



**SKILLED LABOR PERFORMANCE ASSESSMENT ON SELECTED PUBLIC
BUILDING CONSTRUCTION PROJECT OF SNNPRS**

MSc. THESIS

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BUILDING CONSTRUCTION PROJECT OF SNNPRS**

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**SCHOOL OF GRADUATE STUDIES
HAWASSA UNIVERSITY
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This is to certify that the thesis entitled “**Skilled labor performance assessment on selected public building construction project of SNNPRS**” submitted in partial fulfillment of the requirements for the degree of Masters of Science with specialization in construction technology and management the Graduate Program of the School of Civil Engineering and has been carried out by **Bizunesh Bekele**; ,under my supervision. Therefore, I recommend that the student has fulfilled the requirements and hence, hereby can submit the thesis to the school.

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We, the undersigned, members of the Board of Examiners of the final Open Defense by BizuneshBekele, have read and evaluated this thesis entitled “**Skilled labor performance assessment on selected public building construction project of SNNPRS**” and examined the candidate. This is, therefore, to certify that the thesis has been accepted in partial fulfillment of the requirement for the Degree of Masters of Science in Civil Engineering (Construction Technology and Management).

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DECLARATION

I hereby declare that, this thesis prepared for the partial fulfillment of the requirements for Msc. Degree in Construction Technology and Management entitled “**Skilled labor performance assessment on selected public building construction project of SNNPRS**” is prepared with my own effort except for secondary sources which all sources of materials used for the thesis have been duly acknowledged as listed in the bibliography. I declare that this is my original work made with the close advice and guidance of my advisor.

Bizunesh Bekele

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Date: _____

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LIST OF ACRONYMS AND ABBREVIATIONS

BC	Building Contractor
CM	Construction Management
Cps	Construction Projects
EPC	Engineering Procurement and Construction
GC	General Contractor
GTZ	German Technical Cooperation
PAR	Performance Ability Ratio
SNNPRS	South nation nationalities peoples regional state
SPSS	Scientific Package for Social Science
TRIR	Total Recordable Incident Rate
TVET	Technical and Vocational Education Training

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ABSTRACT

Skilled labor force is one of the vital elements for the continuity and successful implementation of construction. This study explored the current status of skilled labor performance in building project of SNNPRS. The main approaches used in collecting information for the study were through a questionnaire survey, case study, interview and personal observations of some major construction sites of SNNPRS. Methodological triangulation and member checking bolstered the trustworthiness of those interpretations. The questionnaire survey was distributed to 114 respondents and a total of 105 responses were received and case studies of seven projects of three trades for each which are concrete, masonry and bar bending was taken. For the analysis of the data, statistical analysis by using SPSS software and descriptive statistics were employed. The finding of the research indicated that most trade not fulfills individual level performance criteria. The crew level performance for most projects with productivity performance ability ratio (PAR) was greater than one indicating that the studied crews' productivity performance was low. The main factor which affect performance of skilled labor in the order of their rank were lack of follow up the work progress, cash flow and financial difficulties, Lack of Training for workers, Inadequate briefing, too much work load and absence of clear uniform standard to accept work. Skilled labor capability impacts the project objectives which are safety, quality, cost and schedule. Thus the researcher recommends possible ways to manage or reduce such factors. Periodic training should prepare in advance in order to improve skill performance and Project managers shall introduce performance management system at individual and crew level so as to have reliable planning and controlling system to manage their work. This study will contribute contractors which undertake construction projects and about ways of improving their current status of skilled labor.

Key words: Capability related factor, Construction trades, Measurement system, Performance Ability ratio (PAR) and performance improvement.

1 INTRODUCTION

1.1 Background

Construction can be identified as a labor intensive industry which carries heavy reliance upon the skills of laborers. Skilful labor force is one of the vital elements for the continuity and successful implementation of construction projects. The construction industry occupies a focal position in a nation's economy and it is a global industry known for its generation of jobs at different skill and professional levels. In terms of value of its output, its global market is reported to be around \$1.5 Trillion as of today(Ambekar, 2017).

Assaf (2006) in Ethiopian construction industry is the highest employer of the nation's manpower after agriculture, Even though it invests with ample manpower; proper attention is not given for development of the industry. One reasons for this human capital acquisition is not well planned and the work method doesn't consider the current global situation. But skilled labor performance had effect on productivity, work quality, projects duration and overall organizational profit not given any scientific solution. This led to skilled workers to capability problem which has significant effect on effective management of time, an able to achieve the desired quality, budget and safety of themselves to overcome needed to have standard guide line how to perform the given task without difficulty, work experience, training which upgrade their status to become fit to technological change and complexity of the given project.

Construction industry in Ethiopia suffers from many problems and complex issues in performance. In fact construction industry change throughout the world, this need qualified skilled labor to business environment within which construction organizations operate. Organizations failing to adapt and respond to the complexity of the new environment tend to experience survival problems. With increasing higher users' requirements, environmental awareness and limited resources on one side, and high competition for construction business market place on the other side, contractors have to be capable of continuously improving

their skilled labor performance this mainly focus on skilled labor qualification, capacity building.

The other issue which is fundamental to skilled labor is Performance. Performance is related to many topics and factors such as time, cost, quality, client satisfaction; productivity and safety. In the selected Cities there are many construction projects such as roads, buildings and water supply projects which are being executed by different grade of local contractors.

Different researchers argued that labor performance management techniques could be perceived as theoretical, difficult and expensive for construction companies to adopt. It is important to note that labor performance is the 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.

Allmon (2000) found that most of the organizations not following a proper performance evaluation procedure for labor force. Though there are many advantages from performance evaluation, however, they believe that they can enhance the skills of laborers through performance evaluation process and speedup the progress of the project with a good quality. But hardly apply it.

Wiley (1962) before the project management establishes productivity standards it must decide what work methods will be used in the production process Performance standards are essential components to determine the performance ability ratio of trades even though it fundamental to project success management not concern it.

Alemu (2015)describe that the causal problems for low productive performance was analyzed and it was found that unfulfilled conditions from project site external bodies, lack of project management systems, poor technical management in areas of developing productivity standards and construction methods, average leadership efficiency and low project culture towards workers satisfaction are responsible for skill labor performance.

Hence, the purpose of this paper is to study the state of the SNNPRS construction industry with respect to skill labor qualities, availability, the prevalence, causes and effects on building project objective delivery.

1.2 Statement of the Problem

Construction industry plays an important role in the national economy of any country by generating job opportunity, infrastructure development, constructing facilities and many other roles. An understanding of the construction project performance management and its problems is essential for all who are associated with the construction industry. There are several problems influencing the performance of construction projects. One of the main problems facing the construction industry, in developing countries such as Ethiopia, is construction project management failure. Studies show that significant amount of money is being lost through project management failure which is related to effectiveness of skilled labor. Initially, the capability problems are identified from literature review and researcher experiences and initiated to know the root cause.

The performance of skilled labor is substandard this may lead to unwanted rework and delay in project. Because management not give any attention on the other hand most the activities are performed by skilled work force and in some remote area the overall project controlled by senior skilled labor in addition to that Some contractor hires experienced skilled labor than graduate engineer this led project cost overrun and delay . The failure of skilled labor to met this led to performance loss Alemu(2015) one of the greatest and severe problems from various project-costs components such as labors, materials and equipment's, labor component are considered the most risky because labor is more variable and unpredictable than other project-cost components, it becomes necessary to understand different factors which impact on project objective.

Michael (2015) has shown that 20 % of these construction projects fail to achieve their goal as a result of delays, or cost overruns that can put any construction project at risk. One of the important part of these construction projects are laborers' productivity, since Labor account for 30-50% of the construction budget it is important to study what are the factors that affect

labor' productivity in the Construction projects. As a result of many factors which affect the successful completion of the project, especially time, cost and quality of the projects.

Although the past literature provides wealth of information about influence of craft labor shortage on construction project, less attention has been given to quantifying the impact of craft labor availability on construction project performance. Karimi (2016) shows that projects that experienced craft shortages results in significant higher growth in cost overrun, time overrun, and safety incident and also lower productivity compared to projects that did not.

From the statements above we can understand that skilled labor availability and capability plays important roles in the success of construction projects because the outcome of every construction project relies on having all proper resources such as materials, labors, plants and equipment function as it should be.

Therefore, the paper identifies and presents skilled labor performance in building project of SNNPRS. In addition to that the key factor which affects performance of skilled labor and impact of capability of skilled labor to project objective in construction industry are addressed finally assessing way of improvement of the problem described.

1.3 objectives

1.3 .1 General objective

The general objective of this study was to assess the performance of skilled labor in public construction project of SNNPRS.

1.3.2 Specific objectives

The specific objectives of the study are described as follows.

- To assess the skilled labor capability in building construction project in selected site in SNNPRS.
- To investigate the key factors that affects the quality of skilled labor in SNNPRS building construction project.

- To identify the impact of skilled labor capability on overall project objective
- To assess ways of improving skilled labor performance.

1.3.3. Research questions

Each sub objective had been reached by answering the following research questions.

1. How is the capability of skilled labor performance in building construction projects of selected sites in SNNPRS?
2. What are the key factors which affect skilled labor in building construction projects of the cities?
3. What is the impact of skilled labor capability on overall project objective?
4. What are the possible ways of improving skilled labor performance in building construction projects of SNNPRS?

1.4 Scope of the Study

The need for this study were to assess the capability of skilled labor and their performance and practices of different contractors doing public building construction projects under SNNPRS mainly Hawassa ,Dilla ,and Arbaminch cities. The scope of this study were investigating the problems faced by construction firms with respect to capability of skilled labor and its impact on project objectives which is budget, quality, and time.

The technical skilled labor are different trades from them Mason, Carpentry, electrician, finishing worker and Plumbing trades selected for these studies. These trades were selected because of their level of dominance in building construction works.

1.5 Significance of the study

The findings from this study create awareness on the existing practice of performance of skilled labor and challenges that the contractors face to capability improvement problem and offer suggestions on how they can be avoided.

Thus, this study is considered significant for the following reasons.

- It is important to building professionals and the general public because it will create awareness on how quality of skilled labor can adversely affects project performance.
- Help contractors which under take construction projects about ways of improving their current status of skilled labor.
- Serve as a skilled base to scholars and researchers interested in carrying out further research in this field

2. LITERATURE REVIEW

2.1. Definitions of key terms

Labor: According to merriam-webster, (2017) defined as a task that requires the exertion of body and mind or both. Labor is an important source in construction because it is the one that combines all the other resources namely materials, plant, equipment, and finance in order to produce the various construction products (wachara 2013).

Skill: According to merriam-webster, (2017) skill defined as having the training, knowledge, and experience that are needed to do something or having a lot of skill.

A skill is an ability to perform a productive task at certain level of competence. Darren, (2012) state that as a skill is associated with a particular task, a person who does not possess such a skill is unlikely to be able to carry out such task or will be less productive than somebody who does possess this skill added that skills are often associated with a qualification and its acquisition through formal and informal training and on-the-job experience.

Performance: Ankrah (2005) can be considered as an evaluation of how well individuals, groups of individuals or organizations have done in pursuit of a specific objective. These objectives vary significantly, but from an industry or organizational perspective, they generally revolve around satisfying the key stakeholders such as customers, employees, shareholders, the various suppliers, government and society as a whole.

Mullins (1993) described performance as relating to such factors as increasing profitability, improved service delivery or obtaining the best results in important areas of organizational activities. Performance factor is a fact or situation which influences a progress of work which can be measured and compared using a set of stated requirements. In construction, because of the numerous participants who contribute towards the achievement of project objectives, for many people it is still unclear the distinction between criteria and factors.

The Oxford Advanced Learner's Dictionary describes the criterion as "a standard or principle by which something is judged, or with the help of which a decision is made" while a factor is explained as "a fact or situation which influences the result of something" Means carrying out a task, the progress of which can be measured and compared using a set of stated requirements therefore.

2.2. Organizational culture and project on the performance of skilled labor

Organizational culture one of the parameter that affects the performance of individuals due to cultural influence of the organization; hence organizations must ensure that the organization environment is suitable for competitiveness. Many studies show that the effects of organizational values to productivity are significant. For culture to contribute a lot for increment of productivity the culture must fit to the external environment and be strong. Quinn (1999) stress that working habit of skilled labor has a greater implication on project this due to the fact that the culture that exists within an organization is important for a number of reasons.

According to Thompson (1993) for an organization to be effective, similarity must exist between the organization's values, its resources and the environment. The culture within the organization reflects in the way that people perform tasks, set objectives and administer the necessary resources to achieve these objectives. It also affects the way people make decisions, think, feel and act in response to the opportunities and threats affecting the organization. It has long been recognized that organizational culture plays a significant role in project performance outcomes.

A strong, unique, and appropriate corporate culture, in the view of Tharp (2005) has the ability to: reduce uncertainty by creating a common way to interpret events and issues; create a sense of order in that member know what is expected; create a sense of continuity; provide a common identity and a unity of commitment; and Provide a vision of the future around which the company can bring together.

2.2.1. Skill Labor standard measurement

Monks (1982) mentioned that work measurement is one approach that leads the way to good performance management. Work measurement involves the use of productivity standards to measure and control the time required to perform a particular task or a group of tasks. Productivity labor standards are measures time it should take for a qualified worker to produce a fixed quantity of a particular operation.

Without reliable and accurate productivity estimates, it would be impossible to improve existing operations and management or effectively plan or new ones, decide on layout and routing considerations; or design new work methods. In addition without appropriate productivity data, the efficiency of work and resource scheduling would be in doubt.

These data are also sometimes used as a basis for product design, work sequencing and workplace design. But it should be recognized that the form of labor performance standards varies with the purpose of the measurement. Accordingly labor productivity standard forms can be displayed as shown below:

Besides, according to their development labor performance standards could be divided into two. These are:

- a) Engineered performance standards
- b) Non-Engineered performance standards

2.2.1.1 Engineered performance standards

These are standards that are developed using recognized principles of engineering and work measurement (Lavin et, al 1980).

The standards developed define the time necessary for a qualified worker, working at a normal pace, under capable supervision, and experiencing normal fatigue and delays, to a defined amount of work of a specified quality when following the prescribed method (Starr 1989).

