WOLKITE UNIVERSITY

COLLEGE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COTM

TITLE: **Assessment of factor affecting labor productivity (case of building projects in Wolkite University)**

PREPARED BY: - Abbush Wako

Erkinesh Fikadu

Rakeb Boru

Berhane Tamirat

Meaza Desalegn

ADVISOR NAME: Mr. .**HUNDE**

DATE OF SUBMISSION: 24/06/2019

PLACE OF SUBMISSION: **Wolkite University**

JUNE 24

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Name of Researchers	ID NO
1, Abbush Wako	ENGR/005/07
2, Erkinesh Fikadu	ENGR/382 /07
3, Rakeb Boru	ENGR/1028 /07
4, Berhane Tamirat	ENGR/212 /07
5, Meaza Desalegn	ENGR/715 /07

APPROVED BY THE BOARD OF EXAMINERS

NAME	SIGNATURE
_____ ADVISOR	_____
_____ EXAMINER (INTERNAL)	_____
_____ EXAMINER (EXTERNAL)	_____
_____ CHAIRPERSON	_____

AKNOLOGMENT

First, we thank our GOD, the most Gracious and the most Merciful, for giving us the will and strength to complete this research.

Second, we wish to express our deep gratitude to our advisor, Ins. HUNDE, for his sincere guidance, extensive assistance, critical insight, and patience, without which we would not have been able to complete this research. we are deeply impressed with his wealth of knowledge. It has been a great honor to work with and learn from him.

Our warmest gratitude is to our family for being wonderful parents. There are not Enough words to thank our parents for the love of learning they have instilled to us. Without Their heartwarming encouragement, we would not have had the strength to undertake such a task, and without their loving care, prayers and constant support we could never have completed it.

Last but not the list we would like to acknowledge the support given by all respondents from various companies that made this research possible by responding the questionnaires and share ideas on research related issues.

Abstract

One of the wide ranging problems that the construction industry facing; especially in developing countries is Poor productivity of construction workers. This problem has a great effect on cost, quality and time overruns in construction projects.

As construction is a labor-intensive industry, this paper focuses on Assessment of factors affecting labor productivity. So, the research examines the common factors affecting labor productivity of building construction projects, effects of labor productivity on project and proposing labor productivity improving methods suggested by construction practitioners in Wolkite. Because an accurate understanding of the correlation between these factors will lead to improved labor productivity.

We used the semi structured interview and questioner data collection technique to collect rich and meaningful data from the participants to assess the problem.

The research result shows that ten critical factors affecting labor productivity which needs more attentions are; Lack of required material, Lack of required tools/equipment, Supervision delay, Increase in the price of material, Differing site condition from the plan, Inspection delay from the author, Accident during construction, Dispute with the designer, Lack of labor experience and Rework.

The research also found that; Exploring, Identifying, and Evaluating Issues Affecting Labor Productivity, Applying appropriate leadership style, motivating the work force, providing training and development, Implementing effective project management processes, pay workers salary as per the productivity and giving measured task for the worker as per the weakly schedules are labor improvement approaches suggested by the respondent. Delay acne of completion period, Increase overhead cost of the company, Quality problem, loss of profit were found to be the major effects of labor productivity.

Finally, based on the analysis of the results, recommendations for contractors and other stake holders have been proposed that enables to improve labor productivity and favors the construction industry for better performances.

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CHAPTER ONE

INTRODUCTION

1.1, Research background

Construction is the world's largest and most challenging industry. Human resource today has a strategic role for productivity increase of any organization, and this makes it superior in the industrial competition. With the effective and optimum uses of it, all the advantages supplied by the productivity growth can be obtained. Construction is a key sector of the national economy for countries all around the world, as traditionally it took up a big portion in nation's total employment and its significant contribution to a nation's revenue as a whole. However, until today, construction industries are still facing number of problems regarding the low productivity, poor safety and insufficient quality. Productivity is the one of the most important factor that affects overall performance of any small or medium or large construction industry.

There are number of factors that directly affect the productivity of labor, thus it is important for any organization to study and identify those factors and take an appropriate action for improving the labor productivity. At the micro level, if we improved productivity, ultimately it reduces or decreases the unit cost of project and gives overall best performance of project. There are number of activities involved in the construction industry. Thus the effective use and proper management regarding labor is very important in construction operations without which those activities may not be possible

1.2, Statement of problem

In the construction industry productivity loss is one of the greatest and severe problems. Previous researches shown that, from various project-costs components such as labors, materials and equipment's; labor component is considered the most risk. Whereas others components (equipment and material) can be determined by the market price. Labor cost in construction industry is estimated to be about 33%- 50% of the entire project cost (A.A.Attar, 2012). Because labor is more variable and unpredictable than other project-cost components, it becomes necessary to understand the effects of different factors on labor productivity. An improve in labor productivity can reduce the project cost in a direct proportion.

Therefore, to address the problem understanding and quantifying the factors affecting labor productivity helps to come with methods to improve labor productivity. In turn also reduce cost of the project and its completion time.

1.3, Research question

1. What are the factors affecting labor productivity on building construction projects in Wolkite University?

2, what are the effects of labor productivity on building construction industry?

3, what are methods suggested by construction practitioners to improve productivity?

1.4, Objective of the Study

1.4.1, General objective

The objective of this research is to assess factors affecting the labor productivity (case of building project in Wolkite).

1.4.2, Specific objective of the research

The specific objectives of the studies are:-

1. To identify factors affecting labor productivity on building construction projects in Wolkite University.

2. To identify effects of labor productivity on building construction projects.

3. To propose methods suggested by construction practitioners to improve productivity.

1.5, Significance of the study

Productivity has a great significance in the construction industry. Labor productivity constitutes a significant part of production input for construction projects. In the construction industry, many external and internal factors are never constant and are difficult to anticipate.

This factor leads to a continuous variation in labor productivity. It is necessary to bear in mind that a reduction in productivity affects the schedule of the work and causes delays. The consequences of these delays could result in serious money losses. Further, considerable cost can be saved if productivity is improved because the same work can be done with less manpower, thus reducing overall labor cost.

Increased productivity in the construction industry benefits the two Contracting parties; the Client and the Contractor of the project.

From the Client's perspective, increased productivity lowers costs, shortens construction schedules and achieves better returns on investments. From the contractor's perspective, increased productivity leads to a more satisfied customer, leads to faster turnover and increased profits.

The Result that will be drawn from this study could be used by the construction practitioners of the Ethiopian construction industry to take account of these factors at an early stage in order to minimize the time and cost overrun. Besides the investigated factors can serve as a checklist for construction practitioners to give attention to enhance the productivity of labors so as to make the project to be completed as per the plan.

1.6, Scope and limitation of the study

The scope of this research is limited to the study of labor productivity on building construction projects, because of time limit and financial problem. Low labor productivity affects all contractors of different class and category. However, the research focused was only on building construction companies and projects due to the fact that construction of buildings uses many labors with various positions.

On the other hand grade three and above building & general contractors are selected by taking in to consideration these contractors have more experience on many projects related to the study area. Besides building projects located in Wolkite University which are under taking by grade one contractors are the targeted projects of the study. As it is studied by different researches most of construction projects fails to be completed within the contract time and budgeted cost. Low labor productivity is one of the reasons for delay and cost over run for the construction projects.

Thus, this research studies mainly the critical factors which affect labor productivity and its effect on building projects in Wolkite.

CHAPTER TWO

LITERATURE REVIEW

It was stated by Yiakoumis (1987) that there has been no standard definition of productivity in construction industry because each company defined productivity depending on their own internal system which is not the same in each company. And none of them succeeded in forming standard definitions or survey tools that can be used to collect standard productivity data Park et al (2005). Also, each construction project is unique and non-repetitive.

Olomolaiye (1998) classified the productivity factors into two categories: external factors the ones outside the control of the organization management and internal factors related to the productivity factors originating within the organization. From their viewpoint, the nature of the industry, usually the separation of design and construction functions, has affected construction productivity through delay in drawings, design changes, and following rework. Construction clients have sometimes been obstructions to construction productivity because of their lack of suitable knowledge about construction procedures. Moreover, being an outdoor industry, construction performance is extremely affected by weather conditions. In addition to the factors disused, health and safety regulations, and codes of practices are other external factors influencing task operations and productivity. In the internal category, management inadequacies could result in a waste of resources with consequent losses in productivity; adoption of modern technology and training for the laborer would increase productivity.

