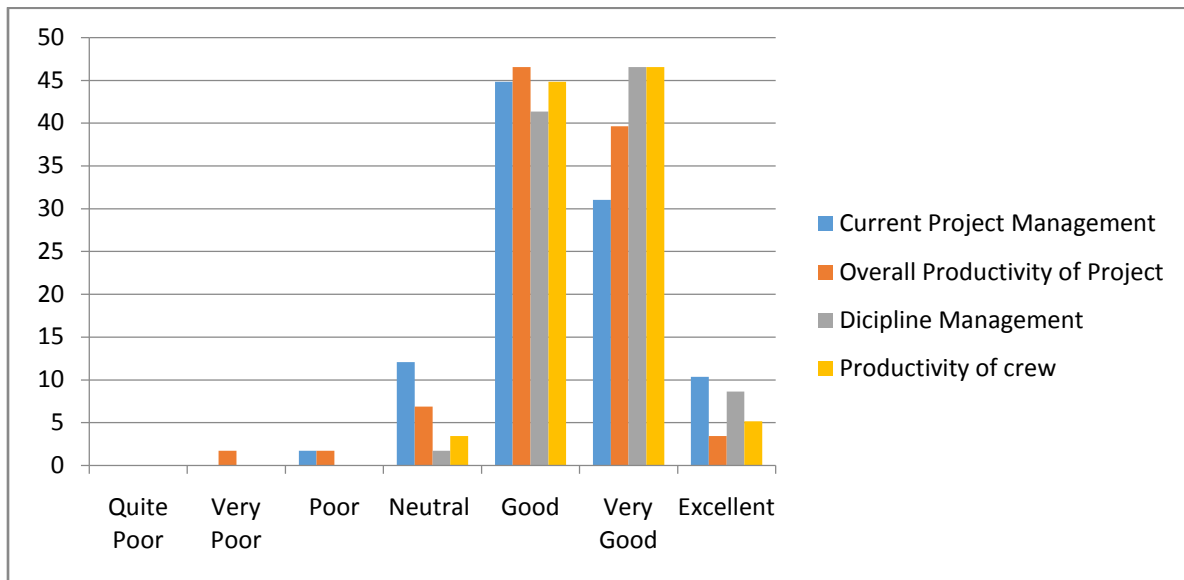


Figure 3.5 Percentage of respondents rating current project management, overall productivity of project, management of discipline & productivity of specific crew.

4.3 Ranking of key parameters influencing both positively and negatively in each category

The evaluation score for each parameter was determined by the formulas given in Chapter 3 are used to determine the ranking of parameters. The evaluation score is first normalized to a range of 1 to 100, and then the ranks of each parameter will be sorted. In this section the rankings of the factors from each category based on the normalized value will be evaluated. It is essential to determine the primary factors influencing CLP both negatively and positively in each category of the parameters. This will help to determine the primary factors influencing CLP in different level and have mitigating strategy in each level of projects. In most of the previous studies overall ranking and category ranking were only done which will not identify the individual parameters which influence most in each of the category.

There are 9 common categories for the PM and Crafts survey. In addition, there are 8 categories for the PM survey. In the first category of both the PM and Crafts survey which is labour and crew related category, “Late start and early finish of work affect crafts performance” has been ranked first which affect CLP negatively. “Clear goals are given to foreman and crafts” have been ranked first in influencing CLP positively. In Crafts survey “Remunerations (salary, benefits) are satisfactory” has been ranked first which affect negatively CLP. “There is a really good cooperation between craftsmen in a crew” has been ranked first in positively influencing CLP.

The top 5 ranking of both positively and negatively in this category has been presented in Table 4.1. The result shows that the PMs are pointing figures on trade workers for poor CLP where as the trade worker are complaining on their “low wages” for poor results on CLP. This shows that the problem exist in either of the two where the trade workers are not using their working times even if there wage rates is high or low. Therefore, strict follow up and controlling procedures should be implemented in controlling working times. In addition the top two negatively influencing parameters rated by trade workers are related to wage rates and compensation. Therefore, adequate wage rates and compensation should be given by project managements in order to improve the CLP.

Table 4.1 Ranking of “labour and crew related” category factors.

PM survey labour and crew related category ranking					
Negative Influence	ES	Rank	Positive Influence	ES	Rank
Late start and early finish of work affect crafts performance	22.37	1	Clear goals are given to foreman and crafts	29.37	1
Unrealistic expectations have demotivated the workforce and reduced their productivity.	19.44	2	Craftsmen have a positive attitude towards the task	23.82	2
Craftsmen’s skill is not fully utilized	12.73	3	Craftsmen’s labour union status (unionized or not unionized) and its benefits are important in their day to day performance	23.81	3
Absenteeism of craftsmen is well tracked	11.84	4	There is a good cooperation between craftsmen	22.22	4
Work motivation of crafts is not adequate to perform day to day tasks.	11.79	5	Crew team spirit is high	21.87	5
Crafts survey labour and crew related category ranking					
Negative Influence	ES	Rank	Positive Influence	ES	Rank
Remunerations (salary, benefits) are satisfactory	26.04	1	There is a really good cooperation between craftsmen in a crew	51.98	1
There is frequent crew turnover	6.09	2	Craftsmen use alcohol and drugs during work hours.	49.50	2
The crew size is not adequate for the task at hand	5.40	3	Work is fairly assigned to the different crews	37.08	3
Crew is given adequate training before commencement	4.62	4	There is a really good cooperation between the different crews	37.06	4
Craftsmen have the required physical fitness	4.12	5	Crew is experienced and has the necessary competence	36.76	5

The second category in the survey is the “material and consumable”. In this category, the PM survey identifies “Material is delivered on time” has been ranked first in negatively influencing CLP. This confirms that Amanuel (2016) findings which rates “shortage of material” as the top one ranking for negatively influencing factor. “Delivered materials are of high quality” has been ranked first in positively influencing CLP. Whereas in crafts survey the questionnaire was classified into two the frequency and agreement types. “Materials are not delivered on time to task location” in the frequency type and “Vertical movement material is slow” in the agreement type has been ranked first negatively influencing CLP. “The materials delivered have quality problems” in frequency type and “Temporary material storage is not located close to work location” has been ranked first in positively influencing CLP. And in comparison between the survey groups it is observed that both agree on negatively influencing parameter which is material is not delivered on time. In addition Amanuel (2016) findings also conforms this finding, this shows that delivery of materials on construction sites have been consistently influencing CLP and particular attention should be given. The survey groups also agree on the top positively influencing parameter which is “Delivered materials are of high quality”.

Table 4.2 Ranking of “material and consumable” category factors

PM survey material and consumables category ranking					
Negative Influence	ES	Rank	Positive Influence	ES	Rank
Material is delivered on time	18.52	1	Delivered materials are of high quality	13.58	1
Required quantity of material is not delivered on time	17.36	2	Temporary material storages are properly planned	11.88	2
Material order tracking system is too long for operation	14.20	3	Material order tracking system is in place	10.56	3
Temporary material storages are properly planned	6.85	4	Material is delivered on time	8.06	4
Material order tracking system is in place	6.24	5	Material movement practices are well planned	7.71	5
Crafts survey material and consumables category ranking					
Frequency type					
Negative Influence	ES	Rank	Positive Influence	ES	Rank
Materials are not delivered on time to task location	22.81	1	The materials delivered have quality problems	13.77	1
There a shortage of consumables	7.91	2	There a shortage of consumables	11.59	2

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The materials delivered have quality problems	7.67	3	Materials are not delivered on time to task location	8.37	3
Correction work has to be done because of quality problems of prefabricated products	4.93	4	Correction work has to be done because of quality problems of prefabricated products	8.05	4
Agreement Type					
Vertical movement material is slow	5.77	1	Temporary material storage is not located close to work location	19.57	1
Horizontal material movement is slow due to lack of clear pathway	5.15	2	The site has a very good material order tracking system	16.64	2
It takes a very long longer time and effort to unload materials	2.85	3	It takes a very long longer time and effort to unload materials	12.07	3
The site has a very good material order tracking system	2.59	4	Vertical movement material is slow	9.66	4
Temporary material storage is not located close to work location	2.06	5	Horizontal material movement is slow due to lack of clear pathway	9.55	5

“Equipment and tool” is the third category, the PM survey identified “Work places are not equipped with adequate man lifts” and “Power source (electric or fuel) are sufficiently provided” as the first ranking influencing CLP negatively and positively respectively. In the crafts survey like the “material and consumable category has been two type. “There is a shortage of good transportation equipment (cranes, forklifts)” in the frequency type and “Tool crib attendant takes time to get the asked tool” in the agreement type has been ranked first in negatively influencing CLP in this category. “Electrical power gets disconnected during operation” in the frequency type and “The work tools provided are not of the required quality” in the agreement type has been identified as mostly influential positively in CLP. In this category also there is an agreement between the PM and crafts survey where both groups raise the problem of transportation of materials in the site where the PM survey identified the problem of equipments for man lifts and the crafts survey identified the problem of transportation equipments as the most negatively influencing parameters. This shows there is great problem of transportation equipment which negatively affects CLP. In addition both survey groups agree on the sufficient power source is provided which positively influence CLP.

Table 4.3 Ranking of “Equipment and tool” category factors

PM survey equipment and tool category ranking					
Negative Influence	ES	Rank	Positive Influence	ES	Rank
Work places are not equipped with adequate man lifts	13.91	1	Power source (electric or fuel) are sufficiently provided	23.43	1
Equipments and tools frequently breakdown	11.97	2	There are adequate material transportation equipment (cranes, forklifts)	17.03	2
Service time for equipments and machineries are during non-working days (time)	8.26	3	Appropriate equipment type is provided for each type of work	13.54	3
There are adequate and quality work tools	4.72	4	There are adequate and quality work tools	11.64	4
Power source(electric or fuel) are sufficiently provided	4.26	5	Service time for equipments and machineries are during non-working days (time)	9.56	5
Crafts survey equipment and tool category ranking					
Frequency type					
Negative Influence	ES	Rank	Positive Influence	ES	Rank
There is a shortage of good transportation equipment (cranes, forklifts)	18.07	1	Electrical power gets disconnected during operation	12.10	1
Electrical power gets disconnected during operation	11.68	2	Workers can't get the required power tools to do their jobs	11.93	2
Workers can't get the required power tools to do their jobs	10.80	3	Workers can't get the required hand tools to do their jobs	11.11	3
Workers can't get the required hand tools to do their jobs	10.47	4	There is a shortage of good transportation equipment (cranes, forklifts)	10.48	4
Damages of equipments/tools	8.70	5	Damages of equipments/tools	9.11	5
Agreement Type					
Tool crib attendant takes time to get the asked tool	3.49	1	The work tools provided are not of the required quality	23.70	1
When I look for tools, I can't find them because they are misplaced	2.32	2	Appropriate equipment type is not provided for each type of work	18.81	2
Appropriate equipment type is not provided for each type of work	2.14	3	When I look for tools, I can't find them because they are misplaced	17.78	3
The work tools provided are not of the required quality	1.98	4	Tool crib attendant takes time to get the asked tool	15.27	4
Service time for equipments and machineries are during working days(time)	1.01	5	Service time for equipments and machineries are during working days(time)	12.99	5

“Leadership training is provided to foremen” negatively influencing and “Span of control of foreman is properly considered in the development of crews” positively influencing parameters were identified in the PM survey as the most influential. Whereas, the trade workers identify “The crew number is too large for one foreman” as negatively is influencing and “Foreman has the required experience” as positively influencing parameters in the “Foreman related” category. In this category there is disagreement between the two survey groups where the PM survey identified there is lack of training to foremens whereas the crafts surveys identified crew number is too large to manage to foreman’s where this parameter is ranked top positively by the PM survey. Therefore further investigation is necessary to identify the parameter where both groups will agree on.

Table 4.4 Ranking of “Foreman related” category factors

PM survey foreman related category ranking					
Negative Influence	ES	Rank	Positive Influence	ES	Rank
Leadership training is provided to foremen	13.17	1	Span of control of foreman is properly considered in the development of crews	10.00	1
Follow up and control of crews by forman's are adequate	4.93	2	Foreman’s fairness in performance review of craft workers is checked by supervisors	9.00	2
Superintendents(general forman's) usually follow uniform work rules	4.59	3	Follow up and control of crews by Forman’s are adequate	8.00	3
Efforts are taken to reduce turnover of foremen	3.74	4	Foremen receive performance evaluation on regular basis	7.00	4
Foremen receive performance evaluation on regular basis	2.87	5	Superintendents(general Forman’s) usually follow uniform work rules	5.00	5
Crafts survey foreman related category ranking					
Negative Influence	ES	Rank	Positive Influence	ES	Rank
The crew number is too large for one foreman	2.85	1	Foreman has the required experience	10.00	1
There is a frequent change of foremen	2.48	2	Foreman has been trained for leadership	9.00	2
There is fairness in performance review of craft workers	1.73	3	Foreman has appropriate skill in proper resource allocation	8.00	3
Feed back on performance is provided to foremen on regular basis	1.29	4	In this project clear goals are provided by Project Managers	7.00	4
Foreman management style is participative and motivating	1.01	5	Foreman management style is participative and motivating	5.00	5

“Washrooms are closely located” negatively influencing and “Lunchroom locations are properly planned” positively influencing parameters were identified the first rank in the PM survey of the “site condition” category. “Camp facilities (recreation and shops) are adequate” influencing negatively and “Temporary electrical service is always provided” influencing positively has been ranked first in the crafts survey of the “Location property” category. Whereas “Work condition has excessive noise, dust and fumes” influencing negatively and “In this project, the tasks are repetitive” influencing positively has been ranked top in the “Task Property” category of the crafts survey. These results also make a conformation on Amanuel (2016) findings which ranks “incomplete facilities (water & power supply & sanitary facilities)” 6th in influencing CLP negatively.

