Evaluation of Performance Efficiency and Effectiveness of Public Constructions Projects the Case of Shashemene City

Jemal Burka Jeldo

A Thesis Submitted to the Department of Civil Engineering

School of Civil Engineering and Architecture

Presented in Partial Fulfillment of the Requirement for the Degree of Master's in

Civil Engineering (Specialization of Cem)

Office of Graduate Studies

Adama Science and Technology University

Jan, 2024

Adama, Ethiopia

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Approval Page of M.Sc. Thesis

I, the advisor of the thesis entitled "**Evaluation of Performance Efficiency and Effectiveness of Public Constructions Projects the Case of Shashemene City"** and developed by Jemal Burka, hereby certify that the recommendation and suggestions made by the board of examiners are appropriately incorporated into the final version of the thesis.

Dr. Bahiru Bewket _____ _____

Major Advisor Signature Date

We, the undersigned, members of the Board of Examiners of the thesis by Jemal Burka have read and evaluated the thesis entitled "**Evaluation of Performance Efficiency and Effectiveness of Public Constructions Projects the Case of Shashemene City"** and examined the candidate during the open defense. This is, therefore, to certify that the thesis is accepted for the partial fulfillment of the requirement of the degree of Master of Science in ***Civil Engineering (CE).***

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Finally, approval and acceptance of the thesis are contingent upon the submission of its final copy to the Office of Postgraduate Studies (OPGS) through the Department Graduate Council (DGC) and School Graduate Committee (SGC).

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School Dean Signature Date

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Declaration

I hereby declare that this Master Thesis entitled "**Evaluation of Performance efficiency and effectiveness of public constructions projects the case of Shashemene City"** is my original work. That is, it has not been submitted for the award of any academic degree, diploma, or certificate in any other university. All sources of materials that are used for this thesis have been duly acknowledged through citation.

Jemal Burka _____ _____ _____

Name of the Student Signature Date

Recommendation

I, the advisor of this thesis, hereby certify that I have read the revised version of the thesis entitled "**Evaluation of Performance efficiency and effectiveness of public constructions projects the case of Shashemene City"** prepared under my guidance by Jemal Burka submitted in partial fulfillment of the requirements for the degree of Masters of Science in ***Civil Engineering (Specialization of CEM)***

Therefore, I recommend the submission of the revised version of the thesis to the department following the applicable procedures.

Bahiru Bewket (PhD)	_____	_____
Major Advisor	Signature	Date

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LIST OF ABBREVIATIONS

PMI- Project Management Institute

RII- Relative Importance Index

KPIs - Key Performance Indicators

SPSS -Statistical Package for Social Science

CSFs- Critical success factors

UIIDP-Urban institutional infrastructure development program

PMPF- Performance measurement process conceptual framework

ANOVA- Analysis of Variance

Abstract

The construction industry is one of the most rapidly growing industries in the world. Construction projects provide many investment opportunities across various related sectors. In Ethiopia, the construction industry is the highest share of government budget in terms of government development program and plays important role in contributing to economic growth of the country and creation of employment opportunities. In Ethiopia construction project performance problems appears through different directions, instead of achieving their planned goals. The project success can be indicated by the project performance and project performance measured by efficiency and effectiveness.

The structure of evaluating construction project performance efficiency and effectiveness was identified in this research. Therefore, the study was focused on evaluation of performance efficiency and effectiveness of public constructions projects the Shashemene city. The critical factor influencing efficiency and effectiveness of public constructions projects and the factor affecting performance of public construction project are identified and presented to the respondents to rank and score them. The ranking of the factors was done using relative importance index (RII). Questionnaire survey was containing a list of the thirteen (13) and twenty-eight (28) for the first and second objective respectively. the result of relative importance index (RII) of the critical factor influencing efficiency and effectiveness of public constructions projects are the positive impact of the project to the environment; RII=54.6% and the running of projects according to the schedule; RII=54.2% are the efficiency and effectiveness factor respectively. Whereas, Contractual Relationship factors, RII=78.3%, are factor affecting performance of public construction project.

The current performance state of shashemene city public construction projects in terms of time and cost are identified based on respondent's responses. Most of the public projects are facing the problem of cost overrun and time overrun with 78.8% and 84.8% respectively.

Lastly, after critically reviewing and discussing the project success and performance, the conceptual framework for construction project performance measurement was developed.

***Keywords**: - public project, Effectiveness, Efficiency, performance*

CHAPTER ONE

1. INTRODUCTION

1.1. Background of the Study

The construction industry is one of the most rapidly growing industries in the world. The construction sector is an important industry branch at both the global and national levels. Construction projects provide many investment opportunities across various related sectors. Therefore, the construction sector is an important economic indicator for developing countries. The construction industry in developing countries plays a vital role in creating both economic growth and employment opportunities for the country. The past two decades have been marked by intense debates about the role, scope and performance of public sector institutions and organizations. Furthermore, private supply is generally considered to be more cost effective than public supply, although these effective have been accused of coming at the expense of efficiency.(Hookana, 2011)

Construction industry has complexity in its nature because it contains a large number of parties such as clients, contractors, consultants, stakeholders, shareholders, regulators and others. Construction industry makes significant contributions to the socio-economic development process of a country. The Construction Industry also can be described as the sum of all economic activities related to civil and building works: their conception, planning, execution, and maintenance. Such works normally comprise capital investment in the form of roads, railways, airports, ports and maritime structures, dams, power generating stations, irrigation schemes, health centers and hospitals, educational institutions, warehouses, factories, offices and residential premises. It is also defined generally as an economic activity directed to the creation, renovation, repair or extension of fixed assets in the form of buildings, land improvements of an engineering nature, and other such engineering constructions as roads, bridges, dams, etc. (Hagos & Shewangzaw, 2009).

In developing countries, governments engage in various kinds of construction projects. These projects aim at achieving five objectives; relevance, efficiency, effectiveness, impact and sustainability. These objectives have been referred to as the five pillars of community development projects (Ika, 2012). In the current state of the construction industry, A systems approach to performance measurement has influenced many construction Companies,

administrations, public and private customers and other projects Stakeholder. Performance measurement is the regular collecting and reporting of information about the inputs, efficiency and effectiveness of construction projects.(Takim et al., 2003)

The success of a construction project can be indicated by project performance. The performance of a project will be dependent on various factors including project complexity, contractual arrangements, relationships between participants in the project, competency of project manager, and the abilities of the key members in projects. Project performance is usually judged and quantified by performance measurement. Performance measurement is the common method to collect and report the information related to the inputs, efficiency, and effectiveness of a construction project(Leong et al., 2014)

Evaluating the performance of projects will help establish benchmarks of high-performance projects for cross-learning and for potential improvement of low performance projects. An overall performance can be fully evaluated by two distinct measures which are effectiveness and efficiency(Welde & Volden, 2018). In the context of public services, evaluation and measurement have often focused on performance aspects other than productivity. Evaluation of the projects aiming to achieve better measurement in provision of public services may conclude that such efforts have not been successful in dealing with public problems.(Hookana, 2011a) The traditional criteria comprising time, cost and quality, attempts to achieve only the economic objectives of a construction project. The economic objective can at best address the three pillars of community development projects namely; relevance, efficiency and effectiveness but can hardly account for the other two pillars, namely, impact of the project on the community and sustainability of the constructed facility.(Ngacho & Das, 2015a)

The structure of evaluating construction efficiency, effectiveness and overall performance is identified from the input–output supply side.(Hu & Liu, 2018). In particular, when defining and measuring overall efficiency one requires that a behavioral objective be specified, along with value or pricing information. Traditionally, these objectives have been revenue maximization, cost minimization or profit maximization.(Asmild et al., 2007).The most significant factor for overall performance is awareness of and compliance with rules and regulations. The results would be helpful to public construction project professionals in taking proactive measures for successful completion of public projects.(Tabish & Jha, 2011)

According to (Crawford & Bryce, 2003), an evaluation of project success is from the efficiency and effectiveness dimensions. Project efficiency ("doing the thing right") is concerned with cost and process management (i.e. the efficient conversion of inputs to outputs within budget and on schedule) and a wise use of human, financial and natural capital. Whilst, project effectiveness ("doing the right thing") is concerned with the development of worthiness or appropriateness of the chosen project goal. A project may be efficient (i.e. implemented on or ahead of time and cost schedules) but may be ineffective if the internal logic of the project is not grounded in reality (i.e. the development hypothesis is invalid) or if the goal of the project does not address what are in fact the core liabilities of the target community (i.e. the initial development problem analysis was weak). (Hookana, 2011b) states that measuring project success for the process criteria for project management is measuring efficiency, while measuring effectiveness refers to measuring the success of the resultant system or organization benefits, getting something right and meeting goals. Given the above arguments, it may be said that project success must consider both the project outputs (efficiency) and project outcomes (effectiveness).

