

JIMMA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

JIMMA INSTITUTE OF TECHNOLOGY

CONSTRUCTION ENGINEERING AND MANAGEMENT STREAM



Assessment of Factors Affecting Labor Productivity in Road Construction
Projects in Oromia Regional State Bale Zone

By- Melese Mengistu

November, 2015

Jimma Ethiopia



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Oromia Region Bale Zone

A Thesis Submitted To the School of Graduate Studies of Jimma University in Partial
Fulfillment of the Requirement for the Degree of Master of Science in Construction
Engineering and Management

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November, 2015

Jimma Ethiopia

Declaration

I hereby declare that this thesis:

Assessment of Factors Affecting Labor Productivity in Road Construction Projects in Oromia Region Bale Zone is my original work and has not been submitted and presented to any other Universities than the University of Jimma for any type of academic degree.

Name	Signature	Date
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This thesis has been submitted for examination with my approval as university Supervisor

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External Examine

Acknowledgement

All praises to the God Almighty who has created this world of knowledge for us. He is The Gracious and The Merciful. He bestowed man with intellectual power and understanding, and gave him spiritual insight, enabling him to discover his “Self” know his Creator through His wonders, and conquer nature.

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Abstract

Construction labor costs account for 30-60% of the total cost of a project. Construction labor productivity is a critical for the profitability of construction projects (Madi, 2003).

The study aims at identifying the factors affecting labor productivity in road construction projects in Oromia regional state Bale Zone from the view point of different respondents including project managers, construction supervisors, engineers and other who have experience in road construction. About 61 Factors were identified through literature review and grouped into eleven groups. Respondents were required to rate how 61 factors affecting labor productivity with respect to their importance.

The 11 groups of factors which have significant impact on the labour productivity are ranked depending on their RII as: Material/Equipment Factor 1st with RII of 0.819, Manpower/Work Force Factor 2nd with RII of 0.764, Management Factor 3rd with RII of 0.737, Quality factors 4th with RII of 0.720, Supervision Factor 5th with RII of 0.699, Safety factor 6th with RII of 0.691, Motivation Factor 7th with RII of 0.682, Schedule Factor 8th with RII of 0.647, Political factor 9th with RII of 0.620, Natural/environmental Factor 10th with RII of 0.566 and Cultural and religious factor 11th with RII of 0.541. According to the result of the study the top factors that affect labor productivity includes: Lack of experience of labor, Material construction shortage, Lack of labour skills, Accident, tools and equipment shortage, Labor's bad habit, Poor site management, Lack of Labor surveillance, Payment delay and Ignore safety precautions.

The reliability, validity of data is tested using Chronbach's Alpha value ($\alpha = 0.973$) by SPSS. The degree of agreement of respondents is checked by Pearson correlation coefficient and there is high degree of agreement between respondents regarding the factors affecting labor productivity.

It's recommended that road construction organization assign project manager and construction supervisors with sufficient management skills in project, minimize Accident and any safety problems, develop human resources through proper and continuous training programs frame a strong assignment, vision and a planned approach to overcome poor productivity of labor. It's recommended that the government should consider as major concern, to enforce hard and fast laws and regulation that help to obtain productive work force in the road construction.

Key words: factors, labor productivity, road construction

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Acronyms

ASIST Technology	Advisory Support, Information Services and Training for Labor-based
CEM	Construction Engineering and Management
CPM	Critical Path Method
ERA	Ethiopian Road Authority
ETB	Ethiopian Birr
G.C	Gregorian calendar
GNP	Gross National Product
GVC	Gross Value Added
ORA	Oromia Road Authority
R	Rank
RII	Relative Important Index
RSDP	Road Sector Development Program
PERT	Program Evaluation and Review Technique

CHAPTER ONE

INTRODUCTION

1.1 Background

There is no doubt that construction industry is a key activity in any economy; it influences, and is influenced by the gross domestic product (GDP) of that nation (Cox et al, 1998, cited in Madi, 2003) but construction industry share of GDP in developed countries is more than construction industry share of GDP in developing countries (Cox et al, 1998, cited in Madi, 2003).

It is evident that the socio economic development of any country is highly dependent on the amount of economic and social infrastructure, whether it is public or private. One of the major sectors contributing for infrastructure growth is the construction industry.

The construction industry is also highest recipient of government budget in terms of government development programmers'. Hence a little improvement in this sector will undoubtedly generate a lot of benefit.

In most countries, experience and literature have revealed that construction labor costs account for 30-60% of the total cost of a project (Mostafa, 2003). Therefore, construction labor productivity is a critical importance to the profitability of most construction projects. Many researchers have identified these problems as factors that affect the productivity of construction and will subsequently affect the performance of a company and the overall economy of the country.

Researchers has long been a concerned to the Problems in increasing productivity, in which the identification and evaluation of the factors that affect productivity have become critical issues faced by project managers for a long time in order to increase productivity in construction . To achieve the income expected from any construction project, it is important to have control of the productivity factors that contribute to the integrated composition of production, such as labor, equipment, and cash flow.

1.2 Historical Development of Roads in Ethiopia

Ethiopia's economic growth is highly dependent on the agricultural sector. Therefore, development efforts to change the existing socio-economic condition of the nation would also be dependent on the efficiency of this sector for the foreseeable future. However, a better

Performance of the agricultural sector in particular, and the sustainable economic growth of the Country at large would be achieved through an improvement of the basic infrastructure. Consequently, the road network has been identified as a serious bottleneck for the economic development of the country (Gebrehewor, July 1994).

The provision of adequate road transport services (in quality, coverage and organization) is essential for the economic and social development of Ethiopia. Road transport accommodates 95% of passenger/freight movements in the country, import/distribution of petroleum products, fertilizers, relief food and collection/export of coffee from rural areas (Leul K., Petros A., Yulianos K., 2008).

Road sector construction projects in Ethiopia are means through which development strategies are achieved. Development strategies which are fulfilled through successful road projects out end to import accessibility of rural areas, lower costs associated with transport maintenance and open more areas for development activities (Leul K., Petros A., Yulianos K., 2008).

Road are a primary communication to all sectors of economy and the population .It is widely recognized that an efficient road infrastructure is a big requirement for economic and social development. Ethiopia having physical topography is characterized by mountains, gorges and rivers. This topographic nature, besides determining the long history of the country (enabling the defenses of the country from outside invading forces), was found to limit the level of development of the surface transport structure. This has resulted in the use of head loading and pack animal transport for a long period in the county's history (Leul K., Petros A., Yulianos K., 2008).

It is recorded by historians that planned road building, with primitive and local technology, was initiated during emperor Theodros (1855–1868). With some European employment, Theodros was able to build roads having a width of 9 to 12 meters from Debre Tabor Gonder and from Gojam to Mekdella (Leul K., Petros A., Yulianos K., 2008). Emperor Minilik II after defeating the Italian invaders at Adwa in 1896 used the captured Italian army members to build roads connecting the central region of the country with the northern parts. Generally speaking this Status of road construction in Ethiopia and its future activities roads were not of adequate standard and capable of carrying wheeled traffic. In fact the period was characterized by absence of motor vehicles, since they were not imported. It is recorded that it was in 1907 that the first two motor vehicles were imported to the country .In late 1920's

with the coming to power of Emperor Haile Selassie I road building responsibility was bestowed to the Ministry of Public works and considerable efforts were exerted to develop the system. During this period, a number of motor vehicles were imported which promotes a direct impact on the level of the expansion of network. By 1936, before the second Italian invasion, there was about 2,000 Kms of roads in the country (Gebrehewor, July 1994).

During the Italians occupation (1936-1941), tremendous road construction was undertaken by the Italians for their militaristic and economic purpose. The Italians roads building accomplishment were noteworthy when one considers that much of their work was done in some of the most formidable road building areas in the world. During approximately four years period and without benefit of modern earthmoving equipment, principally utilizing large quantities of forced labour of Ethiopian nationals and some 60,000 imported Italian labors, they built and improved some 6,000 Kms of roads and trails(Gebrehewor, July 1994).

In 1997 E.C Phased road sector development program (RSDP) provided a coordinated framework for intervention along with policy, institutional and regulatory reforms have been launched. It was almost ten years since Ethiopia engaged in a massive road sector development program (RSDP I and II), constructing, upgrading and maintaining a total of 78,569 km of roads with a total cost of 25.4 billion birr. Now the country is engaged in the over ambitious RSDP (Leul K., Petros A., Yulianos K., 2008).

1.3 Statement of the problem

The Ethiopian construction industry suffers from delays and cost overruns, which are indicators of productivity problems. Very little has been done in terms of labor productivity with respect to the road construction industry. In an effort to try and correct this situation this research study carried out assessment of factors affecting labor productivity.

Knowing factors affecting Labor Productivity could be used in improving labor productivity in construction sites and determines the required resources to execute the activities of the projects and required duration which is in conformity with specifications contracted time of the project.

There are many research worldwide had been done on labor productivity, which investigating factors that affect labor productivity. But none of them address the factors that affect labor

productivity in Ethiopian road construction. Even-though the construction industries in every corner of the world have many common features, they are different in features such as methods of construction, perception of labor, management of the construction project, labor culture of work and others.

By understanding the behaviors of construction industry of Ethiopian, investigation of factors that affect labor productivity in road construction of projects is very essential. The researcher is inspired to assess the factors related to Ethiopian contexts and provide practical suggestions and recommendations aiming to upgrade the knowledge in order to improve the labor productivity in road construction projects in Ethiopia, specifically Bale zone.

1.4 Research Questions

1. What are the factors affecting labor productivity in road construction projects?
2. What is their relative importance from the viewpoints of respondents?
3. Which significant factors mostly affecting labor productivity?

1.5 objective of the study

1.5.1 General objective

To assess the factors affecting labor productivity in road construction projects in Bale zone.

1.5.2 Specific objectives

- To identify and discuss various factors affecting labor productivity
- To determine and analyze the Relative Important Index (RII) of factors
- To determine the significance of factors affecting labor productivity

1.6 Significance of the Study

The research study assessed the important factors affecting labor productivity in road construction. Understanding these factors is helpful for the construction professionals who work on the initial phases of construction planning in order to efficiently deliver the project plan. The main goal of the research study is to provide essential information about factors affecting labor productivity to the project management teams who enable the project's success.

The study is helpful for further research studies on construction management on road construction in other areas of Ethiopia. The findings of the study inform the stakeholders about factors affecting labor productivity in road construction in Bale zone. This enlightens the way to solve problems related to poor labor performance and low productivity of labor.

For the Construction Companies this gives guidance and an overview on Labor Productivity in road construction project in building a suitable Labor Productivity Plan with its characteristic and condition.

Likewise for Construction Companies in Ethiopia, this serve as wake-up call about the main factors affecting to the fluctuation of labor productivity in construction project and they can probably manage Labor Productivity more effectively.

1.7 Scope and delimitation of the Study

This study is conducted in some selected road constructions projects found in Oromia Region Bale zone.

The research is concerned with road construction only and did not take into account the other categories of construction industry like heavy engineering construction (tunnels, bridge, dams), industrial projects (factories and workshops), and utilities construction (sewage and water supply).

The Research is focused on labor productivity without including total factors productivity and financial productivity.

This research also includes evaluation of the factors affecting labor productivity and way of improving.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents a review of relevant literature related to factors affecting labor productivity and consists of definitions related to project and project management, definitions of productivity, total productivity and construction productivity. This chapter also states the factors and propose conceptual model for this study.

2.2 Definition related to project and project management

2.2.1 Project

A guide to the Project Management Body of Knowledge (2008, p. 5) has defined a project as “a temporary endeavor undertaken to create a unique product, service, or result. The temporary nature of projects indicates a definite beginning and end. The end is reached when the project’s objectives have been achieved or when the project is terminated because its objectives will not or cannot be met, or when the need for the project no longer exists. Temporary does not necessarily mean short in duration. Temporary does not generally apply to the product, service, or result created by the project; most projects are undertaken to create a lasting outcome”. Lake (1997) defined a project as “a temporary endeavor involving a connected sequence of activities and a range of resources, which is designed to achieve a specific and unique outcome and which operates within time, cost and quality constraints and which is often used to introduce change”.

2.2.2 Project management

Project management has been defined by PMBOK (2008, p.8) as “The application of knowledge, skills, tools and techniques to project activities to meet project requirement” Yuong (2007) defined project management as “a dynamic process that utilizes the appropriate resources in a controlled and structured manner to achieve some clearly defined objectives indentified as strategic needs”.

2.3 Definitions Related To Productivity

2.3.1 Productivity

Prokopenko (1987) defined that “productivity is the relationship between the output generated by a production or service system and the input provided to create this output.

Thus, productivity is defined as the efficient use of resource – labors, capital, land, materials, energy and information in the production of various goods or services. Productivity can also be defined as the relationship between results and the time it takes to accomplish them. Time is often a good denominator since it is a universal measurement and it beyond human control. The less time taken to achieve the desired result is the more productive the system”. Prokopenko also stated that “regardless the type of production, economic or political system, the definition of productivity remains the same. Thus, though productivity may mean different things to different people, the basic concept is always the relationship between the quantity and quality of goods or services produced and the quantity of resources used to produce them”.

Eatwell and Newman (1991) defined productivity as a ratio of some measure of output to some index of input use. Put differently, productivity is nothing more than arithmetic ratio between the amount produced and the amount of any resources used in the course of production. This conception of productivity goes to imply that it can indeed be perceived as the output per unit input.

International Labor Office (as cited in Mostafa, 2003) described productivity as “Productivity is a comparison between how much you have to put in to the projects in terms of manpower, material, machinery or tools and the result you get out of the project. Productivity has to do with the efficiency of production. Making a site more productive means getting more output for less cost in time, Productivity covers every activity that goes into completing the construction site works, from the planning state of the final site clearing, if the contractor can carry out these activities at lower cost in less time with fewer workers or with less equipment the productivity will be improved”.

Overall, productivity could be defined as the ratio of outputs to inputs

Productivity = Outputs / Inputs

Where, outputs could be in units or dollar value of product or service, revenue generated or value added. Input could be in units or dollar value relating to labor, equipment, materials, capital, so it will be very important to specify the inputs and outputs to be measured when calculating productivity.

2.3.2 Labor Productivity

At the national level, labor productivity is computed by taking the entire economically active population as the input and the total value of goods and services produced as the output (Prokopenko, 1987).

National productivity = GNP/Population

It is general knowing that almost all the definitions of productivity centre on ‘outputs’ and ‘inputs’. Unfortunately, definition of either output or input or both may sometimes pose more difficulty to the understanding of what productivity is. For output, it is in the form of goods if visible and services if invisible. Input on the other hand is less easily defined. Since production (creation of goods and services) is a team effort thereby making the demand for inputs to be interdependent, various elements (inputs) are involved in the production of output. This makes the definition of input more complex than that of output. To ease this problem of defining inputs, it is common a practice to classify inputs into labor (human resources), capital (physical and financial assets), and material. Again, in an attempt to circumvent the difficulty of defining inputs, productivity is sometimes defined as goods and services produced by an individual in a given time. In this sense, time becomes the denominator of output with the assumption that capital, energy and other factors are regarded as aids, which make individuals more productive.

Freeman (2008) stated that Labor productivity is equal to the ratio between a volume measure of output (gross domestic product or gross value added) and a measure of input use (the total number of hours worked or total employment).

Labor productivity = volume measure of output / measure of input use

“The volume measure of output reflects the goods and services produced by the workforce. Numerator of the ratio of labor productivity, the volume measure of output is measured either by gross domestic product (GDP) or gross value added (GVA). The measure of input use reflects the time, effort and skills of the workforce. Labor input is measured either by the total number of hours worked of all persons employed or total employment”.

2.3.3 Total Productivity

Total productivity can be described as the overall measure of economic effectiveness on the basis of output per unit of all resource(s) utilized. In the last decade, there has been a definite

move towards its utilization and that is the ratio of total output to the sum of all input factors (Stainer, 1997) as Equation.

$$TP = \frac{O}{L+M+C+E+Q}$$

Where, TP = Total Productivity

O = Total Output

L = Labor Input

M = Material Input

C = Capital Input

E = Energy Input

Q = Other Input

2.3.4 Construction productivity

Productivity in construction is often broadly defined as output per labor hour. Since labor constitutes a large part of the construction cost and the quantity of labor hours in performing a task in construction is more susceptible to the influence of management than are materials or capital, this productivity measure is often referred to as labor productivity. However, it is important to note that labor productivity is a measure of the overall effectiveness of an operating system in utilizing labor, equipment and capital to convert labor efforts into useful output, and is not a measure of the capabilities of labor alone. For example, by investing in a piece of new equipment to perform certain tasks in construction, output may be increased for the same number of labor hours, thus resulting in higher labor productivity (Hendrickson, 1998).

Hendrickson also presented that construction output may be expressed in terms of functional units or constant dollars. In the former case, labor productivity is associated with units of product per labor hour, such as cubic yards of concrete placed per hour or miles of highway paved per hour. In the latter case, labor productivity is identified with value of construction (in constant dollars) per labor hour. The value of construction in this regard is not measured by the benefit of constructed facilities, but by construction cost. Labor productivity measured in this way requires considerable care in interpretation.

2.4 How Does Productivity Relate to the Construction Industry?

Increased productivity in the construction industry can be viewed from two perspectives, the consumer and the contractor. From the consumer's perspective, increased productivity lowers costs, shortens construction schedules, offers more value for the money, and achieves better returns on investments. From the contractor's perspective, increased productivity leads to a more satisfied customer, while also providing a competitive advantage, and in return leading to faster turnover and increased profits (Horner 2001).

2.5 Factors affecting construction productivity

There are numerous events that can cause a loss of labor productivity. Thomas and Zavrski (as cited in Rojas, 2008) had developed a factors model, There are two broad categories related to the work that affect labor productivity. These are work to be done and the environment in with the work is done and it can be viewed as either contributing to or inhibiting this conversion process.

2.6 Different Factors Affecting Labor Productivity

The Following factors that affect labor productivity in construction projects are determined by (Gundecha-September 2012).

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. Working overtime initially result in increased output, but continuing overtime may lead to increased costs and reduced productivity. Time used by a construction laborer on productive activities averages about 30% of the total time available. 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.

Schedule Compression: When there are early delays in a project; compressions of the overall time frame to complete the assigned task on schedule is common. 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 material tools or equipment to support the extra labor's, resulting in difficult for planning and coordinating the task, and unavailability of experienced labors.

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 reduced. Interference among the various crews and laborers is due to mismanagement on construction sites. For example, a steel-fixture 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.

Safety: Accidents have high impacts on labor 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. Small accidents resulting from nails and steel wires can stop work and, thus, decrease productivity. 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.

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.

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.

Manpower Group: Literature shows that a lack of labor experience is the factor which negatively affects labor productivity and proves that, to achieve good productivity, labor 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. Misunderstanding among laborers creates disagreements about responsibilities and the work bounds of each laborer, which leads to a lot of work mistakes and decreases labor productivity. Lack of compensation and increased laborer age negatively affect labor productivity because labor speed, agility, and strength decline over time and reduce productivity.

Motivation: Motivation is one of the important factors affecting construction labor productivity. Motivation can best be accomplished when laborers' 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 Motivation.

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 laborers 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. 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. With non completion 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.

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. Laborers 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.

Project Management Factors: Improper scheduling of work, shortage of critical construction equipment or labor, may result in loss of productivity. Improper planning of project-initiation procedures generally lead to lost labor productivity. Additionally, poor site layout can contribute to a loss of productivity. Laborers have to walk or drive a long way to lunch rooms, rest areas, washrooms, entrances, and exits, affecting overall productivity.

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).

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.

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.

ASIST technical team (Zimbabwe and Kenya) - Productivity Norms for labor-based road construction states the following as factors that affect the labor in construction:

1. Motivation and experience of the workforce
2. Organization of the work
3. Type and condition of tools and equipment provided to the worker
4. Continual monitoring of performance.

Olomolaiye P., Kaming P., Holt G., and Harris F., 1996, state the Factors negatively affecting labor productivity in construction projects, identified and ranked according to their severity. Their results indicated that the main 10 factors negatively affecting labor productivity are: Length of work day; Equipment breakdown; Lack of materials; Lack of proper equipments; Lack of proper tools; Inadequate supervision skill; Material type; Large volume of work; Quality required; and Work complexity.

Length of work day: This could be attributed to the fact that increasing length of work day leads to a lot of problems as fatigue, absenteeism, accidents, and supervision problems which directly lead to productivity loss. Increasing length of work day was mainly due to schedule acceleration and labors most of the time are paid the same wages, which adversely affects morale and positive attitudes of the workers toward the work, that result in loss in productivity. Also, fatigue causes deterioration in morale and positive attitude.

Equipment breakdown: Is the most severe problem between all factors was equipment break down. These breakdowns are mainly due to poor maintenance and lack of regular service.

Lack of proper equipments: This factor has a great negative effect on labor productivity; equipment shortages have a high effect on labor productivity, and ranked in advanced positions of all factors negatively affecting labor productivity. If there is a lack of equipment, productivity will decrease.

Lack of proper tools: The close ranking of this problem and the previous one could have been merged in the same factor from the beginning. Lack of proper tools can be caused by poor maintenance programs leading to frequent breakdown. It has been reported that the main problems regarding tools management, is a careless attitude of workers in handling them and lack of proper maintenance schemes (such as oiling at appropriate intervals and replacing worn parts).

Inadequate supervisors' skills: This could be partly because supervisors do not attend refresher courses. Most of the supervisors are trained but their formal training stops when they leave school.

Material type: Most of the materials used in construction tasks are not easy to handle and to put in place especially in the lack of needed equipments and the absence of the new

technology in most of the construction tasks. Labors spent a lot of the time assigned for the task in handling the materials through the various stages of the project, which result in decreasing the direct work and productivity loss.

Large volume of work: As most of the construction projects suffer delays and always in need of schedule acceleration and this result in large volume of work, and labors don't care about achieving this as long they are being paid.

Quality required: The main cause of this problem is poor communication due to inaccurate instructions and inaccurate drawings.. The most common form of communication is verbal and, moreover, face-to-face. The other reason is that most of the contracting used traditional approach.

The frequency of meetings between contractors, clients, and designers may not be as often as it should and this brings gaps in communication. Another common problem was incomplete drawings prevent a project from being progressed smoothly due to, for example, delays for revision or clarification of drawings and specifications, there is no doubt why this factor has a high effect on productivity.