2.1. Review of Labor Productivity from Previous Study

Past studies and research show the number of factors affecting productivity, there are still anonymous factors need to be further studied even in developed countries Emsley (2002). A study by Arditi (2000) stated that policies to rise productivity are not always similar in each country. Their study identified different factors affecting labor productivity and grouped them according to their characteristics such as, design, execution plan, material, equipment, labor, health and safety, supervision, working time, project factor, quality, leadership and coordination, organization, owner/consultant, and external factors.

Adrian (1987) Classified the productivity factors causing low productivity as industry-related factors, labor-related factors, and management-related factors. Industry-related factors, essentially, are the characteristics of the construction industry, such as the uniqueness of construction projects, varied

locations, adverse and unpredictable weather, and seasonality. Labor-related factors include the union's influence, little potential for learning, and lack of motivation. Management-related factors usually refer to a lack of management for tools or techniques.

2.2. Different Factors Affecting Labor Productivity from Previous Studies

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

i. **Time:** During construction projects, there are many tasks which cause a loss of productivity. Past study shows productivity decreases with working overtime. The most frequently stated reasons are fatigue; increased absenteeism; decreased morale; reduced supervision effectiveness; poor workmanship, resulting in higher rework; increased accidents Horner (1995). Working overtime initially result in increased output, but continuing overtime may lead to increased costs and reduced productivity Hinze J. W, (1999). 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 Alinaitwe Park et al (2005).

ii. **Schedule Compression:** When there are early delays in a project, compressions of the overall time frame for a later activity are often the way to compensate interruptions and to complete the assigned task on schedule. From a professional scheduling perspective, schedule compression may be possible without accelerating individual work activities by utilizing float in the project's overall schedule. However, on many projects, schedules are not fully resource loaded. As a consequence, a properly updated schedule reflecting the delays may show the project finishing on time without shortening individual activities. Schedule compression may result to force extra labors for the desired task by the contractor because of shortening the overall duration, allowing the contractor to complete the total remaining work. Schedule compression, when linked with overtime, often results in major productivity losses due to shortages of material tools or equipment to support the extra labor's, resulting in difficult for planning and coordinating the task, and unavailability of experienced labors National Electrical Contractors Association, (1983).

iii. **Type of Project:** To accomplish substantial productivity, every member of a crew requires adequate space to perform task without being affected with/by the other crew members. When more labors are allotted to perform particular task, in a fixed amount of space, it is probable that interference may occur, thus decreasing productivity. Additionally, when multiple trades are assigned to work in the same area, the probability of interference rises and productivity may be 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 Sanders S. R. (1991).

iv. **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. An accident that causes an injured person to be hospitalized results in a work decrease of the crew for which the injured employee worked. Small accidents resulting from nails and steel wires can stop work and, thus, decrease productivity Sanders and Thomas, (1991). Even insufficient lighting shows decreased productivity because sufficient lighting is required to work efficiently and because insufficient lighting has negative effects. Employing a safety officer helps labors to recognize the required safety regulations and to follow them, which can reduce the number of accidents, thus increasing productivity.

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

vi. **Managerial Factors:** Managers' skill and attitudes have a crucial bearing on productivity. In many organizations, productivity is low even though the latest technology and trained manpower are made available. Low productivity is because of inefficient and indifferent management. Experienced and committed managers can obtain surprising results from average people. Employees' job performance depends on their ability and willingness to

work. Management is the catalyst to create both. Advanced technology requires knowledgeable laborers who, in turn, work productively under professionally qualified managers. It is only through sound management that optimum utilization of human and technical resources can be secured.

vii. **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. The absence of any crew member may impact the crew's production rate because workers will, typically, be unable to accomplish the same production rate with fewer resources and with different crew members. 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 Heizer, (1990).

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

ix. **Supervision:** Generally, projects come across some design, drawings and specification changes during construction. If drawings or specifications are with errors and unclear productivity is expected to decrease since 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. 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.

x. **Material/Tools:** Material management is one of the most important factor 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. The size of the construction site and the material storage location has a significant impact on productivity because laborers require extra time to move required materials from inappropriate storage locations, thus resulting in productivity loss Sanders and Thomas, (1991).

xi. **Project Management Factors:** Improper scheduling of work, shortage of critical construction equipment or 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 Association for the Advancement of Cost Engineering, ((AACE), 2004).

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

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

xiv. **Political Factors:** Law and order, stability of government, etc. are essential for high productivity in the construction industry. The government's taxation policies influence willingness to work and expansion of plants.

2.3. Identification of Possible Factors Affecting Productivity in Building Construction in Wolkite

Based upon the Literature Review, this study extracts various factors affecting labor productivity in construction from the previous research studies. Some similar factors were merged together, and some new factors were added.

Table1.1.Shows possible factors affecting labor productivity in building construction (in case of building project in Wolkite) collected from past study and literature review. It does not take into consideration any significant value; they are arranged in alphabetic order.

Table 1. Possible Factors Affecting Labor Productivity in Alphabetical Order, (Gundecha, September 2012)

Sr.	Factors Affecting Labor Productivity at Building Construction
1	Accidents
2	Construction method
3	Drawings and specifications alternated during execution
4	Government regulation
5	High quality of required work
6	Increasing number of laborers
7	Inefficiency of equipment
8	Inspection delay
9	Insufficient transportation mean
10	Insufficient lighting
11	Labor absenteeism
12	Labor disloyalty
13	Lack of competition
14	Lack of financial motivation system

15	Lack of labor experience
16	Lack of periodic meeting with labor
17	Labor personal problems
18	Lack of place eating and relaxation
19	Lack of training sessions
20	Low quality of raw materials
21	Material shortage
22	Misunderstanding among laborers
23	Misunderstanding between laborers and superintendents
24	Misuse of time schedule
25	Payment delays
26	Rework
27	Supervisors' absenteeism
28	Tool and equipment shortages
29	Type of activities in the project
30	Unsuitability of materials storage location
31	Violation of safety precautions
32	Weather change
33	Working at high places
34	Working overtime

To explore issues affecting labor productivity we (group members of the research) must understand the knowledge and experiences of successful construction company leaders. In above literature review, we included information from several sources. Our objective in this study is to identify factor affecting labor productivity (in case of projects found in Wolkite), propose and recommend methods used by construction practitioner's to improve labor productivity.

CHAPTER THREE
RESERCH METHODOLOGY

This chapter will explain all the method used in gather all the information in this study. The methodology describes the practical way in which the whole research project is organized.

The research methodology is based on a literature review in order to analyze existing scientific articles regarding factors affecting CLP. The main instrument of collecting data from construction companies are interview and structured questionnaire. These ways of data acquisition has proved to be extremely efficient at providing large amounts of data at relatively low cost.

The questionnaire comprised of statements generated on the basis of the factors listed in Table 1.1 and specific objective of the project. For this purpose, literature review became a determining issue since data acquired from papers and related publications are the base for the structured questionnaire survey preparation. Participants was required to rate the statements as to their Effect on labor productivity taking into account time, cost, and Quality based on their own experiences on construction sites. The main characteristics of the questionnaire design was that the statements used is easy to read and, understand with no room for interpretation–Furthermore, accuracy and time efficiency in filling out the questionnaire has to be of essence. The need of taking as little time as possible for construction companies to respond was considered very seriously in order to obtain the maximum possible answers.

3.1, Study Area and time it takes

The research will take place is in Wolkite town, in its sub city (Wolkite university).the research also takes three months (30/02/2019 - 24/06/2019) from the beginning of the research to submission date.

3.2, Sources of Data

To achieve the intended objective and to answer the research questions of the study, different sources of data will be used. As a primary data collection; questionnaire and semi-structured interviews were used. To collect secondary data, archival documents were used.

3.3. Population of the Study

The populations used in this research are south region Wolkite Zone, Wolkite university building construction projects and The others populations are project participants such as, office engineers, site engineers, Forman, and labors of the selected project.

3.4, Design of Research Instruments and Method of Data Collection

3.4.1. Questionnaire

In this research, a set of questionnaires will be used because it is a suitable way to gather data from respondents. Often questionnaires are the only feasible way to reach a number of respondents large enough to allow statistically analysis of the results Nil Amponsah A., (2007)).

The choices of using this method are made based on a variety of factors including the type of information to be gathered and the available resources for the research.

3.4.2. Design of Questionnaire

A questionnaire is a series of questions asked to individuals to obtain statistically useful information about a given topic. When properly constructed and responsibly administered, questionnaires become a vital instrument by which statements can be made about specific groups or people or entire populations. In designing the questionnaire, the objectives of the study were first established. This was done to help in determining what questions to ask and how to ask them. Very short and concise questions were fielded as questions that are long and wordy may appear confusing to respondents. All these were done in order to ensure that the responses received would be reliable.