Construction industry plays a vital role in any developing country. This is mainly because developing countries are considerably dependent on the growth and development of their physical infrastructures and because the linkage of the construction industry to both economic and social sectors is very significant (Gudeta, 2020). According to African Business Information Report (2018), the construction industry and infrastructure development in Africa's second most populous country, the Federal Democratic Republic of Ethiopia. The Ethiopian construction industry is characterized by a large number of micro-entrepreneurs, the majority of whom operate in the country's informal economy. Ethiopia's formal construction sector covers indigenous and indigenized firms, as well as numerous major foreign civil engineering and construction companies. The country has consistently invested more than 30% of GDP into Gross Fixed Capital Formation (GFCF) expenditure since 2010 and as a result. The market value of the construction sector is currently estimated at more than US$7bn. According to the 2017 edition of African Economic Outlook, construction activities in Ethiopia accounted for 15.9% of GDP at current prices during the 2015/16 fiscal year.

In Ethiopia construction project performance problems appears through different directions. Due to several reasons' construction projects in Ethiopia construction projects challenges in their performance instead of achieving their planned goals. Most these challenges are related with

project performance. The current dominant practices in performance management influence many construction firms, Consultants and both public and private clients, among other types of project stakeholders.

In recent years, Ethiopia infrastructure development and urbanization are booming, and the weight of construction industry in the national economy has been increasing. But, the present state of the construction industry fails in meeting domestic and international quality standards and the performance demand expected from the sector (MoWUD, 2006). Construction projects have problems with construction techniques and management as well as limitation of funds and time. The critical problems are inability to complete the projects on schedule, low quality work, and cost overrun during their execution phase. Therefore, strengthening of institutional capacity, adaptation of new technologies and modern project management principles will be required in order to maximize the efficiency and effectiveness of the construction industry.(Wubetu, 2016)

According to (Gadisa & Zhou, 2019) recognized that government-financed infrastructures projects in Ethiopia have suffered from different generic interrelated factors; which comprise contractor factors, project owner factors and project contract management factors as the first three core problems, and followed by construction materials supply factors, project external environment factors, design - procurement factors and project stakeholder related factors.

Ethiopia is not exceptional. The last two decades are the period that the construction industry has radically changed. It has great deal of contribution to different sectors, such as manufacturing, agriculture, transportation, education, health etc. Therefore, evaluating the efficiency and effectiveness of the public construction projects performance is a current issue that should be considered as to how it has been done and look for some areas which need improvement to achieve project objectives.(Yohannes, 2017) .

Public construction projects in Ethiopia are parts of the country's development initiative. It shared considerable amount of the country's scarce financial resources. In Ethiopia, the construction industry is the highest recipient of government budget in terms of government development program. It plays important role in contributing to economic growth of the country and creation of employment opportunities. According to the GDP data obtained from the Planning and Development Commission of Ethiopia, the contribution of the sector for economic growth has been great and large. The ten years data showed that the sector contributed to economic growth of

the country with minimum of 10.9 % in the year 2009/10 and maximum of 38.7% in the year of 2012/13.(Deneke, 2020)

In this research, this paper documents and discusses empirical analysis mainly to factors related with evaluation of performance efficiency and effectiveness of the public construction projects in shashemene City by the four groups of project stakeholders, namely: clients, consultants, regulatory body and contractors. The statistical analysis initially deals with the mean values of responses and ranks them using relative importance index (RII). Detailed comparisons of ranking order were made between the groups.

1.2 Statement of the problem

The construction industry in developing countries plays a vital role in creating both economic growth and employment opportunities for the country. The past two decades have been marked by intense debates about the role, scope and performance of public sector institutions and organizations. Furthermore, private supply is generally considered to be more cost effective than public supply, although these effective have been accused of coming at the expense of efficiency.(Hookana, 2011) .

Overall performance, construction efficiency and effectiveness were all strongly correlated with pure technical efficiency and not correlated with scale efficiency.

The overall performance indicators were better correlated with the effectiveness indicators, which demonstrate the significance of enterprise management for construction industry performance. Furthermore, the inefficiency of the Chinese construction industry was mainly embodied in the indicator of effectiveness. Furthermore, the coefficients of variation became smaller and more well-balanced across the whole industry. Therefore, the whole Chinese construction industry showed healthy development in the activity periods, especially in construction efficiency.(Xu & Yeh, 2011).Evaluation of efficiency and effectiveness public Construction project is a very necessary for project success and formulating strategies.(Tabish & Jha, 2011) .

The Ethiopian construction industry has many challenges to improve management performance because of ineffectiveness and inefficiency performance problems in terms of cost over runs, time over runs, poor quality of work, low productivity among other problems.(Wedajo & Serbeh-Yiadom, 2014). It has been verified that the construction industry can be characterized by inefficient and ineffective service delivery. It is also suggested that due to less emphasis to

planning, failure to update schedule on time, poor contract management, poor site supervision, inflation price of construction materials, change order, delayed payments, schedule overrun, quality defect cost overrun, capacity problems, weak organization, and coordination failing public infrastructures projects execution in Ethiopia suffer from performance failure(Gadisa & Zhou, 2019).

Most of public project in the Shashemene City are funded by World bank institutional and urban infrastructure development program (UIIDP). According to World bank institutional and infrastructure development program (UIIDP,2018) project performance assessment report of Ethiopia showed that, the overall performance of the project in most City in this program including shashemene City are satisfactory with 54%. This implies that the rest 46% has shortcoming with lack of efficiency and effectiveness.

According to (Wubetu, 2016) , In Ethiopia the infrastructure development and urbanization are growing, and the weight of construction industry in the national economy has been increasing. But, still there is inefficiency problems that occurs due to waste that results in the use of equipment, materials, labor or capital in larger quantities than those considered as necessary in the construction of a building and hence, there is a need for strengthening of institutional capacity, adaptation of new technologies and modern project management principles in order to maximize efficiency of the construction industry. Government allocates huge amount of budget for the construction of different building and infrastructure projects to achieve their objectives. The objectives of the owners could be financial, social, and political and in which ever the case controlling and monitoring the efficiency and effectiveness of the project is crucial. Therefore, evaluating the performance efficiency and effectiveness of public construction project is very important to connect industry and project goals and objectives for improvement of process and method of doing things and administering projects.

There are a shortage of studies on the efficiency and effectiveness of public construction project in Ethiopia. To fill these gaps, the researchers were conduct evaluation of performance efficiency and effectiveness of public construction project in the shashemene City, Oromia, Ethiopia.

1.3 Objectives

1.3.1 General Objectives

The General objective of the study is to evaluate performance efficiency and effectiveness of public constructions projects in Shashemene City.

1.3.2 Specific objectives

The specific objectives of the study are: -

- To measure the critical factor influencing efficiency and effectiveness of public constructions projects in Shashemene City.
- To identify the factor affecting performance of public construction project in the shashemene town
- To assess the current performance state of public construction projects in terms of time and cost in Shashemene City.
- To develop a framework for performance measurement of public construction project in shashemene City.

1.4 Research questions

1. To what extent the efficiency and effectiveness of public constructions projects achieved in Shashemene City.?
2. What are the factors affecting performance of public construction project in the shashemene City?
3. What are the current performance state of public construction projects in terms of in terms of time and cost in Shashemene City.?
4. How to develop a framework for performance measurement of public construction project in shashemene City.?

1.5 Significance of the study

This study is significant to initiate and review the existing practices, methods of work and performance management system to improve efficiency and effectiveness performance of public constructions projects in Shashemene City. It also used to recommend the best practice approach/strategies in handling and minimizing inefficiency and ineffective problems. Also, it

helps to evaluate existing policies, regulations, and manuals to create helpful environment for effective and efficient coordination and allocation of resources for the achievement of project outcomes and client satisfaction. Based on the findings, it encourages each stakeholder to play their role for the successful achievement of public construction project. In the future, it used as reference material for students who are willing to pursue related post graduate studies.

1.6 Limitation and Scope of the study

1.6.1 Scope

The scope of the study is bounded different aspects: geographical, sectoral and Project years. Geographically, the Research was focused on public construction project in the Shashemene, Oromia region. Sectorally, the research focus on public construction projects from (2009-2014E.C) in the City by Municipality and state budget. The study was including public construction projects that classified as roads, straight light, buildings, land fill and drainage projects etc. The data was collected from the stakeholder targeting respondents that located in the study area.