An engineered standard contains two basic elements; these are normal time, which is the timed cycle time of the job for a normal worker; a personal, fatigue and delay (PF&D) allowance. Its standard development consists of three stages.

There are three commonly used methods to develop engineered standards; these are direct time study, predetermined data, and work sampling (Lavin et, al 1980).

Direct time study: Direct time study is the approach most frequently employed to set labor output standards by observing the work of a single operative for short timed cycle tasks. The rationale for using direct time study rests on the assumption that a valid output standard can be estimated by observing a single worker performing a particular task provided of course that he has sufficient skill to perform the task and that he works according to the standard method developed by method study.

That is:

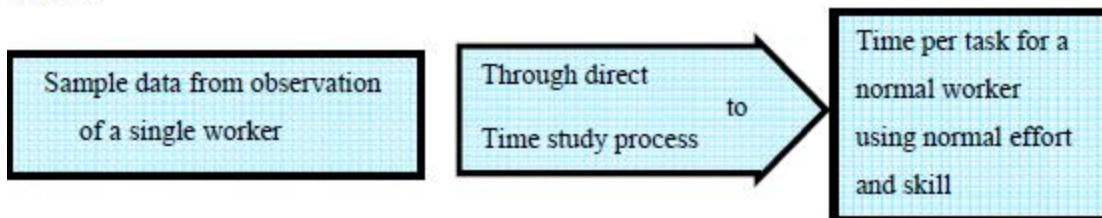


Figure 2.1 The Essence of Direct time study (Adapted from R.m, 1968)

2.2.1.2 Non-engineered performance standards

These are standards that are developed by simulating, estimating and analyzing past data and experience of the works Lavin et,al (1980). Despite their inaccuracy these methods are commonly used by most construction industries of developing countries, because their development requires less time and expense and the productivity data can be obtained before entering into construction hence can be used for labor budgeting and pricing. More over some cost engineers believe that the productivity standard develop by this method is quite sufficient in accuracy for construction where there are so many assumptions. The common non engineered methods of work measurement are technical estimates, historical standards and staffing patterns.

Technical estimate: This is a method of standard development by which performance of a worker to do a certain task is estimated from historical reports, standard data, and rough time studies in combination with the estimator judgment to produce the standard. It is usually done by experienced supervisors Lavin et,al (1980). Standard developed by this method is commonly used for scheduling, controlling, priority ranking and costing.

Historical standards: This is a method of standard development by which productivity of a certain operative is estimated by collecting facts data of inputs and outputs and correlating them Lavin et,al (1980). The data shall be collected for a sufficiently long period of time to represent the real trend, and the likely trend of the data for a certain future period is forecasted by applying simulation methods. The data then obtained is analyzed by applying descriptive statics to determine the mean productivity of the operator. It is usually used for warehousing and administrative purposes but some countries do also use this method to develop labor productivity standards.

Staffing pattern estimates: These are estimates that are used to assess the amount of indirect labor required for a certain construction team doing direct productive work Lavin et, (1980).It is based on assessing the ratio of indirect to direct personnel of past similar activities. It is commonly used for administrative purposes.

2.2.2 Measurement system in construction project

To introduce a work measurement system a construction company shall prepare a system plan for implementing, operating, and maintaining work measurement in its operation. As a minimum the plan should provide guidance on establishing and maintaining standard accuracy, conducting engineering value analysis to improve operations, revisiting standards and related system data and using labor productivity standards as an input to budgeting, estimating, production planning, and performance evaluation.

There are two major type of management system: -Traditional management approach and the performance management approach.

2.2.2.1. Traditional management approach

It is the usual approach to focus on the worst end of workers in the traditional approach. Foreman often come down hard on workers and crews which they fell to perform well. The effect of this kind of management is to push the few worst end workers to the average hence increasing number of average workers and crews but more average workers are not motivated to the best performers Productivity performance scale

2.2.2.2. Labor Productivity Performance Parameters (Benchmarks)

It is important to note that labor performance is the 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. Hence labor productivity can show the efficiency of labor if it is used comparatively, not absolutely. productivity measurement information's required also varies with managerial level Hence there is a need to establish benchmarks for lower level measures to monitor single activities and higher level measures to gauge project and industry wide performance.

For continual assessment and improvement of labor performance at any managerial level, it is advisable to establish bench marks for the purpose of comparisons.

Benchmarking is defined as “a systematic and continuous measurement process; a process of continuously measuring and comparing an organization business process against business leaders anywhere in the world to gain information which will help the organization to improve its performance” according to Adel-Hamid Mohammed (2001) Benchmarking can be internal, external, classic, traditional, process, performance, functional, strategic or a combination.

The idea behind each is the same; to identify measure, compare, perform gap analysis, adapt and implement new ideas.

In construction there are two commonly used benchmarks that use labor performance as a major input. These are:

a) Project level labor performance benchmarks

b) Work team (Crew) level labor performance benchmarks

2.2.3. Labor work methods development

Performance standards are essential components to determine the performance ability ratio of trades. However, before the project management establishes productivity standards it must decide what work methods will be used in the production process (Wiley, 1962).

The first phase of method analysis is to study the work being performed at a single work station or interrelationships among several work stations (Wiley, 1962).

According to their scope method analysis is divided in to two. These are:

- a) Intra work station method study
- b) Inter work station method study

2.2.3.1 Intra work station method study

This is a method study which studies the movement of man and machines at a single work stations R.M (1968).Here the analysis is highly detailed and concerned with the minutest aspects of the task. In the description and analysis of intra work station tasks, the work methods are often divided in to three general categories:

1. Single operator, using only hand tools
2. Single operator, using a single machine
3. More than one operator or more than one machine

For each of these categories there is a separate approach, but all three approaches are actually variations on the same theme. All provide a means for outline the sequence in which elements of work are accomplished by each significant work performer under study. In the case of the single operator using hand tools, the significant work performers are his two hands and hence a standard chart called operator chart or left and right hand chart are used (Wiley, 1962) .

In the case of the second intra work station tasks involving machines, the significant work performers are the operator himself and the machine. Accordingly the man machine chart is used for method description and study (Wiley, 1962).

In the case of the third intra work station tasks involving a combined effort of man and machines a chart shall be prepared for each man and machine to describe and study the task; such kind of chart is called multiple activity analysis chart.

2.2.4.2 Inter work station method study

This is a methodology which studies the movement, flow, of a material or semi processed product from one work station to another Wiley, (1962). Here the analyst approaches the existing work by taking bird's eye view, or "big picture" perspective of the production process.

The most appropriate descriptive form for this kind of conceptual method study is the process chart Wiley (1962), R.M (1968). This chart presents the overall picture of the production process, each step of the production process being divided into operation, transportation, storage, inspection and delay (Wiley, 1962).

This study does not research the work methods of the production trades however it stresses the fact that for effective performance management used to improve the performance of skill labor and, which are the basis for attaining competitive skill labor

2.3. Major criteria for skilled labor capability

Medugu, (2011) mentioned that where highly capable personnel are utilized, the impact of skilled craftsmen in the industry is very visible in its end products. This is because they are directly involved in speedy realization of construction projects delivery since they are involved in the technical aspect of such contract. However, where qualified skilled craftsmen are involved, it tends to eliminate the concern of poor quality, low productivity, late project completion which often result to conflicts, cost and time overruns. Abiola, (2004) believe that this problem is mostly attributed to poor level of workmanship which normally results to rework of defective or unsatisfactory work done by incompetent skilled craftsmen. In addition, skilled craftsman also helps to raise productivity, reduction of accident, less supervision, increased organization stability and flexibility.

Skill labor attain the following quality

1. Have good knowledge in method and sequence of construction
2. Good handling of tool and equipment
3. Attentions paid to standards and regulation
4. Good communications within the crew
5. Time management

2.3. Challenge in attaining skill labor capability in building construction

2.4.1 Rapid Change in technology

The construction industry all over the world is experiencing rapid changes in technology. Dubem I.I Stephen (2012) Views this reason is not far-fetched because of the ever increasing sophistication in this age of computer technology which has made it obligatory for organization to meet changing situations with globalization in the construction industry and client demand. Okuntade (2014) highlighted that the construction industry all over the world have been adapting to the occasionally change in technology with skills acquisition program to meet demands. This however, hast these has great constraints and influence on the workforce.

2.4.2 Lack of Organization Training and Retraining of Skilled Craftsmen:

Training for capacity building is central to sustain economic growth and development because human capital is the greatest asset of any organization Long et al (2012a: Long et al., 2012b). But construction firms in Ethiopian which is very narrow, because they seem to focus on the financial gains forgetting the people that make the job and money.

Among the multiple problems of craftsmen training as most construction firms hardly discuss about how to improve the workforce but on how the workforce will improve themselves. Kassimuka (2012), assert that the absence of craftsmen training and retraining program in an organization often manifests tripartite problems incompetence, inefficiencies and ineffectiveness. Therefore, without a training policy provided by an organization the

tripartite problems earlier mentioned will be threaten. The author suggests that training and development should be viewed as veritable tools that help to improve the outdated nature of the construction industry in to a modern construction industry through updating of staffs and manpower development.

2.3.3 Poor Remuneration of Skilled Craftsmen

This is a major reason the construction industry is having problems of attracting and retaining skilled workforce. In most developing countries, there is no regulation guiding minimum wage for construction workers. Fagbenle (2004) put forward that different wages are paid in across the country. This issue prompt construction worker to pursue other career or migrate to where they will be better remunerated. The nature of the construction industry is a contributing factor that makes it difficult for construction workers to join trade union. This informs the reason wages cannot be jointly negotiated, as it is in the case in government establishment. The workers in turn do not work with full loyalty in this respect Fagbenle, (2004).

2.3.4 Lack of Motivation of Skilled Craftsmen

Human potential is boundless but it requires motivation in order to excel this stress Fagbenle ,et al (2004) describe motivation is an art of inspiring someone to work. Ironically, but majority of construction firms in do not motivate their skilled workforce for improved productivity. Since lack of motivation has always resulted to high staff turnover in the industry. Fagbenle (2004) opine that motivation of skilled workforce can be achieved in many ways, but whatever method is adopted, it must be realized that economic rewards must be among the chief consideration. It is therefore necessary that a sound wage policy is laid down with well-structured incentive and bonus plan. Ugheru, (2006), he finds that other considerations to aid motivation include: financial incentives, promotion, job security, welfare package, and participation in decision This being the productivity model in terms of time, how can we apply this to individual human being is something to be thought about.

2.3.5 Lack of Appeal to Young, Potentially Skilled Workers

The construction industry lacks appeal to young, potentially skilled workers which increasingly give poor image associated with construction labor as work done by less intelligent craftsmen (incompetent craftsmen). Darren et al. (2012) thinks this is due to the inefficiencies which lead to poor workmanship that result to rework that brings about cost and time overrun. Poor image and career paths over the last couple of years has discouraged young people from seeing the construction industry as a viable career path. According to Awe (2006) the Nigerians youth no longer show interest in skill acquisition unlike the case in developed countries such as the UK where reports indicate that demand from young people for apprenticeships is outstripping the number of training places available in the country.

2.3.6 Low social recognition

Social recognition is argued to be of fundamental importance for employees, as it contributes to perceptions of Self-worth and identity Bjarnason, (2008). It has been noticed that, reluctance on the part of younger generation such as school leavers to find occupation in skilled trades in construction sector Pathirage (2008). Lack of social recognition in the traditional society, despite better financial gains, is believed to be the main cause behind the problem.

2.3.7 Non-permanent status of laborers

In general, the workforce of contractors is highly mobile. Because of that, individual employers will not get any benefit through developing skills of those laborers. The whole society will be benefited by training laborers. But contractors are generally reluctant to invest capital on those who may be soon someone else's employees Allmon, (2000). The findings revealed that though there are many advantages from performance evaluation, most of the organizations not following a proper performance evaluation procedure for labor force. However, they believe that they can enhance the skills of laborers through performance evaluation process and speedup the progress of the project with a good quality. A

combination of all suggested methods to evaluate and promote laborers is presented Allmon E.(2000) industry.

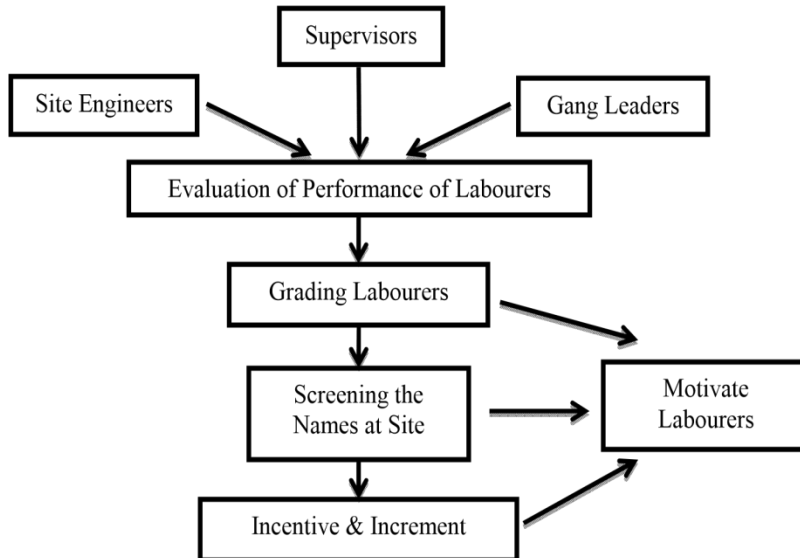


Figure 2.2 performance evaluation procedures for labor force (source Allmon E.(2000))

According to figure2.2 the supervisors, site engineers and gang leaders should follow a proper effective performance evaluation criterion and then grade the laborers with incentives and increments in order to motivate them. Then, their performance level can be kept in a high level.

2.4. Factor which affect the performance of skill labor in project

2.4.1 Material Related Factors

The size of the construction site and the material storage location has a significant impact on performance because laborers require extra time to move required materials from inappropriate storage locations, thus resulting in productivity loss. Po Thomas (1991) or-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.