3.4.3, Research Design

The answers for the structured part of the questionnaire are based on Liker's-scale of four ordinal measures of agreement towards each statement (from 1 to 4) as shown in the following sections. The reasons for adopting this simple scale are:

- To provide simplicity for the respondent to answer, and
- To make evaluation of collected data easier

Liker's-scale is important to know respondents' feelings or attitudes about something. The respondents must indicate how closely their feelings match with the question or statement on a rating scale.

After the factors effecting labor productivity in building construction projects are identified; respondents are asked about their agreement on effects of labor productivity on building construction.

Accordingly the respondents choose one of the following based on their experience.

1- Not applicable

2- Does not affect it

3- Somewhat affects it

4- Directly affects it

After the respondents expressed to what extent the selected factors affect labor productivity at construction site, respondents were asked about effects of labor productivity on building construction project based on the following choices.

1- Not applicable

2- Does not affect it

3- Somewhat affects it

4- Directly affects it

The questionnaires are prepared in such a way that detailed information can be gathered in a systematically prepared matrix table.

3.5, Ethical Research

We will not start the interview process prior to obtaining approval from the collage. After obtaining consent, we will ask participants to confirm their willingness to participate in the research. Through providing the consent form, we will inform the potential participants that participating in the study was voluntary and they would not receive payment or other compensation for taking part in the study. We will advise the potential participants of their right to participate or withdraw from the study.

3.6, Data Collection Technique

The qualitative interview is one of the most preferred data collection means that researchers employ to gather rich and meaningful information. we used the semi structured interview and questioning data collection technique to collect rich and meaningful data from the participants.

The face-to-face interviews included open-ended semi structured questions and written form of question included close ended and open ended questioner. We was maintained an open channel of communication with the participants to build a positive relationship and encourage them to answer the interview questions.

Each participant received enough time to answer each question. We used the interview questions to gather data about factors affecting labor productivity, effects of labor productivity on building constructions and provided a framework for meaningful follow-up questions.

3.8, Data Analysis

Using data analysis enables researchers to provide answers to their research. We perform follow-up member checking by conducting multiple questioners and interviews with participants to capture in-depth information.

Both descriptive and qualitative statistics are employed in the data analysis. In the analysis the "Mean score" method is adopted to establish the relative importance of factors and effects of labor productivity for construction projects in Wolkite University. As discussed earlier Liker's scale of four ordinal measures of agreement towards each statement (1, 2, 3 and 4) is used to calculate the mean score for each factor that is used to determine the relative ranking.

The mean score (MS) for each variables of cost overrun is computed by using the following formula;

$$MS = \frac{\Sigma (f \times S)}{N}$$

Where:

MS – Mean score

f– Frequency of responses for each score

S– Scores given to each factor (from 1 to 4)

N– Total number of responses concerning each factor

3.9, Considerations for the Survey

The main consideration for a survey was that it should be easy for respondents. If questions are too complicated, possibility of high drop-out rate will studied. Care has to be taken, so that the initial questions did not negatively influence the results of subsequent questions.

CHAPTER FOUR

ANALYSIS AND DISCUTION

4.1. Introduction

This part of the study provides an indication of the results and discussions found from the data analysis. The results are found from the questionnaire respondents and interviewers participating in the project from Wolkite university construction projects. Each part answers the research questions and achieves the objectives of the research. The tables show participants' Mean score and rank of factors affecting labor productivity on project respondents in each part.

4.2. Factors affecting labor productivity on building construction projects in Wolkite University.

4.2.1. Manpower Factors Affecting Labor Productivity

Table 4.1 and Figure 4.1 show the ranking of the various factors for the manpower group. A lack of labor experience was ranked first in the manpower group, with Mean score value of 3.5,

Lack of labor experience has a great influence on productivity. This result is supported by Paulson, (1975) who found that the craftsmen's experience affects labor productivity. This conclusion is also supported by Heizer J. a. (1990) who established that the knowledge of the craftsman affects job-site productivity. This result is acceptable because experience improves both the intellectual and physical abilities of laborers which, consequently, increase labor productivity.

Lack of competition between laborers had a great effect on labor productivity and ranked in the 2nd position for the manpower group, with Mean score of 3.

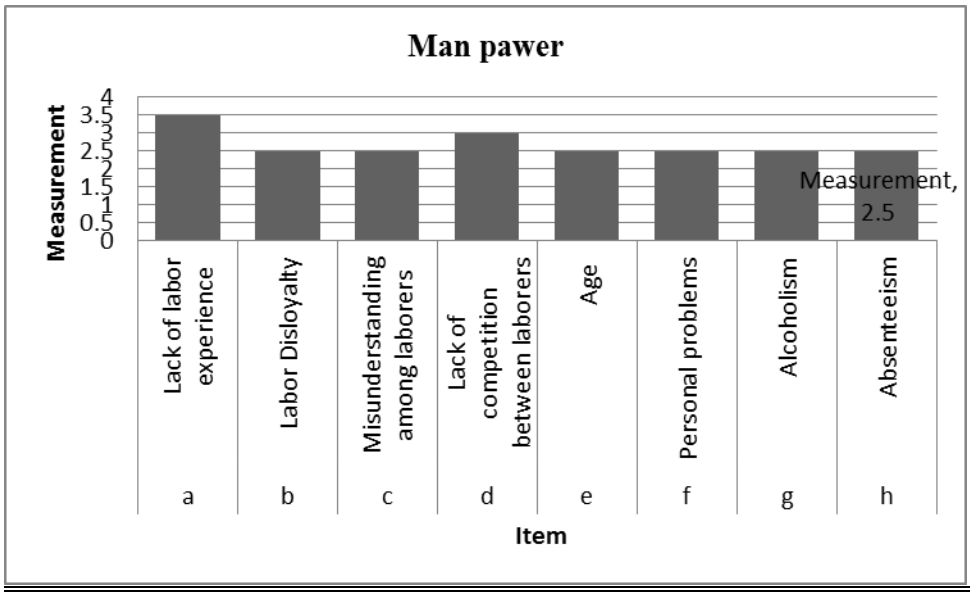


Figure 1. Manpower Factors.

Labor disloyalty, misunderstanding among laborers, age, personal problem, absenteeism and alcoholism are ranked 3rd in the manpower group, with mean score of 2.5.

This result is acceptable because; example misunderstanding among laborers can creates disagreement among them and about the responsibilities for each laborer, which leads to a lot of mistakes in work and, consequently, affects labor productivity.

Labors' age Heizer and Render (1990) supported this result, citing that the age factor generally affects job-site productivity. This result is justified because speed required to perform particular task and strength decline over time affecting labor productivity.

Labor absenteeism factors also affect labor productivity this result is justified given the transient nature of the local workforce and the ease with which construction contractors could hire additional laborers to cover absenteeism.

Personal problems were ranked 3rd in the manpower group, mean score of 2.5. This result might be justified because personal problems cause mental disturbance for laborers, and thus can affect labor safety more than labor productivity.

Alcoholism ranked 3rd in the manpower group, with mean score of 2.5, consuming alcohol at the construction site may lead to various negative effects on other laborers who are working.

Alcohol consumption may lead to rework, misplacing the job work, and accidents, thus completely or partially stopping the construction work and affecting labor productivity.

4.2.2. External Factors Affecting Labor Productivity

Table 4.2 and figure 4.2 illustrate the ranking of factors for the external group. Supervision delays inspection delay from the authorities and rework were ranked 1st in the external group, with mean score of 3.5.

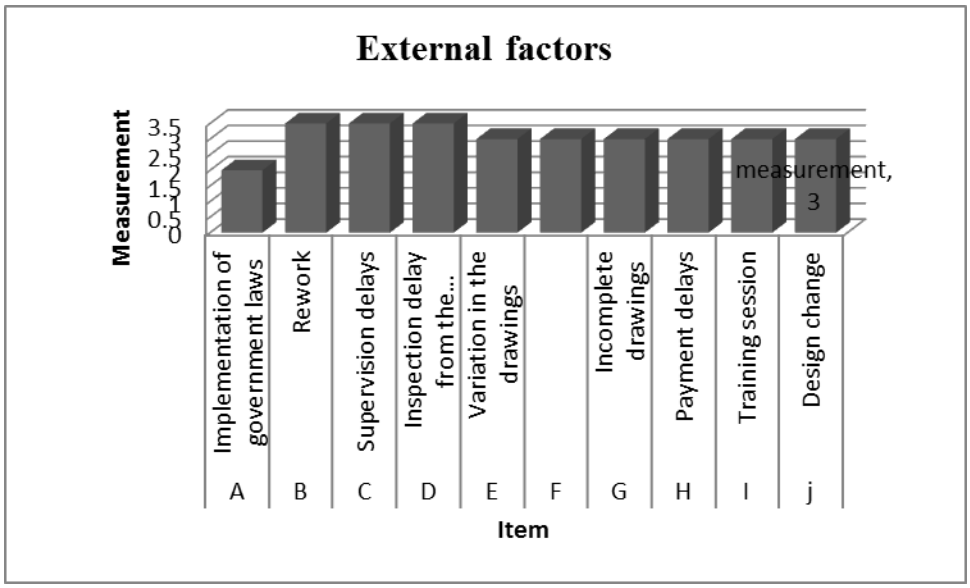


Figure 2 External Factors.