1.6.2 Limitation

Due to time limitation, this research was considered public construction project only and focus on efficiency and effectiveness of public constructions projects in Shashemene City and way of improving. However, there are different analytical and practical issues of efficiency and effectiveness of public constructions; the discussions on these issues were limited to efficiency and effectiveness of public constructions, parameters which are listed under independent variable these are time, cost, quality, and client satisfaction. Due to shortage of time and budget, only randomly selected public constructions project that formally contracted from 2009-2014 E.C has been investigated. Therefore, the research findings are not included the private constructions project as well as complete evaluation of actual practices.

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CHAPTER TWO

2. Literature Review

2.1 introduction

This chapter presents the findings from different reviewed literatures on the subjects of Construction project performance, project performance evaluation, measure of performance evaluation, conceptual frame work of project and effectiveness, efficiency of public construction project. Performance evaluations of any project are measured by performance key indicator and the level of key performance indicator (KPI). The literature review tried to highlight factor affecting performance of public project and effects of inefficiency and ineffectiveness of public project. It also trying to make the reviewed literatures as theoretical and empirical (related studies) review of the existing literature based on its specific objectives

2.2 Project Performance

2.2.1 Definitions and Concepts

According to Project Management Body of Knowledge (PMBOK) pp 5(2008), project is defined as: - project is a temporary endeavor undertaken to create a unique product, service or result. The temporary nature of projects indicates a definite beginning and end. The end is reached when the project's objectives have been achieved or when the project is terminated because its objectives will not or cannot be met, or when the need for the project no longer exists.(Von Wangenheim et al., 2010).

Performance is carrying out a task, the progress of which can be measured and compared using a set of stated requirements. Performance has been described as the degree of execution of certain task (TRADE, 1995). It is related to the prescribed objectives which form the project considerations. From project management perspective, it is all about meeting stakeholders' needs and expectations from a project. It invariably involves placing consideration on three major project elements i.e. time, cost and quality.

Various literature and researchers have revealed that performance should not be considered only as the achievement of project schedule, time and quality. It is having a broader concept that can be assessed taking different parameter relating to the objective of different stakeholders for a particular project. Customer satisfaction, meeting specifications, health and safety, environmental

responsiveness are some of the concerns when evaluating successful achievement of project objectives.

2.2 Performance measurement in construction

Performance measurement is fundamental to management planning and control and has accordingly received considerable attention from both academicians and practitioners. The construction industry has been criticized for its underperformance and performance measurement has gained more attention as many researchers have placed considerable emphasis on the importance of developing and implementing performance measurement methods. The construction firm stakeholders require the development of models that compare firm performance in terms of efficiency and effectiveness.(Tsolas, 2011)

Overall performance, construction efficiency and effectiveness were all strongly correlated with pure technical efficiency and not correlated with scale efficiency. The overall performance indicators were better correlated with the effectiveness indicators, which demonstrate the significance of enterprise management for construction industry performance**.**(Hu & Liu, 2018)**.**

Performance measurement is the regular collecting and reporting of information about the inputs, efficiency and effectiveness of construction projects. They use the performance measurement to judge their project performances, both in terms of the financial and non-financial aspects and to compare and contrast the performance with others, in order to improve programmed efficiency and effectiveness in their organizations.(Takim et al., 2003)

The success of a construction project can be indicated by project performance. The performance of a project will be dependent on various factors including project complexity, contractual arrangements, relationships between participants in the project, competency of project manager, and the abilities of the key members in projects. Project performance is usually judged and quantified by performance measurement. Performance measurement is the common method to collect and report the information related to the inputs, efficiency, and effectiveness of a construction project (Leong et al., 2014)].

Performance Measurement (PM) is a vital tool that can enhance the capturing of knowledge and hence provide improved construction performance, at both corporate and project levels. Measurement is a core activity for sector that is focused on delivering results. Performance is

measured primarily allow maximizing the results that are meaningful to organizations by adjusting product or service, using the capabilities and funding available. It enhances the development of a learning organization by capturing and analyzing what is happening in the firms or industry environment, especially through its customers, employees, suppliers, partners and new technologies(Mbugua et al., 1999).

Performance measurement expressed as a process of quantifying the efficiency and effectiveness of firm operation. The performance measures employed are the metrics used to quantify the efficiency and effectiveness of firm operation, as two performance dimensions.(Tsolas, 2011).*"*Performance measurement has two main aims: to connect company goals and objectives to improvements and to set targets for improvement activity (Grünberg, 2004)

According to a critical review of (Deng et al., 2012),performance measurement in construction can be broadly done at three general levels.

1. Industry level: assesses the performance of the industry, both nationally and internationally
2. Business level: measures the performance of the construction organization, including both one-time evaluation and continuous measurement. The spreading and embedding of lessons learnt to generate improvement in project businesses and construction.
3. Project level: evaluate the performance (and success) of construction projects. This may work over the project lifecycle, but most project organizations measure insufficiently to induce improvement opportunities within a project hence potential benefit is to obtain general lesson for spreading and embedding of lessons on other projects.

In the manufacturing and construction industries, performance measurement is used as a systematic way of judging project performance by evaluating the inputs, outputs and the final project outcomes. However, very few companies systematically measure their performance in a holistic way. Moreover, the existing systems tend to focus more on product and less on process and design. This can lead to the suboptimal quality of the performance measurement system, the misjudging of relative performance, and to satisfaction and the denying of appropriate rewards to the deserving(Takim et al., 2003)

Measuring the public sector performance, in the conception of the authors, implies taking into consideration the distinction between: the means used (inputs), the process (throughput), the product (output) and the effect achieved (outcome). Performance assessment can be achieved through some measurement categories (Profiroiu & Profiroiu, 2007)

1. Measuring the resource economy, this can be determined by comparing the purchase price of the inputs with the designated value.

2. Measuring the costs, this involves measuring in monetary expression the resource consumption in order to provide a particular product or service.

3. Measuring the efficiency, which takes into account the obtained result in relation to the resources used, and a project is effective if the maximum results are achieved with a given level of resources, or if it uses the minimum resources for a certain level of the result.

4. Measuring the effectiveness, this is quantified by the ratio of the actual result to its expected level. The process of measuring the effectiveness faces difficulties concerning the assessment and the quantification of the results, which often have non-physical form, and cannot be directly measurable. The results of the public projects can have both economic and social nature.

5. Measuring the quality of services, this is designed to follow the degree to which the public product/service satisfies the requirements of the citizens. In this sense, the quality includes the effectiveness of a project. The deficiency of this method consists in the fact that the quality is a vague concept and far too complex that is not sufficiently reflected by indicators. The concept of quality encompasses not only the quality of the product/service offered, but also the quality of the production process and the quality of the system.

6. Measuring the financial performance

7. Measuring the overall performance

Performance measurement in the public sector, namely in public using performance evaluation systems is a step in public administration reform that brings innovativeness, rigor and transparency of these structures. The idea of performance in public administration involves a high level of service provided by it, namely their continuous improvement in terms of effectiveness and efficiency, and satisfaction and expectations of citizens (Leoveanu, 2016)

2.3 Evaluating the performance effectiveness and efficiency of public projects

Performance evaluation processes to measure the relative performance effectiveness and performance efficiency of projects based on their expected and actual performance objective values. With an optimization model, the performance effectiveness evaluation process obtains a set of optimal weights on the performance objectives of the project by maximizing the total performance effectiveness value of all projects.(Xu & Yeh, 2011). Project evaluation is an effective tool in project management which requires appropriate measurement of performance

levels. It is a systematic analytical method, which is conducted a sometimes to measure and explain project performance issues.

Considering efficiency, evaluation criteria for evaluation of a project is likely that we might have an accurate perception about the project's cost and ultimate outputs, but there is little chance of assessing whether there is a reasonable correlation between them. The situation is much the same for effectiveness or goal achievement.(Samset & Christensen, 2017) .

Efficiency and effectiveness are the central terms used in assessing and measuring the performance of organizations (is an indicator that is obtained by reporting the outcome effects to the efforts made). The efficiency of public expenses implies a relation between the economic and social effects resulted from implementing a program and the effort made to finance that program. The effectiveness is the indicator given by the ratio of the result obtained to the one programmed to achieve.(D. M. Mihaiu et al., 2018) Peter Drucker believes that there is no efficiency without effectiveness, because it is more important to do well what you have proposed (the effectiveness) than do well something else that was not necessarily concerned). The relationship between efficiency and effectiveness is that of a part to the whole, the effectiveness is a necessary condition to achieving efficiency.(Drucker, 1995)

Evaluating the performance of projects will help establish benchmarks of high-performance projects for cross-learning and for potential improvement of low performance projects. An overall performance can be fully evaluated by two distinct measures which are effectiveness and efficiency.(Chiou et al., 2010) Performance evaluation processes are developed to evaluate the relative performance effectiveness and performance efficiency of a set of completed projects based on their expected and actual performance. The performance effectiveness evaluation process evaluates the performance of a project based on the degree to which it achieves the expected project performance objectives. To obtain the performance effectiveness value of a project, the achievement degree of each project performance objective is to be aggregated with its objective weight by a weighted-sum aggregation method. The objective weight indicate the relative importance degree to which a performance objective of a project to the organization goals. (Xu & Yeh, 2011) .