2.4.2 Equipment and Technology Related Factors

Anwar Zeb (2015) stress that inappropriate type and size of construction equipment often affects the performance of construction projects. 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. Lack of equipment and frequent damage of equipments are investigated as the main casual factors for low performance because it takes a long time for the laborers to complete the specific work.

2.4.3 Labor Related Factors

Adel-Hamid (2001) state that there should be sufficiently skilled and experienced laborers on projects in order to make the projects productive. If labors are unskilled and in lack of experience, they take longer time to complete specified task and there will be a possibility of rework, therefore incompetence of labors can be considered as one of the possible causes for the decrease in productivity. Lack of labor experience, high absenteeism of labors, incompetence of labors, use of alcohol and drugs, overcrowded labor force, poor relationship between labors, indiscipline labors, and personal problems are the main factors which negatively affects labor performance.

2.4.4 Health and Safety Related Factors

Choudhry (2008) state that at construction projects accidents are frequently happened which has high impact on labor performance. 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. Accident that causes an injured person to be hospitalized results in a work decrease of the crew for which the injured employee not able to do the given task and small accidents resulting from nails and steel wires can stop work and, thus, decrease productivity Thomas (1991). Providing safety equipment and 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 performance.

2.5.5 Supervision Related Factors

Work inspection by the supervisor is an essential process to precede the work. For example, the contractor cannot cast concrete before an inspection of the formwork and steel work, thus affecting labor performance Zakeri, et al., (2010). With non-completion of the required work according to the specifications and drawings, supervisors may ask for the rework of a specific task. Unclear instruction given by supervisors, change of supervisors, incompetence of supervisors and supervisor's absenteeism are some of the major contributing factors for low labor performance.

2.4.6. Project Characteristics Related Factors

Performance of skill labor is highly dependent on the characteristics of the project such as uniqueness, complexity, size, site congestion, contract type and appropriate site layout for temporary facilities.

Construction projects are complex, unique and more often difficult. Projects in construction are never designed or built exactly in the same manner as previous projects. Environmental factors such as the landscape, weather and physical location force every project to be unique from its

Construction projects are complex, unique and more often difficult predecessors. There are also aesthetic factors that create uniqueness from project to project. Such factors have a significant impact upon major project characteristics. While most construction personnel find this uniqueness to be an attractive element for a career in construction, it can have an adverse effect upon construction productivity Carl (1999)

2.4.7 Quality of Work Related

Quality of work related issues have an influence on the performance of labor on the construction projects. Ambiguous Specification, correction/rectification of works and rework are some of the factors related to quality issues that affects labor performance by increasing labor lost hours.

2.5.8 Leadership, coordination

Management complicates progress in performance of skill labor within the construction industry. Past studies found that poor management was responsible for over half of the time wasted on a job site. Good management is required for profitability and success. Poor scheduling and communication between the project office and the head quarter contribute a lot besides cash flow problems in causing disruption of projects temporarily.

According to Abid (2018) Managers' skill and attitudes have a crucial bearing on performance. In many organizations, performance is low even though the latest technology and trained manpower are made available Chinny (2010) Low performance 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.

2.4.9. 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 Thomas (1991). 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.

Extreme weather conditions (such as extreme heat or cold) will also increase absenteeism and turnover. Various natural factors affecting labor performance 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. 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, or it can also be factored separately. Either way, there is usually a performance loss to consider. The following are some of the factors Lays under this category; Bad weather (rain, hotness, etc.), Unstable political conditions and Holiday's among other.

2.5. Factors affecting cost and time of skilled labor in project

Skilled labor performance greatly impacts the objective of the project. Because repeated rework create late delivery of the project and waste of material or resources this effect addressed by a number of study. Among those study Lack of experience and competency of labors contribute to project success. Jorge et al (2005) mentioned that, productivity cannot be achieved by speed and harder work only without adopting better work practices, whereby insufficient skilled workers are the most important factor that industry stakeholders are concern about Okuwoga (1998) stated that cost and time performance has been identified as general problems in the construction industry worldwide. James (1999) obtained that project schedule and budget performance are controlled by the dynamic feedback process. Those processes include the rework cycle, feedback loops creating changes in productivity and quality, and effects between work phases.

2.5.1 Rework

Rework in construction projects is referred to as the unnecessary effort of redoing a process or activity that was incorrectly implemented in the first instance Ekambaram(2006); Abdullah (2012) describe that in construction projects, rework which lead to cost and time overruns can result from an array of factors such as poor workmanship by incompetent craftsmen, errors, omissions, failures, changes, poor communication and poor coordination. To some extent, the level of rework in construction projects would be depend on external factors such as excessive workload, market conditions for instance, increased defects and from limitations on the availability of competent subcontractors Adamu(2011); Dai (2009);

Enshassi (2007) Rework and wastages are considered as non-value adding endemic symptoms that could adversely affect the performance. Productivity and ultimately profit margins Ekambaram, (2006); Abdullah et al. (2011) Some Previous studies also indicated that the costs of rework in poorly managed projects can be as high as 25% of contract value and 10% of the total project costs Abdullah et al. (2012).

2.5.1.1 Time overruns

Odesola, (2014) describe time overrun as the time during which some part of construction project is completed beyond the project completion date or not performed as planned due to an unanticipated circumstance. Ijgah E.A (2012), state that time overruns is one of the causes resulting from rework which adversely affect performance, productivity and ultimately profit margins. The problem of project time overrun is of international concern. As numerous studies related to causes of time or cost overruns have been conducted worldwide and mostly in developed countries. Ijgah E.A.(2012).

Time overrun affects the project owners, contractors and other project participants. Project owners may be affected through lost benefits that could have accrued from the completed facility, while contractors may have to spend more on labor and plant, pay penalties as per the contract or even lose other profitable contracts because resources for the next job are tied up on delayed projects Lawal, (2008); Odesola,(2014); Olatunji,(2007)

2.5.1.2 Cost Overrun

The evidences impact of project duration variation on cost performance has been discussed frequently in the past literature Akintoye, (2000) attempt to identify the factors influencing project cost estimating practice. Conducting factor analysis, it was revealed that the extent of variation in project duration is one of the seven influencing factors contributing to the project cost performance.

2.6.1.3 The Impact through Quality Performance

Fayek et al, (2003) attempted to quantify the cost of each cause of rework in a mining expansion venture project regarding “insufficient skill levels” causes, lack of adherence to procedure and shortage. Overall, two causes in the area of human resource capability, insufficient skill levels and inadequate supervision and job plan, account for 13.12% of the total construction field rework cost.

2.5.1.4 The Impact through safety incidents occurrence

As mentioned before, a tight scheduling and scheduled overtime are the common circumstances of a project executing with a shortage of skilled labor. Ahmed et al. (1999) identified a tight construction schedule as the most serious factor affecting construction site safety. Overtime duties also can cause physical fatigue on craft workers Lyneis (2007), which can seriously affect implementation of construction site safety Cheng et al., (2004). Furthermore, the consequence of tight scheduling is the higher work pressure on craft workers. The evidences of the influence of perceived work pressure by workers on unsafe work behavior have been discussed by several researchers. They claimed that workers tend to take safety shortcuts when they feel they are under pressure during the work Choudhry (2008); Brown et al., 2000).

Less experienced workers are more prone to safety incidents due to the lack of familiarity with proper construction procedures and processes. Choudhry (2008) found that experience has a significant role in unsafe behavior of craft workers. Glazer et al. (2005) found that factors such as inappropriate acts, inexperience, and deviations from safety instructions were the most common reasons for injuries, contributing to of all observed injuries in their study.

2.6. Skill labor performance improvement

The production process is a complex, adaptive ongoing social system. The interrelationships between labor, capital and the socio-organizational environment are important in the way they are balanced. Productivity improvement is how we successfully identify and use the main factors of the socio-production system. In connection with this we can identify three

main performance factor groups. These are job related, resource related and environment related Joseph (1999) this study focused on the job related, and skill labor quality related.

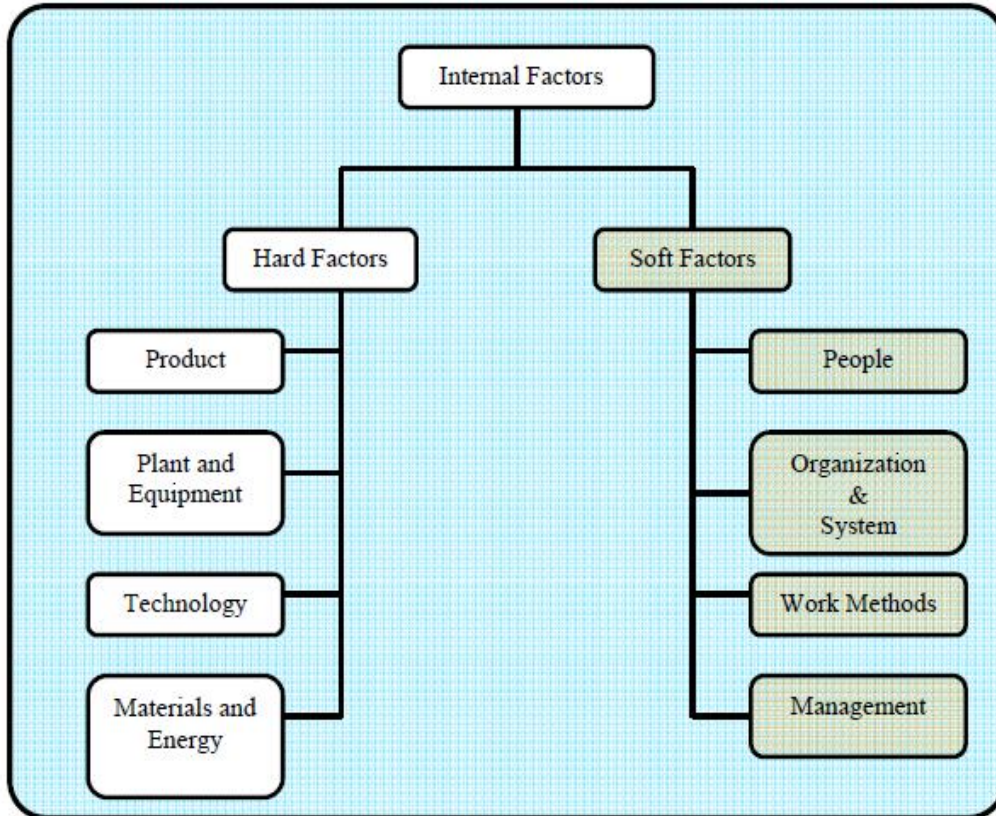


Figure 2.3 Factors Model at Organization Level [Joseph, (1999)]

As the figure depicts that the two factors of internal production stated by Joseph are categorized in to two broad parts i.e.: Hard and soft.

- i. Hard factor which include product, plant and equipment, technological change and material and energy. These factors difficult changed in short period of time.
- ii. Soft factor include people, organization and system, work method and management. These factors can be changed in short period of time.

Construction works like any other production works also contains these factors to a different degree in different levels. This research focus on the improvement of those factors which can be changed easily (soft), by applying the knowledge of management science and organizational management, more specifically performance based management.

As this study focuses on soft factors, it is essential to describe how we can improve the Performance of each factor.

People: as the primary source and the central factor in performance improvement drives, the people in the organization all have a role to play to output of the project as human resources the role of a person has two aspects: application and effectiveness application is the degree to which people are willing to apply labor to their work.

Standards of performance play an important role the capacity. It should be set at a high but achievable level Ankrah (2005). He stated that if the standard set is too high, then the capacity decreases. The second factor in performance improvement is effectiveness, is the extent to which the application of human effort brings the desired results in output and quality.

It is a function of method, technique, personal skill, knowledge, attitude and aptitude the “ability to do”. This can be improved through training and development, promotion, and career planning. Hence the approaches that should be employed to improve labor performance are: wages and salaries, training and education, social society, rewards, participation, attitude to work, supervision, cooperation, attendance, turn over and job security.

This is explained by the Ambekar, (2017). Motivation of a person decreases if it is either satisfied or blocked from satisfaction. In order to stimulate and maintain motivation, the following should be done: A set of values conducive to higher productivity should be developed in order to bring about changes in the attitude of managers, engineers and workers. Motivation is basic to all human behavior and to efforts in productivity improvement. Workers’ success in increasing productivity should be reinforced immediately not only in the form of money but also in providing recognition, respect involvement, learning opportunities and elimination of un expected penalty.

Organization and system: this one improvement of performance is the organization and system. The main reason for low productivity of firms is because of their inflexibility.

Systems are always designed for certain situations but things will not be the same forever, all procedures designed should likewise change. Hence dynamism and flexibility should be incorporated into the system design in order to maximize performance.

Work methods: improving work methods are very important where most skilled labor only has experience and much of the activities are require large amount of labor or labor intensive as declared by Brachet (2012). Work methods aim to make manual work more productive by improving the way the work is done, movements performed, tools used, the workplace lay out, the materials handled and equipments employed. Work methods are systematically improved by analyzing present methods, eliminating unnecessary work and performing necessary work efficiently.

Management style: Bailey (2009) emphasize that much of the contributions in improving performance are gained from improved management, because management is responsible for the effective use all resources under its control. However, there is no perfect management style for all contexts, but effectiveness depends on the plan which include when, how and to whom the manager applies the style the characteristics of the trade applied on it this led to not only improve the performance of skilled labor but also benefit of the project outcome.