Past study by Guhathakurta, (1993) proves that inspection delays are an important process; for example, because contractors cannot cast concrete before inspection of formwork and steel work, the inspection delay contributes to delays in work activities. It completely stops the task that requires the presence of supervisors, such as casting concrete and backfilling. Additionally, it delays the inspection of completed work which, in turn, leads to a delay in the commencement of new work.

Rework ranked also ranked 1st in the external group, with Mean score of 3.5. Past study from Makulsawatudom, (2004) confirmed that rework is one of the major factors in the construction industry

to affect labor productivity in building construction. The study also listed rework as one of the critical factors effecting productivity and stated that rework is due to incompetent craftsmen and supervisors.

Variations in the drawings, Incomplete drawings, Payment delays, complex design in the given drawing and Design changes were ranked 2nd in the external group, with Mean score of 3.

Thomas, (1999) stated that "there is a 30% loss of efficiency when work changes are being performed. This result can be interpreted as changes to specifications and drawings that require additional time for adjustments of resources and manpower so that the change can be met. Also known as designer errors and omissions, these changes relate to plans that are incomplete or contain errors that are difficult to find until the construction contractor finds them well after the construction phase of the project has started. With most construction contracts, where the contractor bids on designs that are completed prior to contract award, the owner is liable for the designer's errors and omissions".

Payment delays in the construction industry are adversarial and disastrous. Late payment affects a company's cash flow and may ultimately lead to a business's failure. Timeliness of payment is important to avoid the risk of the late-payment problem. A study by Zou, (2007) pointed out that project-funding problems have been identified as cost-related risks, time-related risks, and quality-related risks which can significantly influence the delivery of a construction project. The risk of delayed payment from the owner impacts the duration and cost of the project. These risks causes the project's cost to increase abnormally and, subsequently, delay the project's progress.

Training sessions factors that affect labor productivity (Table 4.11). Past studies from Lema N.,(2002), Cheung, (2004), and Iyer,(2005) stated that persons entering the construction industry directly from high school usually start as inexperienced in construction industry or as laborers. They can learn from their job quickly by working closely with experienced people. Whereas, skilled laborers, such as carpenters, bricklayers, plumbers, and other construction trade specialists, most often get their formal instruction by attending a local technical school or through an employer-provided training program.

Implementing government laws was ranked 3rd in the external group, with mean score of 2.as the result shows government law has no direct effect on productivity.

4.2.3. Resource Factors Affecting Labor Productivity

Table 4.3 and Figure 4.3 show the ranking for factors of the resource group. A lack of required construction material and Lack of required tools/or equipment's was ranked first in the resource group, with Mean score of 4, and was both are first among all 42 factors affecting labor productivity (Table 4.11).

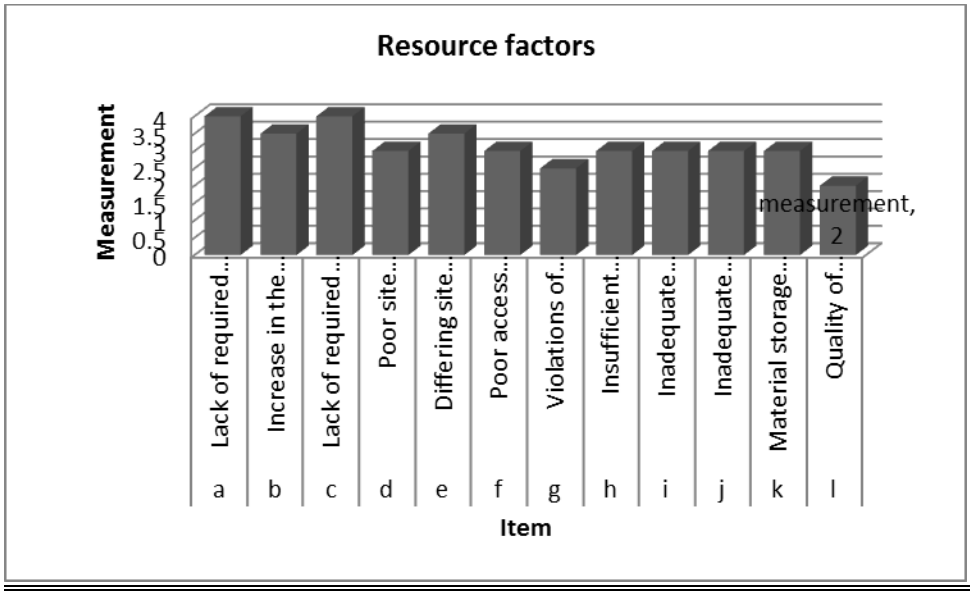


Figure 3. Resource Factors**.**

Damodara, (1999) Since material resource contribute 40-60% of the total project cost, it is supposed to be one of the most important factors which required good knowledge to improve labor productivity in construction. Past study shows, required consideration is not given to material resource management and its effects on labor productivity. It is impossible to complete any particular task without availability of required materials. A material shortage is ranked first position among factors affecting labor productivity in the United States, United Kingdom, Indonesia, Nigeria, Singapore, and Kenya Guhathakurta S. a.,(1993) lack of material refers to the inaccessibility of certain materials or the excessive time expended to obtain them. Thomas et al. (1999) estimated that poor material management caused an 18% work-hour overrun. This study found a total of 35.6 man hours of unproductive time attributed to material unavailability, which amounts to 9.5% of the total wasted time.

A lack of required construction tools/equipment also ranked 1st group in the resource group, with Mean score 4, and in the same group with shortage of required material among all 10 critical factors affecting labor productivity (Table 4.11). This result can be justified as major equipment on the site, including cranes, passenger/cargo lift, trailer concrete pump, truck mixer, and safety scaffolding. The entire construction process depends heavily on this equipment. For example, the truck mixer and concrete pump are indispensable to transport and place concrete. Any interruption in the use of the equipment leads to serious material-handling problems as well as a slowdown or a stoppage of operations. Therefore, the availability of equipment is regarded as important for construction progress. Past studies by Guhathakurta and Yates, (1993); Olomolaiye et al., (1996) prove that a lack of equipment is one of the principal factors that negatively affect labor productivity.

Differing site conditions from the plan and increase in the price of materials are ranked 2nd in the resource group, with Mean score of 3.5, and in the 2nd group among the 10 critical factors affecting labor productivity (Table 4.11),

A differing site or unpredicted condition occurs when underlying site conditions for a construction project are uncovered after the contract between the contractor and the owner has been executed and were not previously expected or included in the design documents. Differing site conditions are worth making note of only if the contractor experiences an increased cost and/or delay. Common examples of differing site conditions occur when a contractor performs earth excavation and uncovers objects or soil types that were previously unforeseen, requiring extraordinary measures to accommodate. These extraordinary measures can easily cost the contractor extra money and/or time above that for which was originally contracted.

An increase in the price of material was ranked 2nd in the resource group, with mean score 3.5, and 2nd group among critical factors affecting labor productivity.

Insufficient lighting was ranked third in the resource group, with mean score of 3. Failure to have adequate lighting may lead to different consequences, such as misplacing a particular job, or even serious accidents and the death of laborers at construction sites, thus negatively affecting labor productivity.

Poor access within a construction site also ranked in the 3rd the resource group, with Mean score of 3. Study from Sanders S. R., "Factors affecting masonry productivity.",(1991) proves one of the common reasons for low productivity is poor access within the construction site. Poor access reduces the free movement of labor and, consequently, reduces labor productivity. Interference between crews and laborers is caused by mismanagement on construction sites, with steel fixers suffering more of the mismanagement, possibly because they are more dependent on other trades. For example, if the carpenters have not completed the formwork, steel fixers have to wait before fixing the reinforcement rods.

The material storage location also ranked in 3rd the resource group, with Mean score of 3. A past study of Sanders and Thomas, (1991) stated that the size and the organization of the materials' storage location has a significant impact on masonry productivity. This result is justified because laborers need more time to bring required materials from unsuitable storage locations, negatively affecting productivity.