The policy orientation towards sustainable economic development focuses on increasing the efficiency of the public sector in equitable supply of goods and services needed by citizens. Efficiency, an important element of development, is more easily to be highlighted in the private

sector than in the public sector, whose activities are directed, towards covering the needs of citizens, to a greater degree, as much as possible, the allocation of resources being related to supply of goods and services. According to authors, the interpretation of efficiency and effectiveness refers to the relationship between inputs and outputs, between the obtained results and the expected ones, increasing productivity.(Florina, 2017) .According to the paper of (D. M. Mihaiu et al., 2018) ,The effectiveness and efficiency of public spending indicate that the efficiency and effectiveness analysis is based on the relationship between the inputs (entries), the outputs (results) and the outcomes (effectiveness).

Performance evaluation is a most important to all organizations. Performance appraisal is an official and evaluation of an individual performance and were checked an individual performance on a continuous, and Employees are a key element of any organization. The performance appraisal systems developmental tools used to measure the real performance in an organization and the strategic goals of the organization are associated to that individual performance. To capture a broader range of issues relevant to decision-makers and other stakeholders evaluated Norwegian transport projects ex-post by using a generic framework that consists of six evaluation criteria, which together cover different aspects of project success. For a presentation of the evaluation framework and a more thorough discussion of the motivation for applying it to public infrastructure projects in high-income countries such as Norway, The criteria as used in the ex-post evaluation of transport projects in Norway are summarized in Table below by (Welde & Volden, 2018)

Table 2. 1: Evaluation criteria used in ex-post evaluations

Economic efficiency	- Did the project deliver value for money as summarized by the net present value or benefit-cost ratio?
Effectiveness	- Were the stated outcome goals achieved? - -To what extent did the project contribute to the goal achievement?
Cost performance	- To what degree was the project delivered within the agreed scope and budget?

Strategic success	- Relevance: Is the project aligned with the government's strategic objectives for the transport sector? - Is it in line with the needs and priorities of different stakeholders? - Other impacts: Has the project had any other positive or negative impacts other than those planned? - Sustainability: Are the positive effects derived from the project likely to continue - and the negative effects acceptable – in the long-run?

2.4 Measure of performance evaluation

Performance Measurement (PM) is a vital tool that can increase the capturing of knowledge and hence provide improved construction performance, at both company and project levels. Measurement is a core activity for sector that is focused on delivering results. Performance is measured primarily allow maximizing the results that are meaningful to organizations by adjusting product or service, using the capabilities and funding available. Performance measurement provides information for strategic evaluation. It also provides a broad / comprehensive/ picture of a business and a strategic focus on critical business issues and on continuous improvement (Mbugua et al., 1999).

According to (Takim et al., 2003), performance measurement used as the systematic ways of performance measurement have influenced many construction firms, government sectors, public and private clients and other project stakeholders. Performance measurement is the regular collecting and reporting of information about the inputs, efficiency and effectiveness of construction projects. They use the performance measurement to judge their project performances, both in terms of the financial and non-financial aspects and to compare and contrast the performance with others, in order to improve program efficiency and effectiveness in their organizations.(Takim et al., 2003).

Measuring the public sector performance, in the conception of the authors, implies taking into consideration the distinction between: the means used (inputs), the process (throughput), the product (output) and the effect achieved (outcome).(D. M. Mihaiu et al., 2018). To more correctly evaluate the overall performance and to fully capture the insights of lacking efficiency or effectiveness for non-storable commodities, it is imperative to measure the efficiency and

effectiveness simultaneously because both terms represent distinct aspects of performance.(Chiou et al., 2010).

In public sector, effectiveness, efficiency and quality are regarded as an essential component of organizational performance indicating the need for attention in daily management. In the context of public sector evaluation and measurement have often focused on performance aspects other than productivity. Evaluation of the projects aiming to achieve better measurement in provision of public services may conclude that such efforts have not been successful in dealing with public problems.(Hookana, 2011). (*Kaplan and Norton - 2001 - Transforming the Balanced Scorecard from Performan.Pdf*,) stated that one of the main reasons for the failure of performance measurement system development projects is the sole emphasis on the top level of an organization.

Performance measurement has two main aims: to connect company goals and objectives to improvements and to set targets for improvement activity (Grünberg, 2004). Measurement enables increased visibility of the quality and progress of a certain task and helps to justify, manage and evaluate quality and productivity improvement programs at the operations level. The point has been made that proper measurement goals are those that focus as much on communication as on evaluation and targets (Pekuri et al., 2011)

According to a critical review of (Deng et al., 2012) performance measurement in construction can be broadly done at three general levels.

I. Industry level: assesses the performance of the industry, both nationally and internationally
II. Business level: measures the performance of the construction organization, including both one-time evaluation and continuous measurement. The spreading and embedding of lessons learnt to generate improvement in project businesses and construction.
III. Project level: evaluate the performance (and success) of construction projects. This may work over the project lifecycle, but most project organizations measure insufficiently to induce improvement opportunities within a project hence potential benefit is to obtain general lesson for spreading and embedding of lessons on other projects.

(Mohamed, 1996) presented a three-level framework on how the concept of performance measurement could be related and adapted to construction, providing insights as to why and at what level the performance measurement should occur. Internal performance measurement is the

examination of an individual organization's current processes and practices for the purpose of identifying improvement targets that relate to how the organization does business and how its customers evaluate their services. Project performance measurement measures the performance of projects in which the organization is involved; its aims are meeting customer requirements, measuring productivity rates, and validating and maintaining its estimating databases. External benchmarking is mainly concerned with the selection and implementation of managerial and technological breakthroughs developed by other industries, in order to generate significant improvement in construction.

Project performance can be measured and evaluated using a large number of performance indicators that could be related to various dimensions (groups) such as time cost, quality, client satisfaction, client changes, business performance, health and safety.(Saleh,2009). Project performance is usually judged and quantified by performance measurement. Performance measurement is the common method to collect and report the information related to the inputs, efficiency, and effectiveness of a construction project.(Leong et al., 2014)

2.5. Conceptual frame work of project evaluation

According to Upton (2001), a conceptual framework can be defined as a set of broad ideas and principles taken from relevant fields of enquiry and used to structure a successive study. Therefore, a conceptual framework is a research tool intended to assist a researcher to develop awareness and understanding of the situation under examination and to communicate with a study(Upton et al., 2001). Hence, a conceptual framework is used to outline possible courses of action or to present a preferred approach to an idea or thought that developed based on the literature reviewed in respective to study undertaken.

Source: (D. M. Mihaiu et al., 2018) The effectiveness and efficiency of public spending, p.3.