Table 4.5 Ranking of “site condition” category of the PM survey and “Location property” of the trade survey factors

PM Survey site condition category ranking					
Negative Influence	ES	Rank	Positive Influence	ES	Rank
Washrooms are closely located	13.89	1	Lunchroom locations are properly planned	10.66	1
Measures are taken to minimize weather (temperature, wind, humidity, precipitation) effects	12.69	2	Washrooms are closely located	7.72	2
Work locations are confronted with excessive noise, dust, and fumes	12.47	3	Adequate camp facilities are provided	7.31	3
Adequate recreation facilities are not provided	11.89	4	Measures are taken to minimize weather (temperature, wind, humidity, precipitation) effects	6.42	4
Adequate camp facilities are provided	6.35	5	Work locations are confronted with excessive noise, dust, and fumes	4.84	5
Crafts Survey Location property category ranking					
Negative Influence	ES	Rank	Positive Influence	ES	Rank
Camp facilities (recreation and shops) are adequate	20.40	1	Temporary electrical service is always provided	21.14	1
Washrooms are closely located	15.81	2	Adequate lunchrooms are closely located	17.12	2
Camp facilities (residences) are adequate	15.72	3	The work area is not clean	14.59	3
The work area is protected from weather effect	13.56	4	The work area is congested	14.31	4
On average the weather is harsh (temperature, wind, humidity, precipitation)	8.24	5	Location of work scope (distance and elevation) is convenient	7.13	5

Amanuel (2016) ranked “Incomplete and in accurate drawings” as the 3rd top factor influencing CLP negatively. In this study also “Drawings and specifications are often not complete and require updates” parameter has been identified to be negatively influencing parameter in the engineering category of the PM survey. Whereas “Drawings and specifications are made available well ahead of implementations” parameter as positively influencing parameters in engineering category.

Table 4.6 Ranking of “Engineering” category factors

PM survey engineering category ranking					
Negative Influence	ES	Rank	Positive Influence	ES	Rank
Drawings and specifications are often not complete and require updates	36.07	1	Drawings and specifications are made available well ahead of implementations	18.34	1
Frequently change in drawings and specification	27.34	2	Timely submission of material approvals from supervisors	12.46	2
Incompetence of supervisors	13.86	3	Incompetence of supervisors	4.03	3
Timely submission of material approvals from supervisors	8.73	4	Frequently change in drawings and specification	1.64	4
Drawings and specifications are made available well ahead of implementations	4.57	5	Drawings and specifications are often not complete and require updates	1.32	5
Crafts survey engineering category ranking					
Negative Influence	ES	Rank	Positive Influence	ES	Rank
Change in design	7.61	1	Drawings and specifications are readily available	20.33	1
Available drawings and specifications are not readable	4.12	2	Adequate job instructions are not provided	14.13	2
Incompetence of supervisors	2.87	3	In this site, the response time for drawing questions is acceptable	11.88	3
In this site, the response time for drawing questions is acceptable	2.56	4	Change in supervisor	10.92	4
Change in supervisor	2.51	5	Available drawings and specifications are not readable	9.96	5

In the health related category, the PM survey identified “Daily job hazard assessment system is in place” as negatively influencing parameters in this category. “Tailgate safety meetings are time taking” were also identified positively influencing parameter in this category. The crafts survey also identified “Safety Clothing's & tools are well provided” as negatively influencing

and “Frequency of accidents and personal injury is low” as positively influencing parameters in health related category.

Table 4.7 Ranking of “health related” category factors

PM survey health related category ranking					
Negative Influence	ES	Rank	Positive Influence	ES	Rank
Daily job hazard assessment system is in place	20.07	1	Tailgate safety meetings are time taking	11.79	1
Regular health and safety training is not provided	19.75	2	Sorting of waste materials (Concrete, Steel, Wood) is strictly implemented	8.82	2
Environmental inspections and audits are not well planned	16.05	3	Project site safety rules are stringent	8.31	3
Safety sign board and materials are well provided	15.65	4	Corrective actions are frequently taken to meet environmental requirements	7.26	4
Safety clothing's & tools are well provided	14.80	5	Safety clothing's & tools are well provided	5.85	5
Crafts survey health related category ranking					
Negative Influence	ES	Rank	Positive Influence	ES	Rank
Safety Clothing's & tools are well provided	14.45	1	Frequency of accidents and personal injury is low	22.21	1
Unsafe working conditions are common	11.84	2	Safety sign board and minimize accident and injury.	18.33	2
Safety sign board and minimize accident and injury.	2.96	3	Stringent safety rules are negatively affecting productivity	16.75	3
Provision of Safety tools is prohibiting work progress	2.26	4	Provision of Safety tools is prohibiting work progress	10.48	4
Stringent safety rules are negatively affecting productivity	1.82	5	Unsafe working conditions are common	7.43	5

In addition to the common category for the PM and crafts survey other categories which are not common were used to identify the parameters in the crafts survey. In the crafts survey “project management” category where the only category which is not common with the PM survey. In this category “Remuneration (salary, bonus and incentives) are fairly set” parameter where identified negatively and “Hiring practices are fair and competence based” where identified positively influencing parameters.

Table 4.8 Ranking of “project management” category of crafts survey

Crafts survey project management category ranking					
Negative Influence	ES	Rank	Positive Influence	ES	Rank
Remuneration (salary, bonus and incentives) are fairly set	23.52	1	Hiring practices are fair and competence based	17.07	1
There is a lack of project follow up from the project management	5.50	2	Workers are facing frequent layoffs	15.03	2
There is a high level of paperwork	5.18	3	Work packages are properly planned and assigned to workers	18.07	3
Workers are facing frequent layoffs	2.77	4	The site has clearly laid out organization structure	20.81	4
Work packages are properly planned and assigned to workers	2.50	5	Unrealistic schedule is given to tasks	12.66	5

In the PM survey there are other categories which are not common with the crafts survey the top parameter rankings in each category is presented in Table 4.4.

Table 4.9 Top Parameter Ranking of PM survey categories

Category	Negative Influence	ES	Positive Influence	ES
PROJECT DELIVERY AND CONTRACT	Labour contract type as compared to contracts including material are ineffective in improving the site performance	7.04	Lump sum contract types have similar effect on craft productivity as compared to admeasurements types	7.07
PROJECT COMPLEXITY	Change orders due to design changes are frequently made	22.03	Most of the tasks in this project have repetitive nature	21.16
PROJECT MANAGEMENT PRACTICES	Scope Management Practices: The process of defining and documenting scope of work and different project needs to meet organization objectives is often missing	12.46	Procurement Management Practices: Proper evaluation criterion is applied to select qualified bidders	26.59
PROJECT BEST PRACTICES	Zero accident techniques are effectively applied	17.01	Work permit process is efficient and proactive	19.73
PROJECT OWNER NATURE	Owners don't pay to contractors in timely manner	17.74	Owner's primary driver is quality	23.05
ORGANIZATIONAL	Number of employees in the organization as compared to competitors is low	9.64	Work operation strategies and system increase performance of the organization	31.29
PROVINCIAL (REGIONAL)	Prices for outputs (project completion costs) are substantially increasing	23.94	The available labour for construction projects in Addis Ababa is adequate	19.05
NATIONAL	Public unrest due to political, economical or other issues	51.55	Ethiopia have more young population	37.70

As it is shown in table 4.4 “Change orders due to design changes are frequently made” parameter in the “project complexity” category and “Owners don’t pay to contractors in timely manner” parameter in the “Project owner nature” category have been identified the top parameters influencing negatively in each category. The same result has been identified by Amanuel (2016) findings where “financial difficulties of the owner (payment delay)” factor and “change in work order (variation)” factors where 5th and 10th respectively in the top ten negatively influencing factors. Among the top 10 negatively influencing factors identified by Amanuel (2016) findings 5 of them were also identified as the top one negatively influencing parameters in each of their categories in this study.

4.4 Overall group ranking of the category

There are 9 categories from the crafts survey and 15 categories from the PM survey. From each of the surveys category rankings is presented in this section. In the crafts survey “Location Property”, “Equipment and tools” and “Material and Consumables” categories have been identified from 1st to 3rd respectively in influencing negatively. Whereas “Foreman related”, “Labour and Crew related” and “Equipment and tools” categories are rated from 1st to 3rd respectively positively influencing.

In the PM survey the top three categories rated negatively are “National”, “Engineering” and “Project Complexity” respectively. However, “Foreman related”, “Labour and crew related” and “project management practice” categories have been rated positively from 1st to 3rd. The ranking of both crafts survey and Pm survey categories are shown in the table 4.5 and 4.6.

Table 4.10 Ranking of Crafts Survey Categories.

No.	Category	Negative Impact Ranking	Positive Impact Ranking
1	LABOUR AND CREW RELATED	8	2
2	MATERIAL AND CONSUMABLES	3	7
3	EQUIPMENT AND TOOLS	2	3
4	FOREMAN RELATED	9	1
5	TASK PROPERTY	6	5

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No.	Category	Negative Impact Ranking	Positive Impact Ranking
6	LOCATION PROPERTY	1	9
7	ENGINEERING AND INSTRUCTIONS	7	8
8	SAFETY	4	4
9	PROJECT MANAGEMENT	5	6

Table 4.11 Ranking of PM survey categories.

No.	Category	Negative Impact Ranking	Positive Impact Ranking
1	LABOUR AND CREW RELATED	8	2
2	MATERIAL AND CONSUMABLES	6	9
3	EQUIPMENT AND TOOLS	7	5
4	FOREMAN	13	1
5	SITE CONDITIONS	5	12
6	PROJECT DELIVERY AND CONTRACT	12	14
7	ENGINEERING	2	10
8	PROJECT COMPLEXITY	3	13
9	HEALTH, SAFETY and ENVIRONMENT	4	15
10	PROJECT MANAGEMENT PRACTICES	14	3
11	PROJECT BEST PRACTICES	11	8
12	PROJECT OWNER NATURE	10	6
13	ORGANIZATIONAL	15	4
14	PROVINCIAL	9	11
15	NATIONAL	1	7

4.5 Top ten key parameters that influence CLP in each survey

In this section the parameters from each survey groups are ranked depending on their positive and negative influences. The top ten ranking parameters are presented as shown in Table 4.7

Table 4.12 Top Ten Parameters influencing negatively and positively from PM survey

Rank	Negative Impact		Positive Impact	
	Parameters	ES	Parameters	ES
1	Public unrest due to political, economical or other issues	100.00	Ethiopia have more young population	100.00
2	There is high inflation rate in Ethiopia	88.17	Work operation strategies and system increase performance of the organization	82.99
3	Drawings and specifications are often not complete and require updates	69.98	Clear goals are given to foreman and crafts	77.88
4	Ethiopia has a stable political system	63.98	Procurement management practices: proper evaluation criterion is applied to select qualified bidders	70.51
5	Incompetence of consultant firms hinders the execution of projects.	61.58	Span of control of foreman is properly considered in the development of crews	69.16
6	Incompetence of contractors firms hinders the execution of projects.	60.58	Craftsmen have a positive attitude towards the task	63.18
7	Quality of labour across the nation is low	53.18	Foreman's fairness in performance review of craft workers is checked by supervisors	63.18
8	Frequently change in drawings and specification	53.03	Craftsmen's labour union status (unionized or not unionized) and its benefits are important in their day to day performance	63.15
9	Prices for outputs (project completion costs) are substantially increasing	46.43	Competition from international firms has raised the efficiency of Ethiopian firms	63.15
10	Late start and early finish of work affect crafts performance	43.39	Power source(electric or fuel) are sufficiently provided	62.15

Among the top ten factors in the PM survey the 3rd and 8th factors are also top ten rated by Amanuel (2016) findings, in her study “Incomplete and In accurate drawings” and “change of work order (variation)” have been rated 3rd and 10th. This confirms that still “Drawings and specifications are often not complete and require updates” and “Frequently change in drawings and specification” factors are affecting CLP. When comparing the other top ten factors from the previous study, most of the factors are more dependent on national factors which did not have a relation. Among the top ten negatively influencing factors, four of them are under the “National” category. This shows that how the current public unrest due to political, economical and other issues are affecting the CLP. However those results are temporary due to situation of the country on the study period. Therefore, one can take the other top three unrelated parameters which are

“There is high inflation rate in Ethiopia”, “Drawings and Specifications are often not complete and require updates” and “Incompetence’s of consultants firms hinders the execution of the projects” as negatively influencing parameters for CLP.

In the positively influencing top ten factors four of them are rated with the “Forman and related” category. Among those factors most of them are related with management of formen such as “Clear goals are given to foreman and crafts”, “Span of control of foreman is properly considered in the development of crews” and “Foreman’s fairness in performance review of craft workers is checked by supervisors”. In addition, the findings show Ethiopia’s high rate of younger population is top factor in influencing CLP positively.

The crafts survey also identified the top ten negatively and positively influencing parameters as shown in table 4.8. In this survey the top two factors from the top ten factors are related with remunerations of crafts workers which are categorized in “Labour and Crew related” and “Project Management” categories. This implies that the major factor affecting CLP is the remunerations of crafts worker. In addition, among the top ten factors 5 factors are from the “Location Property” category. Those factors shows that the inappropriate site conditions such as camp facilities, wash room locations are among the major factors in influencing negatively CLP.

The “Forman related” category has been rated 2 times and “Labour and Crew related” has been rated 8 times in influencing CLP positively by crafts workers. They have rated “Forman has the required experience” and “Forman has appropriate skill in proper resource allocation” 3rd and 10th in positively influencing CLP. This result is similar with the PM survey where “Forman related” category has been rated first in positively influencing CLP. This implies that Forman are influencing to increase CLP.