An inadequate transportation facility for workers are ranked 3rd in the resource group, with Mean score of 3. Past study from Lama and Samson (1995) states that a transportation facility also affects labor productivity. If the construction site is located on the outskirts of a city/town with inadequate public transportation facilities, labors find it difficult to reach the construction site.

Violation of safety laws was ranked 4th in the resource group, with Mean score of 2.5 construction is one of the most unsafe industries Suazo, (1993). The major causes of accidents are related to the unique nature of the industry, human behavior, difficult work-site conditions, and poor safety management, which result in hazardous work methods, equipment, and procedures. Preventing occupational injuries and illness should be a primary concern among both employees and employers. In the construction industry, the working environment is constantly changing sites that exist for a relatively short time as well as activities and inherent risks that change daily. Within a short time of a hazard being identified and dealt with, typically, the workplace has changed, bringing new hazards. Davies, (1990).

4.2.4. Miscellaneous Factors Affecting Labor Productivity

Table 4.5 and Figure 4.5 shows the ranking factors for the miscellaneous group. Accidents during construction, dispute with designer and weather condition were ranked 1st in the miscellaneous group, with Mean score of 3.5, and in 2nd group among 10 critical factors that affect labor productivity.

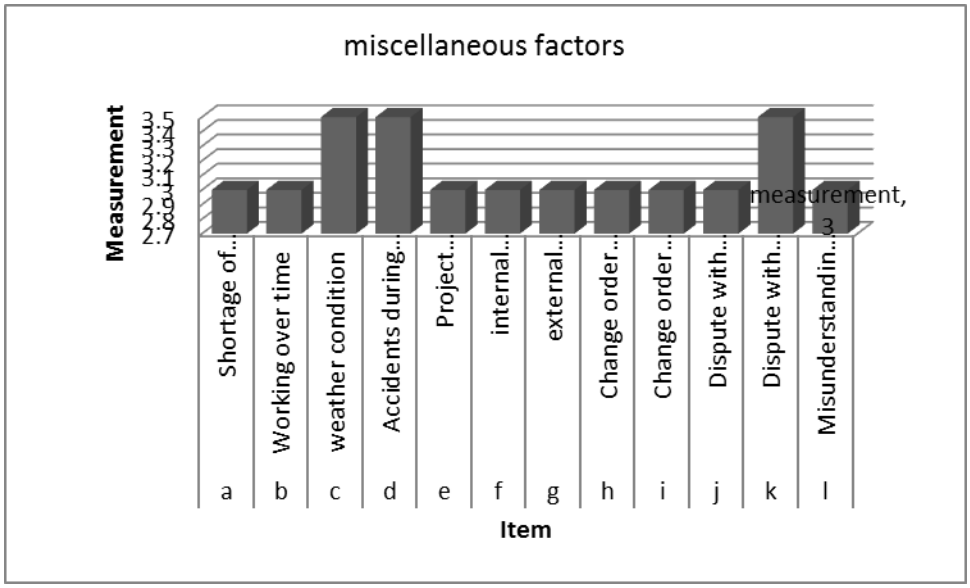


Figure 4. Miscellaneous Factors.

A study from Sanders and Thomas, (1991) showed that **accidents** have a significant impact on labor productivity. The authors stated three different types of accidents:

i. Total stoppage of performing task for number of days due to accidents resulting in death of injured labors.

ii. Injured labor or labors hospitalized for at least 24 hrs. It can decrease the productivity at the site or can result in complete stoppage of the work.

iii. Few cases where productivity can be affected marginally is accidents resulting from nail and steel wired at the job task.

Disputes with the Design Engineer also ranked 1st in miscellaneous factors group, with Mean score of 3.5 and 2nd in the group of critical factors affect labor productivity. This result can be justified because design engineer shortages are changes that result from defective or confusing aspects of construction designs and specifications which cannot be discovered until the contractor begins performing task sketched on drawing sheets. Design deficits are frequently the result of poor quality control in the design process, and they are manageable. The owner is also responsible for the contractor's costs due to

designer errors, such as unreasonable delays in reviewing shop drawings, failure to provide drawings or design information in a timely fashion, failure in timely inspections, and other delays due to the designer's contract-administration problems (Bramble, 2000).

Weather conditions (temperature, precipitation, humidity) are also ranked in the same group with accident and dispute with design engineer in miscellaneous group, with mean score of 3.5 and 2nd in the group of critical factors affect labor productivity. A majority of the construction-related activities are performed in an open atmosphere and can be seriously affected by unexpected, extreme weather.

Shortage of water and/or power supply, Project objectives is not well defined, internal Communication, external communication, Change order from the designers, Change order from the owners, Dispute with owners, Misunderstanding between the owner, contractor & the and working overtime was ranked in the 2nd miscellaneous group, with Mean score of 3.

Working overtime can be a negative factor causing various problems such as increase in absenteeism and reduced in safety (Horner R. M., 1995).It is generally introduced to achieve acceleration of the assigned task. It is generally used to make up for delays in projects. The extra work under overtime is usually paid time and half of the regular wages.

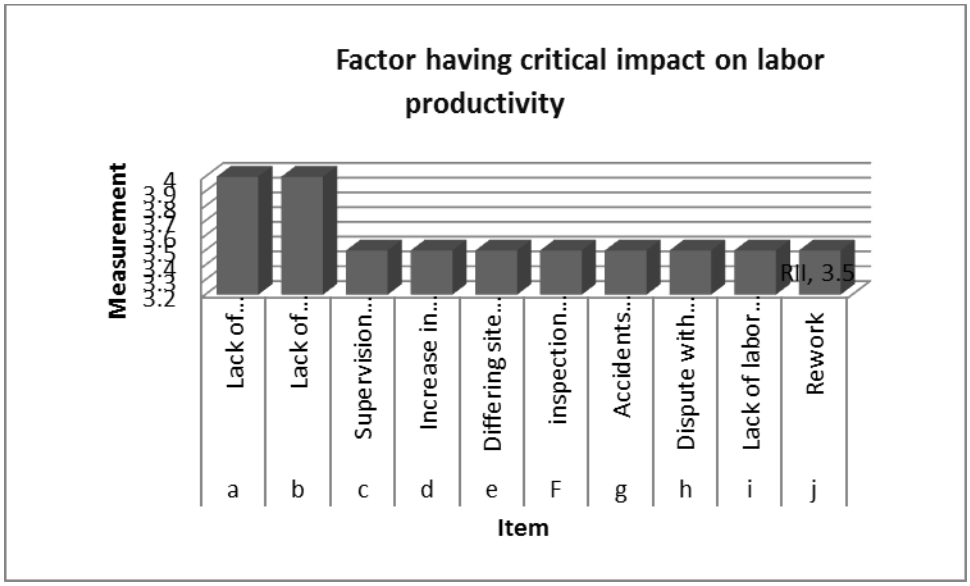
The project objective not being well defined also is a factor that affects labor productivity. Poor planning, inadequate estimates, lack of training, lack of productivity standards, and poor project management are the factors involved with the project objective not being well defined.

4.2.5. Ten Factors having Critical Impact on Labor Productivity

The critical factors rated by respondents with respect to their level of effect. The study was performed by considering the rate given by the respondents for the 42 factors affecting labor productivity for building construction, The most affecting ten factors with the highest level of effect on labor productivity by considering all responses are 1) lack of required construction material and lack of required tools/or equipment's with a value of mean score=4, 2) Supervision delays, Increase in the price of materials, differing site condition from the plan, Weather condition, Accidents during construction, dispute with design engineer, Lack of labor experience and rework with a value of mean score=3.5.

The ten factor having critical factors with their mean score greater than 3 are as described in the table below;

Figure 5 the top group of Ten Factors having Critical Impact on Labor Productivity



4.2.6. Group of Factors Affecting Labor Productivity

Group ranking according to the respective factors affecting labor productivity is shown in Table 4.7 and Figure 4.7. It Is calculated by taking into consideration the average Mean score value for all the factors that affect labor productivity in construction. Resource factors was the top group, with an average Mean score of 3.1667, and the manpower group was at the bottom, with average Mean score value of 2.6875.