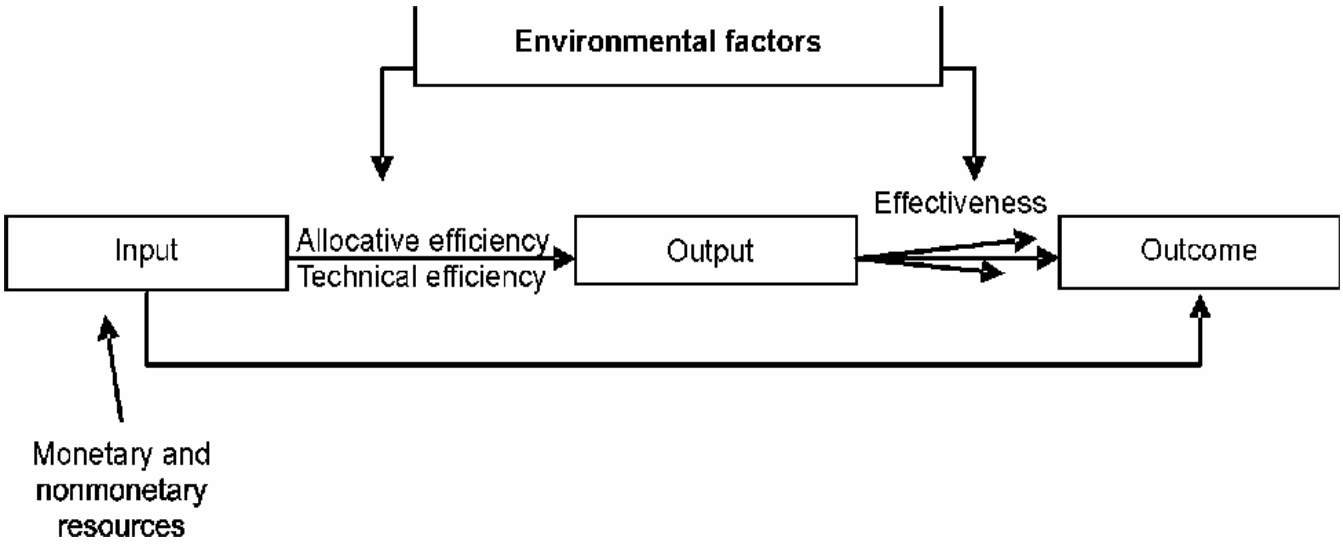


Figure 2. 1: Conceptual framework of the efficiency and the effectiveness

2.6. Project performance indicator

According to (TRADE, 1995), Performance measures quantitatively tell something important about products, services, and the processes that produce them. They are tools to help us understand, manage, and improve what organizations do. They provide with the information necessary to make intelligent decisions about what to do, How well an organization is doing?, Whether Goals have been met, If customers are satisfied, If processes are in statistical control, and where improvements are necessary.(*World Trade Summary 1995 | WITS | Text*, 1995)

A performance indicator is composed of a number and unit of measure. The number gives us a magnitude (how much) and the unit gives the number a meaning (what). Performance measures are always tied to a goal or an objective (the target). Performance measures can be represented by single dimensional units like hours, meters, nanoseconds, dollars, number of reports, number of errors, etc. They can show the variation in a process or deviation from design specifications. Single-dimensional units of measure usually represent very basic and fundamental measures of some process or product More often, multidimensional units of measure are used ((*World Trade Summary 1995 | WITS | Text*, 1995).

These are performance measures expressed as ratios of two or more fundamental units. These may be units like Kilometer per Liter (a performance measure of fuel economy), number of accidents per million hours worked (a performance measure of the company's safety program), or number of on-time vendor deliveries per total number of vendor deliveries. Performance measures expressed this way almost always convey more information than the single-dimensional or single-unit performance measures.

According to TRADE (1995); most performance measures can be grouped into one of the following six general categories. However, certain organizations may develop their own categories as appropriate depending on the organization's mission: -

1. Effectiveness: A process characteristic indicating the degree to which the process output (Work product) conforms to requirements. (Are right things being done?)
2. Efficiency: A process characteristic indicating the degree to which the process produces the required output at minimum resource cost. (Are we doing things, right?)

3. Quality: The degree to which a product or service meets customer requirements and expectations.
4. Timeliness: Measures whether a unit of work was done correctly and on time. Criteria must be established to define what constitutes timeliness for a given unit of work. The criterion is usually based on customer requirements.
5. Productivity: The value added by the process divided by the value of the labor and capital consumed.
6. Safety: Measures overall health of the organization and the working environment of its employees.

2.6.1. Key performance indicator in construction

Key Performance Indicators (KPIs) reflect a project's goals and provide means for the measurement and management of the progress towards those goals for further learning and improvement. Consequently, the functionality of the KPIs approach has made it one of the most popular and valuable tools among recorded literature regarding the measurement of the level of sustainability of construction projects.(Kylili et al., 2016). The purpose of the KPIs is to enable measurement of project and organizational performance throughout the construction industry (The KPI Working Group, 2000).

(Collins, 2002) believes that the process of developing KPIs involved the consideration of the following factors.

1. KPIs are general indicators of performance that focus on critical aspects of outputs or outcomes.

Only a limited, manageable number of KPIs is maintainable for regular use. Having too many (and too complex) KPIs can be time- and resource-consuming.

2. The systematic use of KPIs is essential as the value of KPIs is almost completely derived from their consistent use over a number of projects.
3. Data collection must be made as simple as possible.
4. A large sample size is required to reduce the impact of project specific variables. Therefore, KPIs should be designed to use on every building project.
5. For performance measurement to be effective, the measures or indicators must be accepted, understood and owned across the organization.

According to KPI Report for The Minister for Construction By The KPI Working Group dated January 2000, The Leve the KPI groups and their associated indicators are shown in the table, below. The definitions for these indicators and guidance on their use are given in the section KPI **The Level of KPIs: -** Headline Indicators provide a measure of the overall, rude state of health of a firm, Operational Indicators bear on specific aspects of a firm's activities and should enable management to identify and focus on specific areas for improvement and Diagnostic Indicators provide information on why certain changes may have occurred in the headline or operational indicators and are useful in analyzing areas for improvement in more detail. The indicators are identified as applicable at project and/or company levels. In some cases, the company indicator is the average value of that company's project indicators, the indicators are identified as appropriate to the various members of the supply chain to which they could be applied. For all indicators an organization may have to use estimated, predicted or actual data depending on the stage of progress on the project

Table 2. 2: UK Working Group Report on Key Performance Indicator

Indicatorgroup	Indicator	Level
Time	1. Time for Construction	Headline
	2. Time Predictability – Design	Headline
	3. Time Predictability – Construction	Headline
	4. Time Predictability – Design & Construction	Operational
	5. Time Predictability – Construction (Client Change Orders)	Diagnostic
	6. Time Predictability – Construction (Project Leader Change Orders)	Diagnostic
	7. Time to Rectify Defects	Operational

Cost	1. Cost for Construction 2. Cost Predictability – Design 3. Cost Predictability – Construction 4. Cost Predictability – Design & Construction 5. Cost Predictability – Construction (Client Change Orders) 6. Cost Predictability – Construction (Project Leader Change Orders) 7. Cost to Rectify Defects	Headline Headline Headline Operational Diagnostic Operational

Client satisfaction	1. Client Satisfaction Product – Standard Criteria 2. Client Satisfaction Service – Standard Criteria 3. Client Satisfaction – Client-Specified Criteria	Headline Headline Operational
ChangeOrder	1. Change Orders – Client 2. Change Orders – Project Manager	Diagnostic Diagnostic
Quality	1. Defects 2. Quality Issues at Available for Use 3. Quality Issues at End of Defect Rectification Period	Headline Operational Operational

Business performance	1. Profitability (company) 2. Productivity (company) 3. Return on Capital employed (company) 4. Return on Value Added (company) 5. Interest Cover (company) 6. Return on Investment (client) 7. Profit Predictability (project) 8. Ratio of Value Added (company) 9. Repeat Business (company) 10. Outstanding Money (project) 11. Time taken to reach Final Account (project)	Headline Headline Operational Operational Operational Operational Operational Diagnostic Diagnostic Diagnostic Diagnostic
Health andSafety	1. Reportable Accidents (fatalities) 2. Reportable Accidents (non-fatal) 3. Lost Time Accidents 4. Fatalities	Headline Operational Operational Operational

Source: - UK Working Group Report on Key Performance Indicator, 2000.

Evaluating the performance of construction projects on the above KPIs is, however, not so easy because a construction project is completed as a result of a combination of many events and interactions over its entire life. Thus, KPIs of construction projects themselves depend on uncountable number of project-related events and variables. Researchers have suggested the inclusion of vital few factors which will capture the essence of all project-related variables for measuring the performance on KPIs. These vital few factors, popularly termed as critical success factors (CSFs) have been classified by different researchers from different perspectives. In the present work, the researcher classified the factors governing the success of a project into six groups based on various characteristic features affecting the KPIs of a construction project. The six CSFs are named as project-related, client-related, consultant-related, contractor-related, supply chain-related and external environment-related factors.(Ngacho & Das, 2015)

2.7 Factor affecting performance of public project

Project performance can be investigated and evaluated using a large number of performance indicators, expressed by factors such as time, cost, quality, client satisfaction, client changes, and health and safety (Cheung et al., 2004) .A theoretical framework of the performance evaluation of construction projects are based six critical success factors (CSFs named as project-related, client-related, consultant-related, contractor-related, supply chain-related and external environment-related factors and their effects six KPI in terms of time, cost, quality, safety, minimum site disputes and environmental impact(Ngacho & Das, 2015)

(Chan & Chan, 2004) grouped the factors under the headings of client, project, project environment, project team leaders, project procedures and project management procedures. In the present work, we have categorized the factors into six broad heads based on various characteristic features affecting each individual KPI of a construction project. These are:

1. Project-related factors. These are the specific pre-selected success factors during project construction which essentially deal with the type, size and complexity of construction projects and other related aspects. These characteristic features are those not attributable to the stakeholders, supply chains or the project environment.
2. Client-related factors which are primarily concerned with the client's knowledge and experience with different type of projects as well as his project management capabilities.
3. Consultant-related factors which cover aspects pertaining to the preparation of design documents, drawing details, changes in design documents, specifications of the project, etc.
4. Contractor-related factors which are responsible for quality management practices adopted by the contractors, their technical expertise, site management and supervision skills, etc.
5. Supply chain-related factors encompass those factors relating to the selection of suppliers, procurement of right materials and equipment, availability of labor, etc.
6. External environment-related factors which deal with the economic, social, political, technological and ecological environment affecting the success of a construction project.