Table 4.13 Top ten parameters influencing negatively and positively from Crafts survey

Rank	Negative Impact		Positive Impact	
	Parameters	ES	Parameters	ES
1	Remunerations (salary, benefits) are satisfactory	100.00	There is a really good cooperation between craftsmen in a crew	103
2	Remuneration (salary, bonus and incentives) are fairly set	90.30	Craftsmen use alcohol and drugs during work hours.	98
3	Materials are not delivered on time to task location	87.59	Foreman has the required experience	97

4	Camp facilities (recreation and shops) are adequate	78.31	Work is fairly assigned to the different crews	102
5	There is a shortage of good transportation equipment (cranes, forklifts)	69.38	There is a really good cooperation between the different crews	100
6	Washrooms are closely located	60.72	Crew is experienced and has the necessary competence	93
7	Camp facilities (residences) are adequate	60.34	Craftsmen trust in the skills and judgment of their supervisors	99
8	Safety Clothing's & tools are well provided	55.47	In this project, craftsmen have negative attitude towards the task	89
9	The work area is protected from weather effect	52.05	Craftsmen are well disciplined in early start & late quit time of work.	92
10	Unsafe working conditions are common	45.45	Foreman has appropriate skill in proper resource allocation	95

4.6 Overall parameter ranking in both PM and crafts survey

The ranking of the overall parameters from both the crafts and PM survey were also identified. The evaluation score from either of the survey have been used to determine the ranking. And the following top ten parameters have been identified in negatively influencing CLP: 1. “Remunerations (salary, benefits) are satisfactory”, 2. “Public unrest due to political, economical or other issues”, 3. “There is high inflation rate in Ethiopia”, 4. “Materials are not delivered on time to task location”, 5. “Camp facilities (recreation and shops) are adequate”, 6. “Drawings and specifications are often not complete and require updates”, 7. “There is a shortage of good transportation equipment (Cranes, forklifts)”, 8. “Ethiopia has a stable political system”, 9. “Incompetence of consultant firms hinders the execution of projects.” and 10. “Washrooms are closely located”. Among those factors “Materials are not delivered on time to task location”, “Camp facilities (recreation and shops) are adequate” and “Drawings and specifications are often not complete and require updates” were identified by Amanuel (2016) findings which are still major negatively influencing factors for CLP.

But during the period of doing this research, the public unrest due to political, economic and other issues in the country ranked 2nd, the inflation rate of the country is increasing very rapidly which is also ranked 3rd. And this result the remuneration of crafts workers not satisfactory which is ranked 1st affecting CLP in the country. Therefore since the survey is conducted in political crisis period. The result indicates that the political crisis of the country is the root cause for influencing the CLP. When looking to other top factors influencing the CLP the findings are similar with the Amanuel (2016) findings which are still exists.

An overall ranking of the positively influencing parameter were also conducted and the following ten parameters were identified. 1. “There is a really good cooperation between craftsmen in a crew”, 2. “Craftsmen use alcohol and drugs during work hours”, 3. “Work operation strategies and system increase performance of the organization”, 4. “Clear goals are given to foreman and crafts”, 5. “Foreman has the required experience”, 6. “Work is fairly assigned to the different crews”, 7. “There is a really good cooperation between the different crews”, 8. “Crew is experienced and has the necessary competence”, 9. “Procurement Management Practices: Proper evaluation criterion is applied to select qualified bidders” and 10. “Craftsmen trust in the skills and judgment of their supervisors”.

4.7 Comparison of perspective difference between the project managers and trades survey

34 common parameters from both the PM survey and crafts surveys are used to determine the perspective difference between the survey groups. The evaluation score both in positive and negative are used to determine the difference in perspective. The maximum of the difference between the two survey groups either in the crafts and PM survey are used to make comparison. In addition the impact ratings of the identified parameters from both perspectives were again used for statistical analysis and the results used to compare group means using an F-test.

According to respondent’s rankings of negative influence parameters, the most significant difference in perspective between the PM and crafts groups was identified to be “There is a shortage of good transportation equipment (Cranes, forklifts)” in which the crafts group rated highly negatively. This shows that even though the project management team thinks that there are sufficient transportation equipments the trade workers don’t agree with that. Unlike wise the trade workers think drawings and specification are readable whereas the project management teams don’t agree with that. Table 4.9 shows the top five highly different parameters from each survey groups with its F-values. The F-value indicates that “there is a shortage of good transportation equipment (cranes, forklifts)”, “available drawings and specifications are not readable” and “safety clothing’s & tools are well provided” factors have significant differences between the PMs and trade workers groups with 95% confidence level. The differences in perspective between the two groups in the 34 parameters are shown in the appendix.

Table 4.14 Top 5 difference in perspective of negative influence parameters

No	Factors	SCORE(crafts)	SCORE(PM)	Difference (Severity Score)	F-Value
1	There is a shortage of good transportation equipment (cranes, forklifts)	69.38	7.59	61.79	13.7*
2	Available drawings and specifications are not readable	15.83	69.98	54.15	20.9*
3	Materials are not delivered on time to task location	87.59	35.92	51.67	3.5
4	Washrooms are closely located	60.72	26.94	33.78	1.6
5	Safety clothing's & tools are well provided	55.47	28.71	26.76	13.5*

“Crew is experienced and has the necessary competence” has been ranked first among the positive influence parameters with highest difference in perspective where the crafts survey rated more positively. The F-value indicates that “Crew is experienced and has the necessary competence” and “Frequency of accidents and personal injury is low” factors have significant differences between the PMs and Trade workers groups with 95% confidence level. The top 5 difference in perspective rated positively has been shown in table 4.10.

Table 4.15 Top 5 Difference in perspective of Postive influence Parameters

No	Factors	SCORE(Crafts)	SCORE(PM)	Difference (Severity Score)	F-Value
1	Crew is experienced and has the necessary competence	70.72	12.60	58	18.7*
2	Craftsmen trust in the skills and judgment of their supervisors	70.45	16.84	54	2.3
3	There is a really good cooperation between craftsmen in a crew	100.00	58.94	41	0.5
4	Frequency of accidents and personal injury is low	42.72	5.85	37	4.5*
5	There is fairness in performance review of craft workers	32.44	69.16	37	3.2

CHAPTER FIVE

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The conclusions from this study are summarized as follows:

- The results from the study have identified the parameters influencing CLP in a well organized manner unlike previous studies so that every stakeholder in the industry can use this finding as an important input. Categories rankings from micro to macro level have been identified. And from the overall category rating “Location Property” category has been ranked first in affecting CLP negatively rated by trade workers. Whereas, “National” category has been ranked first by the project management in negatively affecting CLP. “Forman Related” category has been ranked first in positively influencing CLP rated by both the trade workers & project management.
- As the study also identified the factors influencing CLP in two independent groups. The top ranking of individual factors from the two survey groups were identified as follows, “the public unrest due to political, economic or other issues” in the PM survey and “remuneration (salary, benefits) is not satisfactory” in the trade survey has been ranked first in negatively affecting CLP. Whereas “Ethiopia have younger population” rated by PMs & “There is a good cooperation between craftsmen in a crew” rated by trade workers survey have been ranked first in positively influencing parameter.
- This study also identified negatively and positively influencing factors unlike previous studies. The top three negatively influencing factors are 1. “Remunerations (salary, benefits) are satisfactory”, 2. “Public unrest due to political, economical or other issues”, 3. “There is high inflation rate in Ethiopia” And the top three positively influencing parameters from both survey groups are 1. “There is a really good cooperation between craftsmen in a crew”, 2. “Craftsmen don’t use alcohol and drugs during work hours”, 3. “Work operation strategies and system increase performance of the organization”.
- A Comparison has also been made between the two survey groups. In comparison of the perspective difference between negative influencing parameter rated by trade workers and project management, it’s identified that trade workers think there is a shortage of good transportation equipments whereas project management think there is sufficient. In

addition the project management think there is available drawings and specification which are not readable whereas the trade workers think unlikely the drawing and specification are readable.

- “Crew is experienced and has the necessary competence” has been rated first by having a greatest difference between the trade workers and project management where trade workers rated highly positively. This implies there is an argument between trade workers and project management in the experience and competence and this need further investigation on such those factors where to reach into a common understanding.
- The result of this study have shown the complex and interlinked nature of the parameters influencing CLP. For example the top three negatively affecting factors from both survey groups are 1.“Remunerations (salary, benefits) are satisfactory”, 2. “Public unrest due to political, economical or other issues” 3.“There is high inflation rate in Ethiopia”. And this shows the interdependency between the factors where in settling the public unrest of the nation can decrease the inflation rate and which in turn can increase the remuneration satisfaction. And this result shows that, studies on factor influencing CLP have to be done from different levels and perspectives.

5.2 Recommendations

The following recommendations of this research are presented as follows:

- It is observed from this study that factors influencing CLP can vary from time to time depending on the current situation that is happening in Ethiopia. Even though in the previous studies different factors have been identified, since it does not include necessary factors at all level such as national level which is ranked first category in negatively affecting in the project management survey, it was difficult to identify the factors more accurately without considering from all the levels. Therefore, future researches which will be conducted should include parameters from national or may be international level to task level parameters.
- The result of this study shows that how the current Ethiopia’s political, economic and other related issues have been affecting CLP. Therefore, immediate action should be taken by the government in settling those issues.

- The identified parameters can be a great input for government construction regulatory, contractors, consultants and clients to make an adjustment on their operations by considering the parameters influencing negatively and positively. Even though some of the top parameters were identified in previous studies since no mitigation efforts are not taken, still those parameters are influencing CLP. Therefore stake holders should make an action on mitigating those negatively influencing parameters where as keeping on the positively influencing parameters.
- The results of this study also have a similarity with previous studies done with the same context. This implies that even though some of the factor which affect CLP has been determined before, either the identified factors were not well aware to the responsible bodies to make a mitigating action or there is no measures taken by the responsible bodies specially contractors in mitigating those problems. Therefore, it is recommended to make a workshops and seminars by academic institutions and government regulatory and make an awareness of those contractors, consultants, clients and government regulatory.

5.3 Future Research Areas

- This study has been done in Addis Ababa building projects. But researchers in the future can do in different parts of the country using the same methodology adopted by this study.
- Other construction sectors such as industrial, water works projects can also be researched in order to identify the key parameters in each context. And a comparative analysis between two different contexts can be done.
- The identified parameters in this study can also be used for future researchers for developing a model of predicting CLP and a great input for developing productivity improvement strategies.
- It is identified that some parameters such as “There is a shortage of good transportation equipment (cranes, forklifts)” and “Crew is experienced and has the necessary competence” have a perspective difference between the two survey groups the trade workers and project management. Those parameters need further investigations to reach into a common understanding.

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**APPENDIX A: EVALUATION SCORE AND RANKINGS OF TRADE
WORKERS SURVEY**

Factor No.	Factors	Negative Score	Positive Score	Negative Impact Ranking	Positive Impact Ranking
2.27	Remunerations (salary, benefits) are satisfactory	100.00	7.82	1	98
10. 11	Remuneration (salary, bonus and incentives) are fairly set	90.30	4.79	2	100
3.1	Materials are not delivered on time to task location	87.59	16.11	3	87
7.1	Camp facilities (recreation and shops) are adequate	78.31	2.94	4	102
4.1	There is a shortage of good transportation equipment (Cranes, forklifts)	69.38	20.15	5	77
7.7	Washrooms are closely located	60.72	13.42	6	94
7.9	Camp facilities (residences) are adequate	60.34	1.51	7	103
9.5	Safety Clothing's & tools are well provided	55.47	9.35	8	97
7.6	The work area is protected from weather effect	52.05	7.24	9	99
9.1	Unsafe working conditions are common	45.45	14.30	10	90
4.2	Electrical power gets disconnected during operation	44.84	23.28	11	64
4.5	Workers can't get the required power tools to do their jobs	41.48	22.95	12	67
4.4	Workers can't get the required hand tools to do their jobs	40.22	21.38	13	73
4.6	Damages of equipments/tools	33.42	17.52	14	85
7.1	On average the weather is harsh (temperature, wind, humidity, precipitation)	31.66	13.72	15	92
4.3	I wait in a line for man lifts	30.75	15.78	16	88
3.3	There a shortage of consumables	30.38	22.30	17	71
3.2	The materials delivered have quality problems	29.46	26.50	18	61

Identification and Comparative Analysis of Key Parameters Influencing Construction labour productivity of Building Projects in Addis Ababa.

Factor No.	Factors	Negative Score	Positive Score	Negative Impact Ranking	Positive Impact Ranking
8.5	Change in design	29.21	12.77	19	95
6. 7	Work condition has excessive noise, dust and fumes	29.11	22.42	20	69
2.1	There is frequent crew turnover	23.40	12.02	21	96
3.7	Vertical movement material is slow	22.17	18.59	22	81
10.12	There is a lack of project follow up from the project management	21.12	27.07	23	60
2.1	The crew size is not adequate for the task at hand	20.72	34.31	24	37
10.1	There is a high level of paperwork	19.89	3.60	25	101
3.8	Horizontal material movement is slow due to lack of clear pathway	19.78	18.37	26	83
3.4	Correction work has to be done because of quality problems of prefabricated products	18.91	15.48	27	89
2.2	Crew is given adequate training before commencement	17.76	27.62	28	57
6. 5	In this project, change orders are frequent	16.39	18.52	29	82
6. 4	In this project, rework is frequent	15.95	16.87	30	86
8.2	Available drawings and specifications are not readable	15.83	19.16	31	79
2.14	Craftsmen have the required physical fitness	15.81	39.50	32	26
7.4	The work area is not clean	14.08	28.06	33	56
4.8	Tool crib attendant takes time to get the asked tool	13.39	29.37	34	52
2.11	Craftsmen are not properly treated by foreman	13.37	41.69	35	23
7.8	Adequate lunchrooms are closely located	12.87	32.93	36	41
2.18	For new craftsmen, job site orientation program is carried out	12.78	48.52	37	14

Identification and Comparative Analysis of Key Parameters Influencing Construction labour productivity of Building Projects in Addis Ababa.