Work complexity: This problem has a noticed negative effect on labor productivity as it was ranked tenth . The cause of this problem is that of designs that are not easily applicable because designs do not take into account the available resources for construction purposes and inadequate appreciation of construction techniques.

Kazaz et al (2008) determined four factors and it's variables as presented in the following Table

Table 1 Factor affecting on construction workforce productivity

Socio-psychological factors	Organizational Factors
<ul style="list-style-type: none"> • Work discipline • Health and safety conditions • Work satisfaction • Creating competition • Relation with workmates • Giving Responsibility • Sharing problems and their results • Social activity opportunities 	<ul style="list-style-type: none"> • Quality of site management • Material management • Systematic flow of work • Supervision • Site layout • Occupation education and training • Crew size and efficiency • Firm reputation

<ul style="list-style-type: none"> • Cultural differences • Worker participation indecision • making Distance from home • Distance from population centers 	<ul style="list-style-type: none"> • Camping conditions • Relaxation allowances
Economic factor	Physical factors
<ul style="list-style-type: none"> • On-time payment • Amount of pay • Working in social insurance • Incentive payments and financial • Rewards • Discontinuity of work • Union membership 	<ul style="list-style-type: none"> • Working at similar activities • Design complexity • Error tolerance • Weather conditions • Disruptions • Schedule compression • Overtime • Shift • Site congestion

Source: Kazaz et al., (2008)

Casey Jo Kuykendall-2007 list the following 12 Factors Affecting Construction Labor Productivity

Management of Construction Tools: Materials and tool management are a large part of any construction project. In more recent years, construction firms have allocated more focus on retaining small tools, which in the past were perceived as “disposable”. Numerous technological advances have been made that enable tool tracking to be more efficient.

Managing Construction Equipment: The Construction Industry Institute states that material and equipment currently comprise 50-60 % of construction project costs (Materials Management Task Force 2007). In addition, lack of proper materials and equipment is the number one cause of construction delays. Good equipment management begins at the time the equipment is purchased. Purchasing the proper equipment that matches the need of the job, while achieving the lowest costs is necessary to attain suitable equipment management. Proper record keeping provides information for planning maintenance and replacement activities, ensuring that they occur at the proper time. Managing construction equipment includes preventative maintenance, planning maintenance, and replacement activities (O’Brien and Zilly 2007).

Access Issues: Very little information is available on access issues on construction sites. Reiterating what was said in the access issues portion of the survey, site drawings should be available indicating where dense areas of labor are working and indicating their route to and from the site. Alternate plans to cut roads should only be made when other acceptable routes are ready. A common problem on construction sites is poor or disrupted access caused by holes and barricades and time spent finding alternate routes.

Management Skills: Construction management is schedule and plan work and materials to make certain that no one is waiting for materials, labor, or the completion of another task. Proper management of construction projects requires knowledge of modern management techniques.

A study at the Center for Construction Industry Studies at the University of Texas at Austin has revealed that poor management was responsible for over half of the time wasted on a jobsite. A construction project is unable to achieve profitability and success without the presence of good management (Tucker 1999). Good management skills include adopting a performance based management viewpoint. This involves setting priorities for improvements, provide cost efficient and easy to use methods, promote a supportive labor management relationship, and cut costs while increasing profits (Alfred 1988).

Safety Issues: Many benefits as well as losses exist through construction safety management. The construction industry is the leader in injuries and lost work days due to injuries. Thus these injuries are very costly. The more visible benefits of construction safety include cheaper workers' compensation coverage that's comes with a lower experience modification rating, also increased quality, and owner satisfaction.

Quality Control: Alfred (1988) states that there are two measures for construction quality, they are accuracy and workmanship. Some benefits associated with quality control are avoided rework, generation of new work methods, and circumventing long term problems. Following is a list of key quality control checkpoints and quality problem areas that should be addressed within a jobsite quality inspection checklist. The list includes:

- Design requirements
- Completed preceding work segments
- Work done by qualified employees
- Accepted materials used

- Appropriate amount of materials
- Scope of work requirements achieved
- Installation specifications met
- Entire work phase complete
- All quality problems have been fixed

Scheduling: The purpose of scheduling is to organize and allocate the resources of, equipment and labor with the construction project's tasks over a set period of time. Benefits of good scheduling include, avoiding project bottlenecks, allowing for suitable procurement or necessary materials, and overall ensuring that the project is completed as quickly as possible. Poor scheduling can result in unnecessary waste of time caused by delays as laborers wait for materials or equipment to become available or proceeding tasks to be completed (Hendrickson 1998). In order to successfully schedule a project, there must be some methodology to the process. Many scheduling methods exist. For the basis of this study it will be assumed that computer based scheduling is applied. The most common scheduling techniques are the Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT) (Hendrickson 1998). Proper applications of scheduling techniques will help avoid unnecessary delays and in turn reduce cost overruns.

Employee Training/Skills: Employee training benefits are much underestimated. Overall, investing in employee training programs will increase productivity and reduce costs caused by rework and lost time.

Employee Age: Many studies suggest that the "working class" is aging, which is leading to a shortage of young skilled workers. The shortage is caused by the retirement of the baby boom generation and popularity within the younger working class to opt for office oriented jobs. Current solutions to this growing problem include a strengthening and modernization of the nation's vocational school system.

Temperature/Humidity: Weather is to some extent unpredictable. When not scheduled adequately, weather can cause delays due to forced changes in the schedule as well as damages causing rework. Productivity decreases in poor weather conditions for many reasons. Some construction processes are affected poorly by suboptimal weather conditions. Hot weather, in particular, has both a physiological and psychological effect on workers. Psychologically workers tend to become restless and irritable. Physiologically they can acquire heat cramps, heat stroke, heat exhaustion, etc. The four factors in a hot environment

that cause the increased stress include: Humidity, Air Movement, Air Temperature and Heat Radiation (Schwarzkopf 1995).

The most effective solution to curb the effect of inclement weather is planning with a consideration for seasonal conditions. Forecast bad weather and plan weather sensitive activities accordingly. In addition, build some amount of flexibility into the work schedule to allow for weather delays.

Employee Motivation: Motivation is defined by Cooper (2004) as “the process that directs your people’s work energy. It is the drive behind your own and your people’s wish to satisfy ‘workplace’ wants and needs.” Most successful leaders consider motivational factors such as praise, recognition, and self-esteem. People’s behavior is affected by motivation, which in turn results in a committed energy throughout the workplace. Some guidelines for increasing motivation within the workplace include: Provide a safe work environment, Recognize good behavior, Show appreciation, Set attainable goals, Develop a fair pay system and Provide adequate training programs (Cooper 2004).

Communication: Good communication is necessary to efficiently complete a project. Lack of sufficient communication can lead to lack of worker motivation. Lack of communication can cause delays due to mistakes causing rework, lack of information causing downtime, and misinterpretation. Although endless options for communication are available, technical problems do exist. Other common problems associated with communication on construction projects include understanding the chain of command and continuously communicating about the project and foreseeing potential problems in the future. This can be avoided by holding regular project management team meetings (Cingoranelli 2007).

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The main methodologies obtained from literature review were: questionnaire survey, interviewing, case studies and modeling. The following topics show summary of the main studies related to performance and their methodologies.

3.2 Research Area

This research presents the factors affecting the productivity of labor in road construction projects in the Oromia region Bale Zone. Bale zone is located in Oromia region in south east and 450 km from capital Addis Ababa. According to a *May 24, 2004 World Bank memorandum*, 11% of the inhabitants of Bale have access to electricity; this zone has a road density of 11.4 kilometers per 1,000 square kilometers (compared to the national average of 30 kilometers). Even though the road coverage of the zone is very little in past, now a day's there is great progress.



Source (Bale Zone Districts Socio Economic Profile, 2001 E.C)

Figure 1 Map of research area- Oromia region Bale Zone

3.3 Research design

One of the principal purposes of the design is to help avoid the situation in which the collected data does not address the initial research questions (Robson, 1993, cited in El Sawalhi, 2002). Site interview and structured questionnaire had been used in this research. Research sequence and summary of methodology used in this research can be presented simply by the following Figure 3.

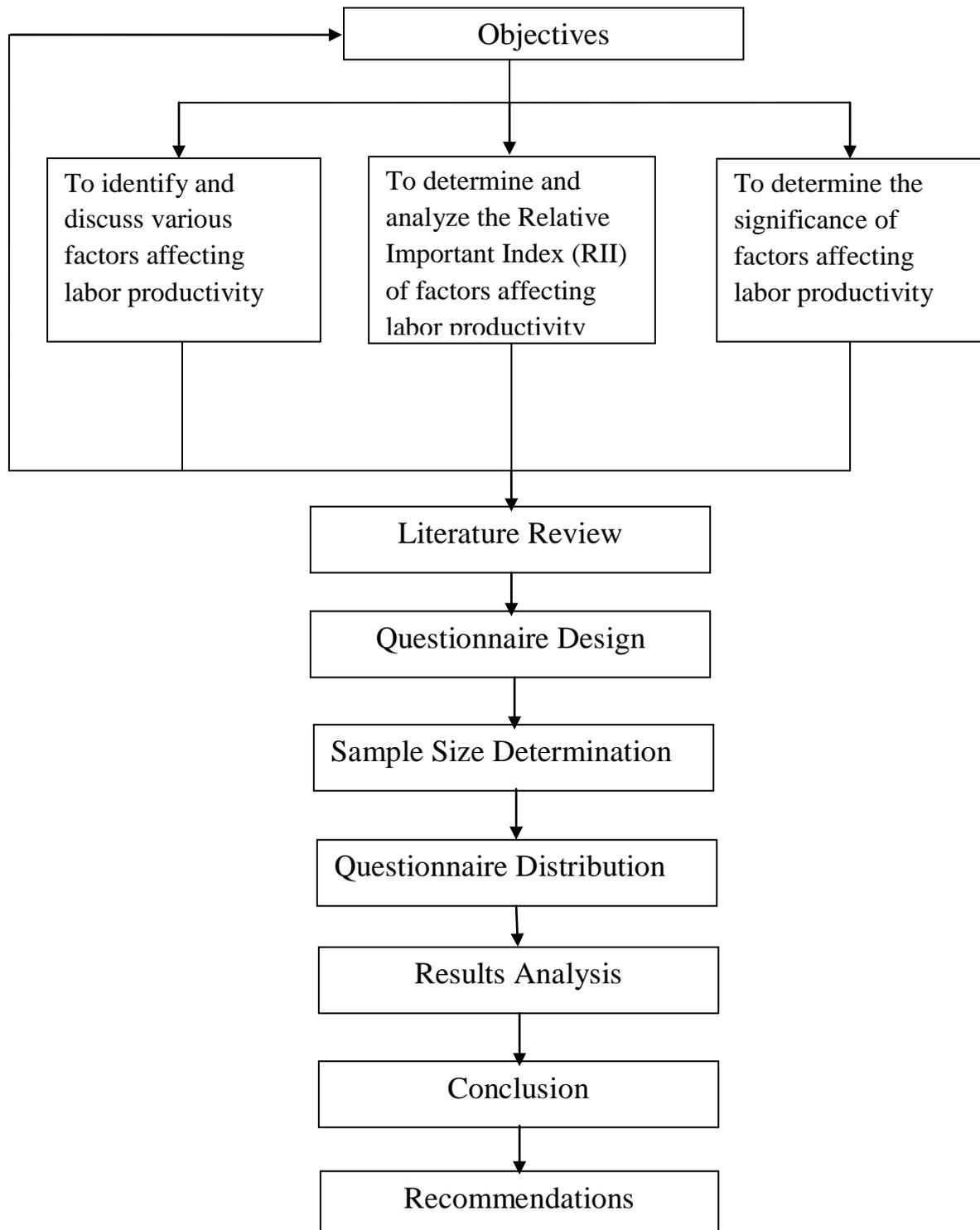


Figure 2 Summary of methodology used in this research

3.4 Study variables

Dependent variables of the study is labor productivity which depend on the identified 61 factors that affect labor productivity, while independent variables of the study are 61 factors which are listed and discussed in the following section 3.5.

3.5 Factors affecting labor productivity in road construction projects

Based on the literatures review, site visits, on site interview and other factors were added as recommended by local experts, 61 factors are selected and grouped to 11 groups according to their characteristics, namely: Workforce, management team, motivation, schedule compression, material and equipment, supervision, safety and. These groups can give a comprehensive summary. The factors and independent variables of the study which are considered in this study are summarized as shown in the below Table.2

Table 2 Summary of factors affecting labor productivity in road construction projects and independent variables of the study

1. Manpower/Work Force Factor	2. Management Team Factor
<ol style="list-style-type: none"> 1. Lack of experience. 2. Disloyalty. 3. Misunderstanding among laborers. 4. Alcoholism. 5. Lack of labour skills 6. Increase of laborer age 7. Labour absenteeism 8. Labour personal problem 9. Ability to adapt changes and new environments 10. Worker's integrity 	<ol style="list-style-type: none"> 1. Poor site management 2. Poor communication 3. Lack of periodic meeting with labors 4. Improper planning and scheduling of work 5. Crew size and composition 6. Construction managers lack of Leadership 7. Change orders 8. Disputes
3. Motivation Factor	4. Schedule Compression Factor
<ol style="list-style-type: none"> 1. Payment delay 2. Non provision of transport means 3. Lack of Incentive payments and financial Rewards 4. Lack of places for eating and relaxation 5. lack of training sessions 6. Relaxation allowances 7. Amount of payment 8. Discontinuity of work 	<ol style="list-style-type: none"> 1. Working 7 days per week without rest 2. Overcrowding 3. Misuse of time schedule 4. Length of work day 5. working overtime

5. Material/Equipment Factor	6. Supervision Factor
<ol style="list-style-type: none"> 1. Material shortage 2. Old and inefficient equipment 3. Tools and equipment shortage 4. Unsuitable material storage location 	<ol style="list-style-type: none"> 1. Misunderstanding between labour and supervisor 2. Inadequate supervisors' skills 3. Lack of labor surveillance 4. Inspection delays 5. Lack of Clear and daily task assignment 6. Insufficient supervision of subcontractors 7. Improper coordination of subcontractors 8. Delay in responding to requests for information
7. Safety factor	8. Natural/environmental Factors
<ol style="list-style-type: none"> 1. Ignore safety precautions 2. Absence of insurance for Accident 3. Accident 4. Absence of safety protective Wear 5. Working at high places 6. Insufficient lighting 	<ol style="list-style-type: none"> 1. Climate and Weather conditions 2. Project location 3. Project site Distance from town
9. Cultural and religious factor	10. Quality
<ol style="list-style-type: none"> 1. Cultural differences among labors 2. Working on holiday 3. Difference of language among labors 	<ol style="list-style-type: none"> 1. high/low quality of required works 2. Quality inspection delay 3. Rework 4. Low quality raw materials
11. Political factor	
<ol style="list-style-type: none"> 1. Labor Law and policies 2. Security of project site 	

The following figure illustrated the conceptual model of all group of factors affecting labor productivity in road construction projects.

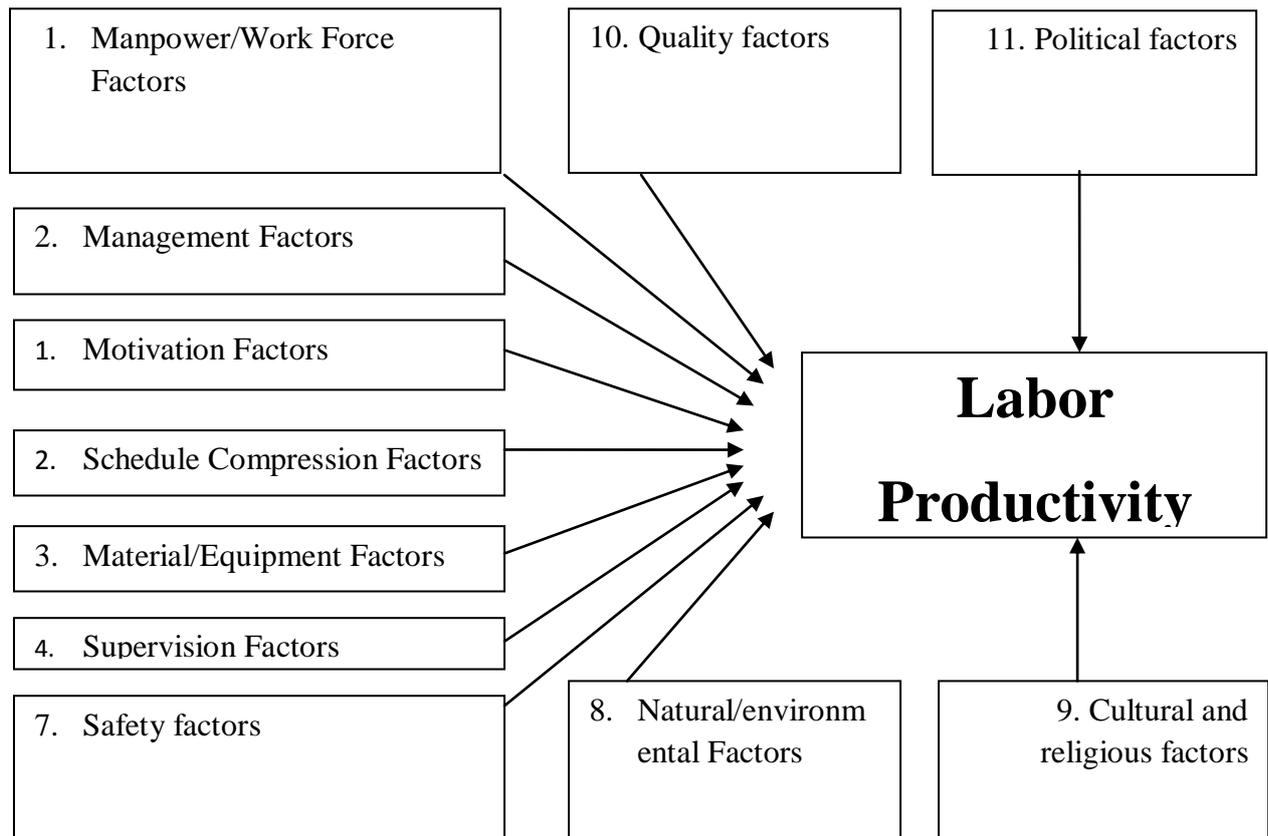


Figure 3 Conceptual model and summary of group of factors that affect labor productivity in road construction projects.

A structured questionnaire survey approach were considered to study the impact of various attributes and factors affecting labor productivity in road construction projects in Oromia region Bale Zone.

The respondents were required to give a scale rate for each factor depending on their experience in road construction projects regarding the factors affecting labor productivity.

The relative importance index method (RII) is used here to determine labor perceptions of the relative importance of factors affecting labor productivity in road construction projects in Oromia region Bale Zone.

Statistical test were done using SPSS soft ware to check the correlation and reliability of the data. The significance of factors affecting labor productivity is determined by using hypothesis test and two tailed test.

3.6 Questionnaire Distribution

The target groups in this study were workers in road construction projects in Oromia region Bale Zone. 9 road projects were selected to consider in this research. The road projects are similar to each other in terms of type road under construction, human resource they have, budget of the project and the other. Since the size is less than 30, there is no need to determine sample size. The sample size of research is 9 road projects found in Oromia region bale zone.

Totally 90 Questionnaires were distributed for 9 road construction projects and 10 questionnaire were distributed for each selected road construction projects in Oromia region Bale Zone.

3.7 Data Measurement

In this research, ordinal scales were used. Ordinal scale as shown in table 3 is a ranking or a rating data that normally uses integers in ascending or descending order.

Table 3 Ordinal scale used for data measurement

Item	Very high	High	Medium	Low	Very low
	Important	Important	Important	Important	Important
Scale	5	4	3	2	1

The relative importance index method (RII) is used here to determine different road projects perceptions of the respondent about the factors affecting labor productivity in road construction projects in Bale zone. The relative importance index is computed as (Cheung et al, 2004).

$$RII = \frac{\sum W}{A \times N}$$

Where:

W is the weight given to each factor by the respondents and ranges from 1 to 5

A = the highest weight = 5

N = the total number of respondents

$$W = \sum [(f_1 \times n_1) + (f_2 \times n_2) + (f_3 \times n_3) + \dots + (f_n \times n_n)]$$

Where f_n = score ranking n_n = corresponding number of responses

3.8 Statistical test of data

3.8.1 Reliability statistics

This section presents test of reliability of questionnaire according to the study. The reliability of an instrument is the degree of consistency which measures the attribute; it is supposed to be measuring (Polit & Hunger, 1985). The less variation an instrument produces in repeated measurements of an attribute, the higher its reliability. Reliability can be equated with the stability, consistency, or dependability of a measuring tool. The test is repeated to the same sample of people on two occasions and then compares the scores obtained by computing a reliability coefficient (Polit & Hunger, 1985).

Chronbach's coefficient alpha (George and Mallery, 2003) is designed as a measure of internal consistency, that is, do all items within the instrument measure the same thing? Chronbach's alpha is used here to measure the reliability of the questionnaire between each field. The normal range of Chronbach's coefficient alpha value between 0.0 and + 1.0. The closer the Alpha is to 1, the greater the internal consistency of items in the instrument being assumed. The formula that determines alpha is fairly simple and makes use of the items (variables), k , in the scale and the average of the inter-item correlations.

$$\alpha = \frac{k r}{1 + (k - 1) r}$$

As the number of items (variables) in the scale (k) increases the value becomes large. Also, if the inter correlation between items is large, the corresponding will also be large. Since the alpha value is inflated by a large number of variables then there is no set interpretation as to what is an acceptable alpha value. A rule of thumb that applies to most situations is:

0.9	Up to 1.0	Excellent
0.8	Up to 0.9	Good
0.7	Up to 0.8	Acceptable
0.6	Up to 0.7	Questionable
0.5	Up to 0.6	Poor
0.0	Up to 0.5	Unacceptable

3.9 Statistical test of data based on projects

Table 4 Reliability statistics of data based on projects

Chronbach's Alpha	Chronbach's Alpha Based on Standardized Items	N of Items
0.979	0.981	9

Table 5 Item statistics of data based on projects

	Mean	Std. Deviation	N
Project 1	26.3115	5.46364	61
Project 2	34.6557	6.47530	61
Project 3	30.6557	6.21258	61
Project 4	31.1967	6.03551	61
Project 5	35.3607	6.57022	61
Project 6	27.8525	5.76725	61
Project 7	35.6557	6.38458	61
Project 8	31.6885	6.17128	61
Project 9	35.1967	7.36845	61

The above table shows the average response of respondents in each projects and standard deviation of responses from the average.