According to previous studies, it could be said that the performance measurement is a process that include factors as Key Performance Indicators (KPIs) such as time, cost, quality, client satisfaction; leadership style and safety in order to enable measurement of current construction projects performance and to achieve significant performance improvements of future projects. It

was obtained that there were many fields and topics which are related to performance such as, construction management, information technology, factors affecting performance of managers, measurement of project performance, key performance indicator and benchmarking. The key performance indicators are used to evaluate performance of construction projects. These indicators can then be used for benchmarking purposes, and will be as a key component of any organization to move towards achieving best practice and to overcome performance problem.(Yada & Yadeta, 2016)

2.8 Success in public construction project

The success of a construction project can be indicated by project performance. The performance of a project will be dependent on various factors including project complexity, contractual arrangements, relationships between participants in the project, competency of project manager, and the abilities of the key members in projects. (Leong et al., 2014a) .Construction firms may operate in adverse conditions, and the extent to which they are successful should be reflected in the financial statements. On the one hand, a direct concern of the management of firms is the extent to which managers use resources efficiently. On the other hand, management's effectiveness in generating profits is also of great interest.

Public evaluation of efficiency puts emphasis on social and economic impact of a project for a public in general, commercial – on financial impact for its participants (investors), budget – on financial impact for federal, regional and local budgets. Public evaluation of efficiency is calculated for largescale projects, which have significant impact on economic, social and ecological situation in a country or on individual regions or industries (projects for public roads construction, reconstruction, capital and current repair)(Baurina et al., 2020)

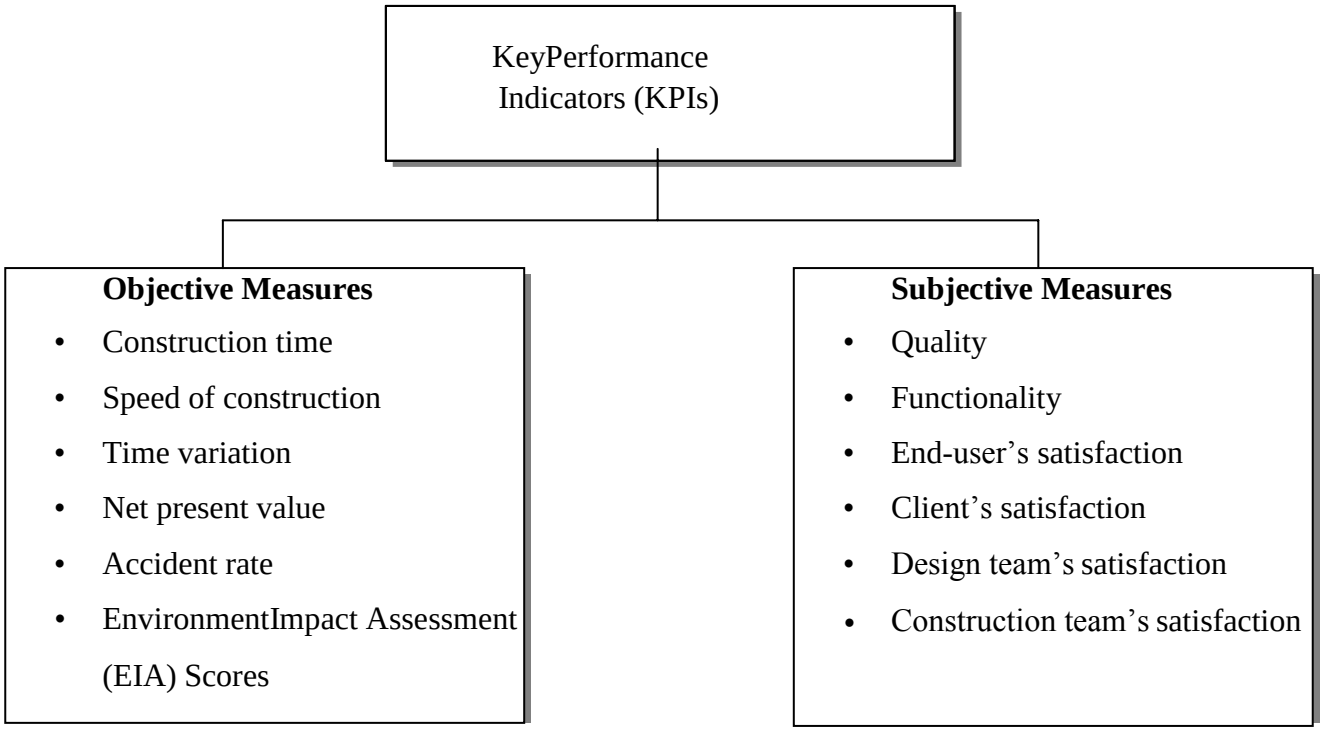
The concept of sustainable development is gaining increasing popularity in construction industry. Previous studies have prioritized on the sustainable performance of construction projects from perspectives of economy and environment, social performance of construction projects has not drawn much attention. Social performance of construction projects refers to the extent which the projects meet the needs of current and future generations. (Xiahou et al., 2018).The author suggest two performance evaluation processes are developed to measure the relative performance effectiveness and performance efficiency of projects based on their expected and actual performance objective values. With an optimization model, the performance effectiveness

evaluation process obtains a set of optimal weights on the performance objectives of the project by maximizing the total performance effectiveness value of all projects.(Xu & Yeh, 2011)

2.8.1 Project success Key Performance Indicators (KPIs)

The purpose of the Key Performance Indicators (KPIs) is to enable measurement of project and organizational performance throughout the construction industry (KPI Working Group, 2000). (Collins, 2002) Advocates that the process of developing KPIs involved the consideration of the following factors:

- KPIs are general indicators of performance that focus on critical aspects of outputs or outcomes.
- Only a limited, manageable number of KPIs is maintainable for regular use. Having too many (and too complex) KPIs can be time and resource consuming.
- The systematic use of KPIs is essential as the value of KPIs is almost completely derived from their consistent use over a number of projects.
- Data collection must be made as simple as possible.
- A large sample size is required to reduce the impact project specific variables. Therefore, KPIs should be designed to be used on every building project.
- For performance measurement to be effective, the measures or indicators must be accepted, understood and owned across the organization KPIs will need to evolve and it is likely that a set of KPIs will be subject to change and refinement.



source:-(Ankrah & Proverbs, 2005)

Figure 2. 2: Key Performance Indicators for Project Success

2.9 Measurement of effectiveness, efficiency of public project

2.9.1 Measurement of project effectiveness

Measuring the effectiveness is quantified by the ratio of the actual result to its expected level. The process of measuring the effectiveness faces difficulties concerning the assessment and the quantification of the results, which often have non-physical form, and cannot be directly measurable. The results of the public projects can have both economic and social nature (D. M. Mihaiu et al., 2018). High effectiveness, in turn, is obtained when the process output exceeds most customer requirements and Effective means Satisfies or exceeds all customer requirements (Sundqvist et al., 2014).The identification of project effectiveness measures are associated with project 'results' in terms of accomplishing core business and project objectives, users' satisfaction and the use of the project as identified by (Cooke-Davies, 2002). According to (Takim & Adnan, 2009) different possible project effectiveness indicators are gathered for effectiveness measures. These are

1. **Client and User Satisfactions: -** Describes the level of 'happiness' of people affected by a project and when the project is delivered to quality, reliability, on-time deliveries, high service levels and minimum cost of ownership.
2. **Level of effectiveness (achievement of outcomes): -** A system is effective if it achieves its objectives and since construction projects are directed towards client's objectives, an effective construction project is one that meets its objective.
3. **Project Functionality and 'Fitness for Purpose': -** Considers project 'functionality' as one of the success measures in the post-construction phase when the project is finished or delivered and project functionality correlate with expectations of project participant and can be best measured by the degree of conformance to all technical specifications
4. **Free from Defects: -** Defines construction defects as work performed that falls below the standard promised or expected by the client or purchaser of the work or services.
5. **Value for Money: -** The provision of adequate services without wasting limited resources and ensuring services are affordable. Typically, the analysis sees 'value' in which the 'benefits' to each party are perceived as value. Earlier work on 'value for money' equated value for money in terms of cost reduction and higher quality thresholds, which lead to greater client satisfaction.
6. **Profitability**: - Profitability is measured in the post-construction phase when the final account is settled and both the paying and the paid parties can be sure of the financial result.
7. **Absence of any Legal Claims and Proceedings: -** The absence of any claims or proceedings on projects is the major criterion to all parties (client, designer, and contractor) for measuring project success. Whenever a project is completed without using jurisdiction to settle conflict, the construction project can be considered efficient.
8. **Learning and exploitation: -** Learning and exploitation can be defined as the process of improving actions through better knowledge and understanding. In construction project development, the lessons learned in executing a project (whether the project is success or failure) could be applied to future projects. Some developers believe that projects that were cancelled because they were late and over-budget could still be a success if they provided learning something that could be applied to future projects.