Factor No.	Factors	Negative Score	Positive Score	Negative Impact Ranking	Positive Impact Ranking
2.16	Craftsmen face regular boredom and fatigue	12.58	19.56	38	78
6. 6	In this project, interruption and disruption are frequent	12.07	28.21	39	55
9.6	Safety sign board and minimize accident and injury.	11.38	35.26	40	35
2.17	Craftsmen are not flexible in accommodating task changes	11.21	31.54	41	48
8.7	Incompetence of supervisors	11.03	17.84	42	84
2. 22	There is a frequent absenteeism of craftsmen	10.96	34.06	43	39
5. 5	The crew number is too large for one foreman	10.96	21.39	44	72
3.6	It takes a very long longer time and effort to unload materials	10.96	23.22	45	66
10.2	Workers are facing frequent layoffs	10.65	28.91	46	54
7.3	The work area is congested	10.22	27.52	47	58
2.26	In this project, clear goals are properly provided	10.15	38.63	48	30
3.9	The site has a very good material order tracking system	9.94	32.01	49	47
8. 3	In this site, the response time for drawing questions is acceptable	9.83	22.85	50	68
8.6	Change in supervisor	9.63	21.01	51	74
10.3	Work packages are properly planned and assigned to workers	9.59	34.77	52	36
5. 4	There is a frequent change of foremen	9.51	32.79	53	43
2.24	In this project, craftsmen's skill is not fully utilized	9.04	29.15	54	53
6. 2	In this project, the tasks are challenging and interesting	9.04	30.33	54	51
4.9	When I look for tools, I can't find them because	8.90	34.20	56	38

Identification and Comparative Analysis of Key Parameters Influencing Construction labour productivity of Building Projects in Addis Ababa.

Factor No.	Factors	Negative Score	Positive Score	Negative Impact Ranking	Positive Impact Ranking
	they are misplaced				
2.21	In this project, craftsmen have an acceptable job security	8.67	31.52	57	49
9.3	Provision of Safety tools is prohibiting work progress	8.67	20.16	57	76
10.5	Unrealistic schedule is given to tasks	8.52	24.36	59	63
8.8	Supervisors absenteeism	8.37	19.11	60	80
8.4	Adequate job instructions are not provided	8.26	27.18	61	59
2.29	Quality of work is higher which avoid work	8.24	42.09	62	22
4.10	Appropriate Equipment type is not provided for each type of work	8.22	36.19	63	33
6. 1	In this project, the tasks are repetitive	7.98	39.15	64	27
3.5	Temporary material storage is not located close to work location	7.91	37.65	65	31
6. 3	Total work volume is too much to handle	7.88	23.24	66	65
4.7	The work tools provided are not of the required quality	7.58	45.60	67	15
2.4	Crew is well balanced between Journeymen and Apprentices	7.53	42.19	68	20
2.25	Feedback on performance is provided to craftsmen in regular basis	7.46	30.91	69	50
9.4	Stringent safety rules are negatively affecting productivity	7.00	32.22	70	46
5.6	There is fairness in performance review of craft workers	6.66	32.44	71	45
2.2	Craftsmen are encouraged to participate in decision making process	6.51	44.29	72	18

Identification and Comparative Analysis of Key Parameters Influencing Construction labour productivity of Building Projects in Addis Ababa.

Factor No.	Factors	Negative Score	Positive Score	Negative Impact Ranking	Positive Impact Ranking
9.2	Frequency of accidents and personal injury is low	6.34	42.72	73	19
2.12	Number of consecutive days on job is in line with craftsmen expectation	6.13	35.68	74	34
2.7	In this project, crew team spirit is low	6.09	45.14	75	16
10.1	Hiring practices are fair and competence based	5.86	32.84	76	42
10.9	Work permits are provided in a timely fashion	5.82	22.30	77	70
7.2	Location of work scope (distance and elevation) is convenient	5.33	13.72	78	91
5.9	Feed back on performance is provided to foremen on regular basis	4.96	38.96	79	29
10.6	Project shift length is not adequate to perform the given tasks	4.82	33.63	80	40
10.7	There is a lack of communication between project managers	4.79	37.15	81	32
2.6	The high crew size is crowding other crews	4.46	32.53	82	44
7.5	Temporary electrical service is always provided	4.11	40.67	83	24
4.11	Service time for equipments and machineries are during working days(time)	3.88	24.99	84	62
5.10	Forman follow up and control of crews by formens are adequate	3.88	52.93	84	13
5.3	Foreman management style is participative and motivating	3.88	53.68	84	11
5.8	In this project clear goals are provided by Project Managers	3.79	42.19	87	20
8.1	Drawings and Specifications are readily available	3.65	39.12	88	28
2.13	In this project, craftsmen have negative attitude towards the task	3.30	69.74	89	8

Identification and Comparative Analysis of Key Parameters Influencing Construction labour productivity of Building Projects in Addis Ababa.

Factor No.	Factors	Negative Score	Positive Score	Negative Impact Ranking	Positive Impact Ranking
10.8	Lock out procedure is not well organized	2.74	13.47	90	93
10.4	The site has clearly laid out organization structure	2.66	40.03	91	25
2.28	Craftsmen are well disciplined in early start & Late quit time of work.	2.49	65.70	92	9
2.3	Crew is experienced and has the necessary competence	1.95	70.72	93	6
2.15	Craftsmen have shown acceptable learning speed	1.53	53.62	94	12
5.7	Foreman has appropriate skill in proper resource allocation	1.48	55.99	95	10
5.2	Foreman has been trained for leadership	1.32	44.83	96	17
5.1	Foreman has the required experience	0.80	77.51	97	3
2.3	Craftsmen use alcohol and drugs during work hours.	0.76	95.22	98	2
2.19	Craftsmen trust in the skills and judgment of their supervisors	0.76	70.45	99	7
2.9	There is a really good cooperation between the different crews	0.53	71.29	100	5
2.23	Craftsmen's labour union status (unionized or not unionized) and its benefits are important in their day to day performance	0.38	20.27	101	75
2.5	Work is fairly assigned to the different crews	0.23	71.34	102	4
2.8	There is a really good cooperation between craftsmen in a crew	0.20	100.00	103	1

APPENDIX B: EVALUATION SCORE AND RANKINGS OF PM SURVEY

Factor No.	Factors	Negative Score	Positive Score	Negative Impact Ranking	Positive Impact Ranking
16.12	Public unrest due to political, economical or other issues	100.00	0.00	1.00	153.00
16.11	There is high inflation rate in Ethiopia	88.17	0.00	2.00	153.00
8.2	Drawings and specifications are often not complete and require updates	69.98	3.49	3.00	143.00
16.1	Ethiopia has a stable political system	63.98	1.65	4.00	148.00
16.2	Incompetence of consultant firms hinders the execution of projects.	61.58	1.20	5.00	150.00
16.3	Incompetence of contractors firms hinders the execution of projects.	60.58	0.84	6.00	152.00
16.6	quality of labour across the nation is low	53.18	1.29	7.00	149.00
8.3	Frequently change in drawings and specification	53.03	4.34	8.00	141.00
15.13	Prices for outputs (project completion costs) are substantially increasing	46.43	0.00	9.00	153.00
2.2	Late start and early finish of work affect crafts performance	43.39	4.34	10.00	141.00
9.5	Change orders due to design changes are frequently made	42.74	2.26	11.00	147.00
10.5	Daily job hazard assessment system is in place	38.93	7.10	12.00	131.00
10.3	Regular health and safety training is not provided	38.32	6.53	13.00	136.00
2.19	Unrealistic expectations have de motivated the workforce and reduced their productivity.	37.72	3.01	14.00	145.00
16.7	Agricultural sector decrease the number of work force seasonally	37.61	0.94	15.00	151.00
3.1	Material is delivered on time	35.92	21.38	16.00	76.00
13.11	Owners don't pay to contractors in timely manner	34.41	8.72	17.00	116.00
3.7	Required quantity of material is not delivered on time	33.68	8.07	18.00	122.00
12.9	Zero accident techniques are effectively applied	32.99	2.71	19.00	146.00
10.13	Environmental inspections and audits are not well planned	31.13	5.01	20.00	139.00
10.2	Safety sign board and materials are well provided	30.35	11.14	21.00	107.00
9.3	Rework is usually done because of error by vendor	29.06	7.22	22.00	129.00
10.1	Safety clothing's & tools are well provided	28.71	15.50	23.00	93.00
15.10.	Construction material price fluctuations are steady in the province	28.12	6.82	24.00	133.00

Identification and Comparative Analysis of Key Parameters Influencing Construction labour productivity of Building Projects in Addis Ababa.

Factor No.	Factors	Negative Score	Positive Score	Negative Impact Ranking	Positive Impact Ranking
3.5	Material order tracking system is too long for operation	27.54	7.35	25.00	128.00
4.3	Work places are not equipped with adequate man lifts	26.98	10.76	26.00	110.00
6.6	Washrooms are closely located	26.94	20.46	27.00	79.00
8.5	Incompetence of supervisors	26.88	10.69	28.00	111.00
12.11	The project lacks behind in the use of automation and integration technologies	25.66	4.76	29.00	140.00
5.1	Leadership training is provided to foremen	25.55	23.55	30.00	69.00
10.4	Daily project briefing and debriefing is properly practiced	25.42	15.04	31.00	96.00
9.4	Rework is usually done because of error by contractor	25.23	8.02	32.00	124.00
2.12	Craftsmen's skill is not fully utilized	24.69	7.22	33.00	129.00
6.2	Measures are taken to minimize weather (temperature, wind, humidity, precipitation) effects	24.61	17.04	34.00	89.00
10.8	Accidents and injury are frequent	24.44	5.85	35.00	137.00
6.1	Work locations are confronted with excessive noise, dust, and fumes	24.19	12.83	36.00	103.00
11.2	Scope Management Practices: The process of defining and documenting scope of work and different project needs to meet organization objectives is often missing	24.17	6.53	37.00	135.00
4.5	Equipments and tools frequently breakdown	23.22	5.68	38.00	138.00
6.5	Adequate recreation facilities are not provided	23.06	10.88	39.00	109.00
2.15	Absenteeism of craftsmen is well tracked	22.97	19.24	40.00	84.00
2.1	Work Motivation of crafts is not adequate to perform day to day tasks.	22.87	22.77	41.00	73.00
2.4	Crew experience and competence is not meeting expectations	22.58	12.60	42.00	104.00
12.10.	Quality management practices, mainly QA/QC are not properly planned and executed	22.48	8.07	43.00	122.00
13.10	Owners don't have sufficient budget in financing projects.	22.18	16.54	44.00	92.00
10.10	Safety inspections and audits are well planned	21.60	8.82	45.00	115.00
12.15	Consultants are not proactive in implementation of projects	21.55	15.44	46.00	94.00
10.9	Safety incident investigation are efficiently carried out	20.97	11.91	47.00	106.00
9.2	Interruption and disruption is common due the large number of processes or steps	18.91	10.88	48.00	108.00

Identification and Comparative Analysis of Key Parameters Influencing Construction labour productivity of Building Projects in Addis Ababa.

Factor No.	Factors	Negative Score	Positive Score	Negative Impact Ranking	Positive Impact Ranking
14.4	Number of employees in the organization as compared to competitors is low	18.70	10.47	49.00	112.00
10.12	Corrective actions are frequently taken to meet environmental requirements	18.55	19.24	50.00	84.00
2.3	Crew trade specific trainings are regularly conducted	17.99	21.02	51.00	77.00
11.4	Cost Management Practices: A process of monitoring the status of the project to update the project budget and manage changes to the cost baseline is not implemented	17.20	10.17	52.00	113.00
11.17	Communication Management Practices: Procedures to be followed on horizontal, vertical and interdepartmental level communications are missing	17.11	8.72	53.00	116.00
8.4	Timely submission of material approvals from supervisors	16.94	33.04	54.00	47.00
13.8	Changes are frequently made by the owner team	16.94	14.43	54.00	98.00
4.6	Service time for equipments and machineries are during non-working days (time)	16.03	25.36	56.00	66.00
15.6	Labour strikes in the construction sector are imminent	15.64	3.46	57.00	144.00
11.13	Risk Management Practices: A risk assessment tool to identify possible risks for proper mitigation is in place	14.86	21.92	58.00	75.00
15.12	There is a substantial expenditure towards energy-related projects as compared to other types	14.37	7.02	59.00	132.00
12.6	Formal team building process was not employed to build shared goals, and improve problem solving skills	14.19	10.02	60.00	114.00
7.2	Labour contract type as compared to contracts including material are ineffective in improving the site performance	13.66	18.74	61.00	86.00
14.8	Annual turnover of employees is high	13.34	8.72	62.00	116.00
2.14	Craftsmen are never involved in decision making process	13.34	20.75	63.00	78.00
3.3	Temporary material storages are properly planned	13.29	31.51	64.00	53.00
11.9	Human Resource (HR) Management Practices: Overall participation of HR in the formulation and realization of competitive strategies and establishment of links between organizational level and individual competences is missing	12.83	13.56	65.00	99.00
13.4	Owner's primary driver is safety	12.66	25.14	66.00	67.00

Identification and Comparative Analysis of Key Parameters Influencing Construction labour productivity of Building Projects in Addis Ababa.

Factor No.	Factors	Negative Score	Positive Score	Negative Impact Ranking	Positive Impact Ranking
2.11	Craftsmen are not flexible in accommodating task changes	12.66	7.48	67.00	127.00
13.5	The project site is transferred timely to the contractor	12.50	17.11	68.00	87.00
13.7	Owner team provides decisions in a timely manner	12.50	14.88	68.00	97.00
12.4	Owners project team have adopted appropriate project risk management practices	12.46	27.20	70.00	61.00
6.4	Adequate camp facilities are provided	12.32	19.38	71.00	83.00
3.4	Material order tracking system is in place	12.10	28.02	72.00	60.00
2.13	Craftsmen do not trust the skills and judgment of their supervisors	11.83	16.84	73.00	90.00
3.8	Material movement practices are well planned	11.74	20.45	74.00	80.00
15.8	The available supervisors for construction projects in Addis Ababa is not adequate	11.61	19.40	75.00	82.00
6.3	Lunchroom locations are properly planned	11.61	28.27	76.00	59.00
12.8	Change management practices are not employed in the planning and evaluations of project changes	11.52	7.77	77.00	126.00
2.20	Incentives provided to employees directly affect their productivity	11.30	49.98	78.00	24.00
13.9	Owners are frequently suspending projects	11.24	19.85	79.00	81.00
3.6	Material unloading practices are ineffective	11.22	13.45	80.00	100.00
12.5	Contractors project team have adopted appropriate project risk management practices	11.00	31.41	81.00	54.00
10.11	Sorting of waste materials (Concrete, Steel, Wood) is strictly implemented	10.80	23.39	82.00	71.00
14.7	Projects awarded per year are few	10.68	12.83	83.00	102.00
3.2	Delivered materials are of high quality	10.26	36.02	84.00	40.00
14.11	Marketing(Bidding) Strategy compared with competitors decreases performance	10.08	8.57	85.00	119.00
11.15	Change Management Practices: A proper change documentation process is not implemented	9.97	15.20	86.00	95.00
5.7	Follow up and control of crews by Forman's are adequate	9.57	30.07	87.00	57.00
11.14	Risk Management Practices: A process for tracking and monitoring different risks and integrating these risks at the organization and project levels to provide a periodic performance assessments and develop mitigation strategies is properly implemented	9.38	28.65	88.00	58.00

Identification and Comparative Analysis of Key Parameters Influencing Construction labour productivity of Building Projects in Addis Ababa.