Table 6 Inter –Item correlation matrix of data based on projects

	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9
P 1	1.000	0.829	0.907	0.858	0.856	0.881	0.868	0.874	0.874
P 2	0.829	1.000	0.838	0.839	0.798	0.868	0.812	0.809	0.818
P 3	0.907	0.838	1.000	0.867	0.808	0.883	0.876	0.857	0.882
P 4	0.858	0.839	0.867	1.000	0.859	0.883	0.882	0.846	0.849

P 5	0.856	0.798	0.808	0.859	1.000	0.814	0.816	0.822	0.788
P 6	0.881	0.868	0.883	0.883	0.814	1.000	0.860	0.881	0.895
P 7	0.868	0.812	0.876	0.882	0.816	0.860	1.000	0.840	0.795
P 8	0.874	0.809	0.857	0.846	0.822	0.881	0.840	1.000	0.843
P 9	0.874	0.818	0.882	0.849	0.788	0.895	0.795	0.843	1.000

The above table shows the correlation between the respondents of different nine projects. As shown in the above table 6 the correlation between respondents of different nine projects ranges from 0.788 to 0.907, which means it falls in acceptable to excellent correlation region. Most of them fall in good correlation region (0.8-0.9) and some of them fall in excellent and acceptable correlation region.

Table 7 Summary item statistics of data based on projects

	Mean	Min	Max	Range	Max/ Min	Variance	N of Items
Item Means	32.064	26.311	35.65	9.344	1.355	11.751	9
Item Variances	39.597	29.851	54.29	24.44	1.819	48.001	9
Inter-Item Covariance's	33.310	27.747	40.38	12.63	1.456	9.443	9
Inter-Item Correlations	0.849	0.788	0.907	0.119	1.151	0.001	9

The average relative importance index of the factors is 0.712, which shows on average all factors have strong effect labor productivity.

Table 8 Item-Total Statistics of data based on projects

Scale Mean if Item	Scale Variance if	Corrected Item-Total	Squared Multiple	Chronbach's Alpha if Item
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	Deleted	Item Deleted	Correlation	Correlation	Deleted
Project 1	262.2623	2241.197	0.935	0.889	0.976
Project 2	253.9180	2178.443	0.884	0.794	0.978
Project 3	257.9180	2176.877	0.930	0.884	0.976
Project 4	257.3770	2195.172	0.925	0.871	0.976
Project 5	253.2131	2175.004	0.876	0.801	0.978
Project 6	260.7213	2212.638	0.938	0.894	0.976
Project 7	252.9180	2176.010	0.903	0.850	0.977
Project 8	256.8852	2192.103	0.908	0.833	0.977
Project 9	253.3770	2091.939	0.903	0.857	0.978

Based on table 8 Chronbach's Alpha value data based on projects range from 0.9 to 1 which shows the data is highly reliable and valid. The correlation between factors is fall in the range of 0.9 to 1.

Table 9 Intra-class Correlation Coefficient of data based on projects

	Intra-class Correlation ^b	95% Confidence Interval		F Test with True Value			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	0.841 ^a	0.787	0.889	48.685	60	480	0.000
Average Measures	0.979 ^c	0.971	0.986	48.685	60	480	0.000

With the Confidence Interval 95% the upper bound and lower bound of Intra-class Correlation Coefficient of data based on projects is on single and average measures are shown in above table 9.

3.10 Statistical test of data based on stratified respondents

Table 10 Reliability statistics of data based on stratified respondents

Chronbach's Alpha	Chronbach's Alpha Based on Standardized Items	N of Items
0.928	0.981	4

Based on the above table 10 the Reliability of data based on stratified respondents is measured by Chronbach's Alpha value (0.928), which shows that the data is reliable and valid.

Table 11 Inter –Item correlation matrix of data based on stratified respondents

	Engineers	Skilled Labors	Supervisors	Managers
Engineers	1.000	0.991	0.930	0.906
Skilled Labors	0.991	1.000	0.933	0.897
Supervisors	0.930	0.933	1.000	0.916
Managers	0.906	0.897	0.916	1.000

The above table shows the correlation between the stratified respondents. As shown in the above table 11 the correlation between stratified respondents ranges from 0.897 to 0.991, which means it fall in acceptable to excellent correlation region. Most of them fall in excellent correlation (0.9- 1) and some fall in very good correlation region.

Table 12 Summary item statistics of data based on stratified respondents

	Mean	Min	Max	Range	Max/Min	Variance	N of Items
Item Means	71.95	27.279	107.83	80.55	3.953	1249.33	4
Item Variances	206.1	30.238	389.73	358.93	12.87	25578.5	4
Inter-Item	157.4	56.232	327.99	271.76	5.833	9262.82	4

Covariance's							
Inter-Item	0.929	0.897	0.991	0.094	1.105	0.001	4
Correlations							

The average relative importance index of the factors is 0.70, which shows on average all factors have strong effect labor productivity.

Table 13 Intra-class Correlation Coefficient of data based on Stratified respondents

	Intra-class Correlation ^b	95% Confidence Interval			F Test with True Value		
		Lower Bound	Upper Bound	Value	df1	df2	Sig
		Single Measures	0.763 ^a	0.676	0.837	13.886	60
Average Measures	0.928 ^c	0.893	0.954	13.886	60	180	0.000

With the Confidence Interval 95% the upper bound and lower bound of Intra-class Correlation Coefficient of data based on projects is on single and average measures are shown in above table 13.

3.11 Identification of Significant and Non Significant Factors

A study was used to collect observations about areas of interest, and statistical analysis was performed. The approach used for this study was the Large-Sample Test of Hypothesis used for population proportion, which is a two-tailed test. Population proportions (or percentages) are often made in the context of the probability, p , of success for a binomial distribution (Mc Clav, 2006).

3.12 Significance Test

The test is formulated as $H_0: p = p_0$ $H_a: p \neq p_0$, (Mc Clav, 2006).

Where, p = population proportion

P_0 = null-hypothesized proportion

3.12.1 Test statistic

$$Z = \frac{\text{Sample proportion} - \text{Null hypothesized proportion}}{\text{Standard deviation of sample proportion}}$$

For degree of freedom $n-1 = 60$ Rejection is regions when $H_a: p \neq p_0$. Reject H_0 if T is greater than $z_{.05} = 1.96$ or less than -1.96 .

For test value between -1.96 to 1.96 do not reject hypothesis since there is no enough evidence, so it is non-significant factor affecting labor productivity.

For test value greater than 1.96 and greater than -1.96 reject hypothesis since more than 50% suggest significant factor affecting labor productivity.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

The questionnaires are designed to collect data regarding the major factors affecting labor productivity in road construction projects in Bale Zone and analyzed in following section.

4.2 Response rate

A total of 83 were received and valid from 90 respondents solicited as shown in the table 14 below.

Table 14 Response rate

Projects	Distributed Questionnaires	Collected Questionnaires	Rate of Return (%)
Project 1	10	8	80
Project 2	10	10	100
Project 3	10	9	90
Project 4	10	9	90
Project 5	10	10	100
Project 6	10	8	80
Project 7	10	10	100
Project 8	10	9	90
Project 9	10	10	100
Total	90	83	92.22

Totally about 90 Questionnaire was distributed for 9 road construction projects in Bale Zone. For each projects 10 Questionnaire was distributed These respondents were projects managers, construction manager, resident engineer, site engineers, office engineer, Foreman, and construction supervisor, as they have a practical experience in road construction

projects. Their sufficient experiences are a suitable indication to find out the perceptiveness of the relative importance factors affecting labor productivity in road construction projects.

4.3 General Information

4.3.1 Grade of contractors

Among the construction organizations that responded to questionnaire; 6 of them are 1st grade GC contractor and two of them are 2nd grade GC contractor and one is grade 3rd GC.

4.3.2 Typical Size of Projects

The size of the projects in Oromia region bale zone region undertaken by the respondents' companies is shown in Table 15.

Table 15 Typical Size of Projects

Typical Size of Project	No. of Projects
5-10 Millions	2
10-100 Millions	5
> 100 Millions	2

4.3.3. Composition of Respondents

The respondents are composed of Project manager, Resident engineer (client's supervisor), Construction supervisor, engineer (Office and site), Construction manager, mason, foreman, superintendents and other. About 17% are managers at different level and 57% are engineers. About 26% of respondents are composed of (mason, foreman, superintendant and others).

The respondents were contacted since they are practitioners in the road construction industry and have adequate knowledge on the issues being ascertained. This shows that the questionnaires were filled by professionals in the road construction industry thereby ensuring the credibility and reliability of the findings.

3.3.4 Years of experience of the respondents

Table 16 Experience of the respondent

Respondent	Years of experience
Project manager	5-10
Engineer	1-5
Construction supervisor	2-5
Other	5-10

Based on the above Table 16 it indicate 11% of the respondents have between 1 to 5 years of experience in the road construction industry, while 51% have between 2 to 5 years and 38% have worked in the industry for more than 5 years. This indicates that the respondents have enough insight in the subject area being researched and therefore proffer responses well enough to warrant adequate conclusion on the findings.

4.3.5 Level of education of respondents

About 69% of respondents have bachelor degree and master's degree in level of education and 31 % of respondents acquire college training. This indicate that the respondent have enough education to assure the questionnaire and to provide their feedbacks regarding the factors that affect labor productivity in road construction projects.

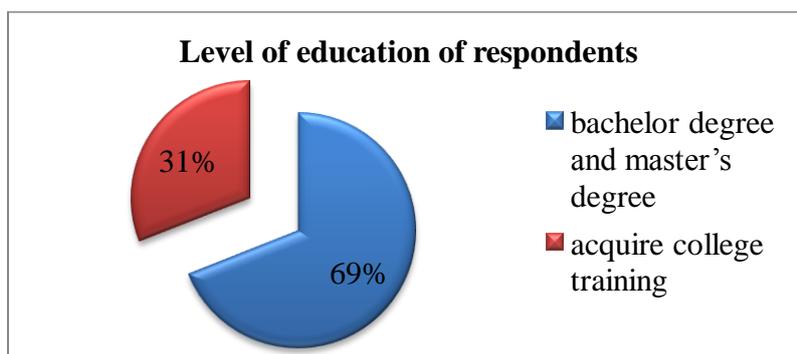


Figure 4 level of education of Respondent to Questionnaire

4.4 Factors Affecting Labor Productivity in Road Construction Projects

The results of this study provide an indication of the Relative Importance Index and Rank of Factors Affecting Labor Productivity in Road Construction Projects in Bale Zone. Table 17 below shows the summary ranking and Relative Importance Index of all factors.

Table 17 Summary of Relative Importance Index (RII) and rank of factors Labor Productivity

Factors	Ordinal scale					Total	RII	Rank
	5	4	3	2	1			
1) Manpower/Work Force Factor								
F1. Lack of experience.	250	116	9	2	0	377	0.908	1
F2. Labor Disloyalty.	175	40	45	26	10	296	0.713	23
F3. Misunderstanding among laborers.	180	84	30	24	4	322	0.776	20
F4. Labor's bad habit	230	120	15	2	1	368	0.887	6
F5. Lack of labour skills	240	108	21	2	0	371	0.894	3
F6. Increase of laborer age	85	60	39	32	22	238	0.574	50
F7. Labour absenteeism	200	116	36	4	0	356	0.858	12
F8. Labour personal problem	130	72	42	30	10	284	0.684	25
F9. Ability to adapt changes and new environments	120	56	51	22	17	266	0.641	33
F10. Worker's integrity	170	40	48	22	12	292	0.704	24
2) Management Factor								
F11. Poor site management	245	108	6	2	4	365	0.88	7
F12. Poor communication and coordination between construction parties	160	112	30	24	1	327	0.788	19
F13. Lack of periodic meeting with labors	100	64	42	18	24	248	0.598	45
F14. Improper planning and scheduling of work	190	128	15	16	0	349	0.841	16
F15. Crew size and composition	195	128	27	2	2	354	0.853	14

F16.	Construction managers lack of Leadership	90	76	60	20	16	262	0.631	37
F17.	Change orders	105	76	45	32	12	270	0.651	31
F18.	Disputes	100	80	51	30	11	272	0.655	30
3) Motivation Factor									
F19.	Payment delay	215	112	36	0	0	363	0.875	9
F20.	Non provision of transport means	180	128	30	10	0	348	0.839	17
F21.	Lack of Incentive payments and financial Rewards	140	80	27	16	18	281	0.678	26
F22.	Lack of place for eating and relaxation	80	32	45	32	28	217	0.523	60
F23.	lack of training sessions	90	36	45	36	23	231	0.556	54
F24.	Relaxation allowances	80	36	60	32	22	230	0.553	55
F25.	Amount of payment	200	116	36	4	0	356	0.858	12
F26.	Discontinuity of work	85	52	40	44	18	239	0.575	49
4) Schedule Factor									
F27.	Working 7 days per week without rest	85	64	57	32	15	253	0.61	41
F28.	Overcrowding	95	60	60	30	14	259	0.625	38
F29.	Misuse of time schedule	85	60	42	40	17	244	0.588	47
F30.	Length of work day	85	60	54	40	13	252	0.607	42
F31.	working overtime	130	72	30	36	11	279	0.672	27
5) Material/Equipment Factor									
F32.	Material shortage	245	120	9	2	0	376	0.906	2
F33.	Old and inefficient equipment	165	128	30	16	0	339	0.817	18

F34.	Tools and equipment shortage	240	120	6	0	3	369	0.889	5
F35.	distance of materials storage location	115	76	45	26	13	275	0.663	29
6) Supervision Factor									
F36.	Misunderstanding between labour and supervisor	110	76	48	32	10	276	0.665	28
F37.	Inadequate supervisors' skills	95	68	39	20	24	246	0.593	46
F38.	Supervision delays	190	124	30	6	1	351	0.846	15
F39.	Lack of Labor surveillance.	230	124	6	0	4	364	0.877	8
F40.	Lack of Clarity of daily task assignment	145	72	48	30	5	300	0.723	22
F41.	Insufficient supervision of subcontractors	115	72	48	6	23	264	0.636	35
F42.	Improper coordination of subcontractors	95	68	51	24	18	256	0.617	40
F43.	Delay in responding a requests for information	105	64	60	20	16	265	0.639	34
7) Safety factor									
F44.	Ignore safety precautions	225	116	6	12	1	360	0.867	10
F45.	Absence of insurance for Accident	85	40	51	38	20	234	0.564	53
F46.	Accident in project site	240	116	9	4	1	370	0.892	4
F47.	Absence of protective safety gear	115	56	30	42	15	258	0.622	39
F48.	Working at high places	75	76	60	46	6	263	0.634	36
F49.	Insufficient lighting	105	44	24	40	23	236	0.569	51
8) Natural/environmental Factor									

F50.	Climate and Weather conditions	75	76	48	36	15	250	0.602	43
F51.	Project location	110	48	36	22	26	242	0.583	48
F52.	Project site Distance from town	65	32	54	36	26	213	0.514	61
9) Cultural and religious factor									
F53.	Cultural differences among laborers	75	44	45	34	25	222	0.536	59
F54.	Working on holiday	85	34	45	34	26	224	0.539	58
F55.	Difference of language among laborers	95	32	33	46	22	228	0.549	56
10) Quality									
F56.	Low quality raw materials	80	80	42	28	19	249	0.6	44
F57.	quality of required works	215	100	36	6	0	357	0.86	11
F58.	Rework	215	108	27	2	3	355	0.855	13
F59.	Quality inspection delay	85	38	54	38	20	235	0.566	52
11) Political factor									
F60.	Labor Law and taxation policies	85	34	45	38	23	225	0.543	57
F61.	Security of project site	155	80	39	38	0	312	0.752	21

Based on the above table 17, the top five factors that highly affect labor productivity is lack of labor experience 1st (RII= 0.908), construction material shortage 2nd (RII=0.906), lack of labor skill 3rd (RII=0.894), Accident on project site 4th (RII=0.892) and tools and equipment shortage 5th (RII= 0.889).

4.4.1 Relative importance index and rank of group of factors

Table 18 relative importance index (RII) and rank of major groups affecting labor productivity

Group of factors	Total	RII	Rank
1) Manpower/Work Force Factor	3170	0.764	2 nd
2) Management Factor	2447	0.737	3 rd
3) Motivation Factor	2265	0.682	7 th
4) Schedule Factor	1287	0.647	8 th
5) Material/Equipment Factor	1359	0.819	1 st
6) Supervision Factor	2322	0.699	5 th
7) Safety factor	1721	0.691	6 th
8) Natural/environmental Factor	705	0.566	10 th
9) Cultural and religious factor	674	0.541	11 th
10) Quality factors	1196	0.720	4 th
11) Political factor	537	0.620	9 th

Based on in the above table 18 Material/Equipment Factor has ranked 1st from 11 groups of factors with RII 0.819 which shows that Material/Equipment is the most dominant factor that affects labor productivity in road construction. Manpower/Work Force Factor rank 2nd place with RII of 0.764 and while Management Factor is in the 3rd place with RII of 0.737. Quality factors are rank 4th with RII of 0.720. The group of factors that ranked on the 5th place is Supervision Factor with RII of 0.699 followed by Safety factor on the 7th place with RII of 0.682. Political factor is ranked on the 8th place with RII of 0.647 and Schedule Factor on the 9th place with RII of 0.620. Natural/environmental Factor and Cultural and religious factor ranked 10th and 11th with RII of 0.566 and 0.541 respectively.

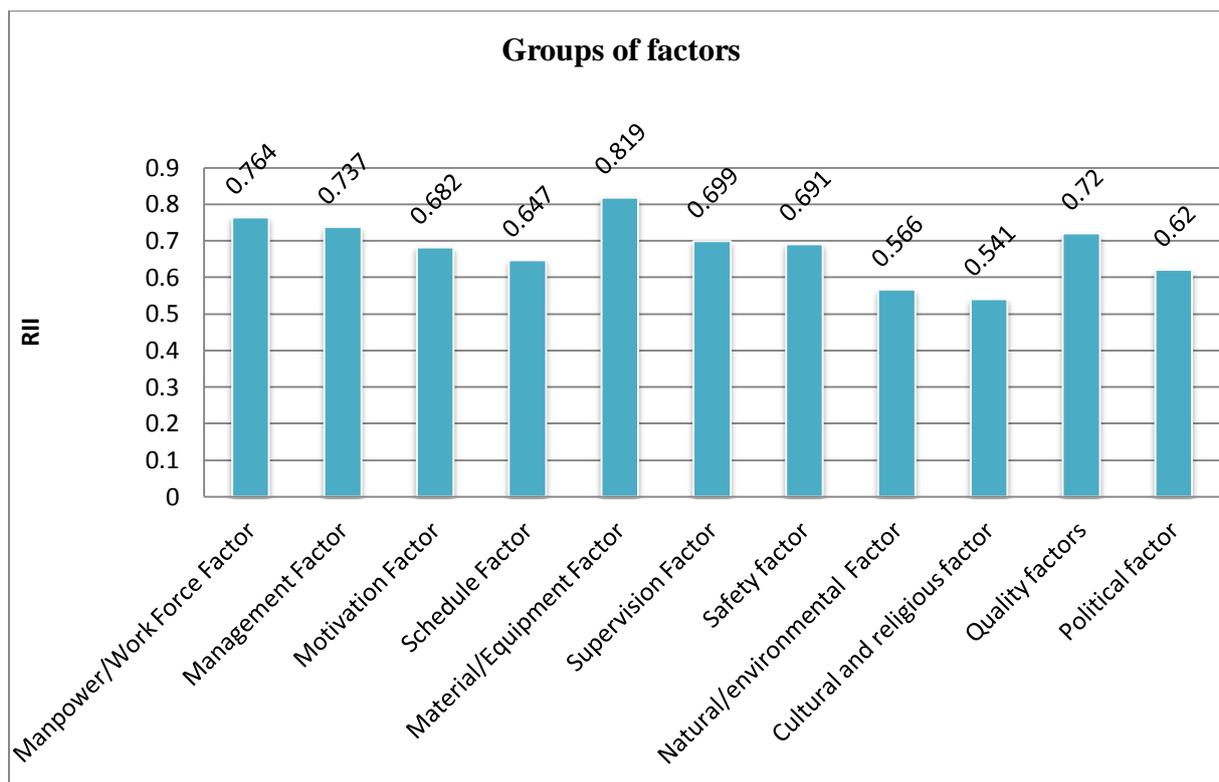


Figure 5 Rank and RII of group of factors affecting labor productivity

4.4.2 Manpower/Work Force Factors

Under Manpower/Work Force Factor there are 10 sub factors are listed and each of them are ranked according to their RII in their group and as a whole. Manpower/Work Force Factor has been ranked second from 11 groups of factors that affect labor productivity with relative importance index of 0.819 which indicates that the factors listed under this group are highly affect the productivity of labor in road construction projects. The relative importance index (RII) and rank of Manpower/Work Force factors are summarized in Table 19.

Table 19 RII and rank of Manpower/Work Force factors

1. Manpower/Work Force factors	Total	RII	Total rank	Rank in group
F1. Lack of experience.	377	0.908	1 st	1 st
F2. Labor Disloyalty.	296	0.713	23 rd	6 th
F3. Misunderstanding among laborers.	322	0.776	20 th	5 th
F4. Labor's bad habit	368	0.887	6 th	3 rd

F5. Lack of labour skills	371	0.894	3 rd	2 nd
F6. Increase of laborer age	238	0.574	50 th	10 th
F7. Labour absenteeism	356	0.858	12 th	4 th
F8. Labour personal problem	284	0.684		
			25 th	8 th
F9. Ability to adapt changes and new environments	266	0.641		
			33 rd	9 th
F10. Worker's integrity	292	0.704	24 th	7 th

The following graph 6 shows the relative importance index (RII) and rank of manpower/work force factor.