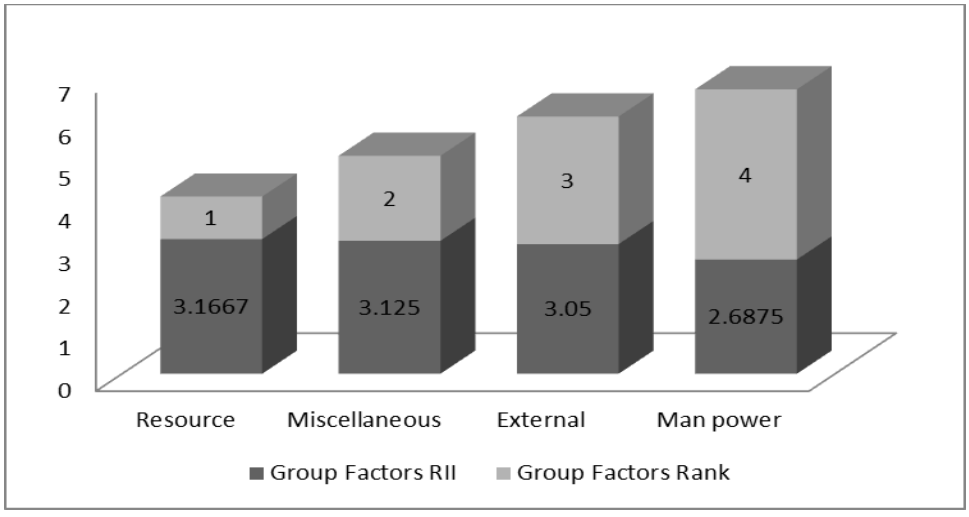


Figure 6. Group Factors.

4.3. Effects of labor productivity on building construction projects.

A decline in productivity can lead to slow economic growth and high inflation. On the other hand, improved productivity can lead to a higher rate of economic Growth and higher living standards for a nation. At an organizational level, productivity measures how well an organization converts input resources (labor, materials, machines, etc.) into goods and services. A decline in productivity will result in an increase in costs and therefore deterioration in the competitive position of an organization. On the other hand, an improvement in productivity can lead to a decrease in the costs and duration of production, an improvement in quality, and therefore a growth in market share.

Construction industries are still facing number of problems regarding the low productivity. Poor productivity of construction workers is one of the causes of cost and time overruns in construction projects.

It is necessary to bear in mind that a reduction in productivity affects the schedule of the work and causes delays. The consequences of these delays could result in serious money losses. Further, considerable cost can be saved if productivity is improved because the same work can be done with less manpower, thus reducing overall labor cost.

Some Effects of labor productivity on building construction projects responded from the respondents are:-

- ❖ Delay acne of completion period
- ❖ Increase overhead cost of the company
- ❖ Quality problem
- ❖ Construction Image

The effects of labor productivity's are not limited to these effects, and the above listed effects discussed below.

I. Delay acne of completion period

Delay acne of completion period can be affected by productivity of contraction labor productivity. As stated above in literatures if we improve labor productivity, their performance can be improved and the project can be finished as scheduled or before the schedule. But in other hand if the output of labors is

not per the scheduled and not improved; project completion time can be delayed and left behind the scheduled period of completion time.

II. Cost overrun

Y1G1. Responded that ; labor productivity have great effect on building project cost, since building projects are labor intensive, poor labor productivity can bring in money loss which influence the project cost to overrun. e.g. if labor that have no experience finished some activities and the activity not proved the work needs rework which Leeds to money loss to replace mistakes. Such situation and money labor productivity related problems but not limited are causes for cost overrun or consume money above budget. But in other side e.g. if we use labor with experience and have high hourly output with expected quality, money loss can be minimized to stick the project cost as planned.

III. Quality problem

Quality: - is defined as meeting or exceeding the requirement of client/owner. Quality in construction is related to satisfying the specification mentioned in the contract. To satisfy specification mentioned in the contract, labor productivity needs to be improved and requires close supervision on every activity to control quality not to be deviated.

Quality deviation: - "Quality is defined as 'conformance to established requirements.' … The term deviation indicates that a product or result that does not fully conform to all specification requirements… Deviation includes changes to the requirements that result in rework…"

Construction industry requires the involvement of quality to ensure that the construction projects are being in the right path.

IV. Construction Image

Reports of buildings collapsing due to poor construction techniques, and an increase in large scale collusion and corruption have resulted in a negative image of the construction industry as a whole. This

negative image is mirrored by the workforce due to the dangerous nature of construction work, and the fact that workers are often exposed to unsatisfactory working conditions on construction sites.

4.4. Methods suggested by construction practitioners to improve productivity.

4.4.1. Presentation of the Findings

This heading contains various methods that emerged from exploring my study's data to answer the research question: What strategies do construction company practitioners use to improve labor productivity in Wolkite University? We conducted structured questioner and semi structured interviews with two construction practitioners to obtain primary source data.

Based on the research question, data analysis of structured question and semi structured interview responses, we identified five core themes that pertained to various strategies that construction company leaders used to improve labor productivity.

The findings related to construction company leaders' strategies regarding (a) issues affecting labor productivity, (b) leadership, (c) motivation, (d) training, and (e) project management.

Theme 1: Exploring, Identifying, and Evaluating Issues Affecting Labor Productivity

The first theme related to exploring, identifying, and evaluating issues affecting Labor productivity. Researchers agreed that because various factors affect labor productivity, construction company leaders should explore, identify, and evaluate the issues that affect labor productivity (Jarkas, 2005).

Various issues affect construction labor productivity, and researchers disagreed on which issues have the most influence on labor productivity (Moselhi & Khan, 2012).Similar to the body of literature, respondents raised and discussed various issues that affect labor productivity in the construction industry.

For example, respondent Y1G1explained that the unique characteristics of the labor work forces are one of the major issues that have an effect on labor productivity. Respondent Y1G1continued that the factors that have a direct effect on labor productivity are skills of laborers, morale of laborers, project management, environment, cultural factors, motivational factors, behavioral factors, poor quality of engineering drawings, weather conditions, lack of construction materials, and lack of tools.

For example, respondent C1P1 noted the following:

The weather conditions have a direct effect on labor productivity.

After September, the weather conditions are considered satisfactory for the laborers to perform their work both inside and outside. However, from June to August, the high rainy period have high effect on labor productivity.

In general, issues affecting labor productivity are different depending on the characteristics of projects and their locations as stated by Jarkas & Haupt, (2015). Moreover, researchers such as Jarkas (2012), Ma, Liu, and Mills (2016), agreed that numerous issues affect labor productivity; therefore, exploring, identifying, and evaluating issues affecting labor productivity can enable construction company leaders to understand the issues that negatively affect labor productivity and improve labor productivity.

Theme 2: Applying an Appropriate Leadership Style

The second principal theme related to applying the appropriate leadership style to improve labor productivity in the construction industry. The importance of applying an appropriate leadership style is one of the main topics that the respondents raised and discussed. The respondents highlighted that depending on the situation, leaders should apply appropriate leadership styles to direct the laborers toward achieving a common goal. The leader in charge of the labor plays a key role in motivating the laborers and improving labor productivity. The study findings indicated that applying an appropriate leadership style depending on the laborers' backgrounds and cultures can enable construction company leaders to improve labor productivity.

The body of literature supports the notion that, for this study, each of the successful leaders applied appropriate leadership styles depending on the situation. By applying an efficient and appropriate leadership style, leaders can direct the laborers and move the project team in the right direction, thus improving labor productivity and ensuring that a construction project runs smoothly (Tabassi et al., 2014).

Similar to Tabassi et al. (2014), **respondent Y1G1** noted the following: In order for the laborers to become productive, the leader should direct and motivate the laborers. Y1G1 say that most of the laborers lack discipline; hence, appropriate supervision is necessary. The supervisor should be from the same culture or place as the laborer so that the supervisor can communicate, guide, and supervise the laborers effectively. Y1G1's best practices and productivity improvement goals indicated that successful construction company leaders set goals and develop techniques to improve laborer motivation to improve labor productivity. Similar to Y1G1's best practices and productivity improvement goals,

Vincent-Hoper et al. (2012)noted that leaders are responsible for achieving and maintaining healthy and efficient working atmosphere by applying the appropriate leadership style. Chan and Mak (2014)explained that, depending on the situation, leaders might apply a transformation all leadership style to encourage the laborers with positive motivation and belief in the work to motivate the laborers and improve labor productivity.

Furthermore, respondent Y1G1explained that "in construction industry motivation relates to reward, which means you need to give the laborers some incentive, such as a bonus or increase their salary". Therefore, in addition to applying transformational leadership style, the leaders can apply transactional leadership style to motivate the laborers in exchange for something valuable to them and respondent Y1H1, noted that the leader has to provide rewards and incentives to the laborers to motivate employees and increase employees' productivity.

In general, applying appropriate leadership style improves labor productivity and brings significant changes to organizational vision, strategy, culture, and attitude. One purpose of applying an appropriate leadership style is to improve labor productivity and achieve better performance. The study's findings indicated that depending on the situation, successful construction leaders can apply appropriate leadership styles according to the laborers' background, culture, and skill to improve labor productivity. Leadership style is one of the main factors influencing expectancy belief. Conclusions supported the theme that applying an efficient and appropriate leadership style can enable construction company leaders to direct the laborers and move the project team in the right direction, thus improving labor productivity and ensuring that a construction project runs smoothly.