Factor No.	Factors	Negative Score	Positive Score	Negative Impact Ranking	Positive Impact Ranking
11.8	Human Resource (HR) Management Practices: Trainings, workshops, seminars are held for employees of the organization in order to improve their qualifications and performance	9.38	26.90	89.00	62.00
4.4	There are adequate and quality work tools	9.16	30.87	90.00	56.00
5.6	Superintendents(general Forman's) usually follow uniform work rules	8.91	25.39	91.00	65.00
15.4	Quality of labour in Addis Ababa is good	8.90	32.14	92.00	52.00
8.1	Drawings and specifications are made available well ahead of implementations	8.86	48.65	93.00	26.00
4.7	Power source(electric or fuel) are sufficiently provided	8.26	62.15	94.00	10.00
7.3	Lump sum contract types have similar effect on craft productivity as compared to admeasurements types	7.92	12.11	95.00	105.00
12.2	Contractors were not involved for alignment in front end planning stage	7.92	8.52	95.00	120.00
15.2	There are many competing projects within the province	7.92	8.45	95.00	121.00
7.1	Design build delivery system as compared to the Design Bid Build are ineffective in improving on site performance	7.70	17.09	98.00	88.00
11.16	Change Management Practices: A process for monitoring and controlling changes of ongoing projects with an analysis on their impact on productivity is properly implemented	7.64	32.33	99.00	51.00
4.1	There are adequate material transportation equipment (Cranes, forklifts)	7.59	45.17	100.00	30.00
12.13	Productivity measurement and improvement practices are effectively implemented	7.33	32.88	101.00	50.00
15.3	Provincial codes and regulations are not supportive of construction projects	7.27	13.23	102.00	101.00
5.2	Efforts are taken to reduce turnover of foremen	7.26	23.29	103.00	72.00
11.19	Business Development Practices: Development of a time scaled business plan with a well-defined set of objectives is always done	7.26	16.69	103.00	91.00
2.17	Performance of craftsmen is regularly evaluated	7.18	32.88	105.00	49.00
15.7	Quality of supervisors is good	6.72	40.43	106.00	35.00
10.7	Project site safety rules are stringent	6.60	22.05	107.00	74.00
4.2	Appropriate Equipment type is provided for each type of work	6.41	35.92	108.00	41.00

Identification and Comparative Analysis of Key Parameters Influencing Construction labour productivity of Building Projects in Addis Ababa.

Factor No.	Factors	Negative Score	Positive Score	Negative Impact Ranking	Positive Impact Ranking
15.9	Taxes (income tax, provincial GST) as compared to other provinces are high	6.26	6.68	109.00	134.00
11.18	Communication Management Practices: Documentation and tracking systems of different communications for fast retrieval of information is properly implemented	6.16	26.31	110.00	64.00
11.1	Integration Management Practices: The process required to ensure that the various elements of the project are properly coordinated is properly implemented	5.80	39.19	111.00	37.00
15.11	Unemployment rate for construction workers in Addis Ababa is high	5.72	35.37	112.00	42.00
5.5	Foremen receive performance evaluation on regular basis	5.57	26.90	113.00	62.00
12.1	Detailed front end planning was carried out by the owner or his representative	5.50	23.49	114.00	70.00
11.3	Cost Management Practices: Identification and documentation of the different stages in the development of the project estimate is properly done	5.39	43.03	115.00	33.00
16.8	Unemployment rate for the construction workers in Ethiopia is high	5.17	46.19	116.00	29.00
13.6	Owner team has the required competence and knowledge in managing the project	5.06	33.76	117.00	45.00
14.3	Number of divisions in the organization as compared to competitors is high	4.69	7.85	118.00	125.00
12.3	Constructability reviews were properly included in the design stage	4.64	24.56	119.00	68.00
16.5	There is adequate labour for construction projects in Ethiopia	4.50	62.01	120.00	11.00
13.1	Owner's primary driver is schedule	4.40	40.09	121.00	36.00
12.7	Material management practices are employed in the planning and controlling of materials	3.74	32.98	122.00	48.00
11.7	Quality Management Practices: A process for monitoring and recording results of executing the quality activities to assess performance and recommend necessary changes is properly implemented	3.71	45.02	123.00	32.00
13.3	Owner's primary driver is quality	3.42	61.14	124.00	12.00
11.5	Cost Management Practices: A reporting system at company level is in place for the identification of cost overruns	3.25	45.16	125.00	31.00
16.4	Competition from international firms has raised the efficiency of Ethiopian firms	3.12	63.15	126.00	8.00

Identification and Comparative Analysis of Key Parameters Influencing Construction labour productivity of Building Projects in Addis Ababa.

Factor No.	Factors	Negative Score	Positive Score	Negative Impact Ranking	Positive Impact Ranking
11.6	Quality Management Practices: Identifying quality requirements and/or standards, and documentation on how the organization will demonstrate compliance is properly implemented	2.96	37.65	127.00	38.00
15.1	Provincial economy is fostering labour productivity	2.82	35.20	128.00	43.00
10.6	Tailgate safety meetings are time taking	2.74	31.27	129.00	55.00
2.5	There is well balanced crew composition (skilled (experienced) and Unskilled (inexperienced))	2.49	50.47	130.00	23.00
2.6	Work is fairly assigned between crews	2.38	53.29	131.00	20.00
15.5	The available labour for construction projects in Addis Ababa is adequate	2.38	50.52	131.00	22.00
12.12	Planning for startup is being properly carried out	2.35	34.38	133.00	44.00
12.14	Work permit process is efficient and proactive	2.22	52.32	134.00	21.00
14.9	Execution of work approach (subcontracting, self-performing, both) is clearly developed	2.15	46.91	135.00	27.00
9.1	Most of the tasks in this project have repetitive nature	1.87	56.13	136.00	17.00
14.6	Organizational structure system (matrix, project based, mixed) is clearly laid out	1.83	33.04	137.00	46.00
5.3	Span of control of foreman is properly considered in the development of crews	1.75	69.16	138.00	5.00
2.9	Efforts are taken to reduce crew turnover	1.59	36.12	139.00	39.00
11.10.	Procurement Management Practices: A project procurement plan detailing what to procure, how, and when is properly developed	1.48	57.73	140.00	16.00
14.1	Organization's principal construction project type (industrial, commercial, infrastructure) is diverse	1.47	42.38	141.00	34.00
13.2	Owner's primary driver is cost	1.16	53.37	142.00	19.00
2.18	Clear goals are given to foreman and crafts	0.94	77.88	143.00	3.00
2.7	Crew team spirit is high	0.88	58.00	144.00	15.00
11.11	Procurement Management Practices: Proper evaluation criterion is applied to select qualified bidders	0.88	70.51	145.00	4.00
11.12	Procurement Management Practices: Documentation of procurement process and follow up to monitor progress is properly implemented	0.88	59.99	145.00	13.00
14.2	The organization has long and successful years in industry	0.73	48.70	147.00	25.00

Identification and Comparative Analysis of Key Parameters Influencing Construction labour productivity of Building Projects in Addis Ababa.

Factor No.	Factors	Negative Score	Positive Score	Negative Impact Ranking	Positive Impact Ranking
2.16	Craftsmen's labour union status (unionized or not unionized) and its benefits are important in their day to day performance	0.66	63.15	148.00	8.00
5.4	Foreman's fairness in performance review of craft workers is checked by supervisors	0.60	63.18	149.00	7.00
14.5	Annual turnover in dollars for the organization is good	0.34	46.78	150.00	28.00
2.10	Craftsmen have a positive attitude towards the task	0.24	63.18	151.00	6.00
2.8	There is a good cooperation between craftsmen	0.24	58.94	151.00	14.00
14.10	Work operation strategies and system increase performance of the organization	0.15	82.99	153.00	2.00
16.10.	Ethiopia have more young population	0.00	100.00	154.00	1.00
16.9	Ethiopian population is steadily increasing	0.00	55.46	154.00	18.00

APPENDIX C: QUESTIONNAIRE OF THE TRADE (CRAFTS) WORKERS SURVEY



ADDIS ABABA UNIVERSITY

ADDIS ABABA INSTITUTE OF TECHNOLOGY (AAIT)
SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING

A Questionnaire for MSc degree on the topic “Identification & Comparative analysis of Key Parameters Influencing Construction Labour Productivity in Addis Ababa Building Projects

Craft workers/ Foreman – Interview Survey

Thank you for participating in this survey.

You have been selected to participate in this interview survey based on the project personnel data provided by your organization. The researcher assures you that, the research data will only be used solely for the academic purpose and will be treated with strict confidentiality. Particular mentioning of names will not be required anywhere.

The survey will be conducted as an interview. The researcher will ask you questions on the survey and he will fill them. You may give any comments and ask questions freely. And you may review the filled questionnaire before submission.

Your open and prompt response is highly appreciated.

RESEARCHER’S INFORMATION

Name: **Yared Beyene**

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Field of Study: **MSc. In Civil Engineering (Construction Technology & Management)**

Advisor: **Dr. Abraham Assefa**

1) BACKGROUND

1.1 Please select your trade:

- | | | |
|--|--------------------------------------|---|
| <input type="checkbox"/> Forman | <input type="checkbox"/> Carpenter | <input type="checkbox"/> bar Bender |
| <input type="checkbox"/> Masson | <input type="checkbox"/> Plasterer | <input type="checkbox"/> Welder |
| <input type="checkbox"/> Plumber | <input type="checkbox"/> Electrician | <input type="checkbox"/> Operator |
| <input type="checkbox"/> Daily Labourers | <input type="checkbox"/> Gang leader | <input type="checkbox"/> other (please specify) |
| <input type="checkbox"/> Mechanic | <input type="checkbox"/> Tiler | _____ |

1.2 How long have you worked in the stated trade? _____ Year(s) _____ Month(s).

1.3 Have you been in other trade of work before? Yes No. if yes, please states the type of trade and the duration. _____.

1.4 Please indicate your employer: _____.

1.5 How long have you been employed by your current employer or on this project? _____ Year(s) _____ Month(s).

1.6 Demographic Information

Age: Under 20 20-30 31-40 41-50 50-60 Over 60

Gender: Male Female

Education: Please specify ALL that apply to you.

- | | |
|--|--------------------------------------|
| <input type="checkbox"/> Vocational & Technical School | <input type="checkbox"/> High School |
| <input type="checkbox"/> Less than High school | <input type="checkbox"/> Collage |
| <input type="checkbox"/> None | |

If none, please state how you develop your skill _____.

1.7 Have you completed a formal on job craft training program related to?

Technical Training: Yes No

Safety Training: Yes No

Managerial/leadership Training: Yes No

Others (Please specify): _____

1.8 Work/Job Condition

During a typical work week, which shift do you usually work: Day Shift Night shift Both

How many hours are you scheduled to work per day: 8 hours 10 hours Other: _____

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For a given work week, how many consecutive days do you generally work? 6 Days 7days Other: _____

For a given work Year, how many Consecutive Months did you work? 12 months 10 months Other: _____

For a given work Year, on average How many days did you get off? 15 days Other: _____

1.9 Based on your experience, rank how well you think the *current project* is being managed?

Quite Poor	Very Poor	Poor	Neutral	Good	Very Good	Excellent
1	2	3	4	5	6	7

1.10 Based on your experience, how would you rank the *overall productivity* of the current project?

Quite Poor	Very Poor	Poor	Neutral	Good	Very Good	Excellent
1	2	3	4	5	6	7

1.11 Based on your experience, rank how well you think your *Discipline* (e.g. Form work) is being managed,

Quite Poor	Very Poor	Poor	Neutral	Good	Very Good	Excellent
1	2	3	4	5	6	7

1.12 Based on your experience, how would you rate the *specific productivity of your current crew*?

Quite Poor	Very Poor	Poor	Neutral	Good	Very Good	Excellent
1	2	3	4	5	6	7

In execution of your daily work activities there are various factors which influence you and your co-workers for effectively and efficiently accomplishing your daily work plan. Therefore, here under there are some factors which are identified by Tsehayae, 2015 from different studies and added from Amanuel, 2016 findings in Addis Ababa building projects.