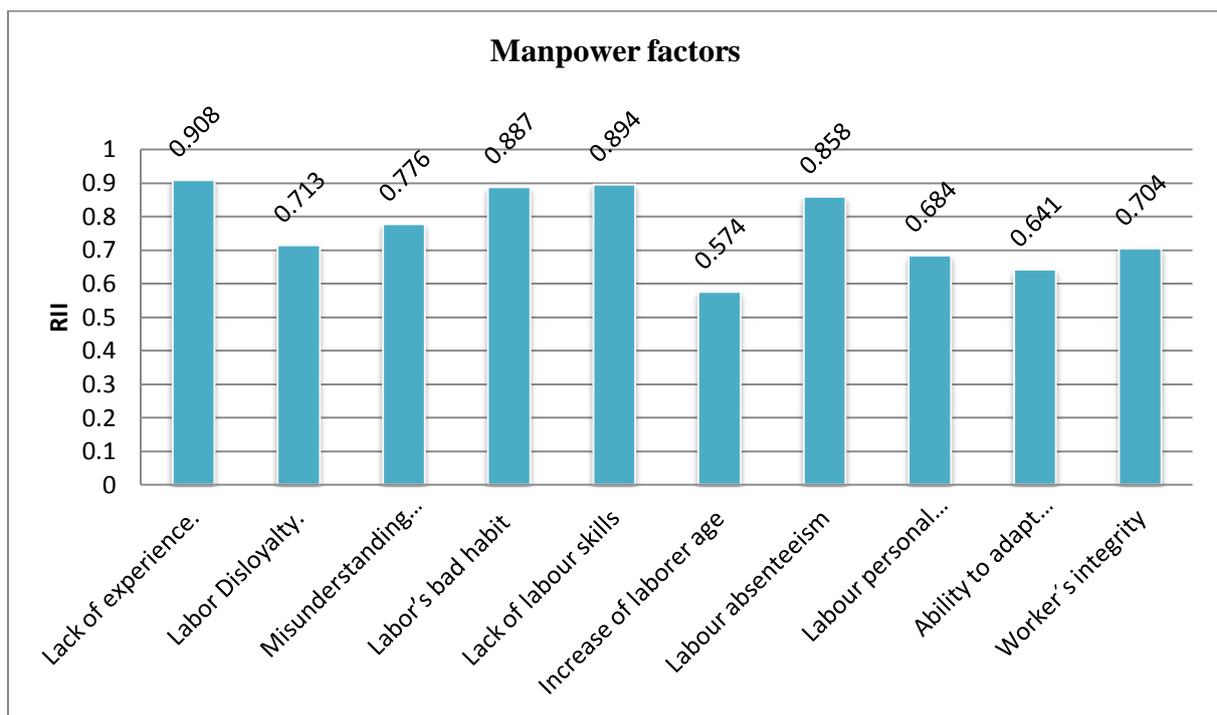


Figure 6 Relative importance index and rank of manpower/workforce factor

From manpower/work force group Lack of experience is ranked in the 1st place with RII of 0.908 and also ranked on 1st place from all factors with RII 0.908. This shows that experienced labors have high productivity and improving the experience of labor this should be the major target for contractors to finish the work within proposed budget and time. Lack of labour skills is ranked 2nd from this group but ranked on 3rd from overall factors. Labor's

bad habit is among most significant factors affecting labor productivity ranked 3rd from its group and ranked 6th. Labour absenteeism, Misunderstanding among laborers and Labor Disloyalty ranked 4th, 5th, and 6th from their group and 12th, 20th and 23th from overall factors respectively. The factor ranked on the 7th place is Worker’s integrity, even though it’s ranked 24 from overall factors. Labour personal problem, Ability to adapt changes and new environments and Increase of laborer age ranked from 8th to 10th respectively from their group with RII of 0.684, 0.641, 0.574 respectively and ranked 25th, 33th and 50th from the overall list of factors.

4.4.3 Management factors

Management factors group have 8 sub factors which ranked according to their relative importance index (RII) value. The study identified the core factors that affect Labor Productivity, under management factors including: Poor site management, Poor communication and coordination between construction parties, Lack of periodic meeting with labors, Improper planning and scheduling of work, Crew size and composition, Construction managers lack of Leadership, Change order and Disputes. This group of factor ranked on 3rd with RII of 0.737 from 11 major groups of factors. Any management problems reduce the output of labor. The labors should follow the instructions of managers, if the managers are weak to lead and manage the all works, the labors productivity decrease. The relative importance index (RII) value and rank in group and overall rank management factors are summarized in the below table 20.

Table 20 Summary of relative importance index and rank of management factors

2) management factors		Total	RII	Overall rank	Rank in group
F11.	Poor site management	365	0.88	7 th	1 st
F12.	Poor communication and coordination between construction parties	327	0.788	19 th	4 th
F13.	Lack of periodic meeting with labors	248	0.598	45 th	8 th
F14.	Improper planning and scheduling of work	349	0.841	16 th	3 rd

F15.	Crew size and composition	354	0.853	14 th	2 nd
F16.	Construction managers lack of Leadership	262	0.631	37 th	7 th
F17.	Change orders	270	0.651	31 th	6 th
F18.	Disputes	272	0.655	30 th	5 th

The following graph show graphical representation of relative importance index (RII) and rank of management factors.

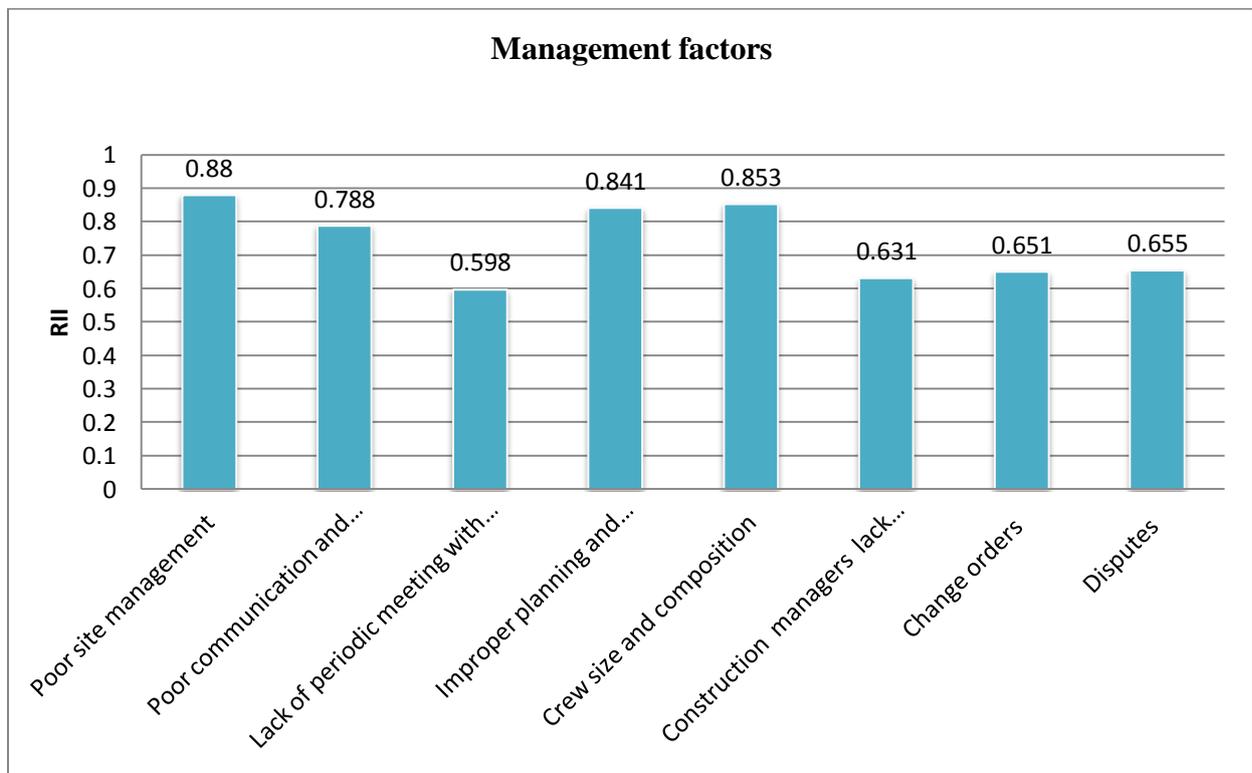


Figure 7 Relative importance index and rank of Management factor

Poor site management is the mostly affect labor productivity and ranked 1st from its group with RII 0.88 and 7th from the overall factors. Crew size and composition, improper planning and scheduling of work, Poor communication and coordination between construction parties and Disputes are ranked from 2nd to 5th in their group with RII of 0.853, 0.841, 0.788 and 0.655 respectively but ranked 14th, 16th, 19th, and 30th from the overall factors. Change orders ranked on the 6th place and 31th from the overall with relative importance index of 0.651 factors is Construction managers' lack of Leadership and Lack of periodic meeting with labors ranked 7th and 8th respectively but ranked 37th and 45th position with RII value of 0.631 and 0.598 respectively.

4.4.4 Motivation Factors

Motivation is extremely important. Non motivated employees can have several negative effects on the work. These include friction on the job, substandard output in quality, a high turnover of employees, absenteeism, tardiness, and many of the disciplinary problems that you wish to avoid.

Human potential is boundless but it requires motivation order o excel (Schrader, 1972 cited in Fagbenle, 1997 Wachira, 2000). Motivation may come in various forms such as money, recognition, bonus, job security, participation in decision-making. It is therefore the responsibility of the contractor to quickly identify the most demanding motivators for his operatives and make use of it. Surprisingly, most of the respondents did not attach any great importance to this factor. It must be stressed here that lack of motivation has always led to high staff turnover in the construction industry thereby leading to lack of continuity in the organization.

There are 8 sub-factors related to motivation factor are shown in table 12. These sub-factors includes: payment delay, Non provision of transport means, Lack of Incentive payments and financial Rewards, lack of places for eating and relaxation, lack of training sessions, Amount of payment and Discontinuity of work. Motivation factor is ranked on the 7th position with RII of 0.682. The relative importance index (RII) value and rank in group and overall rank of motivation factors are summarized in the below table 21.

Table 21 summary of RII and rank of motivation factors

3) Motivation Factors	Total	RII	Over all Rank	Rank in group
F19. Payment delay	363	0.875	9 th	1 st
F20. Non provision of transport means	348	0.839	17 th	3 rd
F21. Lack of Incentive payments and financial Rewards	281	0.678	26 th	4 th
F22. Lack of place for eating and relaxation	217	0.523	60 th	8 th
F23. lack of training sessions	231	0.556	54 th	6 th
F24. lack of Relaxation allowances	230	0.553	55 th	7 th

F25.	Amount of payment	356	0.858	12 th	2 nd
F26.	Discontinuity of work	239	0.575	49 th	5 th

The following graph shows relative importance index (RII) and rank of factors under group of motivation.

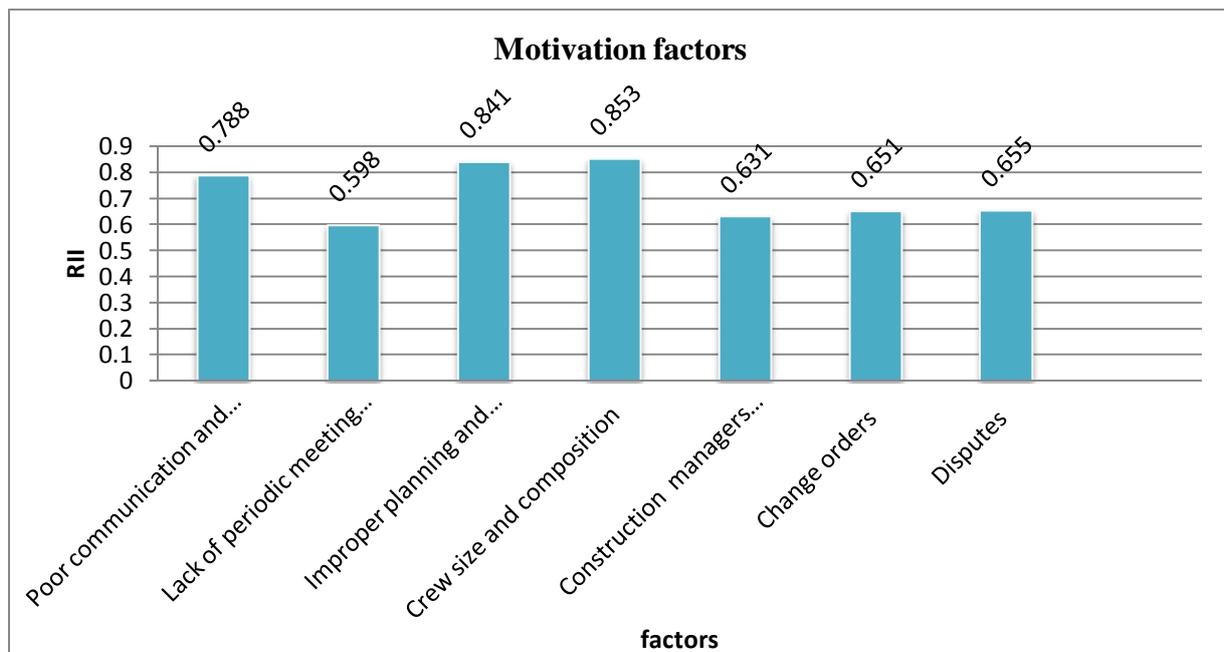


Figure 8 Relative importance index and rank of Motivation factor

Motivation factors are among the factors those affect labor productivity even though its ranked 7th as a whole. From this group payment delay is the most severe factor affecting labor productivity; ranked with 1st and 9th from overall factor. Amount of payment, Non provision of transport means, Lack of Incentive payments and financial Rewards and lack of training sessions ranked from 2nd to 6th position and ranked on 12th, 17th, 26th, 49th, and 54th position in overall rank of factors. Lack of Relaxation allowances ranked 7th in group and 55th in overall rank with (RII=0.553). Lack of place for eating and relaxation is ranked 8th in group, 60th rank in overall rank with RII of 0.523.

4.4.5 Schedule compression Factors

In a typical construction project, a contractor may often find that the time normally expected to perform the work has been severely reduced. The reduction of time available to complete a project is commonly known throughout the construction industry as schedule compression. Schedule compression is a problem because it negatively impacts labor productivity in

various ways, and it becomes a source of dispute between the owners and contractors. Schedule Compression includes factor Working 7 days per week without rest, Overcrowding, Misuse of time schedule, Length of work day and working overtime. Schedule compression factor ranked 8th with (RII= 0.647) while the relative importance index (RII) value and rank in group and overall rank of Schedule compression factor are summarized in the below table 22.

Table 22 summary of RII and rank of Work schedule compression Factors

4) Schedule compression Factors	Total	RII	Overall rank	Rank in group
F27. Working 7 days per week without rest	253	0.61	41 st	3 rd
F28. Overcrowding	259	0.625	38 th	2 nd
F29. Misuse of time schedule	244	0.588	47 th	5 th
F30. Length of work day	252	0.607	42 nd	4 th
F31. working overtime	279	0.672	27 th	1 st

The following graph shows relative importance index (RII) and rank of Schedule compression Factors.

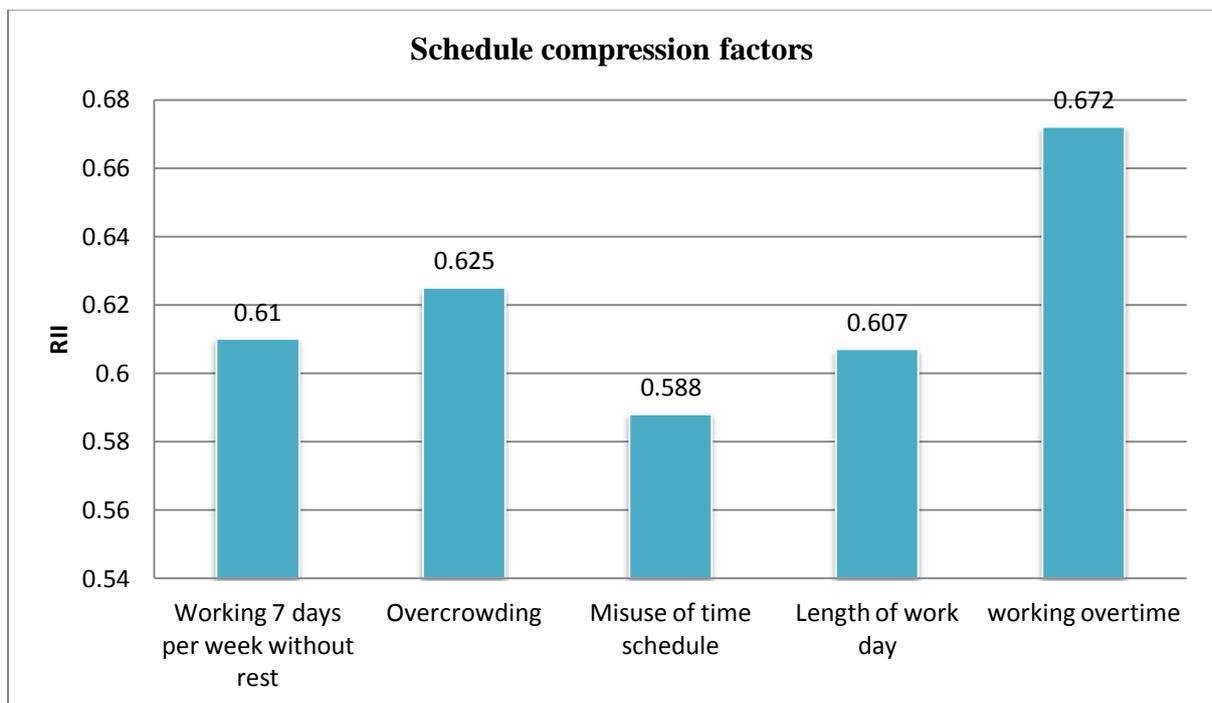


Figure 9 relative importance index and rank of schedule compression factors

Working over time is ranked 1st with (RII= 0.672) 27th from the overall factors. Schedule of longer work days than a standard eight-hour work day lowers output and efficiency through physical fatigue and mental attitude.

Overcrowding is ranked 2nd (RII=0.625) from schedule compression factor. This is caused when work planners hire too many workers for the estimated work scope and duration. Sometimes, when labour in certain areas is scarce, work planners may overcompensate for potential absenteeism and turnover, which creates overstaffing. Another cause is the false assumption that increased manning will always result in increased work productivity.

Working 7 days per week without rest ranked 3rd with RII of 0.61. working in weeks greater than 40-hour work week lowers the productivity and motivation of workers. Length of work day and Misuse of time schedule ranked 4th and 5th position in their group and ranked 42th and 47th from the overall factors respectively.

4.4.6 Material and Equipment Factors

Material and Equipment are very important, as without them work cannot be done progressively or to the required quality. This study have been refined and collected 4 sub-factors related to the main factor of material/equipment which includes: Material shortage, Old and inefficient equipment, Tools and equipment shortage and distance of materials storage location. Material/equipment factor is ranked 1st with RII of 0.819. The relative importance index (RII) value and rank in group and overall rank of Material/Equipment Factors are summarized in the table 23 below.

Table 23 summary of RII and rank of Material/Equipment factors

5) Material and Equipment Factors		Total	RII	Overall rank	Rank in group
F32.	Material shortage	376	0.906	2 nd	1 st
F33.	Old and inefficient equipment	339	0.817	18 th	3 rd
F34.	Tools and equipment shortage	369	0.889	5 th	2 nd
F35.	distance of materials storage location	275	0.663	29 th	4 th

The below graph shows Relative importance index and rank of Material/Equipment factors

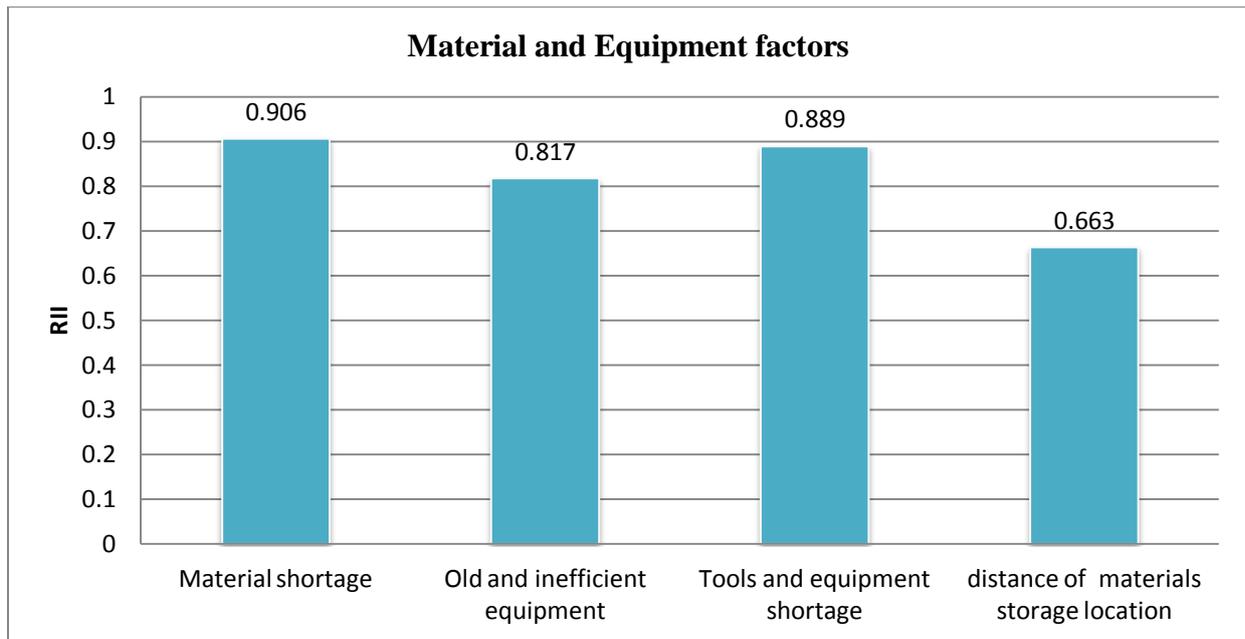


Figure 10 Relative importance index and rank of material/equipment factors

Lack of material and lack of equipment were highlight as the most critical factor affecting the labor productivity because of material are essential for the construction process. Material shortage is ranked 1st from this group and 2nd out of 61 factors with RII of 0.906. Kazaz et al (2008) stated that lack of material is a universal problem and has a significant degrading effect on site productivity for both developed and developing countries.

When adequate supply of material is not possible, workers try not to exhaust their current stockpile of supplies, so they slow down their pace or output in anticipation of a delivery, resulting in idle times and cost overruns.

Tools and equipment shortage is ranked 2nd in its group and 5th place in overall factor rank with RII of 0.889. This is caused when there is insufficient quantity or quality of tools and equipment to meet the needs of the project. Old and inefficient equipment and distance of materials storage location ranked 3rd and 4th in their group with RII of 0.817, 0.663 and ranked 18th and 29th in the overall ranking respectively.