2.7. Gap analysis

Labor productivity and craftsman availability studied by different author with distinct perspective but they are limited to factor that affect labor productivity. This study conducted to fill the gap and addressed the factor which affects skilled labor capability further capability individual and crew level evaluated capability of improvement also mechanism is indicated investigating the impact skilled labor capability on cost, time, and quality also assessed. From literature different scholar from different area of study assessed among those

Table 2.1 summary of factor affecting skilled labor from different author perspective

Authors	factors causing low-skilled workers' performance
Zou, (2007)	mainly arise in large construction projects due to seven reasons such as unfair wages, lack of motivation and incentives, lack of training and re-training, inclement weather condition, design changes, use of low quality tools and equipment and delay in deliverance of materials to sites
Odesola, (2013)	Identified as shortage of skilled workers on sites, poor site management, lack of safety and health services, inefficient plants and equipment and unnecessary over-crowding of skilled workers
Ogochukwu, (2014)	opined that, poor supervision, shortage of skilled workers, delay in supply of materials to site, high rate of accidents on sites and conflicts among skilled workers,
Radosavljevic, (2013)	Delay in payment of wages, too many rework, lack of financial and non-financial incentive schemes, extent of change orders during project execution, incompetent supervision, delay in responding to requests for information, overcrowding of skilled workers, unrealistic scheduling of program of works and shortage of materials and equipment on sites.
Dantong et al.(2011)	Aging of skilled craft workers in the industry, decline in the number of new entrants into skilled trades, poor finding and ineffective state of vocational education and training / retraining system in the country.
Amanueal, (2016)	The top ten labor productivity influencing factors are ; Shortage of material, Delays in decisions making, Incomplete and Inaccurate drawings, Lack of follow up the work progress, Financial difficulties of the owner/Payment delay , Incomplete facilities (water & power supply, and sanitary facilities), Inspection and Instruction delay, Lack of Motivation, Frequent damage of equipments and Change of work order/Variation
Alemu, (2015)	The causal problems for low productive performance was analyzed and it was found that unfulfilled conditions from project site external bodies, lack of project management systems, poor technical management in areas of developing productivity standards and construction methods, average leadership efficiency and low project culture towards workers satisfaction are responsible for low productivity performance.

3. MATERIALS AND METHODS

This chapter discusses the methodological framework within which the study was undertaken. The chapter gave details on research design, research techniques and procedures that were used for the collection of data. It also included general information about the places of field work and the methods adopted on data collection.

3.1. Study area

This study was undertaken in SNNPRS specifically Hawassa ,Dila and Arbaminch Cities; Hawassa City which is the capital of SNNPRS (South Nation Nationalities People's Regional State). Hawassa is a city in Ethiopia on the shores of Lake in the Great Rift Valley. It is located around 273 kilometers south from Addis Ababa via Bishoftu, 230 km North East of Arbaminch, and 75 km North West of Dilla. The town serves as the capital of the southern Nations, Nationalities, and Peoples Region, State and is a special zone of this region. It lies on the Trans-African high and 4 Cairo-Cape Town, and has a latitude and longitude of 7°3'N 38°28' E and an elevation of 1708 meters above sea level. Based on the figures from CSA (2007) the total population of Hawassa Town is estimated 350, 000 total population. Of whom 180, 650 are male and 169, 350 are females and Arbaminch is found in SNNPR it also located 6.03 East latitude and 37.55 longitudes and is situated at elevation 1269 meters above sea level and the total population of town is estimated 200, 373 in 1994

Ethiopian. Dilla is found in SNNPR it also located main road from Addis Ababa to Nairobi the town has a longitude and latitude of 6°24'30"N 38°28'30"E, with an elevation of 1570 meters above sea level.



Figure 3.1 Map of SNNPR cities (Source SNNPR construction bureau 2008)

3.2. Study Subject

In this research, different volunteer participants were included as the study was intended to study assessment of skilled labor performance in construction project selected site in SNNPR. The participants included in this research were professionals in the construction companies more specifically contracting firms like project managers, site engineers, etc.

3.3. Study Design

The types of study used in this research were mainly descriptive. It was attempted to collect data from the relevant respondents to study skilled labor performance in public building construction project. It is considered as a suitable and available research method for the purpose of description about assessment of skilled labor performance in construction project. Descriptive survey research is more convenient in gathering opinion of people on a particular issue. This kind of method is concerned with gathering facts and obtaining perfect precise information concerning the current state of phenomena and whenever possible making conclusion for the facts discovered (Orodho 2012).

3.4. Methodology of data collection

3.4.1 Data Sources

The target population: The target population was the projects environment in SNNPR specifically Hawassa, Arbaminch ,Dilla Cities. And sample took all the active site which under taken and the professionals to the accomplishment of the purpose of this study, the research used purposive sampling method in selecting contractors and operational staffs.

The study employed both qualitative and quantitative data collecting tools. Questionnaire survey, case study and interviews provide the detailed quantitative statistical and qualitative analysis of the selected data instruments. The bulk of the data were collected through administering survey questionnaires' (closed and open-ended questions) (Appendix - Questioner). The quantitative data obtained from the questionnaire survey is organized, coded and categorized using the SPSS software; which facilitates analysis and testing; and the presentation of the statistical outcomes.

Qualitative data made by observation in the site which is the how skill labor perform the given activities , Quantitative data are collected like employee's age, work experience literacy, skill labor capability, factor that affect quality of skill labor and the impact of skill labor to individual and the overall project activities. Interview questions were prepared and asked to be answered by Forman and skill labor to substantiate the results obtained by the questionnaire survey and site observations.

3.5. Sample and Sampling

The sample size of this research was selected from building construction projects that were under construction in SNNPR of 3 cities. Also in selecting sample size ongoing (live) construction projects were considered, this made it possible for the researcher to observe skilled labor performance in public building construction project. For the selecting criteria of sample size the researcher gathered information on all active public building construction projects that are being undertaken by class I because have more experienced in measuring and recording performance of skill labor, most public project executed by grade one contractors. The information was collected from SNNPRS Construction Bureau, the Cities Administration bureau and from the university projects of Hawassa , Arbaminch and Dilla . From this technique a purposive sampling method was adopted to select the sample for the

study as it involves selecting a sample based on experiences or knowledge of the group to be sampled.

Therefore, this study was planned to be conducted on fourteen (14) in Hawassa city, fifteen (15) from Arba Minch and six (6) Dilla building construction projects that are being constructed by construction firms of GC/BC grade one and the sample size may include office buildings, hospital buildings, educational buildings and multi-purpose projects in the city.

After determining the number of sites to study it came to the selection of those who will respond to the questionnaires on the various sites. The target respondents to the questionnaires on the various sites in this research include contractors (i.e. project manager, project engineer, site engineer and office engineer Quantity Surveyor). The researcher adopted a purposive sampling method to select respondents from the contractor side; the reason for this was that all professionals on the site did not have adequate knowledge on the topic.

Table 3.1 Summary on Research Questionnaire respondent

City	Number of project	Respondent from each project	Total
Hawassa City	14	3	42
Arbaminch City	15	3	45
Dilla City	6	3	18
Total	35	3	105

From the total of 114 questions 105 is returned which is $105 \div 114 \times 100 = 92.1\%$ of the total questioner.

3.6. Data Quality

To assure the quality of the data and its fitness some tasks will be done, like pre testing and amendment of questioner, close supervision and cross checking of responses obtained will be done.

3.7. Instruments and Procedures of Data Collection

The data for the study was obtained from the primary and secondary sources. Project managers, site engineers, office engineers, and foreman and soon were the source of information for the primary data. In addition to this, document analyses were made to search out more information on skilled labor performance in public building construction project. Close ended and open ended questions were developed to collect relevant data to the study. The researcher employed different types of data gathering tools. The data from the primary sources were collected through questionnaire, interview, case study and site observation. For secondary data, relevant books, journals and websites were assessed.

3.7.1. Questionnaires

The basic reason for the preference of research questionnaire as contrasting to the other tools is that, it is possible to reach relatively large research within the time limits and helps to achieve possible solutions to the basic research question posed. Burns (1994) accordingly, to collect primary data, questionnaires were developed for contractors that are performing public building construction project at SNNPRS.

3.7.2. Interview

Interview drafted for skill labor and Foremen in order to address status of skill labor, perception of capability, qualification standard rule and regulation work method and cross checking the validity of questioner result. Since the study includes skilled respondents with relatively poor capacity of English language, the interview was translated in to Amharic so that certain inconveniencies and communication barriers were avoided

3.7.3. Case study

A case study of seven projects emphasizing on three construction trades, namely, concrete, steel reinforcement placing and masonry works was made. Case study was chosen as a research strategy because the study involves in depth assessment of the skill labor performance construction process with research questions “How?” and an imbedded “What

and why?” types; to address the capability of skill labor to this trade of work.. The selection of the three trades was due to constraint of resources and time to conduct on all trades, their involvement in most construction works and their use of larger proportion of labor.

3.8. Data Processing and Analyzing

The data had been summarized and content analysis was carried out using narrations and interpretations. The statistical method used to analyze the quantitative data was percentage, ranges and comparison of the data. Tables and graphs are used to present the data more elaborately in accordance with their importance. Therefore, information that will be obtained through these data gathering tools was expected to be effective enough to address each research question.

3.8.1 Pilot study

The piloting was done to test whether the questionnaire was intelligible, unambiguous and easy for respondent to understand and respond to. The professionals participated in this research were contractors. Pilot study of the questionnaire was conducted by investigating sample questionnaires. Six (6) questionnaires were distributed to construction professionals such as projects managers, site engineers and office engineer who have a strong practical experience in the industry. Their sufficient experiences are a suitable indication for pilot study. From the distributed four questionnaires all of the questionnaires were returned. The following are summary of the main results obtained from pilot study:

1. Some factors and sentences should be modified or represented with more details.
2. Some factors were repeated more than one time with the same meaning. So, it should be eliminated.
3. Some factors and sentences should be modified in order to give more clear meaning and understanding.
4. There are some parts of questionnaire required to be written again because they were not clear.
5. Some factors should be rearranged in order to give more suitable and consistent meaning.

6. There are some questions which are not practical or realistic with respect to local

Situations of building construction projects such questions should be removed or modified to be realistic and fit to practical situations.

Based on the comments obtained from the pilot study, the questionnaire was modified and corrected and as a result the final questionnaire have been made more clearer by replacing ambiguous words with simple and understandable ones.

3.8.2 Reliability and validity of data collection instrument

Sound measurement must meet the tests of reliability and validity. In fact, these are the two major considerations one should use in evaluating a measurement tool. In the widest definition, reliability can be described as clearness degree of measurement results from random errors Cohen et al. (2007).

Up to today, lots of reliability coefficients have been recommended for estimating reliability of measurement tools. Alpha coefficient developed by Cronbach (1955), is generally used in acquiring reliability in terms of internal consistency regarding a single test especially in combined measurements. This coefficient is also known as Cronbach's alpha coefficients.

The classification performed by Cohen et al., (2007) was used while interpreting the significance of influence quantities in the study. According to this classification, influence quantities are classified as, weak between 0.00 and ± 0.10 , Small between ± 0.10 and 0.30 , Moderate between ± 0.30 and 0.50 ,Strong between ± 0.50 and 0.80 and Very strong over ± 0.80

In this study Cronbach's alpha coefficients was used to check the reliability of the data collection tool and the internal consistency was indicated according to Cohen et al., (2007) classification.

Validity refers to how fairly you can generalize your findings to other groups or other situations. Also it can refer to the most critical criterion and indicates the degree to which an instrument measures what it is supposed to measure. But the question arises: how can one determine validity without direct confirming knowledge and the answer may be that we seek other relevant evidence that confirms the answers we have found with our measuring tool. Kothari (2004)

In this study the researcher applied the following validity strategies to make the research trustworthy and accurate. First pilot study was done to test whether the questionnaire was understandable, unambiguous and easy for respondent to understand and respond to. Pilot study of the questionnaire was conducted by investigating sample questionnaires. Second prolonged time was spent on the visited construction site. In this way, the researcher developed an in-depth understanding on skilled labor performance in public building construction project. Third triangulation of data was made; by doing this data was collected through different source (i.e. questionnaire survey, interview and observation/site visit).

3.8.3 Project level labor performance benchmarks

These are labor performance benchmarks that are designed to compare the efficiency of one project with another.

Essentially, the benchmarks are external to the project and can be used to compare the efficiency of any two projects working over comparable conditions, often projects under the same corporate management.

The commonly used model in project level labor performance benchmarks is the site based model of Thomas and Zavrskias cited by Adel-Hamid(2001). This model was an analytical approach to compare labor performance in one project to that of another. The elements of the model are:

Thomas established benchmarks on disruption, total labor performance and management contribution and he defined his benchmarks as below.

Disruption index (DI): This is an index which measures the amount of lost work days in the construction life of a project or activity. It is calculated as:

$$\text{Disruption Index} = \frac{\text{Number of abnormal (Disrupted) Work days}}{\text{Total number of work days}} \text{ ----- [Eq.1]}$$

Disruption is temporary stoppages of works due to bad weather, poor work sequencing, congestion or lack of resources in which the total productive time during the cause is only 50% of the normal productive time.

Baseline productivity is the best performance that a contractor can achieve for a particular design. It is a productivity of labor when resources are available and disruptions are practically minimal.

Performance Ratio (PR): This is an index that helps to measure the productivity of the exemplar performance the lower the value, the more productive the exemplar performance.

It is calculated as:

$$PR = \frac{\text{Cumulative productivity}}{\text{Expected baseline productivity}} \text{ [Eq.2]}$$

Project management Index (PMI): This is a dimensionless parameter that reflects the contribution of project management to the cumulative labor performance on the project.

The lower the PMI, the better was the project management's influence on overall performance. It is calculated as:

$$PMI = \frac{\text{Cumulative Productivity} - \text{Baseline Productivity}}{\text{Expected baseline Productivity}} \text{ [Eq.3]}$$

Work team (Crew) level labor productivity benchmarks

These are labor productivity benchmarks that are designed to show the efficiency of a work team or trade by comparing the with the best work performance through its past activity life.

Essentially, these kinds of bench marks are internal and can be used to evaluate the productivity performance of a work team against its best achievement in the past. These are also benchmarks that this study uses. Edward, (1988) has used these measures to evaluate crew performance and for continual productivity improvement.

3.8.3.1 The performance management approach

It is a management approach by which the performance of workers is measured and improvement is made by learning working methods from the best workers (Benchmarking). Two things should be done for this approach to be effective .These are

accurate work measurement to identify exemplar workers and crews and studying these workers to learn their working methods. The effect of this management approach is to shift the majority average workers to the best, hence producing positively skewed performance distribution curve. It has also the effect of improving poorer performers to the average.

$$\text{Performance ability ratio (PAR)} = \frac{\text{Standard performance}}{\text{Actual performance}} \text{ ----- [Eq.4]}$$

The higher the value of PAR; there is high potential for a work team to improve its performance whereas the lower value shows that the trade work is performed efficiently.