The factor questions are structured into two sections: Agreement and Frequency and their respective impacts. Agreement questions are prepared for factors, which will become an issue if they occur on a continual basis (e.g. the crew size is not adequate for the task at hand). Frequency questions rather focus on factors and that occur with varying frequency (e.g. material are not deliver on time location). Frequency questions are used for material and

Identification and Comparative Analysis of Key Parameters Influencing Construction labour productivity of Building Projects in Addis Ababa.

equipment related factors. Please answer the factor questions below as to their existence and effect on construction productivity by circling the appropriate number

2) LABOUR AND CREW RELATED

No.	Factors	Agreement							Impact						
		<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>No Opinion</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>	<i>Strongly Negative</i>	<i>Negative</i>	<i>Slightly Negative</i>	<i>No Impact</i>	<i>Slightly Positive</i>	<i>Positive</i>	<i>Strongly Positive</i>
2.1	The crew size is not adequate for the task at hand	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.2	Crew is given adequate training before commencement	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.3	Crew is experienced and has the necessary competence	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.4	Crew is well balanced between Skilled and Unskilled	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.5	Work is fairly assigned to the different crews	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.6	The high crew size is crowding other crews	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.7	In this project, crew team spirit(motivation) is low	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.8	There is a really good cooperation between craftsmen in a crew	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.9	There is a really good cooperation between the different crews	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.10	There is frequent crew turnover	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.11	Craftsmen are not properly treated by foreman	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.12	Number of consecutive days on job is in line with craftsmen expectation	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.13	In this project, craftsmen have negative attitude towards the task	1	2	3	4	5	6	7	1	2	3	4	5	6	7

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2.14	Craftsmen have the required physical fitness	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.15	Craftsmen have shown acceptable learning speed	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.16	Craftsmen face regular boredom and fatigue	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.17	Craftsmen are not flexible in accommodating task changes	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.18	For new craftsmen, job site orientation program is carried out	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.19	Craftsmen trust in the skills and judgment of their supervisors	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.20	Craftsmen are encouraged to participate in decision making process	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.21	In this project, craftsmen have an acceptable job security	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.22	There is a frequent absenteeism of craftsmen	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.23	Craftsmen's labour union status (unionized or not unionized) and its benefits are important in their day to day performance	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.24	In this project, craftsmen's skill is not fully utilized	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.25	Feedback on performance is provided to craftsmen in regular basis	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.26	In this project, clear goals are properly provided	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.27	Remunerations (salary, benefits) are satisfactory	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.28	Craftsmen are well disciplined in early start & Late quit time of work.	1	2	3	4	5	6	7	1	2	3	4	5	6	7

2.29	Quality of work is higher which avoid rework.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.30	Craftsmen use alcohol and drugs during work hours.	1	2	3	4	5	6	7	1	2	3	4	5	6	7

What would you suggest to improve the above identified issues? _____

3) MATERIAL AND CONSUMABLES

No.	Factors	Frequency							Impact						
		<i>Never</i>	<i>Very Rarely</i>	<i>Rarely</i>	<i>Sometimes</i>	<i>Often</i>	<i>Very Often</i>	<i>Constantly</i>	<i>Strongly Negative</i>	<i>Negative</i>	<i>Slightly Negative</i>	<i>No Impact</i>	<i>Slightly Positive</i>	<i>Positive</i>	<i>Strongly Positive</i>
3.1	Materials are not delivered on time to task location	1	2	3	4	5	6	7	1	2	3	4	5	6	7
3.2	The materials delivered have quality problems	1	2	3	4	5	6	7	1	2	3	4	5	6	7
3.3	There a shortage of consumables	1	2	3	4	5	6	7	1	2	3	4	5	6	7
3.4	Correction work has to be done because of quality problems of prefabricated products	1	2	3	4	5	6	7	1	2	3	4	5	6	7
No.	Factors	Agreement							Impact						
		<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>No Opinion</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>	<i>Strongly Negative</i>	<i>Negative</i>	<i>Slightly Negative</i>	<i>No Impact</i>	<i>Slightly Positive</i>	<i>Positive</i>	<i>Strongly Positive</i>
3.5	Temporary material storage is not located close to work location	1	2	3	4	5	6	7	1	2	3	4	5	6	7
3.6	It takes a very long longer time and effort to unload materials	1	2	3	4	5	6	7	1	2	3	4	5	6	7
3.7	Vertical movement material is slow	1	2	3	4	5	6	7	1	2	3	4	5	6	7
3.8	Horizontal material movement is slow due to lack of clear pathway	1	2	3	4	5	6	7	1	2	3	4	5	6	7

3.9	The site has a very good material order tracking system	1	2	3	4	5	6	7	1	2	3	4	5	6	7
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What would you suggest to improve the above identified issues? _____

4) EQUIPMENT AND TOOLS

No.	Factors	Frequency							Impact						
		<i>Never</i>	<i>Very Rarely</i>	<i>Rarely</i>	<i>Sometimes</i>	<i>Often</i>	<i>Very Often</i>	<i>Constantly</i>	<i>Strongly Negative</i>	<i>Negative</i>	<i>Negative Slightly</i>	<i>Impact No</i>	<i>Positive Slightly</i>	<i>Positive</i>	<i>Strongly Positive</i>
4.1	There is a shortage of good transportation equipment (Cranes, forklifts)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
4.2	Electrical power gets disconnected (Fuel problem) during operation	1	2	3	4	5	6	7	1	2	3	4	5	6	7
4.3	I wait in a line for manlifts	1	2	3	4	5	6	7	1	2	3	4	5	6	7
4.4	Workers can't get the required hand tools to do their jobs	1	2	3	4	5	6	7	1	2	3	4	5	6	7
4.5	Workers can't get the required power tools to do their jobs	1	2	3	4	5	6	7	1	2	3	4	5	6	7
4.6	Damages of equipments/Tools	1	2	3	4	5	6	7	1	2	3	4	5	6	7
No.	Factors	Agreement							Impact						
		<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>No Opinion</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>	<i>Strongly Negative</i>	<i>Negative</i>	<i>Slightly Negative</i>	<i>No Impact</i>	<i>Slightly Positive</i>	<i>Positive</i>	<i>Strongly Positive</i>
4.7	The work tools provided are not of the required quality	1	2	3	4	5	6	7	1	2	3	4	5	6	7
4.8	Tool crib attendant takes time to get the asked tool	1	2	3	4	5	6	7	1	2	3	4	5	6	7
4.9	When I look for tools, I can't find them because they are misplaced	1	2	3	4	5	6	7	1	2	3	4	5	6	7
4.10	Appropriate Equipment type is not provided for each type of work.	1	2	3	4	5	6	7	1	2	3	4	5	6	7

4.11	Service time for Equipments and machineries are during working days(time)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
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What would you suggest to improve the above identified issues? _____

5)FOREMAN RELATED

No.	Factors	Agreement							Impact						
		<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>No Opinion</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>	<i>Strongly Negative</i>	<i>Negative</i>	<i>Slightly Negative</i>	<i>No Impact</i>	<i>Slightly Positive</i>	<i>Positive</i>	<i>Strongly Positive</i>
5.1	Foreman has the required experience	1	2	3	4	5	6	7	1	2	3	4	5	6	7
5.2	Foreman has been trained for leadership	1	2	3	4	5	6	7	1	2	3	4	5	6	7
5.3	Foreman management style is participative and motivating	1	2	3	4	5	6	7	1	2	3	4	5	6	7
5.4	There is a frequent change of foremen	1	2	3	4	5	6	7	1	2	3	4	5	6	7
5.5	The crew number is too large for one foreman	1	2	3	4	5	6	7	1	2	3	4	5	6	7
5.6	There is fairness in performance review of craft workers	1	2	3	4	5	6	7	1	2	3	4	5	6	7
5.7	Foreman has appropriate skill in proper resource allocation	1	2	3	4	5	6	7	1	2	3	4	5	6	7
5.8	In this project clear goals are provided by Project Managers	1	2	3	4	5	6	7	1	2	3	4	5	6	7
5.9	Feed back on performance is provided to foremen on regular basis	1	2	3	4	5	6	7	1	2	3	4	5	6	7
5.10	Formens follow up and control of crews by formens are Adequate	1	2	3	4	5	6	7	1	2	3	4	5	6	7

What would you suggest to improve the above identified issues? _____

6) TASK PROPERTY

No.	Factors	Agreement							Impact						
		<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>No Opinion</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>	<i>Strongly Negative</i>	<i>Negative</i>	<i>Slightly Negative</i>	<i>No Impact</i>	<i>Slightly Positive</i>	<i>Positive</i>	<i>Strongly Positive</i>
6.1	In this project, the tasks are repetitive	1	2	3	4	5	6	7	1	2	3	4	5	6	7
6.2	In this project, the tasks are challenging and interesting	1	2	3	4	5	6	7	1	2	3	4	5	6	7
6.3	Total work volume is too much to handle	1	2	3	4	5	6	7	1	2	3	4	5	6	7
6.4	In this project, rework is frequent	1	2	3	4	5	6	7	1	2	3	4	5	6	7
6.5	In this project, change orders are frequent	1	2	3	4	5	6	7	1	2	3	4	5	6	7
6.6	In this project, interruption and disruption are frequent	1	2	3	4	5	6	7	1	2	3	4	5	6	7
6.7	Work condition has excessive noise, dust and fumes	1	2	3	4	5	6	7	1	2	3	4	5	6	7

What would you suggest to improve the above identified issues? _____

7) LOCATION PROPERTY

No.	Factors	Agreement							Impact						
		<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>No Opinion</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>	<i>Strongly Negative</i>	<i>Negative</i>	<i>Slightly Negative</i>	<i>No Impact</i>	<i>Slightly Positive</i>	<i>Positive</i>	<i>Strongly Positive</i>
7.1	On average the weather is harsh (temperature, wind, humidity, precipitation)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
7.2	Location of work scope (distance and elevation) is convenient	1	2	3	4	5	6	7	1	2	3	4	5	6	7
7.3	The work area is congested	1	2	3	4	5	6	7	1	2	3	4	5	6	7
7.4	The work area is not clean	1	2	3	4	5	6	7	1	2	3	4	5	6	7
7.5	Temporary electrical service is always provided	1	2	3	4	5	6	7	1	2	3	4	5	6	7

7.6	The work area is protected from weather effect	1	2	3	4	5	6	7	1	2	3	4	5	6	7
7.7	Washrooms are closely located	1	2	3	4	5	6	7	1	2	3	4	5	6	7
7.8	Adequate lunchrooms are closely located	1	2	3	4	5	6	7	1	2	3	4	5	6	7
7.9	Camp facilities (residences) are adequate	1	2	3	4	5	6	7	1	2	3	4	5	6	7
7.10	Camp facilities (recreation and shops) are adequate	1	2	3	4	5	6	7	1	2	3	4	5	6	7

What would you suggest to improve the above identified issues? _____

8) ENGINEERING AND INSTRUCTIONS

No.	Factors	Agreement							Impact						
		<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>No Opinion</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>	<i>Strongly Negative</i>	<i>Negative</i>	<i>Slightly Negative</i>	<i>No Impact</i>	<i>Slightly Positive</i>	<i>Positive</i>	<i>Strongly Positive</i>
8.1	Drawings and Specifications are readily available	1	2	3	4	5	6	7	1	2	3	4	5	6	7
8.2	Available drawings and specifications are not readable(in complete)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
8.3	In this site, the response time for drawing questions is acceptable	1	2	3	4	5	6	7	1	2	3	4	5	6	7
8.4	Adequate job instructions are not provided	1	2	3	4	5	6	7	1	2	3	4	5	6	7
8.5	Change in design	1	2	3	4	5	6	7	1	2	3	4	5	6	7
8.6	Change of supervisor	1	2	3	4	5	6	7	1	2	3	4	5	6	7
8.7	Incompetence of supervisors	1	2	3	4	5	6	7	1	2	3	4	5	6	7
8.9	Supervisors absenteeism	1	2	3	4	5	6	7	1	2	3	4	5	6	7

What would you suggest to improve the above identified issues? _____

9) HEALTH & SAFETY

No.	Factors	Agreement						Impact							
		<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>No Opinion</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>	<i>Strongly Negative</i>	<i>Negative</i>	<i>Slightly Negative</i>	<i>No Impact</i>	<i>Slightly Positive</i>	<i>Positive</i>	<i>Strongly Positive</i>
9.1	Unsafe working conditions are common	1	2	3	4	5	6	7	1	2	3	4	5	6	7
9.2	Frequency of accidents and personal injury is low	1	2	3	4	5	6	7	1	2	3	4	5	6	7
9.3	Provision of Safety tools is prohibiting work progress	1	2	3	4	5	6	7	1	2	3	4	5	6	7
9.4	Stringent safety rules are negatively affecting productivity	1	2	3	4	5	6	7	1	2	3	4	5	6	7
9.5	Safety clothing's & tools are well provided	1	2	3	4	5	6	7	1	2	3	4	5	6	7
9.6	Safety sign boards and materials help to minimize accident and injury.	1	2	3	4	5	6	7	1	2	3	4	5	6	7

What would you suggest to improve the above identified issues? _____

10) PROJECT MANAGEMENT

No.	Factors	Agreement						Impact							
		<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>No Opinion</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>	<i>Strongly Negative</i>	<i>Negative</i>	<i>Slightly Negative</i>	<i>No Impact</i>	<i>Slightly Positive</i>	<i>Positive</i>	<i>Strongly Positive</i>
10.1	Hiring practices are fair and competence based	1	2	3	4	5	6	7	1	2	3	4	5	6	7
10.2	Workers are facing frequent layoffs	1	2	3	4	5	6	7	1	2	3	4	5	6	7
10.3	Work packages are properly planned and assigned to workers	1	2	3	4	5	6	7	1	2	3	4	5	6	7
10.4	The site has clearly laid out organization structure	1	2	3	4	5	6	7	1	2	3	4	5	6	7
10.5	Unrealistic schedule is given to tasks	1	2	3	4	5	6	7	1	2	3	4	5	6	7

Identification and Comparative Analysis of Key Parameters Influencing Construction labour productivity of Building Projects in Addis Ababa.

10.6	Project shift length is not adequate to perform the given tasks	1	2	3	4	5	6	7	1	2	3	4	5	6	7
10.7	There is a lack of communication between project managers	1	2	3	4	5	6	7	1	2	3	4	5	6	7
10.8	Lock out procedure is not well organized	1	2	3	4	5	6	7	1	2	3	4	5	6	7
10.9	Work permits are provided in a timely fashion	1	2	3	4	5	6	7	1	2	3	4	5	6	7
10.10	There is a high level of paperwork	1	2	3	4	5	6	7	1	2	3	4	5	6	7
10.11	Remuneration (salary, bonus and incentives) are fairly set	1	2	3	4	5	6	7	1	2	3	4	5	6	7
10.12	There is a lack of project follow up from the project management.	1	2	3	4	5	6	7	1	2	3	4	5	6	7

What would you suggest to improve the above identified issues? _____

Thank you very much.