4.4.7 Supervision Factors

To follow-up and supervise labour while working is a vital aspect of any organization because both it can result in extension of project time and cost, and the quality on site is controlled through inspection of the work completed by the gang. To improve the supervision work, it is necessary to identify the factor affect on it. The supervision factor ranked 5th

position with relative importance index of (RII= 0.699). All supervision factors have a high impact on productivity.

Supervision factor was ranked in their group and out of the 61 list of factors that affect labor productivity according to their importance is shown in the following table 24.

Table 24 Relative importance index and rank of Supervision factors

6) Supervision Factors	Total	RII	Over all Rank	Rank in group
F36. Misunderstanding between labour and supervisor	276	0.665	28 th	4 th
F37. Inadequate supervisors' skills	246	0.593	46 th	8 th
F38. Supervision delays	351	0.846	15 th	2 nd
F39. Lack of Labor surveillance.	364	0.877	8 th	1 st
F40. Lack of Clarity of daily task assignment	300	0.723	22 th	3 rd
F41. Insufficient supervision of subcontractors	264	0.636	35 th	6 th
F42. Improper coordination of subcontractors	256	0.617	40 th	7 th
F43. Delay in responding a requests for information	265	0.639	34 th	5 th

The following graph 11 shows the relative importance index (RII) and rank of supervision factors.

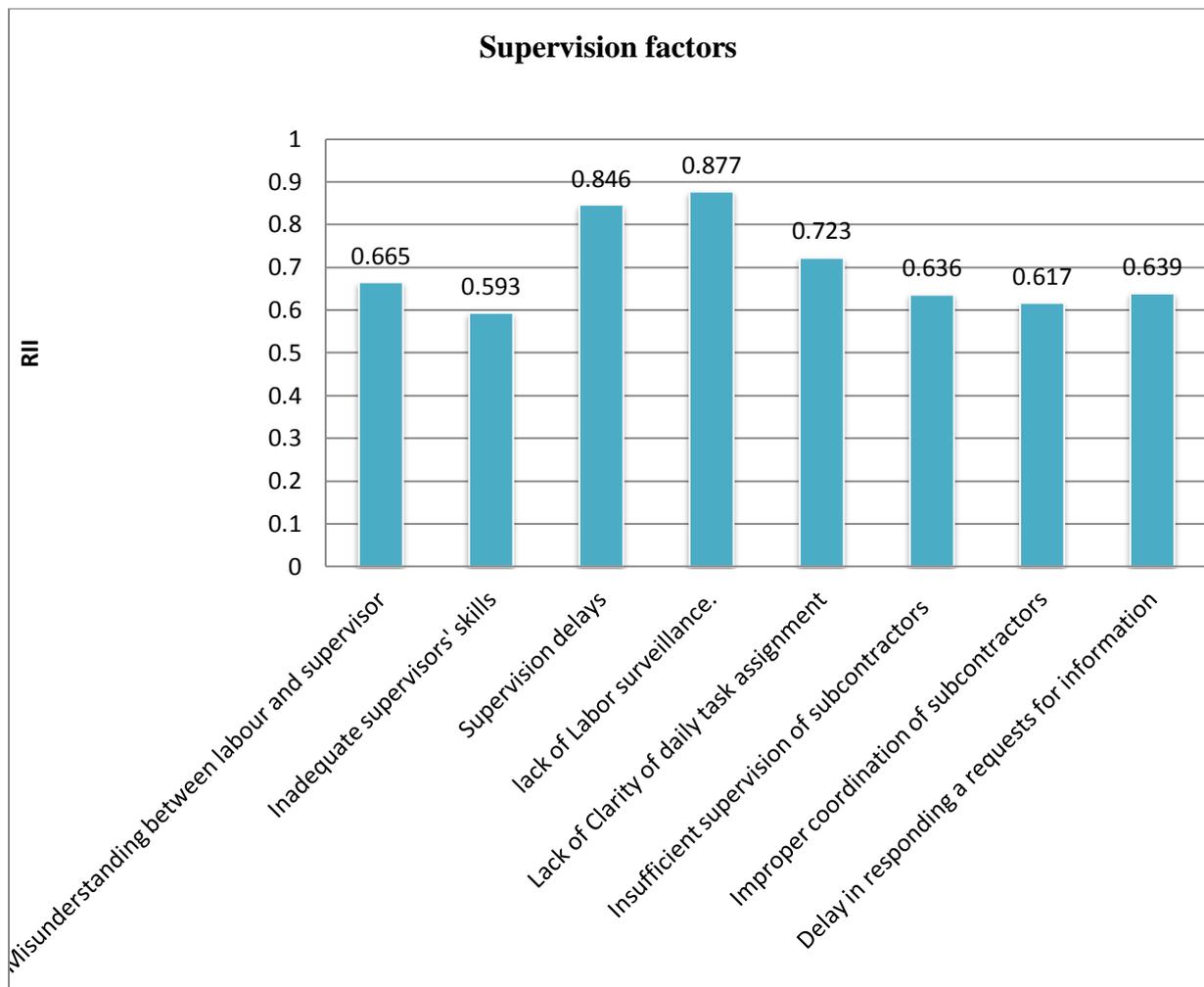


Figure 11 Relative Importance Index (RII) and Rank of supervision factors

Lack of Labor surveillance is the most significant factor that affects labor productivity from this group of factors ranked 1st and 8th position in overall ranking with RII of 0.877. The immediate supervisor should inspect and follow the work of labor and assist them if they encounter problems. Supervision delay is ranked 2nd from this group and ranked 15th position in the overall rank with RII of 0.846. This occurs when supervision is diverted from productive, planned, and scheduled work to analyze and plan contract changes, expedite delayed material, manage added crews, or other changes not in the original work scope and schedule. Supervision delay is also caused by an increase in manpower, work areas, or project size without an increase in supervision. Lack of Clarity of daily task assignment, Misunderstanding between labour and supervisor, and Delay in responding a request for information are ranked from 3rd to 5th position and ranked 22th, 28th, 34th position in the overall ranking respectively. Insufficient supervision of subcontractors ranked 6th (RII=0.636) and 35th in overall ranking. Improper coordination of subcontractors ranked 7th (RII=0.617)

and 40th in overall ranking. Inadequate supervisors' skills ranked 8th (RII=0.593) and 48th out of 61 factors.

4.4.8 Safety factors

Safety is very important aspects of construction projects which are the most hazardous endeavors have many work-related injuries and accidents. Safety factors group is ranked 6th with RII of 0.691. Under the safety group there are 6 factors includes: Ignore safety precautions, Absence of insurance for Accident , Accident in project site, Absence of protective safety equipment and clothing, insufficient lighting, working at high places. The relative importance index (RII) value and rank of safety factors are summarized in the following table 25.

Table 25 Relative Importance Index and Rank of Safety factors

7) Safety factors	Total	RII	Over all Rank	Rank in group
F44. Ignore safety precautions	360	0.867	10 th	2 nd
F45. Absence of insurance for Accident	234	0.564	53 th	6 th
F46. Accident in project site	370	0.892	4 th	1 st
F47. Absence of protective safety equipment and clothing	258	0.622	39 th	4 th
F48. Working at high places	263	0.634	36 th	3 rd
F49. Insufficient lighting	236	0.569	51 th	5 th

The relative importance index and rank of the safety factor are represented by the following graph 12.

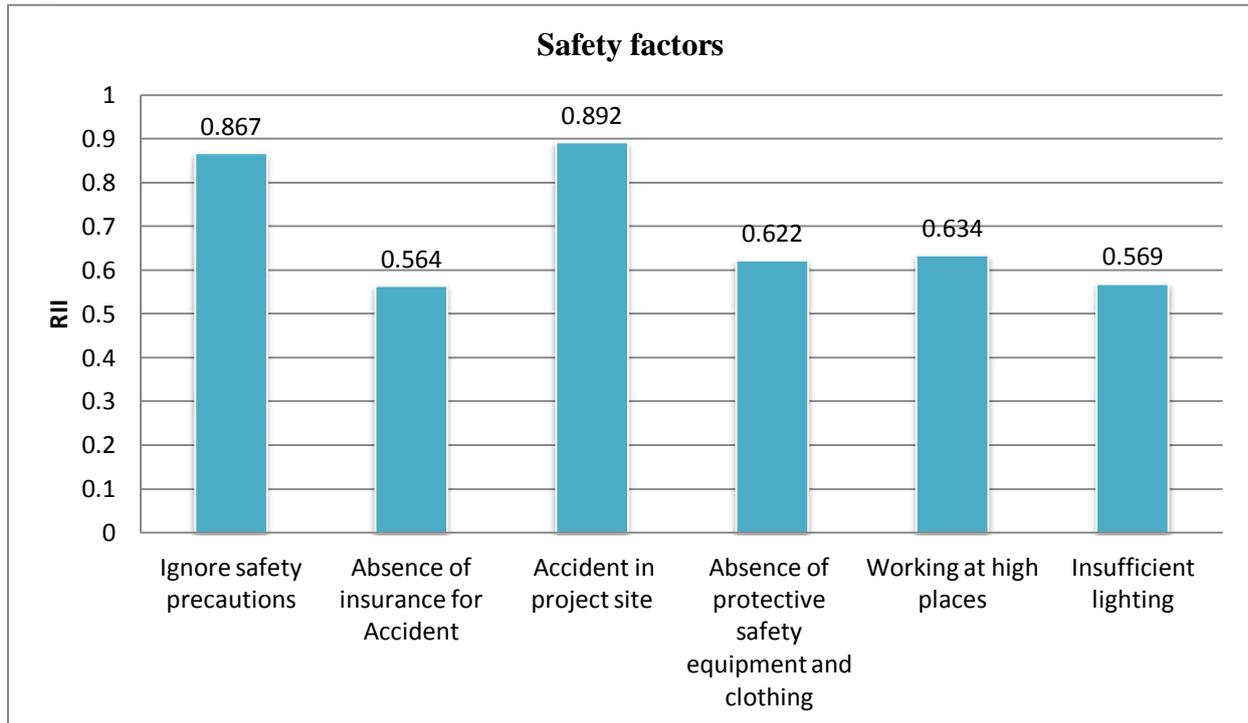


Figure 12 Relative Importance Index and rank of the safety factor

Accident in project site is the most factor affecting labor productivity ranked 1st from this group and ranked 4th position in overall ranking with RII of 0.892. Occurrence of accident on laborers is not only affecting the productivity of the injured laborer; but it also affects and slows down the productivity of workers. Ignore safety precautions ranked 2nd (RII=0.867) and 10th position in overall ranking of factors. Working at high places, Absence of protective safety equipment and clothing, and insufficient lighting ranked from 3rd to 5th with RII (0.634, 0.622, and 0.569) and ranked 36th, 39th, 51th respectively in position in overall ranking. Absence of insurance for Accident; affect the motivation of labor to do work under risky condition and this factor ranked 8th with RII of 0.564 and 53th out of 61 factors.

4.4.9 Natural and Environmental Factors

Labor is affected by unfavorable weather conditions. For instance, when weather apparel such as raincoats or heavy jackets is necessary, labor is hindered. Hot weather, in particular, has both a physiological and psychological effect on workers. Natural/environmental Factors includes: (Climate and Weather conditions, Project site Distance from town, Project location) and ranked 10th with RII of 0.566.

Table 26 Relative Importance Index and rank of Natural/environmental Factors

8) Natural and Environmental Factors	Total	RII	Over all Rank	Rank in group
F50. Climate and Weather conditions	250	0.602	43 th	1 st
F51. Project location	242	0.583	48 th	2 nd
F52. Project site Distance from town	213	0.514	61 th	3 rd

The following graph shows Relative Importance Index and rank of Natural/environmental Factors

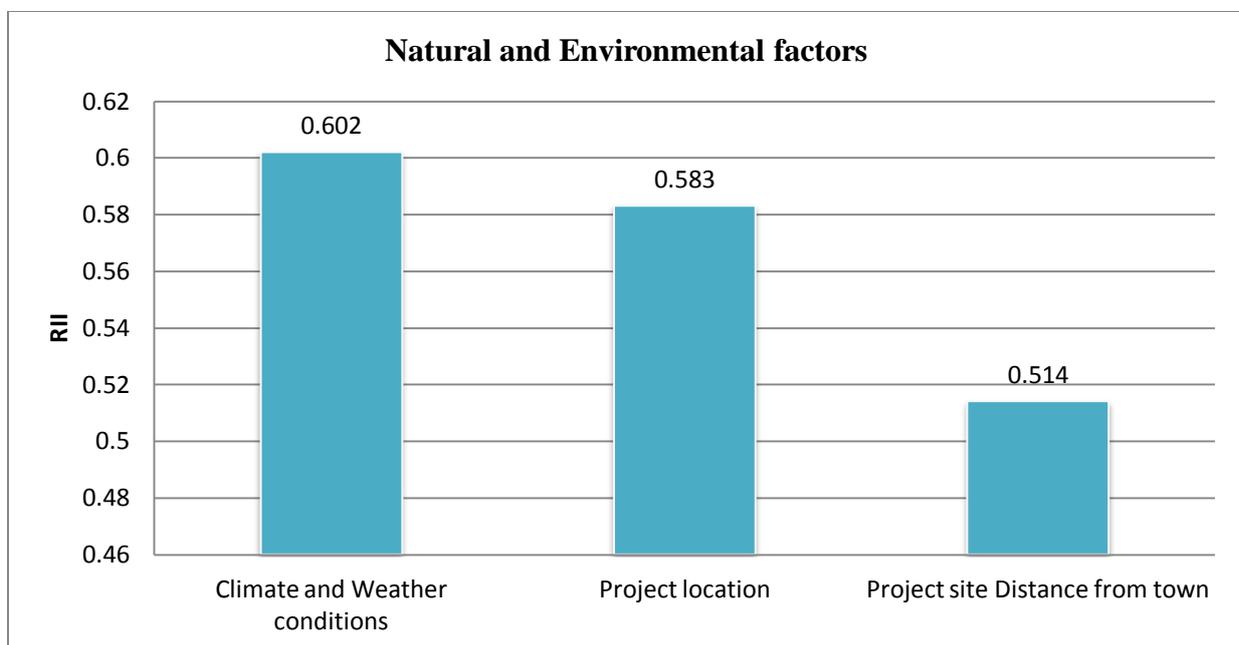


Figure 13 Relative Importance Index and Rank of Natural/environmental Factors

Climate and Weather conditions ranked 1st from this group of factors with RII of 0.602 and 43th in overall ranking. Performing work in a change of season, temperature zone, or climate change resulting in work performed in either very hot or very cold weather, rain, or other changes in temperature or climate can impact workers beyond normal conditions. The most effective solution to curb the effect of inclement weather is planning with a consideration for seasonal conditions. Forecast bad weather and plan weather sensitive activities accordingly.

Project location and Project site Distance from town ranked 2nd and 3rd RII (0.583 and 0.514) from their group and ranked 48th and 61th position in overall ranking respectively.

4.4.10 Cultural and Religious factors

There are many Cultural and religious factors that affect productivity of labor which includes, Cultural differences among labors, working on holiday, Difference of language among labors. Cultural and religious factor ranked 11th with RII of 0.541.

Table 27 Relative Importance Index and rank of Cultural and religious factor Factors

9) Cultural and Religious factors		Total	RII	Over all Rank	Rank in group
F53.	Cultural differences among laborers	222	0.536	59 th	3 rd
F54.	Working on holiday	224	0.539	58 th	2 nd
F55.	Difference of language among laborers	228	0.549	56 th	1 st

The following graph shows Relative Importance Index and rank of Natural/environmental Factors

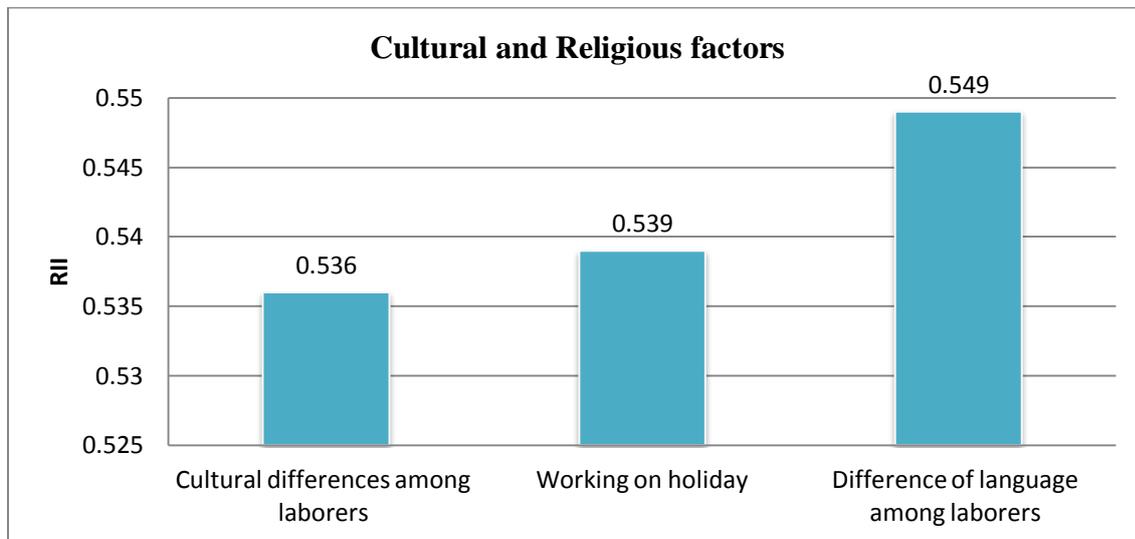


Figure 14 Relative Importance Index and rank of Natural/environmental Factors

Difference of language among laborers is affect labor productivity and ranked 1st from this group and 56th in the overall ranking with RII of 0.549.

Working on holiday ranked 2nd and 58th 56th in the overall ranking with RII of 0.539. If workers work on holidays, there is not only a cost factor for holiday pay, but there is usually a loss of productivity as well. It may be addressed as a morale factor since workers are away from families and working instead of enjoying the holidays, there is usually a productivity

loss to consider. Cultural differences among laborers is ranked 3rd from this group with relative importance index of 0.536.

4.4.11 Quality factors

Quality factors includes: Quality of required works, high/low quality of raw material, Rework, and Quality inspection delay. This factor is ranked 4th (RII=0.720). The relative importance index and rank of Quality factor is summarized in the following table 28.

Table 28 Summary of Relative Importance Index and rank of Quality factor

10) Quality factors	Total	RII	Over all Rank	Rank in group
F56. Low quality raw materials	249	0.6	44 th	3 rd
F57. quality of required works	357	0.86	11 th	1 st
F58. Rework	355	0.855	13 th	2 nd
F59. Quality inspection delay	235	0.566	52 th	4 th

The following graph shows the graphical representation of Quality factor

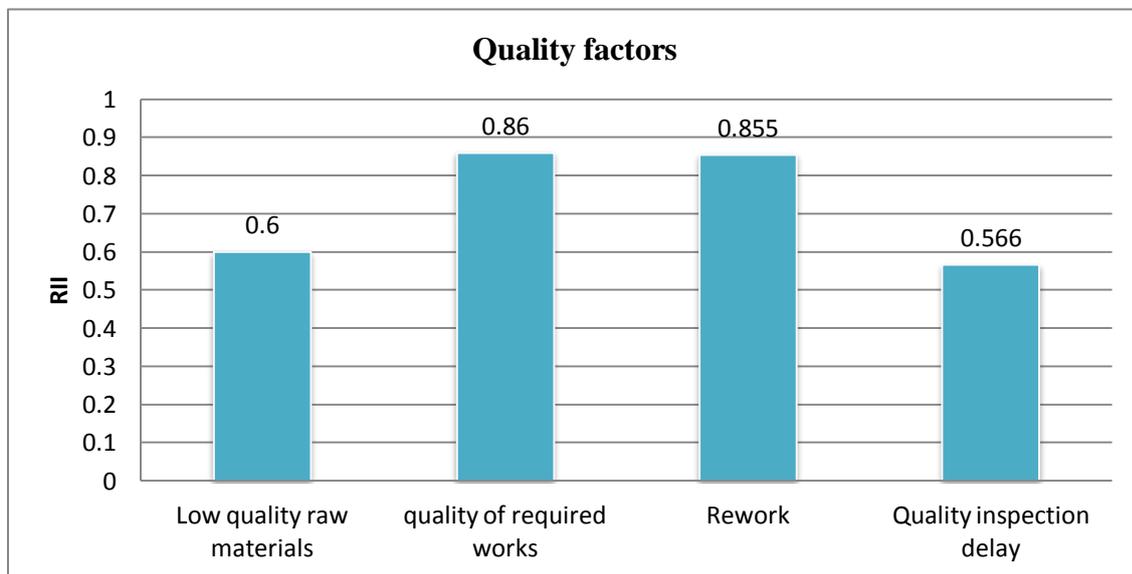


Figure 15 relative importance index and rank of Quality factor

The above Table and graph show the ranking factors for the quality factor group. Quality of required works was ranked first in the quality factor group, with an RII of 0.86, and was eleventh (11th) among all 61 factors affecting labor productivity. Rework was ranked 2nd in

quality factor group, with an RII of 0.855, and 13th among all 61 factors affecting labor productivity. A low quality raw material was ranked 3rd with an RII of 0.6, and 44th among all 61 factors affecting labor productivity. Quality inspection delay was ranked 4th from quality factors group and 52nd position in overall ranking.

4.4.12 political factors

The government’s taxation policies influence willingness to work. Law and order, Security of project site are essential for high productivity in the road construction industry. The relative impotence index rank of political factors are summarized in the below table 29.