A PAR value less than 1 show that the actual performance is greater than the exemplar hence this actual performance will be the next exemplar for future works. But to apply above concept for performance improvement we must make the working practices of the trade under consideration be comparable. This can be made by establishing standard working practice and standard productivity for the trade under consideration. Hence the following section discusses how we determine trade attributes particularly standard performance before the introduction of performance based measurement and on site actual productivity rates.

3.9. Ethical consideration

This study was conducted according to the ethical guidelines of research requirements. For this purpose, before going to conduct the site observation and taking relevant pictures for the study permission will be asked and the objective of the study will be clearly described to the participants. In addition, the researcher will ask the permission of the participants to use the tape recorder and photo camera during and promised them not disclose their photograph and their name without their consent.

4. RESULT AND DISCUSSION

4.1 Introduction

This chapter contains result and discussion of the study and it has four parts. Section one deals with personal information about sample respondents. Second section deals with capability of skilled labor force. Third section deals with the findings of the questions directed towards identifying the key factors for quality of skill labor and the results were discussed. The forth section focuses on studying impact of skilled labor performance on the overall project objective in construction industry and presents the results of the questions directed towards and from this finding a way of improving skill labor performance is drawn.

i) Part one

4.2. Response Rate

Of the total one hundred fourteen question (114) questionnaires distributed 105 one hundred five questionnaires were collected and analyzed and the rest 9 questionnaires were discarded since they were not fully filled. Thus, the response rate of the questionnaires is 105(92.1%).

Table 4.1 Summary of questionnaire distributed and respondent

Category	No Of Questionnaire Distributed	No of Questionnaire Returned	Percentage
Contractor	114	105	92.1%
Total	114	105	92.1%

Questionnaires were delivered to 35 active construction sites that are being undertaken by class one contractors. 105 (92.1%) of the questionnaires were returned (N = 105). The data gathered from the survey were then analyzed using the SPSS software package.

4.3. Personal Information of Respondents

In this section personal information of respondents like: the position of respondents at the site, their educational background and work experience of respondents in the construction industry.

Table 4.2 personal information of respondents

Profile		Contractor	
		Frequency	Percent (%)
Position at the site	Project Manager	20	19
	Assistant Project Manager	31	29.5
	Site Engineer	44	41.9
	Office Engineer	10	9.5
	Total	105	100%
Educational background	Masters	38	36.2
	Degree	67	63.8
	Total	105	100%
Years of experience In building construction	1-5 Years	15	14.3
	6-10 Years	44	41.9
	11-15 Years	31	29.5
	16-20 Years	11	10.5
	>20 Years	4	3.8
	Total	105	100%

From the result obtained from questioners regarding respondents position at the site, 44(41.9%) were site engineers, followed by 31(29.5%) assistant project managers, 20(19%) project managers, office engineers 10(9.5%). Thus, we can conclude most of the respondents were site engineers and office engineers. And concerning respondents educational background, 67(63.8%) were degree holders, followed by 38(36.2%) masters. Thus, we can infer the majority of the respondents were degree holders.

With regard to the experience of respondents, it was revealed that 41.9 (N=44) had 6 to 10 years of experience, followed by 31(29.5%) 11 to 15 years, 15(14.3) 1 to 5 years, 11(10.5%)

had 16 to 20 and, 4(3.8%) >20 years of experience. Thus we can conclude that the majority of the respondents had between 6 to 15 years of experience.

The above result indicates that the respondents are with the appropriate experience hence the result obtained is reliable. In addition to that they are site, office engineers and project managers who are degree and masters holders. This indicates that data collected is more acceptable and vital in adding value to the trend of findings for this study.

4.4. Capability of skilled labor force

Developing and building skill need to be made wisely this requires good information about: where skill development is most needed; how well the skills individuals have acquired are matched with those required in the labor market; and the returns on investments in skills in terms of their achievement of planed objective.

Different criteria can be considered as a criterion for hiring skilled labor in construction industry some of these are; by certification which started from grade 10 certification up to 10+4 TVET and by experience which is no training certification learned on site.

Table 4.3 Qualifications requirement for task level appointment of skilled labor

precondition assignment of skilled labor for each item of work		
	Frequency	Percent
Experience	95	90.5
Certification	10	9.5
Total	105	100

From the above table the researcher attempted to found out which criteria is commonly used for selection of skill labor in the study area. With regard to the requirement of skill labor 90.5 % (N=95) responded that by experience followed by 9.5 % (N=10) by technical collage certificate & level 3 and above .Thus the majority of skill labor hired by experience than by certification.

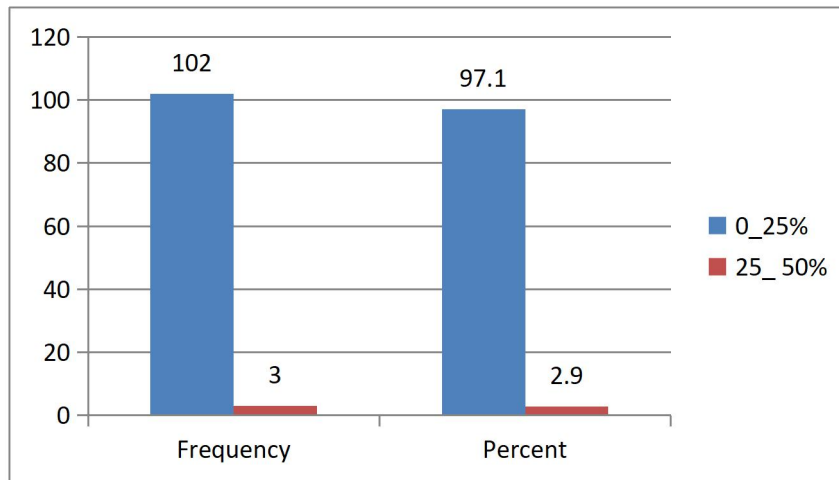


Figure4.1 The amount of female skilled labor from total hired skilled labor

From figure 4.1 the result indicates that total hired skill labor, 97.1 % respondent agreed that female skill labor consist of 0-25%, Followed by 2.9% respondent agreed that female skill labor consist of 25-50%. Thus from the result majority of female skill labor consist of is in range of 0-25% out of total hired skilled labor. Which indicate that female participant is less compared to Male in construction project of SNNPRS.

Table 4.4 skilled labor capability development

	Frequency	Percent
Training prepared by employers to improve skill labor performance		
Yes	37	35.3
No	68	64.7
Total	105	100

From the result 64.7% responded that there is no any specific trainings given, followed by 35.3 %responded as specific trainings given. Thus the majority of the skill labor not took any specific training on skill development in construction site or out of construction site. This is in support of the finding from interview of the lower work force not take any training but informally trained at site by senior skilled worker.

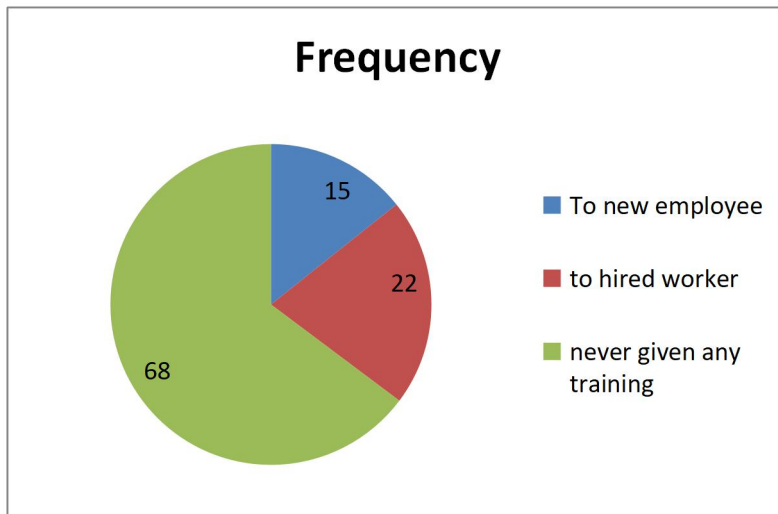


Figure 4.2 Reason for training and determination

From those who had trained the determination need for training 14.3% respond to new employee followed by 21% responded to hired worker and 64.7 % respondents on the study area responded that those in charge of the given task which is related to skilled work not to take any formal technical training but to have learnt through experience on site.

4.5 The status of skilled labor individual level of trades

Where: Extremely practical -5; Very practical -4; Practical -3; Somewhat practical -2; Not practical -1

From the result the reliability of the respondent answer is strong 0.761 which is between 0.50 and 0.80 which can be used as generalizing and representative

Table 4.5 Reliability test result

Reliability Statistics		
Name of trade	Cronbach's Alpha	N of Items
Carpenter	.770	10
Mason	0.797	10
Bar Bender	0.799	10
Finishing work	.680	10
Electrician	.680	10
Plumber	.760	10

Table 4.6 capacity of carpenter for the given criteria

Trade name	capability related criteria	1=NP	2=SP	3=P	4=VP	5=EP	Mean	Rank
Carpenter	have good knowledge in method & sequence	–	6.7	64.8	28.6	–	3.60	2
	attain alternative option if required	–	19.0	49.5	31.4	–	3.12	5
	Good handling of tool and equipments	–	8.6	25.7	61.0	4.8	3.62	1
	attention paid to standards	1.9	52.4	45.7	–	–	2.87	9
	Good communications with the in crew	–	21.0	57.1	21.9	–	3.48	3
	schedule to the give task	–	48.6	51.4	–	–	2.88	8
	Effective management of time	2.9	42.9	54.3	–	–	3.07	7
	delivery of ordered work	–	43.8	54.3	1.9	–	3.14	6
	conformance with specifications	–	44.8	52.4	2.9	–	3.26	4
	Minimize material wastage	–	58.1	41.9	–	–	2.55	10

From the table carpenter achieve capability criteria of in the order of their rank as follows Good handling of tool and equipments, have good knowledge in method & sequence of construction, Good communications with the in crew, conformance with specifications and attain alternative option if required. From the survey result it can be conclude that carpenter has a high probability of defective work which is a significant effect the successive work and delivering project objective. Because of status skilled labor in delivering the given task in accordance to the give specification and quality of work hardly attend. Thus carpenter need to improve the remaining criteria to be competitive in construction industry.

Table 4.7 capability criteria for mason

Trade name	capability related criteria	1=NP	2=SP	3=P	4=VP	5=EP	mean	Rank
Mason	Have good knowledge in method & sequence	–	–	25.7	62.9	11.4	3.86	2
	attain alternative option if required	–	–	30.5	68.6	1.0	3.70	3
	Good handling of tool and equipments	–	–	5.7	69.5	24.8	4.19	1
	attention paid to standards	–	–	83.8	16.2	–	3.16	10
	Good communications with the in crew	–	–	37.1	62.9	–	3.63	4
	Schedule to the give task	–	–	79.0	21.0	–	3.21	8
	Effective management of time	–	–	72.4	27.6	–	3.28	7
	delivery of ordered work	–	–	53.3	32.4	10.5	3.50	5
	conformance with specifications	–	4.8	49	48.6	–	3.44	6
	Minimize material wastage	–	21.9	39.0	39.0	–	3.17	9

The status of skill labor in delivering the given task acquire the give qualification in the project mason have capability criteria as follows in descending order Good handling of tool and equipments, have good knowledge in method & sequence construction, attain alternative option if required, Good communications with the in crew and delivery of ordered work order.

Table 4.8 capability criteria for bar bender

Trade name	capability related criteria	1=NP	2=SP	3=P	4=VP	5=EP	mean	Rank
bar bender	Have good knowledge in method & sequence	-		65.7	39	-	3.66	2
	attain alternative option if required	-	3.8	59.0	65.7	-	3.59	3
	Good handling of tool and equipments	-	-	82.9	59	-	3.79	1
	attention paid to standards	-	-	28.9	82.9	-	3.29	7
	Good communications with the in crew	-	-	48.6	28.9	-	3.48	5
	schedule to the give task	-	1	6.7	48.6	-	3.03	9
	Effective management of time	-	-	40	6.7	-	3.40	6
	delivery of ordered work	-	-	55.2	40	-	3.55	4
	conformance with specifications	-	3.8	31.4	55.2	-	3.28	8
	Minimize material wastage	-	20	62.9	17.1	-	2.97	10

From the table Bar Bender achieve the requirement of the following criteria Good handling of tool and equipments, have good knowledge in method & sequence, attain alternative option if required, delivery of ordered work and Good communications with the in crew thus bar bender also similar to carpenter and mason accomplishment.

Table 4.9 capability criteria for finishing work

Trade name	capability criteria	1=N P	2=S P	3=P	4=V P	5=E P	mean	Rank
finishing work	have good knowledge in method & sequence	-	-	48.6	51.4	-	3.51	2
	attain alternative option if required	-	3.8	62.9	33.3	-	3.3	5
	Good handling of tool and equipments	-	-	64.8	35.2	-	3.35	4
	attention paid to standards	4.80	40	55.5	-	-	3	8
	Good communications with the in crew	-	-	33.3	66.7	-	3.67	1
	schedule to the give task	9.50	39	51.4	-	-	3.13	6
	Effective management of time	2.90	36.2	61	-	-	3.06	7
	delivery of ordered work	-	1	59	40	-	3.39	3
	conformance with specifications	6.70	39	54.3	-	-	3	8
	Minimize material wastage	-	92.4	7.6	-	-	2.07	10

From the table finishing worker achieve capability criteria of in the order of their rank as follows Good communications with the in crew, have good knowledge in method & sequence, delivery of ordered work, Good handling of tool and equipments and attain alternative option if required.