9. **Generate positive reputation: -** In construction project development, project clients are more likely to have a favorable impression of a contractor's company if they have a positive experience in the services offered with a good quality finished product tailored to their initial needs and expectations. A positive reputation may be generated by working closely with construction project management, identifying opportunities for operational improvements, exploiting new technology, product or markets, identifying management information requirements, and resources constraints in offering well defined services and delivering an expected product that fits the client's business objectives

2.9.2 Measurement of project efficiency

Measuring the efficiency, which takes into account the obtained result in relation to the resources used, and a project is effective if the maximum results are achieved with a given level of resources, or if it uses the minimum resources for a certain level of the result.(D. M. Mihaiu et al., 2018). According to (Sundqvist et al., 2014),Efficiency is an internal process rating, while effectiveness is applied as a customer satisfaction rating. The highest degree of efficiency is the obtained when a process is: free from defects, have a low unit cost, short cycle time, no waste, and low cost of poor quality. Efficient means meets all internal requirements for cost, margins, asset utilization and other efficiency measures

The factors influencing efficiency are fluctuating according to and due to the faults and weakness of the client, the contractor, and the consultant. Therefore, it is essential to identify the actual factors influencing efficiency of projects in order to minimize and avoid failures in inefficiency in any construction project. According to National Research Council (NCR) report, on Improving Construction efficiency and productivity with Modular construction (2010), it defines efficiency improvements as ways to cut waste in: - time, costs, materials, energy, skills and energy.

CHAPTER THREE

3. Methodology

3.1. Introduction

Methodology is a plan of action that shows how the problems are investigated, what information are collected using which methods, and how this information was analyzed in order to reach at conclusions and develop recommendations. Research methodology should reflect the understanding of the researcher in order to extract valuable results of the study using various methods available, in single or combination form. Research follows some steps and procedures when conducted. Once the problem statement has been formulated, it should clearly describe the kind of data that is required, and the type of analysis that is most appropriate to analyze the data This chapter presents the elements of methodology that were applied in the study. The chapter covers Description of study area, the type of research design that should use, population and sample, data collection Technique, data analysis, Validity and Reliability and ethical consideration during data collection were discussed.

3.2. Description of study area

The study was conducted in Shashemene City, Oromia region. The city is located at the geographical in southern Ethiopia Located in West Arsi Zone, Oromia Region and it lies between 7□12'N and 38□36' E. Its average altitude is 1937 meters above the sea level. The city is known for its Rastafarian community. The resort of Wondo Genet ,Shala Lake and Senkele Wildlife Sanctuary lies near Shashemane. The town upgraded to the Regiopolis city by Oromia Region Administration. After being Regiopolis city the city administration extends over 50,000 Hectar with 4 sub-cities and 12 Woreda for administrative purpose. Based on the census data in 2007 the population of the city is 110,000 and the total administrative area is considered to be urban.

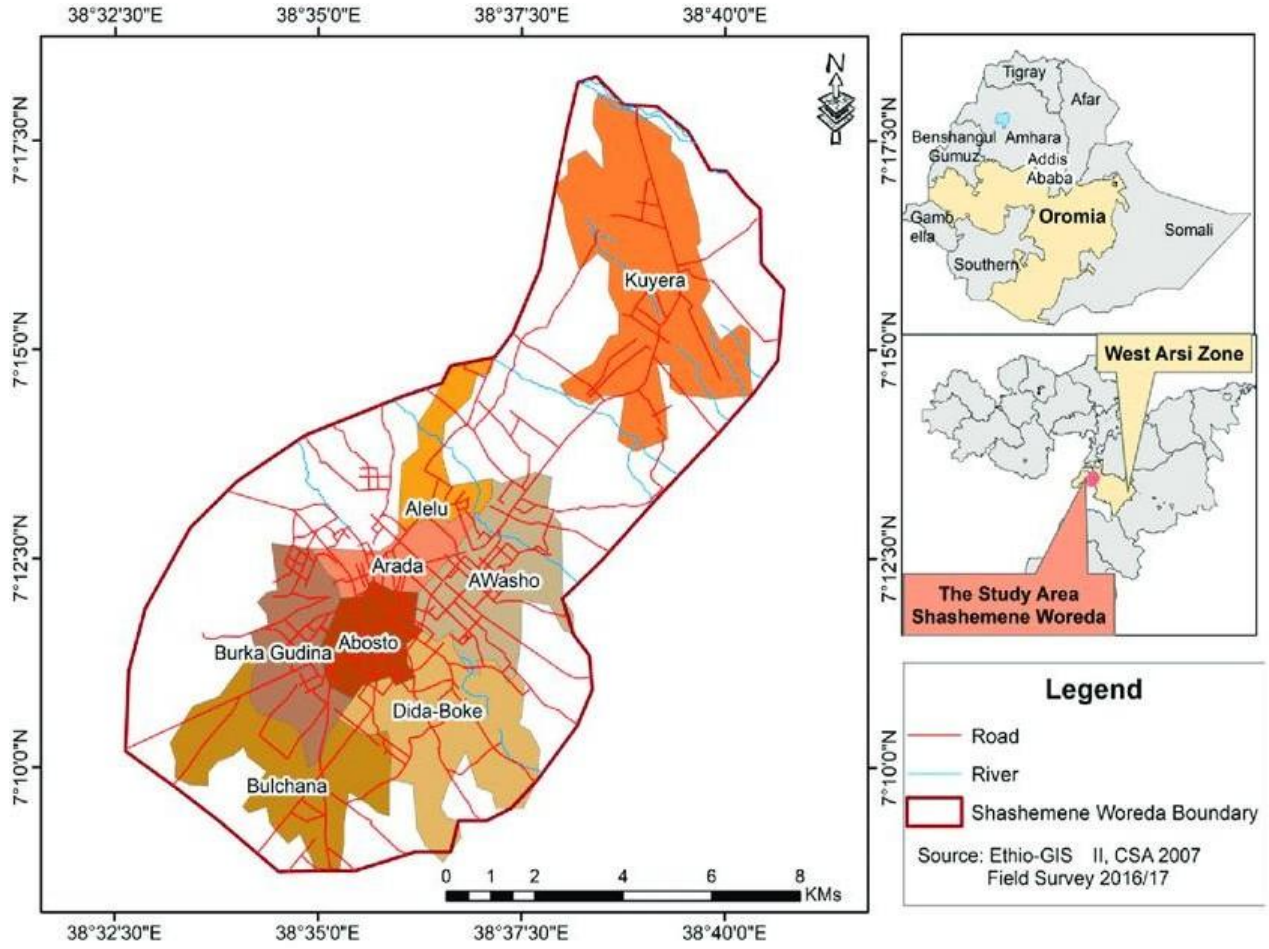


Figure 3. 1 Map of Shashemene city

3.3. Research Design

Research design is the arrangement considered for the collection and analysis of data to achieve the objectives of the research. In this research, both a descriptive and explanatory survey design was used. For the descriptive survey research design, the collected sample data were analyzed using descriptive statistics. In this stage the questionnaire was coded and analyzed using SPSS statistical package for social sciences) and used frequency, percentage, cross tabulation and figures to give a big picture of the data and to show summary of the analysis and to facilitate interpretation of the data.

The objectives of the research were measuring the critical factor affecting efficiency and effectiveness of public constructions projects of Shashemene City, factor affecting performance of public construction project in the shashemene City and to assess the current performance state of public construction projects in terms of time and cost in Shashemene City. Descriptive research

studies are those studies which are concerned with describing the characteristics of a particular individual or of a group. The research will obtain both qualitative and quantitative in nature.