APPENDIX D: QUESTIONNAIRE FOR THE PROJECT MANAGERMENTS SURVEY



ADDIS ABABA UNIVERSITY

ADDIS ABABA INSTITUTE OF TECHNOLOGY (AAIT)
SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING

A Questionnaire for MSc degree on the topic “Identification & Comparative analysis of Key Parameters Influencing Construction Labour Productivity in Addis Ababa Building Projects”

Project Management and Field Supervisors – Interview Survey

Thank you for participating in this survey.

You have been selected to participate in this interview survey based on the project personnel data provided by your organization. The researcher assures you that, the research data will only be used solely for the academic purpose and will be treated with strict confidentiality. Particular mentioning of names will not be required anywhere.

The survey will be conducted as an interview. The researcher will ask you questions on the survey and he will fill them. You may give any comments and ask questions freely. And you may review the filled questionnaire before submission.

Your open and prompt response is highly appreciated.

RESEARCHER’S INFORMATION

Name: **Yared Beyene**

Phone: **+251-0911422224**

E-Mail: **yaredo42@yahoo.com**

Field of Study: **MSc. In Civil Engineering (Construction Technology & Management)**

Advisor: **Dr. Abraham Assefa**

2) BACKGROUND

1.1. Please select your occupation:

- General Manager Operation manager (Coordinator) Construction Engineer
- Contract Administrator Project Manager Site Engineer
- Superintendent General Forman Resident Engineer
- Supervisor other (please specify)

How long have you worked in the stated occupation? _____ Year(s) _____ Month(s).

1.2. Please indicate your

employer: _____.

1.3. How long have you been employed by your current employer and on this project?

Employer: _____ Year(s) _____ Month(s).

Project: _____ Year(s) _____ Month(s).

1.4. How many construction workers (on average) are employed in your organization?

- Less than 50 50-100 101-150 151-200 Over 201

1.5. Demographic Information

Age: 20-30 31-40 41-50 51-60 Over 60

Gender: Male Female

Education: Please specify ALL that apply to you.

- Master's Degree Bachelor's Degree
- College Diploma Vocational or trade school
- Other (please specify): _____

If none, please state how you develop your skill _____.

1.6. Work/Job Condition

During a typical work week, which shift do you usually work:

- Day Shift Night shift Both

How many hours are you scheduled to work per day:

- 8 hours 10 hours Other: _____

For a given work week, how many consecutive days do you generally work?

6 Days 7days Other:_____

For a given work Year, how many Consecutive Months did you work?

12 months 10 months Other:____

For a given work Year, on average

15 days Other: _____

How many days did you get off?

1.7.Based on your experience, rank how well you think the *current project(s)* is being managed?

Quite Poor	Very Poor	Poor	Neutral	Good	Very Good	Excellent
1	2	3	4	5	6	7

1.8.Based on your experience, how would you rank the *overall productivity* of the current project(s)?

Quite Poor	Very Poor	Poor	Neutral	Good	Very Good	Excellent
1	2	3	4	5	6	7

In execution of your daily work activities there are various factors which influence you and your co-workers for effectively and efficiently accomplishing your daily work plan. Therefore, here under there are some factors which are identified by Tsehayae, 2015 from different studies and added from Amanuel, 2016 findings in addis ababa building projects.

The level of Agreement and impact is put besides every question. Please circle the appropriate number based on your experience and thoughts.

2) LABOUR AND CREW RELATED

No.	Factors	Agreement							Impact						
		<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>No Opinion</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>	<i>Strongly Negative</i>	<i>Negative</i>	<i>Slightly Negative</i>	<i>No Impact</i>	<i>Slightly Positive</i>	<i>Positive</i>	<i>Strongly Positive</i>
2.1	Work Motivation of crafts is not adequate to perform day to day tasks.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.2	late start and early finish of work affect crafts performance	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.3	Crew trade specific trainings are regularly conducted	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.4	Crew experience and competence is not meeting expectations	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.5	There is well balanced crew composition (Skilled(experienced) and Unskilled (inexperienced)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.6	Work is fairly assigned between crews	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.7	Crew team spirit is high	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.8	There is a good cooperation between craftsmen	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.9	Efforts are taken to reduce crew turnover	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.10	Craftsmen have a positive attitude towards the task	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.11	Craftsmen are not flexible in accommodating task changes	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.12	Craftsmen's skill is not fully utilized	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.13	Craftsmen do not trust the skills and judgment of their supervisors	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.14	Craftsmen are never involved in decision making process	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.15	Absenteeism of craftsmen is well tracked	1	2	3	4	5	6	7	1	2	3	4	5	6	7

Identification and Comparative Analysis of Key Parameters Influencing Construction labour productivity of Building Projects in Addis Ababa.

2.16	Craftsmen's labour union status (unionized or not unionized) and its benefits are important in their day to day performance	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.17	Performance of craftsmen is regularly evaluated	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.18	Clear goals are given to foreman and crafts	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.19	Unrealistic expectations have demotivated the workforce and reduced their productivity.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.20	Incentives & Salary provided to employees directly affect their productivity	1	2	3	4	5	6	7	1	2	3	4	5	6	7

3) MATERIAL AND CONSUMABLES

No.	Factors	Agreement							Impact						
		<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>No Opinion</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>	<i>Strongly Negative</i>	<i>Negative</i>	<i>Slightly Negative</i>	<i>No Impact</i>	<i>Slightly Positive</i>	<i>Positive</i>	<i>Strongly Positive</i>
3.1	Material is delivered on time	1	2	3	4	5	6	7	1	2	3	4	5	6	7
3.2	Delivered materials are of high quality	1	2	3	4	5	6	7	1	2	3	4	5	6	7
3.3	Temporary material storages are properly planned	1	2	3	4	5	6	7	1	2	3	4	5	6	7
3.4	Material order tracking system is in place	1	2	3	4	5	6	7	1	2	3	4	5	6	7
3.5	Material order tracking system is too long for operation	1	2	3	4	5	6	7	1	2	3	4	5	6	7
3.6	Material unloading practices are ineffective	1	2	3	4	5	6	7	1	2	3	4	5	6	7
3.7	Required quantity of material is not delivered on time.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
3.8	Material movement practices are well planned	1	2	3	4	5	6	7	1	2	3	4	5	6	7

What would you suggest to improve the above identified issues? _____

4) EQUIPMENT AND TOOLS

No.	Factors	Agreement							Impact						
		<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>No Opinion</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>	<i>Strongly Negative</i>	<i>Negative</i>	<i>Slightly Negative</i>	<i>No Impact</i>	<i>Slightly Positive</i>	<i>Positive</i>	<i>Strongly Positive</i>
4.1	There are adequate material transportation equipment (Cranes, Trucks)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
4.2	Appropriate Equipment type is provided for each type of work.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
4.3	Work places are not equipped with adequate man lifts	1	2	3	4	5	6	7	1	2	3	4	5	6	7
4.4	There are adequate and quality work tools	1	2	3	4	5	6	7	1	2	3	4	5	6	7
4.5	Equipments and tools frequently breakdown	1	2	3	4	5	6	7	1	2	3	4	5	6	7
4.6	Service time for Equipments and machineries are during non-working days(time)	1	2	3	4	5	6	7	1	2	3	4	5	6	7
4.7	Power source (Electric or fuel) are sufficiently provided	1	2	3	4	5	6	7	1	2	3	4	5	6	7

What would you suggest to improve the above identified issues? _____

5) FOREMAN RELATED

No.	Factors	Agreement							Impact						
		<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>No Opinion</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>	<i>Strongly Negative</i>	<i>Negative</i>	<i>Slightly Negative</i>	<i>No Impact</i>	<i>Slightly Positive</i>	<i>Positive</i>	<i>Strongly Positive</i>
5.1	Leadership training is provided to foremen	1	2	3	4	5	6	7	1	2	3	4	5	6	7
5.2	Efforts are taken to reduce turnover of foremen	1	2	3	4	5	6	7	1	2	3	4	5	6	7
5.3	Span of control of foreman is properly considered in the development of crews	1	2	3	4	5	6	7	1	2	3	4	5	6	7

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5.4	Foreman's fairness in performance review of craft workers is checked by Managers	1	2	3	4	5	6	7	1	2	3	4	5	6	7
5.5	Foremen receive performance evaluation on regular basis	1	2	3	4	5	6	7	1	2	3	4	5	6	7
5.6	Superintendents(General Forman's) usually follow uniform work rules	1	2	3	4	5	6	7	1	2	3	4	5	6	7
5.7	Follow up and control of crews by foreman's are Adequate	1	2	3	4	5	6	7	1	2	3	4	5	6	7

What would you suggest to improve the above identified issues? _____

6) SITE CONDITIONS

No.	Factors	Agreement							Impact						
		<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>No Opinion</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>	<i>Strongly Negative</i>	<i>Negative</i>	<i>Slightly Negative</i>	<i>No Impact</i>	<i>Slightly Positive</i>	<i>Positive</i>	<i>Strongly Positive</i>
6.1	Work locations are confronted with excessive noise, dust, and fumes	1	2	3	4	5	6	7	1	2	3	4	5	6	7
6.2	Measures are taken to minimize weather (temperature, wind, humidity, precipitation) effects	1	2	3	4	5	6	7	1	2	3	4	5	6	7
6.3	Lunchroom locations are properly planned	1	2	3	4	5	6	7	1	2	3	4	5	6	7
6.4	Adequate camp facilities are provided	1	2	3	4	5	6	7	1	2	3	4	5	6	7
6.5	Adequate recreation facilities are not provided	1	2	3	4	5	6	7	1	2	3	4	5	6	7
6.6	Washrooms are closely located	1	2	3	4	5	6	7	1	2	3	4	5	6	7

What would you suggest to improve the above identified issues? _____

7) PROJECT DELIVERY AND CONTRACT

No.	Factors	Agreement							Impact						
		<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>No Opinion</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>	<i>Strongly Negative</i>	<i>Negative</i>	<i>Slightly Negative</i>	<i>No Impact</i>	<i>Slightly Positive</i>	<i>Positive</i>	<i>Strongly Positive</i>
7.1	Design Build delivery system as compared to the Design Bid Build are ineffective in improving on site performance	1	2	3	4	5	6	7	1	2	3	4	5	6	7
7.2	Labour contract type as compared to contracts including material are ineffective in improving the site performance	1	2	3	4	5	6	7	1	2	3	4	5	6	7
7.3	Lump sum contract types have similar effect on craft productivity as compared to admeasurements types	1	2	3	4	5	6	7	1	2	3	4	5	6	7

What would you suggest to improve the above identified issues? _____

8) ENGINEERING AND INSTRUCTIONS

No.	Factors	Agreement							Impact						
		<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>No Opinion</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>	<i>Strongly Negative</i>	<i>Negative</i>	<i>Slightly Negative</i>	<i>No Impact</i>	<i>Slightly Positive</i>	<i>Positive</i>	<i>Strongly Positive</i>
8.1	Drawings and specifications are made available well ahead of implementations	1	2	3	4	5	6	7	1	2	3	4	5	6	7
8.2	Drawings and specifications are often not complete and require updates	1	2	3	4	5	6	7	1	2	3	4	5	6	7
8.3	Frequently change in drawings and specification.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
8.4	Timely submission of material approvals from supervisors.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
8.5	Incompetence of supervisors	1	2	3	4	5	6	7	1	2	3	4	5	6	7

What would you suggest to improve the above identified issues? _____

9) PROJECT COMPLEXITY

No.	Factors	Agreement							Impact						
		<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>No Opinion</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>	<i>Strongly Negative</i>	<i>Negative</i>	<i>Slightly Negative</i>	<i>No Impact</i>	<i>Slightly Positive</i>	<i>Positive</i>	<i>Strongly Positive</i>
9.1	Most of the tasks in this project have repetitive nature	1	2	3	4	5	6	7	1	2	3	4	5	6	7
9.2	Interruption and disruption is common due the large number of processes or steps	1	2	3	4	5	6	7	1	2	3	4	5	6	7
9.3	Rework is usually done because of error by Designers	1	2	3	4	5	6	7	1	2	3	4	5	6	7
9.4	Rework is usually done because of error by contractor	1	2	3	4	5	6	7	1	2	3	4	5	6	7
9.5	Change orders due to design changes are frequently made	1	2	3	4	5	6	7	1	2	3	4	5	6	7

What would you suggest to improve the above identified issues? _____

10) HEALTH, SAFETY and ENVIRONMENT

No.	Factors	Agreement							Impact						
		<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>No Opinion</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>	<i>Strongly Negative</i>	<i>Negative</i>	<i>Slightly Negative</i>	<i>No Impact</i>	<i>Slightly Positive</i>	<i>Positive</i>	<i>Strongly Positive</i>
10.1	Safety clothing's & tools are well provided	1	2	3	4	5	6	7	1	2	3	4	5	6	7
10.2	Safety sign boards and materials are well provided.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
10.3	Regular health and safety training is not provided	1	2	3	4	5	6	7	1	2	3	4	5	6	7
10.4	Daily project briefing and debriefing is properly practiced	1	2	3	4	5	6	7	1	2	3	4	5	6	7
10.5	Daily job hazard assessment system is in place	1	2	3	4	5	6	7	1	2	3	4	5	6	7
10.6	Tailgate safety meetings are time taking	1	2	3	4	5	6	7	1	2	3	4	5	6	7
10.7	Project site safety rules are stringent	1	2	3	4	5	6	7	1	2	3	4	5	6	7

Identification and Comparative Analysis of Key Parameters Influencing Construction labour productivity of Building Projects in Addis Ababa.