Table 4.10 capability criteria for Electrician

Trade name	capability related criteria	1=NP	2=SP	3=P	4=VP	5=EP	mean	Rank
Electrician	Have good knowledge in method & sequence	–	–	3.8	79	17	4.13	1
	attain alternative option if required	–	–	20	67.6	12	3.92	3
	Good handling of tool and equipments	–	–	22.9	76.2	1	3.78	6
	attention paid to standards	–	–	49.5	50.5	–	3.5	8
	Good communications with the in crew	–	–	9.5	77.1	13	4.04	2
	schedule to the give task	–	3.8	47.6	48.6	–	3.45	9
	Effective management of time	–	–	58.1	26.7	15.2	3.57	7
	delivery of ordered work	–	–	21.9	77.1	1	3.79	5
	conformance with specifications	–	–	9.5	90.5	–	3.9	4
	Minimize material wastage	–	21	66.7	12.4	–	2.9	10

From the required qualification in table above Electrician fulfills the following criteria sequentially described have as follows. have good knowledge in method & sequence of construction , Good communications with the in crew, attain alternative option if required, conformance with specifications and delivery of ordered work. Comparing to carpenter, mason and bar bender and finishing work deliverance of order work by electrical is good. Because the feat to specification requirement of ordered task.

Table 4.11 capability criteria for plumber

Trade name	capability related criteria	1=NP	2=SP	3=P	4=VP	5=EP	Mean	Rank
Plumber	have good knowledge in method & sequence	–	–	3.8	94	1.9	3.98	2
	attain alternative option if required	–	–	8.6	90.5	1	3.92	3
	Good handling of tool and equipments	–	–	8.6	77.1	14	4.06	1
	attention paid to standards	–	–	11.4	88.6	–	3.89	4
	Good communications with the in crew	–	–	37.1	62.9	–	3.63	7
	schedule to the give task	–	1	61.9	37.1	–	3.36	8
	Effective management of time	–	–	96.2	3.8	–	3.03	10
	delivery of ordered work	–	–	29.5	70.5	–	3.7	5
	conformance with specifications	–	–	32.4	67.6	–	3.68	6
	Minimize material wastage	–	3.8	75.2	21	–	3.17	9

From the required qualification in table above plumber fulfills the following criteria sequentially described have as follows. Good handling of tool and equipments, Have good knowledge in method & sequence of construction, attain alternative option if required , attention paid to standards and delivery of ordered work. Similar to electrician feat to specification requirement ordered task high possibility of attaining order task.

4.3. Findings from the Case study

4.3.1 Productivity Performance

Standard is set for crew size for each trades of work by considering how the given task performed hand tool or machines used. To study the capability of skilled labor for the give trade which is how skill labor performs the given task standards verses actual output of the concreting trade including steel fixing and masonry trade taken. During the survey it was

found that the team size to accomplish the same task is different for each project; hence the team size for this survey used for one mixer 2 vibrators & 1 dumper

Concreting team: 2 mason+34 DL+2 carp. + 1mixer+ 5DL+2vibrator

Masonry team: 1mason+1helper+4DL+1 mixer + 5DL

Steel fixing team: 1 bar bender + 2DL

This measurement takes it to account location of the project which is Lowland area and average daily targeted output of trade per unit of man hour, concreting work, Steel bar bender kg/hour, masonry wall M2/hour to used illustrate. The performance ability rate this trade selected. The actual and planed value the date documented for the purpose of payment certificate preparation on hand other trade i.e. electrician, plumber and finishing work data not incorporated due to lack Of data and most project do not take the actual measurement of this trade.

Table 4.11 Crew level performance ability ratio

Project Id	Concreting Trade For footing and slabs			Masonry Trade			Steel fixing Trade		
	Actual	standard	PAR	Actual	standard	PAR	Actual	standard	PAR
	(M3)	(M3)		(M2)	(M2)		(Kg)	(Kg)	
Project 1	12.5	25	2	1.95	3.9	2	—	—	—
Project 2	18	23	1.2	8	11	1.375	—	—	—
Project 3	26	34	1.3	9	10	1.11	87	102	1.17
Project 4	19.44	20	1.03	2	1.5	0.75	556	489	0.88
Project 5	—	—	—	—	—	—	101	101	1
Project 6	20	30	1.5	8	10	1.25	386	460	1.19

The survey indicated that the performance of all trades is below the standard which is greater than one. For example in project 1 the concrete and masonry trades produced only half of their standard (PAR=2). This shows that the site management should do a lot to detect the cause of such a low performance. However, from interview with the project supervisors it was learned that there is no experience in measuring crew performance; hence the problem was not known. This shows one of the deficiencies of traditional management which not on measuring their output.

In project 4, the amount of planned standard was low; this is due to the fact that there is less experience in setting standards and measurement. Another finding which supports the above statement is the percentage of craftsmen who could fill their planned and actual estimates.

These are planned output values that are used during planning; they are transferred historically from their past experience. Surprisingly, these values are not known by most crew foreman and craftsmen. The effect of this management approach is to shift the majority average workers to the best, hence producing positively skewed performance distribution curve.

During an interview with one of the Foremen it was learnt that productivity standards are used during the preparation of their main schedule but I believe that, it is meaningless if the information used during planning is not transferred to the crew by planning. From the above finding we can understand that the project management objectives are not appropriately transferred down to their crews showing that coordination that could have been obtained by this is lost

ii) Part two

4.5.1. The impact of skilled labor capability on the overall project objective

Table 4.12 schedule preparation in consideration of performance

Planning consideration performance/productivity level	Frequency	Percent
yes	58	55.24
No	48	44.76
Total	105	100

From the table 55.24 % respondent consider performance/productivity when schedule the given task followed by 44.76% thus we can conclude majority prepare working schedule. This slight difference with interview , during the interview it was learnt that defining the scope of work packages was seldom done in the surveyed projects and construction personnel usually enters construction without a clear understanding of work in fact Working

schedule prepared by experienced contractors and some of the respondents partially use the real labor productivity data recorded by their companies to determine the required time that will be taken to perform a specific activity, while the rest most of the respondents do not consider it at all.

Table 4.13 Task level standard performance guide line

standard performance guide line at task level usage	Frequency	Percent
yes	93	88.57
No	12	11.43
Total	105	100

As it is mentioned above 88.57% respondents use standard performance guide line to skill labor at task level followed by 11.43% thus we can infer that majority implement at task level.

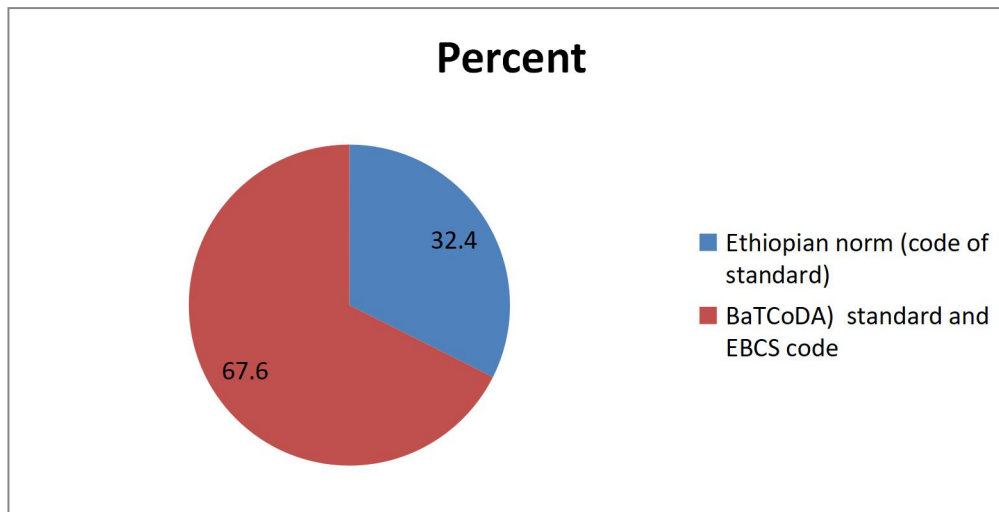


Figure 4.3 Standard guide lines for task level

As it is mentioned above 32.4% (N=34) respondent use Ethiopian norm (code of standard performance guide line to skill labor at task level followed by 67.6% (N=71) (BaTCoDA) standard and EBCS code. From this survey it can be generalized most of the contractors that

the basis of performance guide line was based on the labor performance data published by Ministry of Works and Urban Development (1998).

How skilled labor performance measurement applied in construction project

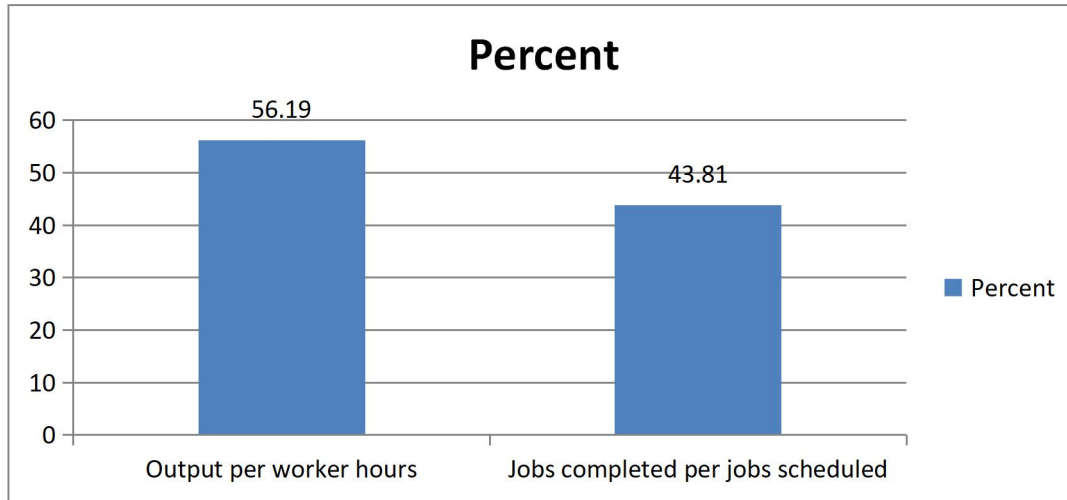


Figure 4.4 Measurement approach/method used during execution work

From survey result a practice of measuring labor productivity it is found out that. “Jobs completed per jobs scheduled” and “Output per worker hours” are implemented 43, 81% and 56.19 % of the respondents respectively as approaches to measure labor performance. Skill Labor Productivity (output per hour) is the main input to determine the duration required to execute an activity. Thus confirm to research by Amanueal, (2016) stressed that during tender preparation contractor should consider labor cost hence the labor productivity (output per hour) is the main input to determine labor costs. In contrast to this during interview with the project managers it was learnt that work measurement is conducted for the purpose of preparing payment certificate and monthly reporting hence no performance /productivity measurement skill labor is done. In addition it was confirmed that no project has installed work measurement system to control performance /productivity.

Table 4.14 Task level measurement of skill labor

comparison of actual skilled labor performance to actual work done	Frequency	Percent
Yes	28	26.67
No	77	73.33
Total	105	100

The respondents were also asked if they use this measurement to compare with actual work the 26.67% compare with actual work followed by 73.33% responded not thus we can infer that majority did not compare with actual work with standard set in fact this values is not inclusive to new technological change of material, equipment and method of construction.

The reason of why Contractors do not Measure Productivity is studied. The reasons given by 36% of the respondents are “negligence”, 27% of the respondents believe that it is due to “lack of awareness” and 18% of the respondents consider that measuring productivity is “difficult to implement”. The result of this assessment indicates that most of the contractors do not measure labor performance as it is responded by 27% of the contractors do not compare performance due to lack of awareness, 36% of them are due to negligence and 18% of the contractors believes that measuring of labor productivity is difficult to implement.

Table 4.15 level of impact of skill labor on project objectives

level of impact quality of skill labor	no impact	slight	moderate	Severe	very severe	Mean	median
reliability	0.761		N of Items= 4				
Cost	–	–	17.1	57.1	25.7	4.09	4
schedule	–	–	19.0	45.7	35.2	4.16	4
Quality	–	–	26.7	67.6	5.7	3.79	4
Safety	–	–	19.0	65.7	15.2	3.96	4

From the result the reliability of the respondent answer is strong 0.761 which is between \pm 0.50 and 0.80 representative to the population

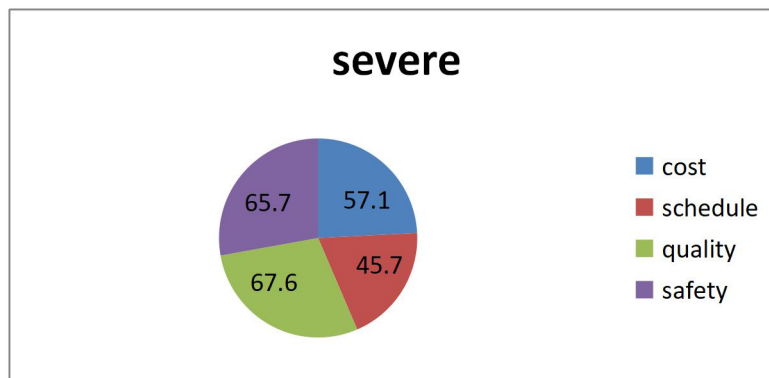


Figure 4.5 Level of impact skilled labor in project

As it is mentioned figure 4.5 skilled labor capability affect the project objective these effects include cost, schedule, quality and safety.

Cost: - skilled labor capability impact the project cost 17.1% respondent it affects is moderate followed by 57.1% severe and 25.7% very severe thus it found that majority of respondent agree on skill labor performance severely impact cost of the building project. This Confirm to interview with the Foremen, it was found that there was no optimized material and tool control issuing procedure in all projects .The procedure being used is too

long and does not take into considerations the cost that will be incurred due to loss of productive time of operatives and also skilled labor and supervision account for of the total rework cost with much research effort on the impact of rework on cost of project over the last two decades, it is now well known that rework in one of the key contributors to the project's cost overrun. Researchers found rework could account for 2.4% to 12.4% of a total cost of a project (1992; Hwang et al., 2009; Love and Li, 2000)

Schedule: - One of the most important tools that are used to control productive time is a schedule as a project plan shows how and when the project to be executed. This statement supports the finding that skill labor performance impact the project output 19% respondent it effect is moderate followed by 50 % severe and 31% very severe thus it found that majority of respondent agree on skill labor capability severely impact schedule of the building project. This confirmed with interview result most skill labor did not have their own personal plan which draft from master plan to fill their planned and actual production they doing it try and error method. This shows that the project management team objectives are not transferred properly to lower management hence there is low hierarchal coordination between the different management levels. The interview also indicates that the practice of preparing successive schedules down the management hierarchy is not satisfactory. Some project managers prepare schedule successively down the hierarchy but the preparation of the schedule by each managerial level is inconsistent with the project master schedule hence no coordination by this practice as well.