Table 29 Relative Impotence Index rank of political factors

11) political factors		Total	RII	Over all Rank	Rank in group
F60.	Labor Law and taxation policies	225	0.543	57 th	1 st
F61.	Security of project site	312	0.752	21 st	2 nd

The following graph show Relative Impotence Index rank of political factors

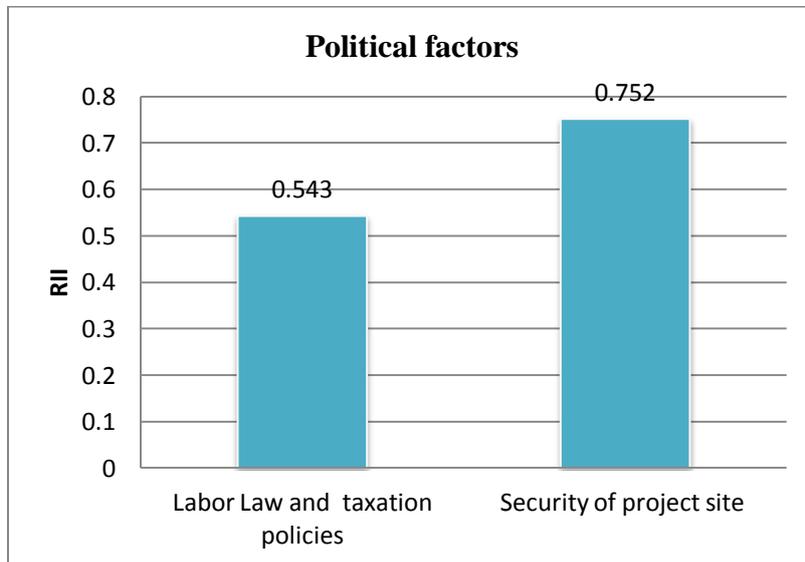


Figure 16 Relative Impotence Index and rank of political factors

Security of project site is ranked on the 1st position from this group with RII of 0.752 and ranked 21st in the total ranking of factors while; labor law and taxation policies is ranked second with RII of 0.543 and ranked on 57th position in overall ranking.

4.5 Overall rank of Factors Affecting Labor Productivity

The following table 30 shows the overall ranking of 61 factors that affect labor productivity in road construction projects.

Table 30 Overall ranking and RII of Factors Affecting Labor Productivity

Factors	Ordinal scale					total	RII	Rank
	5	4	3	2	1			
1. Lack of experience	250	116	9	2	0	377	0.908	1
2. Material shortage	245	120	9	2	0	376	0.906	2
3. Lack of labour skills	240	108	21	2	0	371	0.894	3
4. Accident	240	116	9	4	1	370	0.892	4
5. tools and equipment shortage	240	120	6	0	3	369	0.889	5
6. Labor's bad habit	230	120	15	2	1	368	0.887	6
7. Poor site management	245	108	6	2	4	365	0.880	7
8. Labor surveillance	230	124	6	0	4	364	0.877	8
9. Payment delay	215	112	36	0	0	363	0.875	9
10. Ignore safety precautions	225	116	6	12	1	360	0.867	10
11. Quality of required work	215	100	36	6	0	357	0.860	11
12. Amount of payment	200	116	36	4	0	356	0.858	12
13. Rework	215	108	27	2	3	355	0.855	13
14. Crew size and composition	195	128	27	2	2	354	0.853	14
15. Supervision delays	190	124	30	6	1	351	0.846	15
16. Improper planning and scheduling of work	190	128	15	16	0	349	0.841	16
17. Non provision of transport means	180	128	30	10	0	348	0.839	17

18. Old and inefficient equipment	165	128	30	16	0	339	0.817	18
19. Poor communication and coordination between construction parties	160	112	30	24	1	327	0.788	19
20. Misunderstanding among laborers	180	84	30	24	4	322	0.776	20
21. Security of project site	155	80	39	38	0	312	0.752	21
22. Lack of Clear and daily task assignment	145	72	48	30	5	300	0.723	22
23. Labour disloyalty	175	40	45	26	10	296	0.713	23
24. Worker's integrity	170	40	48	22	12	292	0.704	24
25. Labour personal problem	130	72	42	30	10	284	0.684	25
26. Lack of Incentive payments and financial Rewards	140	80	27	16	18	281	0.678	26
27. Working overtime	130	72	30	36	11	279	0.672	27
28. Misunderstanding between labour and supervisor	110	76	48	32	10	276	0.665	28
29. Unsuitable materials storage location	115	76	45	26	13	275	0.663	29
30. Dispute	100	80	51	30	11	272	0.655	30
31. Change orders	105	76	45	32	12	270	0.651	31
32. Difference of language among labors	90	72	60	36	9	267	0.643	32
33. Ability to adapt changes and new environments	120	56	51	22	17	266	0.641	33
34. Delay in responding to requests for information	105	64	60	20	16	265	0.639	34
35. Insufficient supervision of subcontractors	115	72	48	6	23	264	0.636	35

36. Working at high places	75	76	60	46	6	263	0.634	36
37. Construction managers lack of Leadership	90	76	60	20	16	262	0.631	37
38. Overcrowding	95	60	60	30	14	259	0.625	38
39. Absence of safety protective Wear	115	56	30	42	15	258	0.622	39
40. Improper coordination of subcontractors	95	68	51	24	18	256	0.617	40
41. Working 7 days per week without rest	85	64	57	32	15	253	0.610	41
42. Length of work day	85	60	54	40	13	252	0.607	42
43. Climate and Weather conditions	75	76	48	36	15	250	0.602	43
44. Low quality raw materials	80	80	42	28	19	249	0.600	44
45. Lack of periodic meeting with labors	100	64	42	18	24	248	0.598	45
46. Inadequate supervisors' skills	95	68	39	20	24	246	0.593	46
47. Misuse of time schedule	85	60	42	40	17	244	0.588	47
48. Project location	110	48	36	22	26	242	0.583	48
49. Discontinuity of work	85	52	40	44	18	239	0.575	49
50. Increase of laborer age	85	60	39	32	22	238	0.574	50
51. Insufficient lighting	105	44	24	40	23	236	0.569	51
52. Quality inspection delay	85	38	54	38	20	235	0.566	52
53. Absence of insurance for Accident	85	40	51	38	20	234	0.564	53
54. lack of training sessions	90	36	45	36	23	231	0.556	54
55. Relaxation allowances	80	36	60	32	22	230	0.553	55
56. Difference of language among	95	32	33	46	22	228	0.549	56

labors								
57. Labor Law and taxation policies	85	34	45	38	23	225	0.543	57
58. Working on holiday	85	34	45	34	26	224	0.539	58
59. Cultural differences among labors	75	44	45	34	25	222	0.536	59
60. Lack of place for eating and relaxation	80	32	45	32	28	217	0.523	60
61. Project site Distance from town	65	32	54	36	26	213	0.514	61

Based the above table 30 the top 10 factors those affect labor productivity includes: Lack of experience, Material shortage, Lack of labour skills, Accident, tools and equipment shortage, Labor's bad habit, Poor site management, Labor surveillance, Payment delay and Ignore safety precautions respectively.

For contractors whose face productivity problems on construction site, it is necessary to concentrate on the major factors such as: Lack of experience, Material shortage, Lack of labour skills, Accident, tools and equipment shortage and Labor's bad habit.

Solving these problems is highly important for contractors, encounter productivity problems to fish the Work within budget plan, scheduled time frame and to attain the required quality of the work.

The following figure18 shows the Relative Importance Index (RII) and overall Rank of 61 factors.

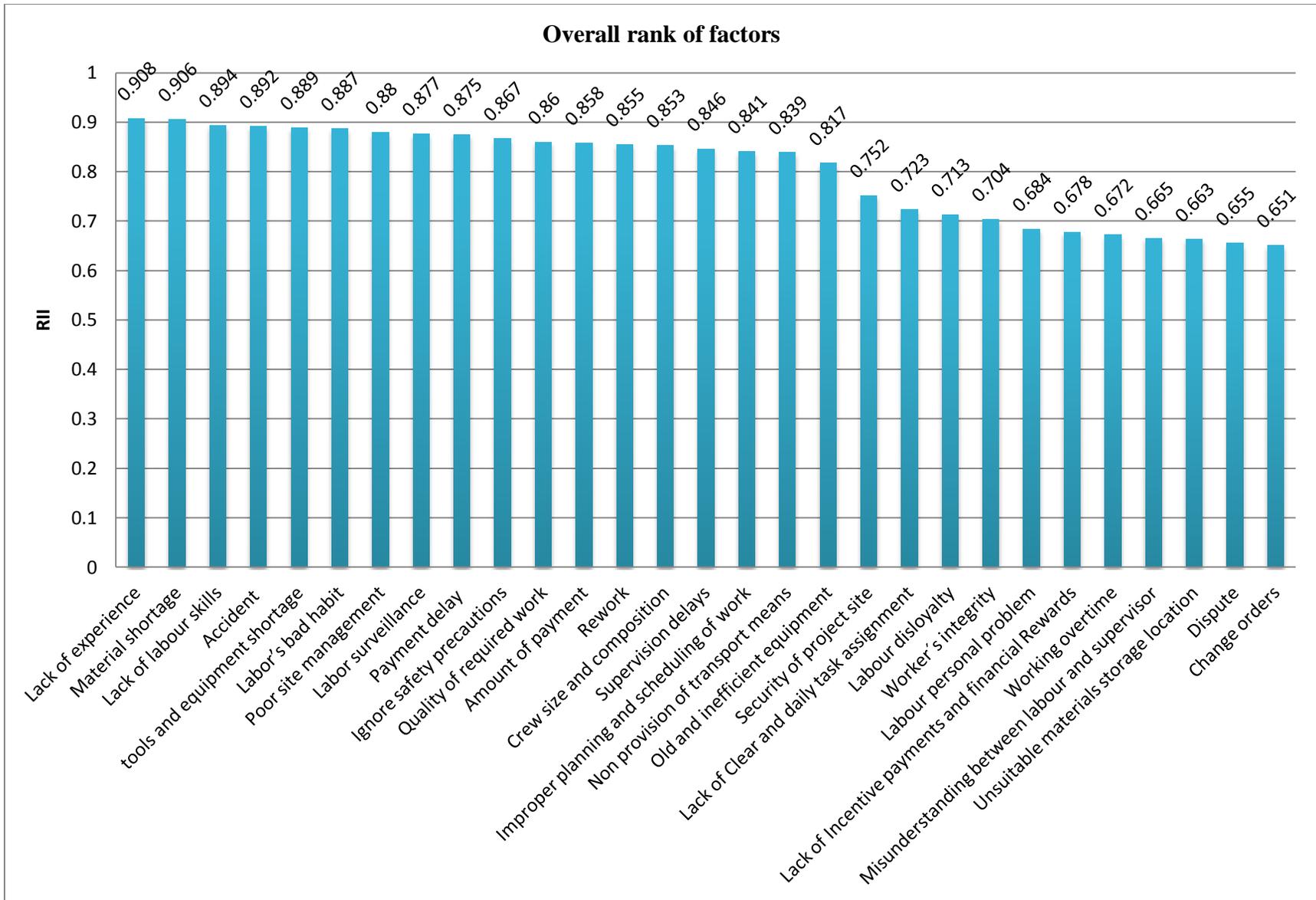


Figure 17 relative importance index and overall rank of factors

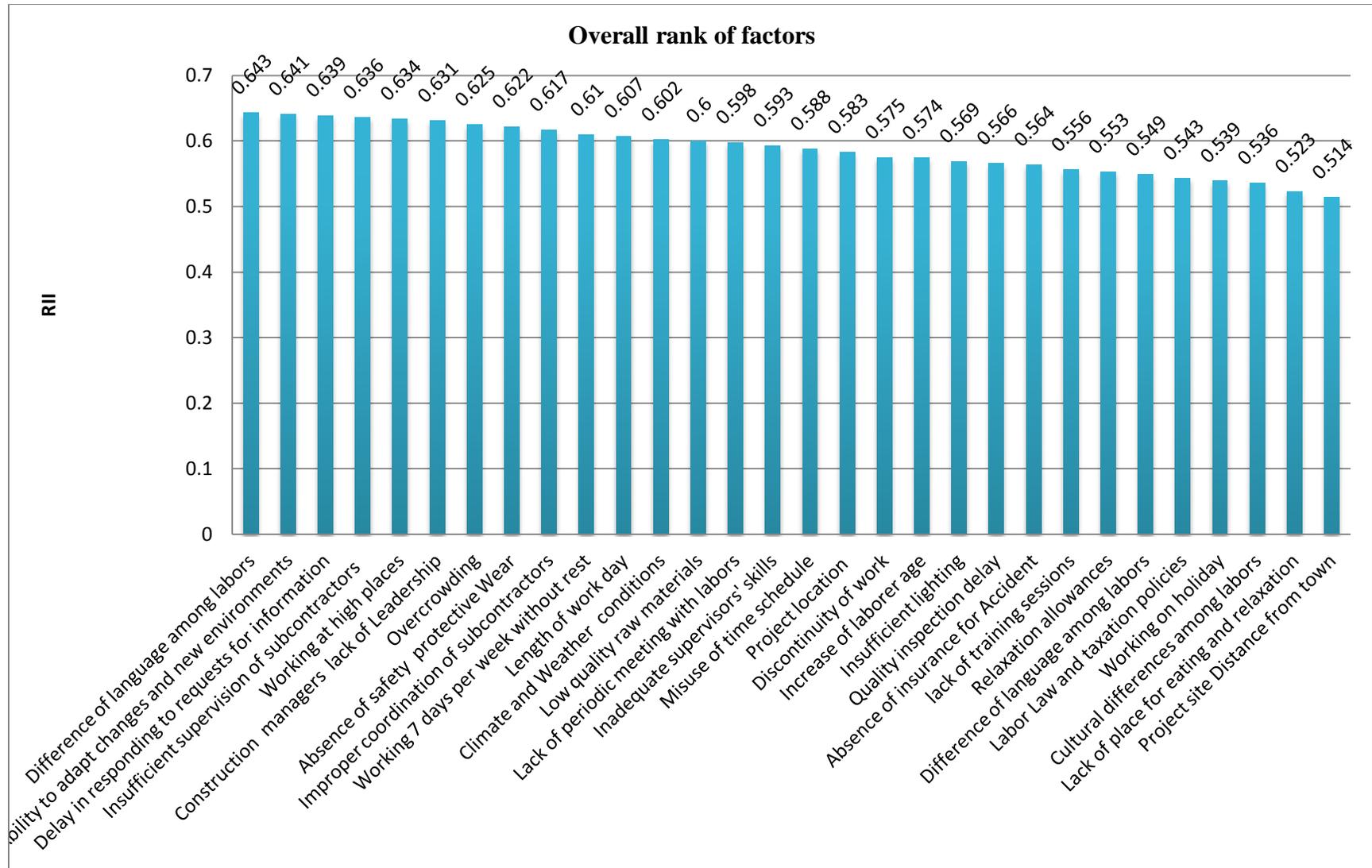


Figure 18 over all Relative Importance Index and rank of all factors

4.6 Degree of agreement between projects

For the projects, values of Chronbach's Alpha were in the range from 0.9 and 1. This range is considered excellent; the result ensures the reliability of each projects response. Chronbach's Alpha equals 0.979 for the entire projects which indicate an excellent reliability of the entire response data.

Correlation is statistical device that measures the strength or degree of a supposed linear association between two or more variables. One of the more common measures used is the Pearson correlation, which estimates a relationship between two interval variables. The correlation between the projects are measured by Pearson Correlation some of the are excellent correlation between projects .Most correlation between the projects fall in good range and few are fall in acceptable range. Generally its fact to conclude that, the response of respondents in different projects regarding the significance of factors is highly similar.

4.7 Degree of agreement between stratified respondents

Degree of agreement between different classes of respondents is measured by Pearson correlation coefficient and R ranges from 0.897 to 0.991. Generally the SPSS test of reliability and correlation shows that the degree of agreement between respondent is a very good and the data is highly reliable and valid.

4.8 Significant and Non-Significant Factors

Identified significant and non-significant are shown in Table 31. Testing $H_0: p = 0.50$ Vs. $H_a: p \neq 0.50$, where p represents that the proportion of respondents who suggested the factor affects labor productivity is significant or non-significant. (T is the test statistic.)

Table 31 Significant and non-significant factors affecting labor productivity

Factors	Result	Comment
Lack of experience.	T = 4 Rejection of T	More than 50% suggest significant factor affecting labor productivity
Labor Disloyalty.	T = 1.2 Not Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity

Misunderstanding among laborers.	T = 2.1 Rejection of T	More than 50% suggest significant factor affecting labor productivity
Labor's bad habit	T = 3.8 Rejection of T	More than 50% suggest significant factor affecting labor productivity
Lack of labour skills	T = 3.9 Rejection of T	More than 50% suggest significant factor affecting labor productivity
Increase of laborer age	T = -0.6 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity
Labour absenteeism	T = 3.5 Rejection of T	More than 50% suggest significant factor affecting labor productivity
Labour personal problem	T = 0.9 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity
Ability to adapt changes and new environments	T = 0.5 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity
Worker's integrity	T = 1.2 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity
Poor site management	T = 3.6 Rejection of T	More than 50% suggest significant factor affecting labor productivity
Poor communication and coordination between construction parties	T = 2.3 Rejection of T	More than 50% suggest significant factor affecting labor productivity
Lack of periodic meeting with labors	T = -0.1 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity
Improper planning and	T = 3	More than 50% suggest significant

scheduling of work	Rejection of T	factor affecting labor productivity
Crew size and composition	T = 3.4 Rejection of T	More than 50% suggest significant factor affecting labor productivity
Construction managers lack of Leadership	T= 0.4 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity
Change orders	T= 0.4 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity
Disputes	T= 0.6 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity
Payment delay	T = 3.7 Rejection of T	More than 50% suggest significant factor affecting labor productivity
Non provision of transport means	T = 3.1 Rejection of T	More than 50% suggest significant factor affecting labor productivity
Lack of Incentive payments and financial Rewards	T= 0.9 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity
Lack of place for eating and relaxation	T= -1.3 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity
lack of training sessions	T= -0.9 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity
Relaxation allowances	T= -0.8 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity
Amount of payment	T= 3.5	More than 50% suggest significant factor affecting labor productivity

	Rejection of T	
Discontinuity of work	T= -0.8 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity
Working 7 days per week without rest	T= 0.1 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity
Overcrowding	T= 0.2 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity
Misuse of time schedule	T= -0.5 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity
Length of work day	T= -0.2 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity
working overtime	T= 0.6 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity
Material shortage	T= 4 Rejection of T	More than 50% suggest significant factor affecting labor productivity
Old and inefficient equipment	T= 2.8 Rejection of T	More than 50% suggest significant factor affecting labor productivity
Tools and equipment shortage	T= 3.8 Rejection of T	More than 50% suggest significant factor affecting labor productivity
distance of materials storage location	T= 0.7 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity
Misunderstanding between labour and supervisor	T= 0.6	Not enough evidence. Non-significant factor affecting labor productivity

	No Rejection of T	
Inadequate supervisors' skills	T= -0.1 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity
Supervision delays	T= 3.3 Rejection of T	More than 50% suggest significant factor affecting labor productivity
Lack of Labor surveillance.	T= 3.7 Rejection of T	More than 50% suggest significant factor affecting labor productivity
Lack of Clarity of daily task assignment	T= 1.4 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity
Insufficient supervision of subcontractors	T= 0.7 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity
Improper coordination of subcontractors	T= 0.1 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity
Delay in responding a requests for information	T= 0.5 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity
Ignore safety precautions	T= 3.4 Rejection of T	More than 50% suggest significant factor affecting labor productivity
Absence of insurance for Accident	T= -0.8 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity
Accident in project site	T= 3.8 Rejection of T	More than 50% suggest significant factor affecting labor productivity
Absence of protective safety gear	T= -0.2	Not enough evidence. Non-significant factor affecting labor productivity

	No Rejection of T	
Working at high places	T= 0.1	Not enough evidence. Non-significant factor affecting labor productivity
	No Rejection of T	
Insufficient lighting	T= -0.8	Not enough evidence. Non-significant factor affecting labor productivity
	No Rejection of T	
Climate and Weather conditions	T= -0.2	Not enough evidence. Non-significant factor affecting labor productivity
	No Rejection of T	
Project location	T= -0.3	Not enough evidence. Non-significant factor affecting labor productivity
	No Rejection of T	
Project site Distance from town	T= -1.3	Not enough evidence. Non-significant factor affecting labor productivity
	No Rejection of T	
Cultural differences among laborers	T= -1.1	Not enough evidence. Non-significant factor affecting labor productivity
	No Rejection of T	
Working on holiday	T= - 1.1	Not enough evidence. Non-significant factor affecting labor productivity
	No Rejection of T	
Difference of language among laborers	T= -1.2	Not enough evidence. Non-significant factor affecting labor productivity
	No Rejection of T	
Low quality raw materials	T= -0.1	Not enough evidence. Non-significant factor affecting labor productivity
	No Rejection of T	
quality of required works	T= 3.4	More than 50% suggest significant factor affecting labor productivity
	Rejection of T	
Rework	T= 3.4	More than 50% suggest significant factor affecting labor productivity

	Rejection of T	
Quality inspection delay labors	T= -0.8 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity
Labor Law and taxation policies	T= -1.1 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity
Security of project site	T= 1.6 No Rejection of T	Not enough evidence. Non-significant factor affecting labor productivity

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The study aims at identifying the factors affecting labor productivity in road construction projects in Oromia regional state Bale Zone from the view point of different respondents including project managers, construction supervisors, engineers and other who have experience in road construction industry. 61 Factors were identified through literature review and grouped into eleven groups. The factors are ranked according to their relative importance index.

Work force factor: Manpower/Work Force Factor has been ranked second from 11 groups of factors that affect labor productivity with relative importance index of 0.819. The result of the “laborer experience and skill” factor agrees with the fact that the Ethiopian construction industry suffers from the lack of trained and skilled workers. The investment in people is very valuable, especially in a country like Ethiopia with a relatively high population and an abundance of labor. The outcome of this research reveals the importance of developing construction labor skills and experience, which can enhance the construction industry and the overall economy.

Management factor: The main task of any managers is to plan, direct and control. Poor management results in poor productivity. The management ineffectiveness causes delays which result in poor productivity. Management factor is ranked on the 3rd position with RII of 0.737. Any management problems reduce the output of labor.

Motivation: Motivation factor is ranked on the 7th position with RII of 0.682. Motivation is extremely important. Even though the motivation factor is ranked on the seventh position, it must be stressed here that none motivated employees can have several negative effects on the work. These include friction on the job, substandard output in quality, a high turnover of employees which leads to lack of continuity, absenteeism, tardiness, and many others. Motivation may come in various forms such as money, recognition, bonus, job security, participation in decision-making, finish and go etc.

Schedule compression Factors: Schedule compression factor ranked 8th with (RII= 0.647). Working longer days or adding days of work on prolonged basis will result in increased injuries and safety problems. Compression of Schedule negatively affect labor productivity in

various ways, negative outcomes of lower labour productivity rates, higher project costs and it becomes a source of dispute between the owners and contractors. As workers become tired from long periods of work, they begin to adjust their pace or slow their productivity to avoid fatigue. When forced to work overtime, employee became disgruntled, causing low morale among other employees. Overtime is expensive to the contractor in terms of both additional wages and lost productivity. Although conditions exist when schedule compression is necessary, this can usually be avoided by proper project planning and crew size.