10.8	Accidents and injury are frequent	1	2	3	4	5	6	7	1	2	3	4	5	6	7
10.9	Safety incident investigation are efficiently carried out	1	2	3	4	5	6	7	1	2	3	4	5	6	7
10.10	Safety inspections and audits are well planned	1	2	3	4	5	6	7	1	2	3	4	5	6	7
10.11	Sorting of waste materials (Concrete, Steel, Wood) is strictly implemented	1	2	3	4	5	6	7	1	2	3	4	5	6	7
10.12	Corrective actions are frequently taken to meet environmental requirements	1	2	3	4	5	6	7	1	2	3	4	5	6	7
10.13	Environmental inspections and audits are not well planned	1	2	3	4	5	6	7	1	2	3	4	5	6	7

What would you suggest to improve the above identified issues? _____

11) PROJECT MANAGEMENT PRACTICES

No.	Factors	Agreement							Impact						
		<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>No Opinion</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>	<i>Strongly Negative</i>	<i>Negative</i>	<i>Slightly Negative</i>	<i>No Impact</i>	<i>Slightly Positive</i>	<i>Positive</i>	<i>Strongly Positive</i>
11.1	Integration Management Practices: The process required to ensure that the various elements of the project are properly coordinated is properly implemented	1	2	3	4	5	6	7	1	2	3	4	5	6	7
11.2	Scope Management Practices: The process of defining and documenting scope of work and different project needs to meet organization objectives is often missing	1	2	3	4	5	6	7	1	2	3	4	5	6	7
11.3	Cost Management Practices: Identification and documentation of the different stages in the development of the project estimate is properly done	1	2	3	4	5	6	7	1	2	3	4	5	6	7

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11.4	Cost Management Practices: A process of monitoring the status of the project to update the project budget and manage changes to the cost baseline is not implemented	1	2	3	4	5	6	7	1	2	3	4	5	6	7
11.5	Cost Management Practices: A reporting system at company level is in place for the identification of cost overruns	1	2	3	4	5	6	7	1	2	3	4	5	6	7
11.6	Quality Management Practices: Identifying quality requirements and/or standards, and documentation on how the organization will demonstrate compliance is properly implemented	1	2	3	4	5	6	7	1	2	3	4	5	6	7
11.7	Quality Management Practices: A process for monitoring and recording results of executing the quality activities to assess performance and recommend necessary changes is properly implemented	1	2	3	4	5	6	7	1	2	3	4	5	6	7
11.8	Human Resource (HR) Management Practices: Trainings, workshops, seminars are held for employees of the organization in order to improve their qualifications and performance	1	2	3	4	5	6	7	1	2	3	4	5	6	7
11.9	Human Resource (HR) Management Practices: Overall participation of HR in the formulation and realization of competitive strategies and establishment of links between organizational level and individual competences is missing	1	2	3	4	5	6	7	1	2	3	4	5	6	7

Identification and Comparative Analysis of Key Parameters Influencing Construction labour productivity of Building Projects in Addis Ababa.

11.10	Procurement Management Practices: A project procurement plan detailing what to procure, how, and when is properly developed	1	2	3	4	5	6	7	1	2	3	4	5	6	7
11.11	Procurement Management Practices: Proper evaluation criterion is applied to select qualified bidders	1	2	3	4	5	6	7	1	2	3	4	5	6	7
11.12	Procurement Management Practices: Documentation of procurement process and follow up to monitor progress is properly implemented	1	2	3	4	5	6	7	1	2	3	4	5	6	7
11.13	Risk Management Practices: A risk assessment tool to identify possible risks for proper mitigation is in place	1	2	3	4	5	6	7	1	2	3	4	5	6	7
11.14	Risk Management Practices: A process for tracking and monitoring different risks and integrating these risks at the organization and project levels to provide a periodic performance assessments and develop mitigation strategies is properly implemented	1	2	3	4	5	6	7	1	2	3	4	5	6	7
11.15	Change Management Practices: A proper change documentation process is not implemented	1	2	3	4	5	6	7	1	2	3	4	5	6	7
11.16	Change Management Practices: A process for monitoring and controlling changes of ongoing projects with an analysis on their impact on productivity is properly implemented	1	2	3	4	5	6	7	1	2	3	4	5	6	7

Identification and Comparative Analysis of Key Parameters Influencing Construction labour productivity of Building Projects in Addis Ababa.

11.17	Communication Management Practices: Procedures to be followed on horizontal, vertical and interdepartmental level communications are missing	1	2	3	4	5	6	7	1	2	3	4	5	6	7
11.18	Communication Management Practices: Documentation and tracking systems of different communications for fast retrieval of information is properly implemented	1	2	3	4	5	6	7	1	2	3	4	5	6	7
11.19	Business Development Practices: Development of a time scaled business plan with a well-defined set of objectives is always done	1	2	3	4	5	6	7	1	2	3	4	5	6	7

What would you suggest to improve the above identified issues? _____

12) PROJECT BEST PRACTICES

No.	Factors	Agreement							Impact						
		<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>No Opinion</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>	<i>Strongly Negative</i>	<i>Negative</i>	<i>Slightly Negative</i>	<i>No Impact</i>	<i>Slightly Positive</i>	<i>Positive</i>	<i>Strongly Positive</i>
12.1	Detailed front end planning was carried out by the owner or his representative	1	2	3	4	5	6	7	1	2	3	4	5	6	7
12.2	Contractors were not involved for alignment in front end planning stage	1	2	3	4	5	6	7	1	2	3	4	5	6	7
12.3	Constructability reviews were properly included in the design stage	1	2	3	4	5	6	7	1	2	3	4	5	6	7
12.4	Owners project team have adopted appropriate project risk management practices	1	2	3	4	5	6	7	1	2	3	4	5	6	7
12.5	Contractors project team have adopted appropriate project risk management practices	1	2	3	4	5	6	7	1	2	3	4	5	6	7

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12.6	Formal team building process was not employed to build shared goals, and improve problem solving skills	1	2	3	4	5	6	7	1	2	3	4	5	6	7
12.7	Material management practices are employed in the planning and controlling of materials	1	2	3	4	5	6	7	1	2	3	4	5	6	7
12.8	Change management practices are not employed in the planning and evaluations of project changes	1	2	3	4	5	6	7	1	2	3	4	5	6	7
12.9	Zero accident techniques are effectively applied	1	2	3	4	5	6	7	1	2	3	4	5	6	7
12.10	Quality management practices, mainly QA/QC are not properly planned and executed	1	2	3	4	5	6	7	1	2	3	4	5	6	7
12.11	The project lacks behind in the use of automation and integration technologies	1	2	3	4	5	6	7	1	2	3	4	5	6	7
12.12	Planning for startup is being properly carried out	1	2	3	4	5	6	7	1	2	3	4	5	6	7
12.13	Productivity measurement and improvement practices are effectively implemented	1	2	3	4	5	6	7	1	2	3	4	5	6	7
12.14	Work permit process is efficient and proactive	1	2	3	4	5	6	7	1	2	3	4	5	6	7
12.15	Consultants are not proactive in implementation of projects.	1	2	3	4	5	6	7	1	2	3	4	5	6	7

What would you suggest to improve the above identified issues? _____

13) PROJECT OWNER NATURE

No.	Factors	Agreement							Impact						
		<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>No Opinion</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>	<i>Strongly Negative</i>	<i>Negative</i>	<i>Slightly Negative</i>	<i>No Impact</i>	<i>Slightly Positive</i>	<i>Positive</i>	<i>Strongly Positive</i>
13.1	Owner's primary driver is schedule	1	2	3	4	5	6	7	1	2	3	4	5	6	7
13.2	Owner's primary driver is cost	1	2	3	4	5	6	7	1	2	3	4	5	6	7
13.3	Owner's primary driver is quality	1	2	3	4	5	6	7	1	2	3	4	5	6	7
13.4	Owner's primary driver is safety	1	2	3	4	5	6	7	1	2	3	4	5	6	7
13.5	The project site is transferred timely to the contractor	1	2	3	4	5	6	7	1	2	3	4	5	6	7
13.6	Owner team has the required competence and knowledge in managing the project	1	2	3	4	5	6	7	1	2	3	4	5	6	7
13.7	Owner team provides decisions in a timely manner	1	2	3	4	5	6	7	1	2	3	4	5	6	7
13.8	Changes are frequently made by the owners team	1	2	3	4	5	6	7	1	2	3	4	5	6	7
13.9	Owners are frequently suspending projects	1	2	3	4	5	6	7	1	2	3	4	5	6	7
13.10	Owners don't have sufficient budget in financing projects.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
13.11	Owners don't pay to contractors in timely manner.	1	2	3	4	5	6	7	1	2	3	4	5	6	7

What would you suggest to improve the above identified issues? _____

14) ORGANIZATIONAL

No.	Factors	Agreement							Impact						
		<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>No Opinion</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>	<i>Strongly Negative</i>	<i>Negative</i>	<i>Slightly Negative</i>	<i>No Impact</i>	<i>Slightly Positive</i>	<i>Positive</i>	<i>Strongly Positive</i>
14.1	Organization's principal construction project type (industrial, commercial, infrastructure) is diverse	1	2	3	4	5	6	7	1	2	3	4	5	6	7
14.2	The organization has long and successful years in industry	1	2	3	4	5	6	7	1	2	3	4	5	6	7
14.3	Number of divisions in the organization as compared to competitors is high	1	2	3	4	5	6	7	1	2	3	4	5	6	7
14.4	Number of employees in the organization as compared to competitors is low	1	2	3	4	5	6	7	1	2	3	4	5	6	7
14.5	Annual turnover in Birrs for the organization is good	1	2	3	4	5	6	7	1	2	3	4	5	6	7
14.6	Organizational structure system (matrix, project based, mixed) is clearly laid out	1	2	3	4	5	6	7	1	2	3	4	5	6	7
14.7	Projects awarded per year are few	1	2	3	4	5	6	7	1	2	3	4	5	6	7
14.8	Annual turnover of employees is high	1	2	3	4	5	6	7	1	2	3	4	5	6	7
14.9	Execution of work approach (subcontracting, self performing, both) is clearly developed	1	2	3	4	5	6	7	1	2	3	4	5	6	7
14.10	Work Operation strategies and system increase performance of the organization.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
14.11	Marketing(Bidding) strategy compared with competitors decreases performance	1	2	3	4	5	6	7	1	2	3	4	5	6	7

What would you suggest to improve the above identified issues? _____

15) PROVINCIAL

No.	Factors	Agreement							Impact						
		<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>No Opinion</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>	<i>Strongly Negative</i>	<i>Negative</i>	<i>Slightly Negative</i>	<i>No Impact</i>	<i>Slightly Positive</i>	<i>Positive</i>	<i>Strongly Positive</i>
15.1	Provincial economy is fostering labour productivity	1	2	3	4	5	6	7	1	2	3	4	5	6	7
15.2	There are many competing Industries within the province	1	2	3	4	5	6	7	1	2	3	4	5	6	7
15.3	Provincial codes and regulations are not supportive of construction projects	1	2	3	4	5	6	7	1	2	3	4	5	6	7
15.4	Quality of labour in Addis Ababa is good	1	2	3	4	5	6	7	1	2	3	4	5	6	7
15.5	The available labour for construction projects in Addis Ababa is adequate	1	2	3	4	5	6	7	1	2	3	4	5	6	7
15.6	Labour strikes in the construction sector are imminent	1	2	3	4	5	6	7	1	2	3	4	5	6	7
15.7	Quality of supervisors is good	1	2	3	4	5	6	7	1	2	3	4	5	6	7
15.8	The available supervisors for construction projects in Addis Ababa is not adequate	1	2	3	4	5	6	7	1	2	3	4	5	6	7
15.9	Taxes (income tax, provincial GST) as compared to other provinces are High	1	2	3	4	5	6	7	1	2	3	4	5	6	7
15.10	Construction material price fluctuations are steady in the province	1	2	3	4	5	6	7	1	2	3	4	5	6	7
15.11	Unemployment rate for construction workers in Addis Ababa is high	1	2	3	4	5	6	7	1	2	3	4	5	6	7
15.12	There is a substantial expenditure towards Industrial related projects as compared to other types	1	2	3	4	5	6	7	1	2	3	4	5	6	7
15.13	Prices for outputs (project completion costs) are substantially increasing	1	2	3	4	5	6	7	1	2	3	4	5	6	7

What would you suggest to improve the above identified issues? _____

16) NATIONAL

No.	Factors	Agreement							Impact						
		<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Slightly Disagree</i>	<i>No Opinion</i>	<i>Slightly Agree</i>	<i>Agree</i>	<i>Strongly Agree</i>	<i>Strongly Negative</i>	<i>Negative</i>	<i>Slightly Negative</i>	<i>No Impact</i>	<i>Slightly Positive</i>	<i>Positive</i>	<i>Strongly Positive</i>
16.1	Ethiopia has a stable political system	1	2	3	4	5	6	7	1	2	3	4	5	6	7
16.2	Incompetence of consultant firms hinders the execution of projects.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
16.3	Incompetence of contractors firms hinders the execution of projects.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
16.4	Competition from international firms has raised the efficiency of Ethiopian firms	1	2	3	4	5	6	7	1	2	3	4	5	6	7
16.5	There is adequate labour for construction projects in Ethiopia	1	2	3	4	5	6	7	1	2	3	4	5	6	7
16.6	Quality of labour across the nation is poor	1	2	3	4	5	6	7	1	2	3	4	5	6	7
16.7	The Agricultural sector decrease the number of work force seasonally	1	2	3	4	5	6	7	1	2	3	4	5	6	7
16.8	Unemployment rate for construction workers in Ethiopia is high	1	2	3	4	5	6	7	1	2	3	4	5	6	7
16.9	Ethiopian population is steadily increasing	1	2	3	4	5	6	7	1	2	3	4	5	6	7
16.10	Ethiopia have more young population	1	2	3	4	5	6	7	1	2	3	4	5	6	7
16.11	There is High inflation rate in Ethiopia.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
16.12	Public unrest due to political, economic or other issues.	1	2	3	4	5	6	7	1	2	3	4	5	6	7

What would you suggest to improve the above identified issues? _____

Thank you very much.