Quality: - Project quality influences the success of the project at hand as well as the long term success of the contractor. Quality involves completing the task correctly to meet the governing specifications. If quality cannot be achieved in once time then there will be high possibility of rework which mean high wasted man hour hence productivity. The survey to investigate the practice of quality management in the projects shows that skilled labor capability impact the project output 26.7% respondent it effect is moderate followed by 67.6 % severe and 5.7 % very severe thus it found that majority of respondent agree on skill labor performance severely impact quality of the building project. This confirm Interview

to the above finding, interview with craftsmen shows that the third major capability problem of the surveyed projects is rework, which is most often related with quality.

safety :- skilled labor capability impact the project on safety 19 % respondent it effect is moderate followed by 65.7 % severe and 15.2% very severe thus it found that majority of respondent agree on skill labor performance severely impact safety of skilled labor in building project. Thus from the above survey result Contractor's management staffs perceive that 65.7% of building construction projects did not have safe work practice. The cause could be lack of safety management, negligence or lack of monitoring by top management.

Top management support of safety represents the extent to which supervisors encourage safe working practices among their subordinates. Hoffman and Mergeson (1999), (as cited in Huang, 2004) also demonstrated that, perceived organizational support was related to improved safety communication and safety commitment as well as lower frequencies of injuries. Generally, through providing information to subordinates or sharing their attitudes or opinions regarding safety, supervisors often act as a driving force affecting the safety of the work place.

This confirm an interview with Foremen I have learnt that there is no project has safety officer. The reason that was forwarded by Foremen was that accident rates in most building construction projects increased but no attention is given to safety of skilled labor.

They also said that even though there are contractual provisions to make the work environment safe; there is less forward control to safety. In connection with this the other most interesting problem observed was that all on site labor routes are full of scrap hence reducing the movement of workers and safety thus these scraps shall be collected timely and placed in the appropriate place. Some contractors remove these scraps at the end of most works this has left the advantage that could have been obtained earlier by reducing hindrances to workers, hence increasing labor performance.

iii) Part three

4.6 Factor which affect performance of skilled labor

Performance of skilled labor affected by different factor; the following are the main

4.6.1. Project related factor

The effect organization and facility which is basic to effective usage of time, space, crew movement and circulation need proper consideration for achievement of the desire goal.

Table 4.16 The effect of project on skilled labor performance

project related factor	low effect	medium effect	high effect	critical effect	no effect	Mean score	Rank
Inappropriate site lay out	–	11.4	56.2	32.4	–	4.21	1
Incomplete facilities (water , sanitary & transportation)	7.6	47.6	42.9	1.9	–	3.39	3
Congestion of Site	–	40.0	60.0	–	–	3.6	2
Size of the project	–	66.7	33.3	–	–	3.33	4

From the survey result congestion of site have high effect on the performance of skill labor which is 60%which confirm to alemu, (2015) the amount of productive time lost due to congestion is between 10 and 20 minutes per day this manly due to Project owners being interested in using their land effectively, reserve places for support shop areas and movement routes are often restricted. This indicates that manpower planners should consider not only workload but also availability of place in determining their crew size.

The survey made on this case show incomplete facility 42.9% High effect the performance of skill labor this result conform with interview with some project managers revealed that temporary facilities are not planned consciously. No project showed on paper site layout design of temporary facilities and their bases.

Thus temporary facilities shall be designed by optimizing their cost with energy and productive time of workers.

From the table above 32.4%respondent mention that in appropriate site layout have a critical effect on the performance of skill labor .In general, the researcher is not satisfied with the

layout of temporary facilities, project offices and shop areas in the surveyed projects. My observations on all projects showed that there could be different alternatives of placing site lay out such that the amount of lost time for tool checkout, material check out and other movement time can be reduced. On site observation by the researcher confirms that these components are not laid out properly so as to increase the performance of skill labor.

4.6.2 Organizational and management related factor

Table 4.17The effect of management on skilled labor performance

related to skilled labor quality	no effect	low effect	medium effect	high effect	critical effect	Mean	Rank
Lack of follow up the work progress	–	–	2.9	65.7	31.4	4.29	1
Change of workers	–	–	45.7	50.5	3.8	4.20	2
Non conformance of personal plan with master plan	–	3.8	58.1	34.3	3.8	4.11	3
Lack of Training for workers	–	–	5.7	77.1	17.1	4.08	4
Inadequate briefing	–	–	12.4	67.6	20.0	3.99	5
Too much work load	–	3.8	10.5	68.6	17.1	3.91	6
Cash flow and financial difficulties	–	–	16.2	47.6	36.2	3.9	7
New worker skill deficiency	–	1.0	32.4	65.7	1	3.86	8
The absence of job security	–	42.9	47.6	9.5		3.76	9
Lack of employee motivation and award	–	1.9	35.2	47.6	15.2	3.74	10
Absence of clear uniform standard to accept work	–	–	10.5	87.6	1.9	3.67	11
Lack of Job satisfaction.	–	–	34.3	57.1	8.6	3.58	12
Faults in design details and specifications	–	–	20.0	74.3	5.7	3.38	13
Mistakes during construction(Rework)	–	–	24.8	60.0	15.2	2.67	14

From the table above organizational and management had a significant effect on skilled labor capability achievement. Because manager is the core to the success of any construction

project is highly dependent on the quality of people who are managing the job. Ensuring that the right people are in place at the right time is important the investigation had shown that the onsite practice of work organizations of the surveyed projects. The main factor which affect performance of skilled labor from the result in the order of their rank are lack of follow up the work progress, cash flow and financial difficulties, lack of training for workers, inadequate briefing, too much work load and absence of clear uniform standard to accept work.

4.6.3 .Related to skilled labor quality

Table 4.18 the effect of quality of skilled labor on performance

related to skilled labor quality	low effect	medium effect	high effect	critical effect	no effect	Mean	Rank
Incompetence of skill labors	–	46.7	47.6	5.7	–	3.59	2
Poor handling of tools , equipment	5.7	55.2	39.0	–	–	3.33	5
Faulty construction techniques	–	65.7	34.3	–	–	3.33	5
lack of tools	1.0	56.2	42.9	–	–	3.42	3
Unqualified technically	–	65.7	34.3	–	–	3.34	4
Over confidence	5.7	22.9	68.6	2.9	–	3.69	1

from the survey result which is related to skill labor capability show that Incompetence of skill have high effect on the project delivery this because skill labors Sufficiently well trained and experienced in order to meet the projects objective if labors are unskilled and in lack of experience, they take longer time to complete specified task and there will be a possibility of rework, therefore incompetence of labors can be considered as one of the possible causes for the decrease in project output Unqualified technically Lack of experience and competency of labors contribute to project success Jorge *et al.*,(2005) mentioned that, productivity cannot be achieved by speed and harder work only without adopting better work practices, whereby insufficient skilled workers are the most important factor that industry stakeholders are concern about.

4.7. Result from interview

Interview questions were prepared and asked to be answered by construction supervisor, Foremen and, skill labor to additionally substantiate and confirm the research findings.

For the purpose of assessing the middle and lower level participants in all construction supervisor, Forman and skill craft man, the researcher uses the interview mode of data collection method. A total of Fifteen construction site 2 of them were conducted in Dill city, 6 from Hawassa city and 7 Arbaminch city. 5 supervisors, 4 Foremen and 6 skilled labors from each trade representative were surveyed and the summary of the result is described as follows.

Summary of answers are presented below for each question.

Personal information of respondent

The survey indicates that majority of them have working experience of 5 to 20 years. This shows that Ethiopians' craftsmen do have longer practical experience thus if it is supplemented by appropriate training the potential of improvement would have been high. The majority of skilled labors have been working in the present project since last year. The projects studied had been running for an average of 14 months at the time the surveys were carried out. It would be reasonable to assume that most of the craftsmen had been on site since project inception and would therefore be familiar with performance problems. It also indicates that most of the skilled labors were under the age of 40. This implies that construction craftsman is a young man's trade and hence if attention is given by the concerned body it can absorb a large amount of unemployment.

Trends of Individual Plan preparation of the respondent

Almost all respondent did not prepare personal plan which is drafted from master plan. Due to that their plan and actual production did not match, this is because they perform with try and error method. Defining the scope of work packages was seldom done in the surveyed projects and construction personnel usually enter into construction without a clear understanding of the work. In fact working schedule prepared by experienced contractors

and some of the respondents partially use the real labor productivity data recorded by their companies to determine the required time that will be taken to perform a specific activity .So that, there were no material optimization and tool control issuing procedure available in all projects. Due to the fact that the procedure is being used is too long, and does not take into consideration of the cost that will be incurred due to loss of productive time of operatives. The responses interview also indicates that the practice of preparing successive schedules down the management hierarchy is not satisfactory.

Occurrence of major defect

The Responses of craftsmen shows that major capability problem of the surveyed projects is rework. This is most often related with quality. In fact, skill labor and supervisors are the main players in causing unwanted rework. Defect at crew level causes might be due to absenteeism or quit of job by workers or intentional workers change by foreman. It is known that as the crew member change frequently it takes a longer time for the team to reach the achievement they planned. Because of cultural confrontation between the new comer and the existing members and the poor understanding by foremen about this problem made them to change the crew member to solve other problems in other work teams.

Measurement of actual performance compare to standard

During interview with the supervisor and Forman it was learnt that work measurement is conducted for the purpose of preparing payment certificate and monthly reporting hence no performance /productivity measurement skill labor is done. In addition it was confirmed that no project has installed work measurement system to control performance /productivity.

Capacity enhancement for skilled labor

Most of the respondents suggested that improvement can be obtained through training. But the trainings shall be given by qualified personnel. To check the appropriateness of the training the respondents recommended participation of supervisor. During training workers having different speed to grasp knowledge shall cooperate with each other. In this way knowledge and skill can be transmitted smoothly. In addition to that work method should

consider technological change like equipment and tools and management plan should applicable to lower level such as skilled labor.

Triangulation

Triangulation offered the following benefits for this study it provide additional sources of valuable insight that could not be obtained from the literature review a lone; it minimize the inadequacies of single –source research by engaging three data source which complemented and verified each other, and also provided richer and more comprehensive information in the sense that the researcher was able to draw information reliable and applicable to the area of study.

5 CONCLUSION AND RECOMMENDATION

5.1 Conclusions

The following conclusions could be drawn from the research work:

- In general it was learnt that contractors are not aware of the importance of formal skill acquisition program more focus on experience than certification Thus skill labor; Foremen and gang leader are not formally trained in trade schools and lacks capacity in transferring and controlling their knowledge to the craftsmen. Construction methods management were not done in a scientific way as demands due to lack of trained manpower in construction methods in the projects ;and standards were used only for planning purposes at higher level; hence could not be used for controlling individual and crew performances. And no quality control system was installed in any of the projects in the form of manuals or otherwise.
- Skill labor at individual level of evaluation, each trade has its own quality and standard requirement to do the given task The finding of the research indicated that the performance of Mason, Bar Bender, Plumber and Electrician are good at all the required criteria. But Carpenter and Finishing worker poor in minimizing material wastage and attention paid to standards. And the crew level performance for most projects with productivity performance ability ratio (PAR) greater than one indicating that the studied crews' productivity performance was low.
- The survey shows that skill labor capability impacts the project cost, schedule quality of work and safety severely. The study had found that there was no standard used as guide line in all projects which is need to purpose of scheduling and quality control. The productivity standard that was used in the schedule was not transferred down to the crews. Contractor's management staffs perceive that majority of building construction projects did not have safe work practice.

- The research had found the factor which affects the performance of skill labor from organizational and environment, management and quality of skill labor the major ones The main factor which affect performance of skilled labor in the order of their rank are lack of follow up the work progress, cash flow and financial difficulties, lack of Training for workers, inadequate briefing, too much work load and absence of clear uniform standard to accept work.

- We can see from the above the result and literature skilled labor improvement is a function of method, technique, personal skill, knowledge, attitude and aptitude the “ability to do”. This can be improved through training and development, promotion, and career planning. Hence the approaches that should be employed to improve labor performance are: wages and salaries, training and education, social society and rewards. Can also be improved from the improvement of systems that is by appropriately designing construction managerial systems in the area of schedule management, productivity measurement and progress, quality and safety control system, organizational and labor relations and resource management systems.

5.2 Recommendation

To the government

- The government should give sufficient attention to skill labor during standard preparation by considering the capacity and method of work used.
- Periodic training should prepare in advance in order to improve skill.
- Education center which technical and vocational training must coordinate with contractor to improve skill labor capacity
- As an obligation hiring criteria for skill labor should be certification in addition to experience which encourages skilled labor to able to acquire sufficient technical and practical aspect of task. Thus regulatory body should follow the implements.

For contractor

- Project managers shall introduce performance management system at individual and crew level so as to have reliable planning and controlling system to manage their work
- Contractors should introduce measurement systems for each trade because reduction in cost and time overrun.
- Lower level supervisors and foremen these personnel lack not only blue collar training in techniques but also knowledge of organizations. Hence contractors and industry leaders should try to enhance the capacity supervisors by providing appropriate training in techniques and some knowledge of organizational behavior.
- Skilled labor do have longer practical experience thus if it is supplemented by appropriate training the potential of improvement would have been high.
- Supervisor and foremen give technical guidance to skill labor in method of construction and rewarded, bounces ,recognition and promotion appreciate to perform their maximum capacity

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Appendix A: Questionnaires for Class I contractors performing public building construction projects

Research Topic **“Assessment of skilled labor performance on public building construction selected site in SNNPRS”**

Dear respondent, the aim of this questionnaire is to obtain necessary data for the partial fulfillment of an MSc thesis in Construction Technology and Management at Hawassa University to address the following objective to assessment of skill labor capability, key factor which affect skill labor performance in construction industry and the impact of skill labor on project delivery.