Theme 3: Motivating the Workforce

The third theme related to motivating the workforce. Motivation is the key factor that affects labor productivity in a positive or a negative way. Y1G1 believes construction company leaders should offer various forms of motivation to keep the laborers productive, which ultimately benefits the construction company. A less motivated worker is less productive and the poor performance of one worker can affect the performance of the entire company. Respondent Y1G1 stated: The morale and motivation of the workforce is affected by the prevailing conditions in the country, the specific project, their management, and their welfare. Motivation will be visibly increased in teams where the leaders clearly explain their target and objectives properly and fairly evaluate performance and strive to support their teams to achieve their targets. There should be a system of evaluating and rewarding performance fairly,

correctly, and in a transparent manner to the maximum degree possible. This will set the framework upon which the workforce would set about performing their tasks.

. Respondent Y1G1 recommended that construction company leaders develop a motivation strategy and constantly motivate laborers to improve labor productivity and achieve the goal. The means of motivating laborers vary among the participating construction companies.

The best practices documentation provided by Y1H1 illustrated that recognition and rewards are key to motivate laborers. The documentation indicates that simple things such as saying "thank you", on-the-spot recognition, and providing company-focused clothing or hats may motivate the laborers.

The respondents' recommendations are in line with the body of literature that motivating laborers improve labor productivity.

The study findings support those of Jarkas and Radosavljevic's (2013) and Tsehayae and Fayek's (2016) conclusions that motivation is the driving force that stimulates workers physically and psychologically to pursue higher goals; hence, motivating the workforce can improve labor productivity.

Theme 4: Providing Training and Development

The fourth theme related to providing training and development of the laborers. Training can have a significant and positive influence in labor productivity in the construction industry. Training and development enable laborers to learn and develop their abilities and to achieve the expected goals. Training the laborers increases the skills of the laborers and enables laborers to work efficiently.

This study's findings indicated that providing training and development to the labor force can improve labor productivity and increase the success rate of their construction company. The body of literature supported the theme that developing training strategy and providing training to the laborers can improve labor productivity. RespondentY1G1 noted: Most of the new laborers are inexperienced and not ready to start work. The supervisor needs to train the laborers in how things are done to overcome the challenges and produce results. Do not expect that the laborer will become productive immediately. You need to consider the learning curve.

Before starting the work, the supervisor should call his team for briefing, guiding, and explaining how to do the work. It is important to motivate and give the laborer advice and guidance on a daily basis.

Similar to respondent Y1G1, respondent Y1H1 noted that the successful strategy for improving labor productivity is to educate the labor force. Training and development improve laborers' flexibility, eagerness, morale, and productivity. Moreover, training enables laborers to learn and develop skills that will assist them achieving better productivity.

At the same time, training and development improve organizational efficiency, output, and performance while decreasing absenteeism, costs, waste, and accidents.

Previous researchers have also concluded that providing training to the laborers increases their skills and knowledge. Colombo and Stanca (2014) noted that labor productivity is 10% higher for workers who have had adequate training; for this reason, providing training and development programs to the laborers can improve labor productivity.

The findings of this study also revealed that developing an effective training strategy and providing effective training and development to the laborers improve labor productivity.

Damodara, K. P. E. (1999), conclusion supported the providing training and development theme that by providing training and development to the laborers and teams, laborers can learn and develop their skills and knowledge, which helps the laborers improve productivity.

Theme 5: Implementing Effective Project Management Processes

The fifth theme related to implementing effective project management processes to improve labor productivity. Project management is a broad topic, and implementing the project management processes (initiating, planning, executing, controlling, and closing) could enable construction company leaders to improve labor productivity. The study findings indicated that understanding and implementing effective project management processes can enable construction company leaders to improve labor productivity and complete construction projects within time and budget.

Several issues affecting construction labor productivity related to project management, for this reason, exploring, identifying, and evaluating the issues affecting labor productivity and implementing effective project management processes and strategies enable construction company leaders to overcome the

issues and simultaneously improve labor productivity. Several issues affected construction labor productivity because of lack of effective project management processes.

Therefore, regardless of the issues that affect labor productivity, implementing effective project management processes enables construction company leaders complete their projects within the given time and budget. Respondent Y1G1 stated that planning, monitoring, and controlling are the fundamental project management processes that enable construction company leaders to improve labor productivity and increase the success rate of construction projects. Similarly, respondent Y1H1 noted that improved labor productivity could result in improved profitability and possibly rewards for the company's employees. Y1H1 also asserted that implementing efficient project management could result in more business for the company.

Hjelmbrekke,(2014) concluded that for a construction project to be successful, construction companies need to have efficient and effective project management processes that facilitate construction company leaders' ability to complete projects (a) on time, (b) within budget, (c) in accordance with the specified requirements, and (d) to the satisfaction of the client.

In conclusion, the study's findings indicated that understanding and implementing project management processes enables construction company leaders improve labor productivity and complete projects within the given budget and time.

CHAPTER FIVE
CONCLUSION AND RECOMMENDATION

The results of the questionnaire survey and discussion of the findings in line with the literature review were presented in the previous section. Conclusions derived from the research findings are made and the relevant recommendations & future research areas are forwarded.

5.1. Conclusion

In today's world, the construction industry is rated as one of the key industry. It helps in developing and achieving the goal of society. Study and knowledge of construction productivity are very important because they cause losses to the governing agencies and also influence the economics of the construction industry. Prior knowledge of labor productivity during construction can save money and time. Investments for these projects are very high and because of the complexity in construction, various factors can highly affect overall productivity, thus the project can end up adding even more time and money in order to be completed.

- The groups of factors which are highly effective are: a, Lack of required construction materials b, Lack of required tools/or equipment's c, Supervision delays d, Increase in the price of materials e, Differing site condition from the plan f, inspection delay from the author g, Accidents during construction h, Dispute with designer i, Lack of labor experience j,
- The results of applying factor analysis showed that Among 10 critical factors, 40% related to resource plan problem, 30% are problem related to external factors and the rest 30% are include miscellaneous factors and man power related poor management.
- Practically it is difficult task to all to improve labor productivity up to 100%. But if you have properly control on above factors, productivity can be improved up to large extent.
- In conclusion, it is believed that the outcomes of this research can provide a starting point from which recommendations could be implemented in order to improve labor productivity
- In general the research result indicates that most construction projects performance is highly affected by poor labor productivity.

5.2. Recommendations

Construction tasks are expensive and frequently cause in arguments and claims, which generally affects progress of construction projects. The environment of construction organizations should be suitable to implement projects with successful completion. In the construction industry, it is necessary to find the weaknesses of particular task in order to solve and overcome them. Mentioned below are the recommendations which were found to be important factors for improving labor productivity in the construction industry.

- A detail schedule of material supply schedule for each project should be provided by the contractors. It should contain the time required to supply materials and the availability of the local market to furnish the required materials in time. Extra attention is required on quality of construction materials and tools used in their projects because using suitable materials and tools reduces both the time taken to finish the work and wastage of materials. Using suitable materials and tools also has a positive effect on the task and thus, better labor productivity can be achieved.
- Special attention should be given by the contractors on the issues related to Shortage of material, Lack of follow up the work progress, Incomplete facilities (water & power supply, and sanitary), Lack of Motivation and Frequent damage of equipment's in order to minimize their impacts on affecting labor productivity.
- The contractor should plan ahead to handle the effect of the critical factors by taking in to consideration the ranks as listed in this study.
- Special attention should be given by the consultants on the issues related to Delay in Decision making, Incomplete and Inaccurate drawings, Inspection and Instruction delay, and Change of work order/Variation in order to minimize their impacts on affecting labor productivity.
- Special attention should be given by the clients on the issues related to Financial difficulties of the owner/Payment delay in order to minimize the impact on affecting labor productivity.
- Organizations should make sure there is enough lighting present at the construction sites which can indirectly reduce the number of accidents. Continuous safety training and meetings should be arranged to achieve better performance in labor productivity.

- Recruiting manager and project managers should recruit appropriate candidate to particular task. Friendly relations should be maintained with labors and made aware of their importance to the organization.
- To achieve 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. Regular meetings should be arranged with the project authorities.
- Complex design and incomplete drawings should be avoided and care should be taken to avoid confusion among the various construction agencies.
- Change orders and design error 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.
- Purchased material should be stored at appropriate location and should be easily accessible and close to constructed buildings to avoid wasting labor time for multiple-handling materials.