Material and Equipment: Material/equipment factor is ranked 1st with RII of 0.819. The findings revealed the importance of the “availability of the materials and their ease of handling” is highly affect productivity. This requires the contractor to prepare a careful delivery plan for the required materials. Also, it reflects the need for proper and efficient selection of the location of material storage. Material and Equipment are very important, as without them work can't be done progressively or to the required quality.

Supervision Factor: To improve the supervision work, it is necessary to identify the factor affect on it. The supervision factor ranked 5th position with relative importance index of (RII= 0.699). Although unnecessary supervision will increase the cost of work, insufficient supervision will result in confusion delays and decrease productivity. The labor productivity is increased by increasing the number of man hours per day that the field supervisor spent in contact with the crew.

Safety factors: Safety factors group is ranked 6th with RII of 0.69. Employees who do not feel tend to be overly cautious when performing their work tasks, thus noticeably slowing productivity. A clear and safe jobsite is conducive to obtaining maximum productivity from labor crews. Many construction companies realize the importance of safety on job site productivity. Contractors are required by state and federal regulations to have in place an active construction safety program, but the degree of implementation on the job site is a matter of commitment by the construction companies. The cost of safety implementation program is considerably less than the cost of lost productivity.

Natural/environmental Factors: This group of factor ranked 10th with RII of 0.566. Bad weather is not adequately anticipated; forcing changes in schedules, production, and damage to completed work. Weather can affect some construction materials, such as concrete and mortar, as well as the efficiency of labor. Protective clothing, such as rain gear or cold

weather gear is necessary to avoid reduction of productivity caused due to bad weather. Hot weather, in particular, has both a physiological and psychological effect on workers.

Initial project planning should consider seasonal weather conditions. Flexibility should be built into the work schedule to allow for downtime during inclement weather. Special consideration is necessary for crews working in non ideal weather conditions. During hot weather cold drinking water must be furnished at the installation location.

Cultural and religious factor: Cultural and religious factor ranked 11th with RII of 0.541. Since our country is too much diversified in language and cultures and any problems arise due to this can be solved by making proper composition of worker and crew.

Quality factor: This factor is ranked 4th (RII=0.720). Low quality of construction will cause redoing work. Redoing work affects the production rate and decreases the output. Work redone maintained a position as one of worst problems leading to poor productivity. Study shows that amount of times spent on rework was between 4.9–7.7man-hr/week. Causes of work redone were mainly due to engineering and management inefficiencies. Many study shows that Craftsmen spent an average of 14.3% of their time redoing work. Proper, clearly & in time quality inspection is required.

Political factors: Any security issue related to project site should solve prior to inception of projects. The right of way and environmental impact assessment should be implemented before the construction started because it cause treat against the productivity of laborers.

5.2 Recommendation

5.2.1 Recommendations for the construction organizations

It is necessary for construction organizations to improve poor labor productivity because low productivity of labor cause delay and cost overrun of the construction projects. Un-solved labor problems on construction site can cause labor turn-out which leads to lack of labor force.

Contractors should assign project manager and construction supervisors with sufficient management skills in project supervision of road projects so that any problem raised would solved immediately. Sufficient Construction material in project site should be delivered prior to the start of the project. Materials should be stored at appropriate location and should be easily accessible and close to project to avoid wasting labor time for multiple-handling of

materials. Also, contractors should provide strong assistance and support regarding the continual training of their craftsmen

It's recommended to develop human resources through proper and continuous training programs frame a strong assignment, vision and a planned approach to overcome poor productivity of labor. In addition to this keeping moral support on the laborer has also significant effect on productivity. Accident and any safety problems should be minimized because overcoming these problems has much significant help in improving poor productivity of laborers on the site and to avoid delay of work arises due to injuries of workers.

Change orders and design errors should be avoided as much as possible. These factors can be costly and time consuming if the work has been done. Work sequences can also be affected due to rework. To achieve the desired results, time required implementing change orders and to make corrections in drawings and specifications should be estimated and scheduled without affecting the project-time completion.

5.2.2 Recommendations for the Government bodies

Road is the major infrastructure which accelerate the growth and transformation plan. Without the construction of road network the ongoing growth transformation plan does not hit its goal, improving the productivity of labor contributes greater role construction of quality roads without delay and cost overran. For the government it should be considered as major concern, to enforce hard and fast laws and regulation that help to obtain productive work force in the road construction. In this regard, the governmental policy should encourage and pay more attention to formal technical education and apprentice programs. It is recommended that the Ethiopian government should enhance and encourage the accessibility to construction materials, either through local availability or by direct imports. This would improve competitiveness among material suppliers, thus helping local contractors to overcome their financial and liquidity problems.

Now Ethiopia is engaged in the over ambitious Road Sector Development Plan (RSDP) by investing \$33.1 billion birr for fiscal year of 2008 E.C and it is the responsibility of the government bodies to keep this plan to hit its goal. It's recommended to the government to invest some percentage of the budget on human resource development though capacity building of managers, construction supervisors and practitioners in road constructions, so that

poor productivity of laborer would be tackled by strong and committed managers, supervisors and engineers.

It should be common interest of contractors, consultants, employers, and policymakers in Ethiopian to improve the productivity level of the road construction sector. The outcomes of this study will assist in achieving this goal by focusing and acting upon the most significant factors perceived to affect the efficiency of road construction labor productivity. The results will become worthwhile in determining the major steps to improve labor productivity in the Ethiopian road construction industry.

5.2.3 Recommendations for Future study

The current research study was limited to the road construction Bale Zone. Federal and state governments invest significant amounts of capital on construction of road projects, railway, hydropower, public institution, condominiums housing construction and other mega projects. So, a study similar to the present research is needed for public building projects, rail way construction and other mega projects in Ethiopia to find factors that affect the productivity of construction projects and labor, which help government to minimize unnecessary cost escalations and project-schedule delays.

The results can be used as a part of further research modeling the interaction relationship between the key factors affecting productivity to improve construction labor productivity in the Ethiopian road construction industry.

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7 Appendix

Appendix a relative importance index and rank of factors depending on responses of respondents in different projects and classes

Factors	Project one			Project two			Project three			Project four		
	T	RII	R	T	RII	R	T	RII	R	T	RII	R
1) Manpower/Work Force Factor												
F1. Lack of experience.	36	0.900	2	46	0.920	4	41	0.911	3	36	0.800	16
F2. Labor Disloyalty.	26	0.650	24	36	0.720	24	32	0.711	22	34	0.756	21
F3. Misunderstanding among laborers.	28	0.700	20	38	0.760	20	38	0.844	11	37	0.822	12
F4. Labor's bad habit	35	0.875	4	41	0.820	11	40	0.889	4	38	0.844	10
F5. Lack of labour skills	33	0.825	10	42	0.840	8	40	0.889	4	43	0.956	1
F6. Increase of laborer age	18	0.450	60	28	0.560	52	26	0.578	42	25	0.556	50
F7. Labour absenteeism	31	0.775	17	43	0.860	6	36	0.800	17	41	0.911	4
F8. Labour personal problem	24	0.600	34	38	0.760	20	30	0.667	26	33	0.733	22
F9. Ability to adapt changes and new environments	25	0.625	29	38	0.760	20	25	0.556	47	25	0.556	50
F10. Worker's integrity	25	0.625	29	32	0.640	33	30	0.667	26	32	0.711	27
2) Management Factor												
F11. Poor site management	32	0.800	14	48	0.960	1	44	0.978	1	36	0.800	16
F12. Poor communication and coordination	32	0.800	14	39	0.780	17	44	0.978	1	36	0.800	16

between construction parties

F13.	Lack of periodic meeting with labors	33	0.825	10	41	0.820	11	29	0.644	31	27	0.600	41
F14.	Improper planning and scheduling of work	29	0.725	19	42	0.840	8	35	0.778	19	37	0.822	12
F15.	Crew size and composition	31	0.775	17	40	0.800	15	38	0.844	12	41	0.911	4
F16.	Construction managers lack of Leadership	23	0.575	40	35	0.700	25	24	0.533	52	28	0.622	37
F17.	Change orders	26	0.650	24	29	0.580	48	27	0.600	36	30	0.667	29
F18.	Disputes	24	0.600	34	31	0.620	38	30	0.667	26	29	0.644	34

3) Motivation Factor

F19.	Payment delay	35	0.875	4	48	0.960	1	39	0.867	9	39	0.867	8
F20.	Non provision of transport means	32	0.800	14	42	0.840	8	38	0.844	12	35	0.778	20
F21.	Lack of Incentive payments and financial Rewards	23	0.575	40	34	0.680	31	31	0.689	23	33	0.733	22
F22.	Lack of place for eating and relaxation	20	0.500	54	25	0.500	58	24	0.533	52	24	0.533	54
F23.	lack of training sessions	19	0.475	58	32	0.640	33	23	0.511	56	26	0.578	46
F24.	Relaxation allowances	19	0.475	58	26	0.520	57	26	0.578	42	25	0.556	50
F25.	Amount of payment	31	0.775	17	43	0.860	6	36	0.800	18	41	0.911	4
F26.	Discontinuity of work	22	0.550	44	30	0.600	42	26	0.578	42	26	0.578	46

4) Schedule Factor

F27.	Working 7 days per week without rest	24	0.600	34	30	0.600	42	31	0.689	23	27	0.600	41
F28.	Overcrowding	20	0.500	54	31	0.620	38	24	0.533	52	28	0.622	37
F29.	Misuse of time schedule	24	0.600	34	27	0.540	54	26	0.578	42	28	0.622	37
F30.	Length of work day	23	0.575	40	29	0.580	48	25	0.556	47	27	0.600	41
F31.	working overtime	26	0.650	24	35	0.700	25	28	0.622	33	30	0.667	29
5) Material/Equipment Factor													
F32.	Material shortage	34	0.850	7	47	0.940	3	43	0.956	3	41	0.911	4
F33.	Old and inefficient equipment	33	0.825	10	41	0.820	11	40	0.889	5	37	0.822	12
F34.	Tools and equipment shortage	34	0.850	7	41	0.820	11	38	0.844	12	40	0.889	7
F35.	Unsuitable materials storage location	25	0.625	29	34	0.680	31	27	0.600	36	30	0.667	29
6) Supervision Factor													
F36.	Misunderstanding between labour and supervisor	27	0.675	21	32	0.640	33	30	0.667	26	29	0.644	34
F37.	Inadequate supervisors' skills	22	0.550	44	32	0.640	33	25	0.556	47	23	0.511	57
F38.	Supervision delays	33	0.825	10	39	0.780	17	40	0.889	5	38	0.844	10
F39.	Lack of Labor surveillance.	38	0.950	1	39	0.780	17	39	0.867	9	39	0.867	8
F40.	Lack of Clear and daily task assignment	27	0.675	21	38	0.760	20	30	0.667	26	33	0.733	22
F41.	Insufficient supervision of subcontractors	22	0.550	44	35	0.700	25	28	0.622	33	30	0.667	29

F42.	Improper coordination of subcontractors	21	0.525	50	31	0.620	38	23	0.511	56	33	0.733	22
F43.	Delay in responding to requests for information	26	0.650	24	30	0.600	42	31	0.689	23	29	0.644	34
7) Safety factor													
F44.	Ignore safety precautions	33	0.825	10	43	0.860	6	37	0.822	16	42	0.933	2
F45.	Absence of insurance for Accident	19	0.475	58	32	0.640	33	25	0.556	47	27	0.600	41
F46.	Accident	35	0.875	4	46	0.920	4	37	0.822	16	42	0.933	2
F47.	Absence of safety protective Wear	25	0.625	29	35	0.700	25	27	0.600	36	25	0.556	50
F48.	Working at high places	25	0.625	29	32	0.640	33	27	0.600	36	31	0.689	28
F49.	Insufficient lighting	23	0.575	40	29	0.580	48	26	0.578	42	22	0.489	59
8) Natural/environmental Factor													
F50.	Climate and Weather conditions	24	0.600	34	30	0.600	42	28	0.622	33	26	0.578	46
F51.	Project location	21	0.525	50	35	0.700	25	24	0.533	52	26	0.578	46
F52.	Project site Distance from town	21	0.525	50	22	0.440	61	25	0.556	47	23	0.511	57
9) Cultural and religious factor													
F53.	Cultural differences among labors	21	0.525	50	27	0.540	54	23	0.511	56	22	0.489	59
F54.	Working on holiday	22	0.550	44	25	0.500	58	22	0.489	60	24	0.533	54
F55.	Difference of language among labors	22	0.550	44	31	0.620	38	22	0.489	60	28	0.622	37

10) Quality factor

F56. Low quality raw materials	20	0.500	54	25	0.500	58	27	0.600	36	30	0.667	29
F57. quality of required works	36	0.900	2	35	0.700	25	39	0.867	9	36	0.800	16
F58. Rework	34	0.850	7	41	0.820	11	35	0.778	19	37	0.822	12
F59. Quality inspection delay	20	0.500	54	30	0.600	42	27	0.600	36	21	0.467	61

11) Political factor

F60. Labor Law and taxation policies	17	0.425	61	27	0.540	54	23	0.511	56	24	0.533	54
F61. Security of project site	27	0.675	21	40	0.800	15	34	0.756	21	33	0.733	22

Factors

Project five			Project six			Project seven			Project Eight			Project nine		
T	RII	R	T	RII	R	T	RII	R	T	RII	R	T	RII	R

1) Manpower/Work Force Factor

F1. Lack of experience.	47	0.940	2	36	0.900	4	45	0.900	5	40	0.889	6	49	0.980	1
F2. Labor Disloyalty.	36	0.720	26	30	0.750	22	36	0.720	25	31	0.689	29	36	0.720	24
F3. Misunderstanding among laborers.	36	0.720	26	31	0.775	20	39	0.780	19	33	0.733	23	42	0.840	17
F4. Labor's bad habit	48	0.960	1	37	0.925	1	43	0.860	11	40	0.889	6	46	0.920	4

F5. Lack of labour skills	45	0.900	5	37	0.925	1	45	0.900	5	40	0.889	6	46	0.920	4
F6. Increase of laborer age	29	0.580	50	23	0.575	44	35	0.700	27	28	0.622	40	27	0.540	53
F7. Labour absenteeism	45	0.900	5	34	0.850	15	47	0.940	3	42	0.933	3	43	0.860	13
F8. Labour personal problem	33	0.660	36	31	0.775	20	37	0.740	21	28	0.622	40	30	0.600	41
F9. Ability to adapt changes and new environments	37	0.740	20	26	0.650	31	32	0.640	40	26	0.578	46	32	0.640	35
F10. Worker's integrity	36	0.720	26	29	0.725	25	33	0.660	35	36	0.800	17	40	0.800	20

2) Management Factor

F11. Poor site management	42	0.840	12	36	0.900	4	42	0.840	14	40	0.889	6	45	0.900	7
F12. Poor communication and coordination between construction parties	37	0.740	20	32	0.800	19	40	0.800	17	36	0.800	17	43	0.860	13
F13. Lack of periodic meeting with labors	31	0.620	42	20	0.500	56	37	0.740	21	23	0.511	58	27	0.540	53
F14. Improper planning and scheduling of work	41	0.820	14	34	0.850	15	44	0.880	8	38	0.844	14	46	0.920	4
F15. Crew size and composition	45	0.900	5	37	0.925	1	43	0.860	11	35	0.778	19	44	0.880	10
F16. Construction managers lack	37	0.740	20	25	0.625	35	28	0.560	53	28	0.622	40	33	0.660	30

of Leadership

F17.	Change orders	35	0.700	29	26	0.650	31	33	0.660	35	28	0.622	40	36	0.720	24
F18.	Disputes	33	0.660	36	26	0.650	31	35	0.700	27	31	0.689	29	32	0.640	35

3) Motivation Factor

F19.	Payment delay	37	0.740	20	36	0.900	4	44	0.880	8	39	0.867	10	45	0.900	7
F20.	Non provision of transport means	42	0.840	12	35	0.875	10	41	0.820	16	39	0.867	10	44	0.880	10
F21.	Lack of Incentive payments and financial Rewards	34	0.680	33	27	0.675	29	35	0.700	27	29	0.644	34	36	0.720	24
F22.	Lack of place for eating and relaxation	26	0.520	58	19	0.475	61	29	0.580	49	23	0.511	58	28	0.560	50
F23.	lack of training sessions	27	0.540	55	28	0.700	27	29	0.580	49	25	0.556	49	33	0.660	30
F24.	Relaxation allowances	21	0.420	61	22	0.550	49	28	0.560	53	29	0.644	34	34	0.680	27
F25.	Amount of payment	47	0.940	2	33	0.825	18	43	0.860	11	38	0.844	14	44	0.880	10
F26.	Discontinuity of work	28	0.560	52	21	0.525	53	27	0.540	59	26	0.578	46	33	0.660	30

4) Schedule Factor

F27.	Working 7 days per week	35	0.700	29	20	0.500	56	33	0.660	35	25	0.556	49	27	0.540	53
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without rest

F28.	Overcrowding	33	0.660	36	28	0.700	27	30	0.600	47	33	0.733	23	31	0.620	37
F29.	Misuse of time schedule	33	0.660	36	20	0.500	56	31	0.620	44	25	0.556	49	30	0.600	41
F30.	Length of work day	30	0.600	46	24	0.600	40	32	0.640	40	32	0.711	25	29	0.580	47
F31.	working overtime	37	0.740	20	25	0.625	35	34	0.680	34	31	0.689	29	33	0.660	30

5) Material/Equipment Factor

F32.	Material shortage	43	0.860	10	36	0.900	4	44	0.880	8	41	0.911	5	47	0.940	3
F33.	Old and inefficient equipment	40	0.800	17	35	0.875	10	38	0.760	20	35	0.778	19	41	0.820	18
F34.	Tools and equipment shortage	45	0.900	5	36	0.900	4	47	0.940	3	45	1.000	1	43	0.860	13
F35.	Unsuitable materials storage location	37	0.740	20	27	0.675	29	33	0.660	35	32	0.711	25	30	0.600	41

6) Supervision Factor

F36.	Misunderstanding between labour and supervisor	35	0.700	29	26	0.650	31	35	0.700	27	28	0.622	40	34	0.680	27
F37.	Inadequate supervisors' skills	31	0.620	42	24	0.600	40	29	0.580	49	31	0.689	29	30	0.600	41
F38.	Supervision delays	41	0.820	14	35	0.875	10	42	0.840	14	43	0.956	2	40	0.800	20

F39.	Lack of Labor surveillance.	45	0.900	5	35	0.875	10	40	0.800	17	39	0.867	10	49	0.980	1
F40.	Lack of Clear and daily task assignment	35	0.700	29	29	0.725	25	37	0.740	21	34	0.756	21	38	0.760	23
F41.	Insufficient supervision of subcontractors	30	0.600	46	25	0.625	35	32	0.640	40	29	0.644	34	33	0.660	30
F42.	Improper coordination of subcontractors	40	0.800	17	22	0.550	49	33	0.660	35	29	0.644	34	24	0.480	58
F43.	Delay in responding to requests for information	31	0.620	42	23	0.575	44	32	0.640	40	34	0.756	21	29	0.580	47
7) Safety factor																
F44.	Ignore safety precautions	43	0.860	10	35	0.875	10	49	0.980	1	38	0.844	14	40	0.800	20
F45.	Absence of insurance for Accident	25	0.500	59	25	0.625	35	31	0.620	44	24	0.533	54	26	0.520	57
F46.	Accident	46	0.920	4	36	0.900	4	45	0.900	5	39	0.867	10	45	0.900	7
F47.	Absence of safety protective Wear	28	0.560	52	24	0.600	40	36	0.720	25	30	0.667	33	28	0.560	50
F48.	Working at high places	34	0.680	33	22	0.550	49	35	0.700	27	29	0.644	34	28	0.560	50
F49.	Insufficient lighting	28	0.560	52	25	0.625	35	35	0.700	27	24	0.533	54	24	0.480	58

8) Natural/environmental Factor

F50.	Climate and Weather conditions	33	0.660	36	21	0.525	53	28	0.560	53	29	0.644	34	31	0.620	37
F51.	Project location	27	0.540	55	23	0.575	44	29	0.580	49	27	0.600	45	31	0.620	37
F52.	Project site Distance from town	24	0.480	60	21	0.525	53	28	0.560	53	23	0.511	58	27	0.540	53

9) Cultural and religious factor

F53.	Cultural differences among labors	31	0.620	42	20	0.500	56	25	0.500	60	24	0.533	54	29	0.580	47
F54.	Working on holiday	27	0.540	55	23	0.575	44	28	0.560	53	23	0.511	58	30	0.600	41
F55.	Difference of language among labors	29	0.580	50	22	0.550	49	25	0.500	60	25	0.556	49	24	0.480	58

10) Quality factor

F56.	Low quality raw materials	30	0.600	46	24	0.600	40	35	0.700	27	24	0.533	54	34	0.680	27
F57.	quality of required works	45	0.900	5	34	0.850	15	47	0.940	3	42	0.933	3	43	0.860	13
F58.	Rework	41	0.820	14	34	0.850	15	48	0.960	2	42	0.933	3	43	0.860	13
F59.	Quality inspection delay	30	0.600	46	23	0.575	44	28	0.560	53	25	0.556	49	31	0.620	37

11) Political factor

F60. Labor Law and taxation policies	34	0.680	33	20	0.500	56	30	0.600	47	26	0.578	46	23	0.460	61
F61. Security of project site	38	0.760	19	30	0.750	22	37	0.740	21	32	0.711	25	41	0.820	18

Factors	Engineers			Skilled labor			Supervisors			Managers					
	T	RII	R	T	RII	R	T	RII	R	T	RII	R			
1) Manpower/Work Force Factor															
F1. Lack of experience.	141	0.910	1	118	0.908	3	82	0.911	1	36	0.900	4			
F2. Labor Disloyalty.	111	0.716	23	93	0.715	23	64	0.711	23	29	0.725	22			
F3. Misunderstanding among laborers.	120	0.774	20	101	0.777	20	70	0.778	19	31	0.775	19			
F4. Labor's bad habit	137	0.884	6	115	0.885	6	81	0.900	3	34	0.850	12			
F5. Lack of labour skills	139	0.897	4	116	0.892	4	81	0.900	3	35	0.875	7			
F6. Increase of laborer age	87	0.561	52	75	0.577	49	52	0.578	47	24	0.600	39			