I can assure you that the research data will only be used solely for the academic purpose and will be treated with strict confidentiality. Particular mentioning of names will not be required anywhere. Your open and prompt response is highly appreciated. I would like to extend my gratitude for taking your precious time to respond to this questionnaire. If you have any inquiry please contact through the following addresses.

RESEARCHER'S INFORMATION

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I. Personal and Company Information

1 Years of experience in the construction industry

1 - 5 years 6 - 10 years
11-15 years 16 - 20 years > 20 years

2 Your position on this site

Projects manager Assistant Project Manager Site Engineer
Office Engineer quantity surveyor

If other, please specify

3 Educational Backgrounds

Masters Degree
Diploma If other, please specify

Part one related to capability of skilled labor force

In this research question skill labor include all the following profession; Carpenter, Mason, Electrician, Bar bender, plumber and finishing worker.

1 What is your requirement for hiring skill labor in your project and what is his/her level of training do you consider?

- Technical college certificate and level one
- Technical college certificate and level two
- Technical college certificate level and three and above
- Other please specify.....

2 what percent consist of female skill labor out of total hired skill labor in your project?

0-25% 25 -50 % 50 -75%

Other please specify

3 What is your precondition to assign skill labor for each item of work?

By experience by certification

Other please specify.....

4 Have you ever prepare any training to improve skill labor performance Yes No

5 If you say yes in question No 3 to whom it belongs to?

To new employee to hired worker other

6 What is the purpose of the training and how do you determine the need for training?

Skill gap upgrading the quality of skilled labor Technological change

Other

7 from the training what significant change skilled labor acquire from who take training at TVET performance improvement training total hires involved personnel with less skill and/or experience?

.....
.....

8 From your experience what is the status of skill labor in delivering the given task with acquire the give qualification in your project

Please indicate your agreement of each by ticking the appropriate boxes.

Where

Extremely practical -5; Very practical -4; Practical -3; somewhat practical -2; Not practical -1

		EP=5	VP= 4	P= 3	S.P=2 2	NP=1
Form the following skill profession						
Carpenter	Capability related					
	Have Good knowledge in method and sequence of construction					
	Attain alternative option if required					
	Good handling of tool, and equipment					
	attention paid to standards					
	Good communications with in crew					
	schedule to the give task					
	Effective management of time					
	delivery of ordered work					
	conformance with specifications					
	Damage to equipment					
	Minimize material wastage					
	If other specify					
Mason	Have Good knowledge in method and sequence of construction					
	Attain alternative option if required					
	Good handling of tool and equipment					
	attention paid to standards					
	Good communications with in crew					
	Make a schedule to the give task					
	Effective management of time					
	delivery of ordered work					

	conformance with specifications					
	Minimize material wastage					
	If other specify					
bar bender	Have Good knowledge in method and sequence of construction					
	Attain alternative option if required					
	Good handling of tool, and equipment					
	attention paid to standards					
	Good communications with the in crew					
	Make a schedule to the give task					
	Effective management of time					
	delivery of ordered work					
	conformance with specifications					
	Minimize material wastage					
	If other specify					
	Electrician	Have Good knowledge in method and sequence of construction				
Attain alternative option if required						
Good handling of tool and equipment						
attention paid to standards						
Good communications with in crew						
schedule to the give task						
Effective management of time						
delivery of ordered work						
conformance with specifications						
Minimize material wastage						
If other specify						

Plumber	Have Good knowledge in method and sequence of construction					
	Attain alternative option if required					
	Good handling of tool and equipment					
	attention paid to standards					
	Good communications with the in crew					
	Make a schedule to the give task					
	Effective management of time					
	delivery of ordered work					
	conformance with specifications					
	Minimize material wastage					
	If other specify					
Finishing worker (plasterer ,gypsum panting etc)	Have Good knowledge in method and sequence of construction					
	Attain alternative option if required					
	Good handling of tool and equipment					
	attention paid to standards					
	Good communications with the in crew					
	Make a schedule to the give task					
	Effective management of time					
	delivery of ordered work					
	conformance with specifications					
	Minimize material wastage					
	If other specify					

Part two impact of skilled labor performance on the overall project objective

1 Do you consider performance/productivity level when you plan your work?

Yes No

2 you say yes in question #No1 do you relate performance/productivity with schedule?

Yes No

3 Do you use standard performance guide line to your skill labor at task level?

Yes No

4 If you say yes in question above at what standard do you consider?

Ethiopian norm (code of standard) (BaTCoDA) standard and EBCS code

Other please specify.....

5 If you say yes in question #No 4 do you use this measurement to compare with actual work procedure?

Yes No

6 If your answer for question #4 is No, How do you compute the completion time required for the work items?

.....
.....

7 During execution of work do you take measurement of actual skilled labor performance?

Yes No

8 If you say **yes** for question No.7, what is your approach/method of Measurement do you used?

Output per worker hours Output per inputs of material & machineries

Jobs completed per jobs scheduled

Other,(please specify).....

9 If you say No for question No.7, what could be your reason?

- Lack of awareness
- Negligence
- It is Unnecessary
- It is expensive
- Scarcity of Time
- Scarcity of trained manpower
- Measuring performance is difficult to implement
- Other,(please specify).....

10 The following table asks for the impact of skilled labor qualification which required by the given standard rate

What is the **level of impact of the quality of skilled labor force to the project delivery in your company**” among the following performance parameters?

Legend;

Slight= (skilled labor issues lead to consumption of contingency, little schedule variance, minor rework and increased near misses)

Moderate =(skilled labor issues lead to project delays, cost overruns, defective work and recordable injuries)

Severe = (skilled labor issues lead to significant project delays, cost overrun, major re work severe injury or fatality)

Very Severe = (skilled labor issues lead to very significantly project delays, cost overrun, major re work severe injury or fatality)

	No impact	Slight	Moderate	Severe	Very Severe
cost					
Schedule					
Quality					
Safety					
If other specify					

Part three related to key factors for quality of skill labor

From your experience, how do you rate the level of effect Factors Affecting quality of skill labor of the following identified cause in your project and rating of the effect and frequency of key factors on Performance of skill labor force?

Legend;

CE=Critical Effect=5 HE=High Effect=4 ME=Medium Effect=3 LE=Low Effect=2

NE=No Effect

No	Factors	Rate of level effects				
		CE=5	HE=4	ME=3	LE=2	NE=1
I	Project Related Factors					
1	Inappropriate site lay out					
2	Incomplete facilities (water & sanitary)					
3	Congestion of Site					
4	Size of the project					
5	If other specify					
II	Organization management related factor					
6	Lack of follow up the work progress					
7	Change of workers					
8	Non conformance of personal plan with master plan					
9	Lack of Training for workers					
10	Inadequate briefing					
11	Too much work load					
12	Cash flow and financial					

	difficulties					
13	New worker skill deficiency					
14	The absence of job security					
15	Lack of employee motivation and award					
16	Absence of clear uniform standard to accept work					
17	Lack of Job satisfaction.					
18	Faults in design details and specifications					
19	Mistakes during construction(Rework)					
	If other specify					
III	related to skilled labor capability					
20	Incompetence of skill labors					
21	Poor handling of tools , equipment					
22	Faulty construction techniques					
23	lack of tools					
24	Faulty construction techniques					
25	Over confidence					
	If other specify					
IV	related to skilled labor quality					
26	Workers physical condition					
27	Lack of professionalism					
28	Noncompliance to					

	standard rules and regulations.					
29	Worker fatigue and boredom.					
30	. Lack of Job satisfaction.					
	If other specify					

INTERVIEW QUESTION

ለውድ መላሽ

በኮንስትራክሽን ማኔጅመንትና ቴክኖሎጂ የሁለተኛ ዲግሪ ማሙያ፣ ጥናት መጠይቅ

በ ሀዋሳ ዩኒቨርሲቲ በኮንስትራክሽን ማኔጅመንትና ቴክኖሎጂ የሁለተኛ ዲግሪን እየሰራሁ እገኛለሁ በመሆኑም ለመመረቄያ የሚሆን አንድ የጥናት ርዕስ መርጨፍ ጥናታዊ ሪፖርት እንዳዘጋጅ ይጠበቃል። ለጥናቱ የመረጥኩት ርዕስ በእጅ ሰራ የ ሰለጠነ ብቃት ደረጃ በኮንስትራክሽን ፕሮጀክቶች ያለው አስተዋጾ የሚል ሲሆን ጥናቱም በአምስት የግንባታ ሙያዎች ላይ ያነጣጠረ ሲሆን የሚከተሉትን ነገሮች ይመረምራል።

1 የጉልበት ውጤታማነት ጊዜ የሚያበክኑ ቀጥተኛ ችግሮች ምን እንደሆኑ

ኮንስትራክሽን ፕሮጀክቶችን ይፈትሻል

2 ለጉልበት ምርታማነት ዝቅተኛነት መንስኤ የሆኑ የኮንስትራክሽን የአመራር

ችግሮችንና መፍትሔዎቻቸውን ይፈትሻል

በመሆኑም ከዚህ ወረቀት ላይ የተያያዙትን መጠይቆች እንደሞሉልኝ እጠይቃለሁ።

የሚሰጡት መረጃ ለጥናቱ ብቻ እንደሚውል እያረጋገጥኩኝ መጠይቁን የሞሉትን

ፕሮጀክቶች ካንጋኒዎች ስም እደማይጠቀስ አረጋግጣለሁ። በተጨማሪም የጥናቱ ኮፒ

በተጠየቀ ጊዜ ለመስጠት ፈቃደኛነቴን እገልጻለሁ።

ከሰላምታ ጋር

አማካሪ

ብዙሃሽ በቀለ

ግርማይ ካሳይ (ዶ/ር)

(ይህ መጠይቅ በመላሽ ቡድን ውስጥ የእጅ ባለሙያ ለሚወክሉ ሆነው በ አናጢ፣ በብረት ፣ አጠቃላይ የ ማስዋብ እና በግንብ ስራ ለተሰማሩ የተዘጋጀ ነው)

1. What is your trade profession?
2. For how much length of time have you been with the present employer?
3. For how much length of time have you been with this project?
4. How old are you?
5. In what condition you attended your trade profession?
6. When and at what condition do you join the construction industry?
7. Have you ever take training related to your skill?
8. Have you prepare personal plan for your appointed task?
9. Have you ever encounter in occurrence of major defect or non conformance to the give design and specification?

For Forman and supervisor

What is your position in this site?

1. In general, how do you describe the performance of your projects (the tendency of project to be completed within the planned time and Budgeted cost)?

Very Good Good Bad Very Bad

2. If your answer is bad/very bad, how do you rate the impact of quality of skill labor on the performance of your projects?

Very High High low Very Low

3. If the answer is Very High / High what could be the possible reason

- Unplanned work schedule Scarcity of trained skilled manpower
- Poor Management
- Other

specify
.....
.....

4. What do you feel could be done to enhance/improve performance of skilled labor on construction site?

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

I. _____

II. _____

III. _____

Appendix B: Ethiopian norms manual cost estimation and productivity of labor

COST ESTIMATION AND UNIT RATE ANALYSIS FOR BUILDING

July 2, 2010

Types of Activities	Unit	Labour composition	Average production rate/hour			
			Highland area	Per 8hrs	Lowland area	Arid area
Pointing on HCB wall	M ²	Plast =1 Chisler=1 DL=1	2.00	16	1.6	1.00
Tyrolin rendering	M ²	Plast. =1 DL = 1	2.50	20	2.0	1.25
Screed flooring –with out	M ²	Plast. =2 DL = 2	1.50	12	1.20	0.75
Granillia tiles flooring expansion joint	M ²	Mason = 1 DL = 2	1.25	10	1.00	0.63
Plastic tiles flooring	M ²	Tiler = 1 DL = 2	2.00	16	1.6	1.00
Timber skirting 10cm high	MI	Carpenter = 1 DL = 1	3.75	30	3.0	1.90
Granilia (cement) tiles skirting	MI	Mason = 1 DL=1 Chisler=1	2.50	20	2.0	1.25
Semi-dressed stone pavement with sand bed and mortar joints	M ²	Mason = 1 DL = 2	1.00	8	0.80	0.50
Plastic skirting	MI	Tiler = 2 DL = 1	4.00	32	3.00	2.00
Ceramic wall tiles laying	M ²	Mason(tiler)=1 DL = 1	0.40	3.2	0.30	0.20
Two coats oil paint	M ²	Painter = 1	1.25	10	1.0	0.60
Plastic paint to wall (3 coats)	M ²	Painter = 1	2.00	16	1.60	1.00
Plastic paint to ceiling	M ²	Painter = 1	1.50	12	1.2	0.75
Glazing (3mm thick)	M ²	Glazier = 1 DL = 1	1.00	8	0.80	0.50

LABOUR IN PUT AND PRODUCTION RATE FOR THE PRODUCTION AND CASTING OF CONCRETE WORKS

Location of work	Labour classification	Number of labourers		
		With one mixer 2 vibrators	With one mixer 2 vibrators & 1 dumper	With one mixer 2 vibrators & 1 fixed crane
Mixing area	Machine operator	1	2	2
	Labourer for cement delivery	2	2	2
	Labourer for sand gauge	4	4	4
	Labourer for gravel gauge	8	8	8
	Labourer for water supply	1	1	1
	Labourer for loading mixed fresh concrete	6	-	-
Casting area	Carpenter	1	1	1
	Carpenter helper	1	1	1
	Vibrator operator	2	2	2
	Mason helper	2	2	2
	Bar bender	1	1	1
	Bar bender helper	1	1	1
	Labourer for conveying concrete mix	14	4	-
	Bucket opener & conveyors	-	-	8
	Gang leader	1	1	1
	Total	45	30	34
Production per day (m ³)	Footing & slabs	20	25	35
	Beams	14	16	24
	Columns	6	8	10

Note: Dire dawa and other similar regions production would be 80% of the A.A. figures/above

For Assab and other arid areas production would be 50% of the A.A. figures/above.