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APPENDIECE

Appendices One

Questionnaire to Construction Contractors at Project

WOLKITE UNIVERSITY

COLLEGE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF CONSTRUCTION TECHNOLOGY AND MANAGEMENT

RESEARCH QUESTIONNAIRE

Dear Respondents,

We are graduating class student of Wolkite University, College of Engineering and Technology, Department of Construction Technology and Management. Currently we are doing final thesis research entitled in Assessment of factor affecting labor productivity (case of building projects in Wolkite University).

We believe your experience and educational background will greatly contribute to the success of our research. The questionnaire is our primary data collection instrument for the research we are conducting on. We kindly request you to give us the right information.

DEFINITION

Productivity can be defined in many ways. In construction, labor productivity, is, units of work placed or produced per man-hour.

Productivity is the ratio of output to all or some of the resources used to produce that output. Output can be homogenous or heterogeneous. Resources comprise: labor, capital, energy, raw materials, etc.

Labor Productivity = Output / Work hour

In general, productivity signifies the measurement of how well an individual entity uses its resources to produce outputs from inputs.

Major objective of our research

1.To identify factors affecting labor productivity on building construction projects in Wolkite University.

2.To identify effects of labor productivity on building construction.

3. To propose methods suggested by construction practitioners to improve productivity.

Thank you in advance for taking your precious time to fill this questionnaire. Please try to answer all the questions openly, as your answers will have an influence on the outcome of the research.

Section 1:- General Information

Personal and Company Information

1, what is the name of the firm?

_____

2. What is your position in the firm?

_____

3. Total years of your experience in the construction industry:

A, Below 2 years B, years 2-5 years

C, 5-10 years D, above 10 years

4. What is the grade of your company?

A, GC 1 B, GC 2 C, GC 3 D, below GC 3

A, BC 1 B, BC 2 C, BC 3 D, below BC 3

5. What is the contract amount (in Birr) of the project?

A, < 20 Million B, 20-50 Million

C, 50-100 Million D, > 100 Million

6. What is the progress/status of the project (ahead/lag) as per the schedule)?

A, Ahead from the schedule B, as per the schedule

C, Lags from the schedule D, Not known

Section 2:- Please indicate to what extent following factors affect labor productivity at construction site

1 – Not applicable; 2 – Does not affect it; 3 – Somewhat affects it; 4 – Directly affects it

No.	Factors Affecting Labor Productivity in Building Construction	Measurement			
1	Man power	1	2	3	4
	a)Lack of labor experience	☐	☐	☐	☐
	b)Labor disloyalty	☐	☐	☐	☐
	c) Misunderstanding among laborers.	☐	☐	☐	☐
	d) Lack of competition between the Laborers.	☐	☐	☐	☐
	e) Age.	☐	☐	☐	☐
	f) Personal problems.	☐	☐	☐	☐
	g) Alcoholism.	☐	☐	☐	☐
	h) Absenteeism.	☐	☐	☐	☐
2	External				
	a) Implementation of government laws.	☐	☐	☐	☐
	b) Rework	☐	☐	☐	☐
	c) Supervision delays	☐	☐	☐	☐
	d) Inspection delays from The authorities.	☐	☐	☐	☐
	e) Variations in the drawings.	☐	☐	☐	☐
	f) Complex designs in the provided drawings.	☐	☐	☐	☐
	g) Incomplete drawings	☐	☐	☐	☐
	h) Payment delays.	☐	☐	☐	☐
	i) Training sessions.	☐	☐	☐	☐
	j) Design Changes.	☐	☐	☐	☐

3	**Communication**				
	a) Change orders from the designers.	☐	☐	☐	☐
	b) Change orders from the owners.	☐	☐	☐	☐
	c) Disputes with owner.	☐	☐	☐	☐
	d) Disputes with designer.	☐	☐	☐	☐
	e)Misunderstanding between the owner, the contractor and the	☐	☐	☐	☐
4	**Resources**				
	a) Lack of required construction materials.	☐	☐	☐	☐
	b) Increase in the price of materials.	☐	☐	☐	☐
	c) Lack of required tools and/or equipment's.	☐	☐	☐	☐
	d) Poor site conditions	☐	☐	☐	☐
	e) Differing site conditions from the plan	☐	☐	☐	☐
	f) Poor access within construction job site	☐	☐	☐	☐
	g) Violations of safety laws.	☐	☐	☐	☐
	h) Insufficient lighting.	☐	☐	☐	☐
	i) Inadequate construction method	☐	☐	☐	☐
	j) Inadequate transportation facilities for workers.	☐	☐	☐	☐
	k) Material storage location	☐	☐	☐	☐
	l) Quality of required work.	☐	☐	☐	☐
5	**Miscellaneous**				
	a) Shortage of water and/or power supply.	☐	☐	☐	☐
	b) Working overtime.	☐	☐	☐	☐
	c) Weather conditions	☐	☐	☐	☐
	d) Accidents during construction	☐	☐	☐	☐
	e) Project objective is not well defined	☐	☐	☐	☐

4) Other Comments on Factors affecting Labor Productivity at Construction Job sites

a)_____

b)_____

c)_____

Section3,general questions on effects of labor productivity on building construction.

1, what are the effects of labor productivity on the building project?

Please list at least five labor productivity's effect on building project from your experience in descending order of effectiveness with most effective first.

VI._____

VII._____

VIII._____

IX._____

X._____

Section4, General Questions of Labor Productivity improving method in Building construction

1. Have you taken corrective actions to improve labor productivity when it becomes lowered?

A, Yes B, No

If you say "Yes", what productivity improvement methods have you applied?

Please list at least five methods in descending order of effectiveness with most effective first.

VI._____

VII._____

VIII._____

IX._____

X._____

2. What do you feel could be done to enhance/improve labor productivity on construction projects?

Please list at least five suggestions in descending order of importance with most important first.

VI._____

VII._____

VIII._____

IX._____

X._____

THANK U!!!

Appendices Two

Table 2. Manpower Factors

Item	Factors affecting labor productivity	Mean score	RANK
1	Lack of labor experience	3.5	1
2	Labor Disloyalty	2.5	3
3	Misunderstanding among laborers	2.5	3
4	Lack of competition between laborers	3	2
5	Age	2.5	3
6	Personal problems	2.5	3
7	Alcoholism	3	3
8	Absenteeism	2.5	3

Table 3. External Factors

Item	Factors affecting labor productivity	Mean score	RANK
A	Implementation of government laws	2	3
B	Rework	3.5	1
C	Supervision delays	3.5	1
D	Inspection delay from the authorities	3.5	1
E	Variation in the drawings	3	2
F	Complex design in the provided drawings	3	2
G	Incomplete drawings	3	2
H	Payment delays	3	2
I	Training session	3	2
j	Design change	3	2

Table 4. Resource Factors

Item	Factors affecting labor productivity	Mean score	RANK
a	Lack of required construction materials	4	1
b	Increase in the price of materials	3.5	2
c	Lack of required tools/or equipment's	4	1
d	Poor site conditions	3	3
e	Differing site condition from the plan	3.5	2
f	Poor access within construction job site	3	3
g	Violations of safety laws	2.5	4
h	Insufficient lighting	3	3
i	Inadequate construction method	3	3
j	Inadequate transportation facilities for workers	3	3
k	Material storage location	3	3
l	Quality of required work	2	4

Table 5. Miscellaneous Factors

Item	Factors affecting labor productivity	Mean score	RANK
a	Shortage of water and/or power supply	3	2
b	Working over time	3	2
c	Weather condition	3	1
d	Accidents during construction	3.5	1
e	Project objectives is not well defined	3	2
f	Internal Communication	3	2
g	External Communication	3	2
h	Change order from the designers	3	2
i	Change order from the owners	3	2
j	Dispute with owners	3.5	1
k	Dispute with designer	3	2
L	Misunderstanding between the owner, contractor & the	3	2

Table 6. Ten Factors having Critical Impact on Labor Productivity

Item	Factors affecting labor productivity	Mean score	RANK
a	Lack of required construction materials	4	1
b	Lack of required tools/or equipment's	4	1
c	Supervision delays	3.5	2
d	Increase in the price of materials	3.5	2
e	Differing site condition from the plan	3.5	2
F	Weather condition	3.5	2
g	Accidents during construction	3.5	2
h	Dispute with owners	3.5	2
i	Lack of labor experience	3.5	2
j	Rework	3.5	2

Table 7. Group Factors

Factors	Mean score	Rank
Resource	3.1667	1
Miscellaneous	3.125	2
External	3.05	3
Man power	2.6875	4