F7. Labour absenteeism	131	0.845	14	113	0.869	13	77	0.856	10	34	0.850	12
F8. Labour personal problem	106	0.684	26	89	0.685	25	62	0.689	26	27	0.675	25
F9. Ability to adapt changes and new environments	99	0.639	34	83	0.638	36	56	0.622	38	27	0.675	25
F10. Worker's integrity	109	0.703	24	91	0.700	24	63	0.700	24	28	0.700	24

2) Management Factor

F11. Poor site management	136	0.877	7	114	0.877	11	79	0.878	6	35	0.875	7
F12. Poor communication and coordination between construction parties	124	0.800	19	102	0.785	19	71	0.789	18	30	0.750	20
F13. Lack of periodic meeting with labors	94	0.606	41	75	0.577	49	53	0.589	44	26	0.650	31
F14. Improper planning and scheduling of work	130	0.839	16	109	0.838	16	74	0.822	15	35	0.875	7
F15. Crew size and composition	132	0.852	13	113	0.869	13	75	0.833	14	34	0.850	12
F16. Construction managers lack of Leadership	97	0.626	37	84	0.646	32	54	0.600	42	27	0.675	25
F17. Change orders	105	0.677	27	84	0.646	32	57	0.633	34	24	0.600	39
F18. Disputes	102	0.658	31	85	0.654	30	59	0.656	29	26	0.650	31

3) Motivation Factor

F19.	Payment delay	136	0.877	7	114	0.877	11	79	0.878	6	35	0.875	7
F20.	Non provision of transport means	129	0.832	17	108	0.831	17	77	0.856	10	34	0.850	12
F21.	Lack of Incentive payments and financial Rewards	105	0.677	27	88	0.677	26	61	0.678	27	27	0.675	25
F22.	Lack of place for eating and relaxation	82	0.529	60	69	0.531	60	46	0.511	60	20	0.500	56
F23.	lack of training sessions	86	0.555	54	77	0.592	45	50	0.556	54	18	0.450	60
F24.	Relaxation allowances	86	0.555	54	72	0.554	56	48	0.533	58	24	0.600	39
F25.	Amount of payment	131	0.845	14	113	0.869	13	77	0.856	10	34	0.850	12
F26.	Discontinuity of work	91	0.587	46	75	0.577	49	50	0.556	54	23	0.575	46

4) Schedule Factor

F27.	Working 7 days per week without rest	94	0.606	41	79	0.608	42	55	0.611	41	24	0.600	39
F28.	Overcrowding	97	0.626	37	81	0.623	40	56	0.622	38	25	0.625	36
F29.	Misuse of time schedule	91	0.587	46	76	0.585	47	53	0.589	44	24	0.600	39
F30.	Length of work day	92	0.594	45	79	0.608	42	54	0.600	42	27	0.675	25
F31.	working overtime	104	0.671	29	87	0.669	27	63	0.700	24	24	0.600	39

5) Material/Equipment Factor

F32.	Material shortage	140	0.903	3	119	0.915	2	82	0.911	1	35	0.875	7
F33.	Old and inefficient equipment	128	0.826	18	107	0.823	18	72	0.800	17	32	0.800	18
F34.	Tools and equipment shortage	141	0.910	1	116	0.892	4	77	0.856	10	36	0.900	4
F35.	Unsuitable materials storage location	107	0.690	25	85	0.654	30	58	0.644	32	25	0.625	36

6) Supervision Factor

F36.	Misunderstanding between labour and supervisor	103	0.665	30	86	0.662	29	60	0.667	28	27	0.675	25
F37.	Inadequate supervisors' skills	93	0.600	43	77	0.592	45	52	0.578	47	24	0.600	39
F38.	Supervision delays	131	0.845	14	110	0.846	15	73	0.811	16	37	0.925	1
F39.	Lack of Labor surveillance.	135	0.871	9	115	0.885	6	78	0.867	9	36	0.900	4
F40.	Lack of Clear and daily task assignment	112	0.723	22	94	0.723	22	65	0.722	22	29	0.725	22
F41.	Insufficient supervision of subcontractors	100	0.645	32	83	0.638	36	56	0.622	38	25	0.625	36
F42.	Improper coordination of subcontractors	95	0.613	40	83	0.638	36	52	0.578	47	26	0.650	31
F43.	Delay in responding to requests for information	98	0.632	35	84	0.646	32	57	0.633	34	26	0.650	31

7) Safety factor

F44.	Ignore safety precautions	134	0.865	10	115	0.885	6	77	0.856	10	34	0.850	12
F45.	Absence of insurance for Accident	87	0.561	52	73	0.562	55	51	0.567	51	23	0.575	46
F46.	Accident	138	0.890	5	115	0.885	6	51	0.567	50	23	0.575	45
F47.	Absence of safety protective Wear	96	0.619	39	80	0.615	41	59	0.656	28	23	0.575	45
F48.	Working at high places	98	0.632	35	87	0.669	27	57	0.633	33	21	0.525	54
F49.	Insufficient lighting	88	0.568	51	74	0.569	52	51	0.567	50	23	0.575	45

8) Natural/environmental Factor

F50.	Climate and Weather conditions	93	0.600	43	82	0.631	39	57	0.633	33	18	0.450	60
F51.	Project location	90	0.581	48	76	0.585	47	52	0.578	46	23	0.575	45
F52.	Project site Distance from town	81	0.523	61	67	0.515	61	45	0.500	61	21	0.525	54

9) Cultural and religious factor

F53.	Cultural differences among labors	83	0.535	58	70	0.538	58	48	0.533	58	21	0.536	53
F54.	Working on holiday	83	0.535	58	70	0.538	58	51	0.567	50	20	0.500	56
F55.	Difference of language among labors	85	0.548	56	74	0.569	52	49	0.544	56	19	0.475	59

10) Quality factor

F56.	Low quality raw materials	90	0.581	48	78	0.600	44	59	0.656	28	22	0.550	51
F57.	quality of required works	133	0.858	11	121	0.931	1	79	0.878	5	33	0.825	16
F58.	Rework	133	0.858	11	115	0.885	6	70	0.778	18	37	0.925	1
F59.	Quality inspection delay	89	0.574	50	74	0.569	52	53	0.589	43	20	0.500	56

11) Political factor

F60.	Labor Law and taxation policies	84	0.542	57	71	0.546	57	49	0.544	56	22	0.550	51
F61.	Security of project site	117	0.755	21	98	0.754	21	68	0.756	20	30	0.750	19

8 English Questionnaire



JIMMA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

JIMMA INSTITUTE OF TECHNOLOGY

SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING

CONSTRUCTION ENGINEERING AND MANAGEMENT STREAM

(QUESTIONNAIRE)

Assessment of Factors Affecting Labor Productivity in Road Construction Projects

The aim of this questionnaire is to study the factors affecting Labor Productivity in Road Construction Projects in Oromia Bale Zone to achieve Masters of Science(M.Sc.) in Civil Engineering with sub specialization of Construction Engineering and Management from Jimma University-Jimma Institute of Technology. This questionnaire is required to be filled with exact relevant facts as much as possible. All data included in this questionnaire will be used only for academic research purpose and will be strictly confidential.

Researcher- Melese Mengistu

Advisor- prof. Emer T. Quezon

Co advisor-Eng. Getachew Kebede, MSc.

August, 2007

1. INSTRUCTION

- ✓ This interview questioner contains two titles. These are general information, factors affecting labor productivity and you are kindly requested to fill the necessary information required on the provide space correctly and with neatness.
- ✓ Please do not write any misleading answer

2. PART ONE

- 1) What is the grade of your company (contractor)? _____
- 2) What is Total project cost in ETB? _____
- 3) What is your current position within the company? Tick one of the following
 - Site Engineer
 - Office engineer
 - Project manager/ Deputy project manager
 - Construction manager
 - Foreman
 - Mason
 - Resident engineer (client)
 - Construction Supervisor
- 4) How many years of experience do you have with this trade work?
 - 0 up to 2 years
 - 2 up to 5 years
 - 5 up to 10 years
 - 10 up to 20 years
- 5) What is your level of education?
 - A) Finished high school C) college training D) degree and above

3. PART TWO

Judge the level of practice of each of the questions under the title factors affecting labor productivity. Select one of the following alternatives by Judging how badly the provided factor affect labor productivity in road construction.

When you tick one from the alternative remember that you are saying.

Very low The factor has very low effect of reducing labor productivity

Low The factor has low effect of reducing labor productivity

Medium The factor has medium effect on labor productivity

High The factor reduce labor productivity highly

Very high The factor reduce labor productivity very highly

Below are numbers of factors that affect labor productivity in road construction project. From your experience, please express your opinion on the importance of the following factors as factors that affecting labor productivity of road construction projects.(Please tick the appropriate box).

Groups/Factors	Very Low	Low	Medium	High	Very High
1) Manpower/Work Force Factor					
F62. Lack of experience.					
F63. Disloyalty.					
F64. Misunderstanding among laborers.					
F65. Alcoholism.					
F66. Lack of labour skills					
F67. Increase of laborer age					
F68. Labour absenteeism					
F69. Labour personal problem					
F70. Ability to adapt changes and new					

environments					
F71. Worker's integrity					
2) Management Factor					
F72. Poor site management					
F73. Poor communication and coordination between construction parties					
F74. Lack of periodic meeting with labors					
F75. Improper planning and scheduling of work					
F76. Crew size and composition					
F77. Construction managers lack of Leadership					
F78. Change orders					
F79. Disputes					
3) Motivation Factor					
F80. Payment delay					
F81. Non provision of transport means					
F82. Lack of Incentive payments and financial Rewards					
F83. Lack of place for eating and relaxation					
F84. lack of training sessions					
F85. Relaxation allowances					
F86. Amount of payment					
F87. Discontinuity of work					
4) Schedule Compression Factor					
F88. Working 7 days per week without rest					
F89. Overcrowding					
F90. Misuse of time schedule					
F91. Length of work day					
F92. working overtime					
5) Material/Equipment Factor					
F93. Material shortage					
F94. Old and inefficient equipment					
F95. Tools and equipment shortage					
F96. Unsuitable materials storage location					
6) Supervision Factor					
F97. Misunderstanding between labour and supervisor					
F98. Inadequate supervisors' skills					
F99. Supervision delays					
F100. Lack of labor surveillance					
F101. Lack of Clear and daily task assignment					
F102. Insufficient supervision of					

subcontractors					
F103. Improper coordination of subcontractors					
F104. Delay in responding to requests for information					
7) Safety factor					
F105. Ignore safety precautions					
F106. Absence of insurance for Accident					
F107. Accident					
F108. Absence of safety protective Wear					
F109. Working at high places					
F110. Insufficient lighting					
8) Natural/environmental Factors					
F111. Climate and Weather conditions					
F112. Project location					
F113. Project site Distance from town					
9) Cultural and religious factor					
F114. Cultural differences among labors					
F115. Working on holiday					
F116. Difference of language among labors					
10) Quality					
F117. Low quality raw materials					
F118. High/low quality of required works					
F119. Rework					
F120. Quality inspection delay					
11) Political factor					
F121. Labor Law and taxation policy					
F122. Security of project site					

4. Other Comments on Factors affecting Labor Productivity in road Construction sites

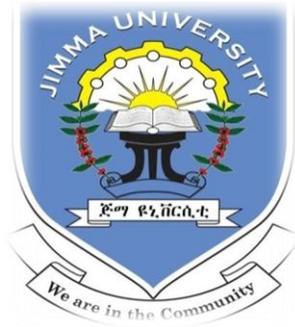
1. _____

2. _____

3. _____

Thank you

9 Amharic Questionnaire



ጅማ ዩኒቨርሲቲ

ድህረ ምረቃ ትምህርት ክፍል

ጅማ ቴክኖሎጂ ኢንስቲትዩት

ሲቪል ና ኢንቨርሎጂንታል ምህንድስና ትምህርት ቤት

የኮንስትራክሽን ምህንድስና ና ማኔጅመንት ትምህርት ዘርፍ

(መጠይቅ)

በ ኦርሚያ ክልል በ ባሌ ዞን ስር በሚገኙ የመንገድ ስራ ወስጥ የ ስራተኛውን ምርታማነትን የሚጎዱ ችግሮችን ለይቶ መሰብሰብና መብጭቻቸውን መጠቆም

የዚህ መጠይቅ ዋና አላማ በ ደቡብ ምስራቅ ኦርሚያ በሚገኙ የመንገድ ስራ ወስጥ የ ስራተኛውን ምርታማነትን የሚጎዱ ችግሮችን ለይቶ ለመሰብሰብና መብጭቻቸውን ለመጠቆም ነው ። የዚህ ጥናት ውጤት የሚወለደው ከ ጅማ ዩኒቨርሲቲ-ጅማ ቴክኖሎጂ ኢንስቲትዩት በ ሲቪል ምህንድስና ስር በኮንስትራክሽን ምህንድስና ና ማኔጅመንት ማስተርስ ኦፍ ሳይንስ (M.Sc.) ለመቀበል የሚወልድ ነው።

ይህ መጠይቅ በተቻለ መጠን በ እውነተኛና ትክክለኛ መረጃ መሞላት አለበት። ከዚህ መጠይቅ የሚገኝ መረጃ የሚወለደው ለ አካዳሚክ ሪሶርች(ትምህርታዊ ጥናት) ብቻ ና ሚስጥራዊነቱ በጣም የተጠበቀ ነው።

ተመራማሪ- መለስ መንግስቱ

አማካሪ- ፕሮፌሰር ኤመር ቲ.ኩይዘን

ረዳት አማካሪ-እንጅነር ጌታቸው ከበደ፣ M.Sc.

ነሃሴ, 2007

ሀ. ትዕዛዝ

- ✓ ይህ መጠይቅ ሁለት ክፍሎች አሉት። የመጀመሪያው ስለ ጠቅላላ እንፎርሜሽን ስሆን ሁለተኛው ደግሞ የሰራተኛውን ምርታማነትን የሚጎዱ ችግሮችን ደረጃ ስለ መስጠት ይሆናል። በሁለቱም ክፍሎች ስር የሚገኙትን ጥያቄዎች ተገቢውን መልስ በተሰጠው ባዶ ቦታ ላይ በትክክል ና በንፅህና እንዲመልሱ በትህትና እጠይቃለሁ።
- ✓ ተመራማሪውን ወዳልሆነ ድምዳሜ የሚያደረስ መረጃ መጻፍ ፈፅሞ አይፈለግም።

ለ. ክፍል አንድ

በዚህ ክፍል ስር የሚገኙትን ጥያቄዎች ተገቢውን መልስ በተሰጠው ባዶ ቦታ ላይ እወኑትና መረጃ ይጻፉ

- 1) የድርጅቱ ደረጃ(ኮንትራክተር) _____
- 2) የፕሮጀክቱ ጠቅላላ በጀት በ ኢትዮጵያ ብር _____
- 3) በሚሰሩበት መስሪያቤት/ካምፓኒ የእርሶ የሰራ ዲርሻ ምንድን ነው?
 - ሳይት ኢንጅነር
 - አፊስ ኢንጅነር
 - ፕሮጀክት ማኔጀር/ ዲፕሎማ ፕሮጀክት ማኔጀር
 - ኮንስትራክሽን ማኔጀር
 - ፎረማን
 - ግንባራ
 - ሬሲደንት ኢንጅነር(የ አሰሪ)
 - ኮንስትራክሽን ሱፐርቫይዘር
- 4) በ መንገድ ኮንስትራክሽን ውስጥ ለሰዓት አመት ሰርተዋል? ----- አመት
 - ከ 0 - 2 አመት
 - ከ2 - 5 አመት
 - ከ5 - 10 አመት
 - ከ10- 20 አመት
- 5) የ ትምህርት ደረጃ
 - ሁለተኛ ደረጃ የጠናቀቀ ኮሌጅ የጠናቀቀ ዲግሪ ና ከዛበላይ

ሐ. ክፍል ሁለት

- ✓ ከዚህ በታች የተዘዘሩትን በመንገድ ስራ ውስጥ የሰራተኛውን ምርታማነትን የሚጎዱ ችግሮችን በምን አይነት ደረጃ ተፅዕኖ እንደሚያደረጉ ከተዘረዘሩት የደረጃ መስጫ ሳጥኖች ውስጥ የራሱን ልምድ ና የሰራ ገጠመኝ በመጠቀም በአንዱ ውስጥ ምልክት ያድርጉ።
- ✓ ያስተውሉ በአንዱ ሳጥን ውስጥ ምልክት ሲያደርጉ፡-

በጣም ዝቅተኛ ችግሩ/ፋክተሩ የሰራተኛውን ምርታማነት የሚጎዳው በጣም ዝቅተኛ በሆነ መልክ ነው

ዝቅተኛ ችግሩ/ፋክተሩ የሰራተኛውን ምርታማነት የሚጎዳው ዝቅተኛ በሆነ መልክ ነው

መካከለኛ ችግሩ/ፋክተሩ በሰራተኛው ምርታማነት ላይ መካከለኛ ተፅዕኖ አለው

ከፍተኛ ችግሩ/ፋክተሩ የሰራተኛውን ምርታማነት የሚጎዳው ከፍተኛ በሆነ መልክ ነው

በጣም ከፍተኛ ችግሩ/ፋክተሩ የሰራተኛውን ምርታማነት የሚጎዳው በጣም ከፍተኛ በሆነ መልክ ነው

- ✓ ከዚህ በታች በደቡብ ምስራቅ ኦሮሚያ በሚገኙ የመንገድ ስራ ውስጥ የ ሰራተኛውን ምርታማነትን ሊጎዱ የሚችሉ ችግሮች ተለይተው ተዘርዝረዋል። የራሱን ልምድ ና የሰራ ገጠመኝ በመጠቀም የችግሩን ደረጃ በማመዛዘን በአንዱ ውስጥ ምልክት ያድርጉ።

ምድብ/ የሰራተኛውን ምርታማነትን የሚጎዱ ችግሮች	በጣም ዝቅተኛ	ዝቅተኛ	መካከለኛ	ከፍተኛ	በጣም ከፍተኛ
1. የሰራተኛው ችግር					
F1. ልምድ ማጣት					
F2. አለመታመን					
F3. የሰራተኛ አለመግባባት					
F4. ሱሰኝነት					
F5. የሰራተኛው ብቃት ማጣት					
F6. የሰራተኛው እድሜ መጨመር					
F7. ከስራ መቅረት					
F8. የሰራተኛው የግል ችግር					
F9. የሰራተኛው አዲስ አካባቢንና ለውጥን ቶሎ አለመልመድ					
F10. የሰራተኛው በጋራ ያለመስራት/አንድነት ማጣት					

2. የማይገኝ መንገድ					
F11.	የሥራ ቦታ/ሳይት ቁጥጥር ማነስ				
F12.	የአመራር አካል የመግለፅ ችሎታ ማነስ				
F13.	ሰራተኛውን በየጊዜው ሰብሰቦ አለማናገር				
F14.	አላአግባብ የሆነ የሥራ ጥላንና ቅድመ ተከተል				
F15.	የሥራ ቡድን መጠንና ስብጥር				
F16.	የኮንትራት-ክሸን አመራር ችሎታ ማነስ				
F17.	የሥራ ለውጥ				
F18.	አለመግባባት				
3. የሥራ ተነሳሽነት					
F19.	የክፍያ መዘግየት				
F20.	የትራኒስፖርት ችግር				
F21.	ለሰራተኛው የገንዘብ መበረታቻ አሰራር አለመኖር				
F22.	የመመገቢያ ቦታና መዘናኛ አለመኖር				
F23.	ለሰራተኛው ተገቢ ስልጠና አለመስጠት				
F24.	አሎዋንስ አለመስጠት				
F25.	የክፍያ መጠን				
F26.	የሥራው ቀጣይነት				
4. የሥራ እስኬጃል ማጣብብ					
F27.	ያለአረፍት በሳምንት 7 ቀን መስራት				
F28.	ሰራተኛ መብዛት				
F29.	የሥራ ቅድመ ተከተልን/ እስኬጃል በትክክል አለመጠቀም				
F30.	የሥራ ሰዓት እረዝመት				
F31.	አቫር ታይም መስራት				
5. የመሰሪያ እቃና መሳሪያ					
F32.	የማቴርያል እጥረት				
F33.	ያረጀና የማይመች ኢኪፕመንት				
F34.	የመሳሪያና ኢኪፕመንት እጥረት				
F35.	የማይመች የማቴርያል ማከማቻ ቦታ				

6. ሱፐርቪዥን					
F36.	የሱፐርቫይዘርና የሰራተኛ አለመግባባት				
F37.	የሱፐርቫይዘር ብቃት ማነስ				
F38.	ሱፐርቪዥን መዘግየት				
F39.	ሰራተኛውን በየግዜው ያለመከታተል				
F40.	ግልፅ ያልሆነ የሰራ ድርሻ				
F41.	የሰብ ኮንትራክተር ቁጥጥር ማነስ				
F42.	የሰብ ኮንትራክተር ኮርዲኔሽን ችግር				
F43.	የኢንፎርሜሽን መዘግየት				
7. ሴሬቲ					
F44.	የሴሬቲ ህጎችን መጣስ				
F45.	የኢንፎርሜሽን አለመኖር				
F46.	አደጋ				
F47.	የአደጋ መከላከያ አለመኖር				
F48.	በቂ ያልሆነ መብራት				
F49.	በከፍታ ላይ ሆኖ መስራት				
8. የተፈጥሮ/ያከባቢ					
F50.	የአይርና የአይር ፀባይ ለውጥ ችግር				
F51.	የፕሮጀክት ቦታ				
F52.	የፕሮጀክት ከከተማ ያለው ርቀት				
9. ባህልና እምነት					
F53.	የባህል ልዩነት				
F54.	በ በአል ቀን መስራት				
F55.	የቋንቋ ልዩነት				
10. የሰራ ጥራት					
F56.	የመስርያ አቃ የወረደ ጥራት				
F57.	የሰራው ከፍተኛ/ዝቅተኛ ጥራት				

F58.	እንደገና መስራት					
F59.	የጥራት እንስጥክሽን መዘግየት					
II. ፖሎቲካ						
F60.	የሰራተኛ ህግና ታክስ ፖሊሲ					
F61.	የፕሮጀክት ቦታ የፀጥታ ሁኔታ					

መ) በ መንገድ ስራ ውስጥ የ ሰራተኛውን ምርታማነትን የሚጎዱ ችግሮች በተመለከተ ማንኛውም አስታየት ካለዎት

- 1) _____

- 2) _____

- 3) _____

አመሰግናለዉ