The data was collected from both primary and secondary sources of data. The primary data has obtained through questionnaire from Owners, Contractors, regulatory body and Consultants of those public construction projects stated under Shashemene City from 2009-2014. The secondary data obtained from review of documents that mostly completed projects, contract documents, project reports, and correspondence letters, temporary or final over hand and payment certificates.

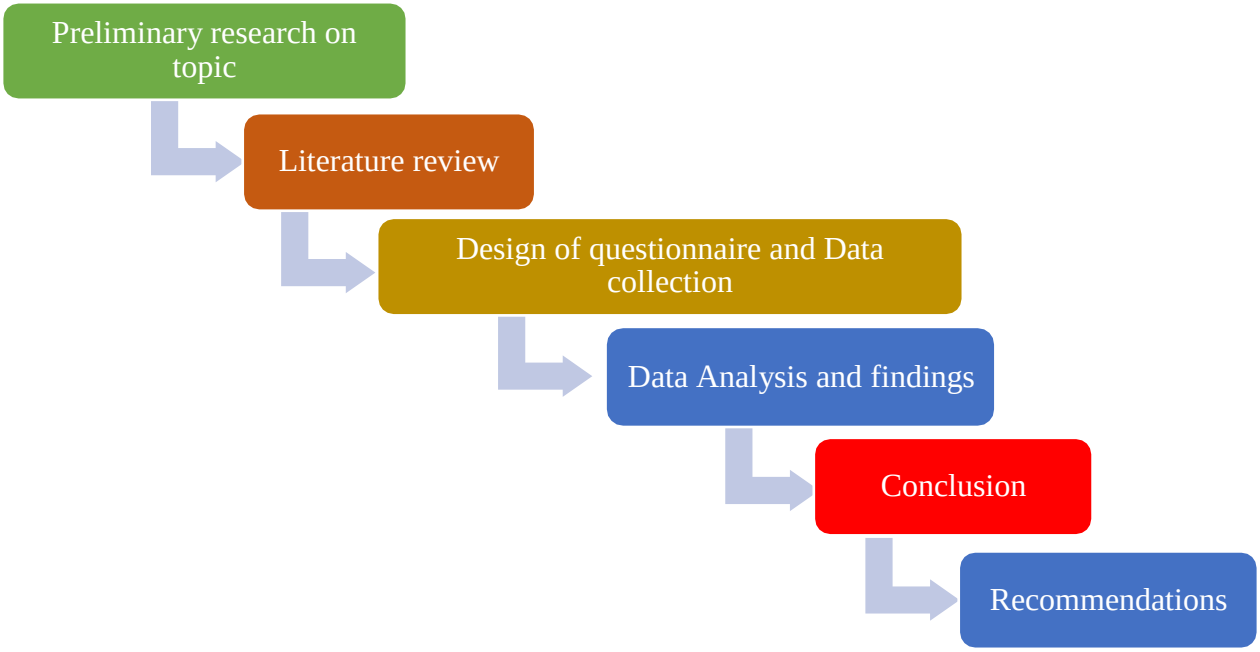


Figure 3. 2: Research sequence: Adapted from Gaba (2013)

3.4. Population and Sample

The population of this research is public construction projects that have been constructed in Shashemene City between the years 2009 to 2014 E.C. The table shows Number of public projects distributed with respect to Category of public project for each participating respondent groups. The population of public project categorized in to four groups Building, road and bridge, Drainage and land fill and Straight light.

Table 3. 1 Number of public projects distributed with respect to Category of public project

Category of public project	Building	Road and bridge	Drainage and Land fill	Straight light	Total
Number of projects	43	67	35	10	155
Percent 100%	27.74 %	43.22%	22.58%	6.45%	100%

Sample Size Determination refers to the number of items to be selected from the universe to constitute a sample. The size of sample should neither be excessively large, nor too small. It should be optimum. An optimum sample is one which fulfills the requirements of efficiency, representativeness, reliability and flexibility. While deciding the size of sample, researcher must determine the desired precision as also an acceptable confidence level for the estimate and hence 95% confidence level is used to calculate the sample size.

An adjustment to the margin of error in Yamane (1967) formula to make it applicable for use in determining optimum sample size for both continuous and categorical variables at all levels of confidence. It has been shown that the degree of accuracy expressed as a proportion (margin of error in Yamane formula), be adjusted by a factor of the ratio of the number of standard deviations that would include all possible values in the range to the t-value for the selected alpha level or confidence level, ρ, Accordingly, ρ = 2 was recommended for categorical variables and ρ=4 for continuous variable (Adam, 2020).

The adjusted Yamane's formula by (Adam, 2020).becomes,

$$\mathbf{n=}\ \frac{N}{+(N\varepsilon)}$$

Equation 3. 1 The adjusted Yamane's formula

Where,

n= minimum returned sample size

N = the population size

ε = adjust margin of error [ε = (ρe /t)]

e = the degree of accuracy expressed as a proportion=0.05

ρ= the number of standard deviations that would include all possible (ρ = 2 is recommended for categorical variables).

t= t-value for the selected alpha level of confidence level=1.96

Project sample calculation

The population size of Project sample is 155, the degree of accuracy expressed as a proportion=0.05 and sample size is required at 95% confidence level and margin of error of 0.05 and categorical variables (ρ = 2)

$$n = \frac{N}{1+(N\varepsilon 2)}$$

$$n = \frac{155}{1+155*(2*0.05/1.96)2} = 110.46 = 111$$

As the specific number of general populations is not known, thus method of random sample selection method is used for sample selection. For the sample of public project, Respondents of the study were contractors, consultants, clients and Regulatory Body. These parties are main stakeholders and they are engaged fully in the construction process. And also, they are the one who decide life cycle process status of the projects, Efficiency, effectiveness and other major future of the project. Each member of the population has an equal chance of being selected.

3.5. Data collection Technique

3.5.1 Questionnaires

Data collection was through self-administered questionnaires, which were distributed by hand in the Shashemene City. Taking into consideration the characteristics of research environment and limited time available to collect data, hand delivering questionnaires was believed the most effective as compared to administering them via Internet or face-to-face interviews. Questionnaire survey was used to assess the perception of construction stakeholders. The population of the research or target group consists of all the public construction projects from the year of 2009-2014 in shashemene city and the respondent include local small micro enterprise and Contractor, client, consultant, Regulatory and others professionals who had been participating in one way or other in

sample projects of public construction activity in Shashemene City. Besides direct participants of projects, stakeholders who are major contributors of the industry are included in the study.

According to(Saunders et al., 2009) the Questionnaires tend to be used for descriptive or explanatory research. Descriptive research, such as that undertaken using attitude and opinion questionnaires and questionnaires of organizational practices, enable to identify and describe the variability in different phenomena. The research has four specific objectives. To achieve each objective of the research questionnaire survey were used. Based on the information from literature review, systematically structured questionnaire was designed to collect information that can help respondent for the research questions and to address the identified problem statements.

Questionnaires were used to gather data because the information could be collected from a large sample and diverse regions, confidentiality were upheld and saved on time. The study used the data from respondents‟ documents and archival documents. The respondent's documents were collected by using questionnaires from contractors, consultants, regulatory body and owners. Archival documents were from completed projects, in which contract documents, project reports, correspondence letters and payment certificates were investigated thoroughly which are very important in identifying the factors affecting the performance of public construction projects. Questionnaire survey is the other strategy which is a very popular method of gathering information as it allows input from various sources such as client, contractor, and consultant, and regulatory bodies. It is commonly used for formal quantitative research.

The questionnaire consisted of four parts. The first part is general background information about the respondent. This includes the demographic questions about the respondents, Years of experience academic qualification, organization and job classification. This information helped the researcher to validate the outcome of the survey, as the research requires involvement of professionals who participated in public construction projects. In the second, third- and fourth-part professionals who had been working for client, contractor, consultant and regulatory body were asked to rank the critical factor influencing the efficiency and effectiveness of public construction project, factor affecting performance of public project and the current performance state of public construction project in terms time and cost respectively in Shashemene City.

The designed Questionnaires survey was sent to 135 professionals selected through stratified random sampling from consultant, contractor, client and regulatory body shashemene city in order to reach majority of the companies and more experienced professionals: 20 to client; 35 to

consultants; and 55 to contractors and 25 to Regulatory body. Out of the 135 questionnaires distributed, 120 were received and only 104 were duly completed and found suitable for analysis, representing a responses rate of 77%.

The respondent professionals mainly site engineers, office engineers, architects, hydraulic engineer, project managers, quantity surveyors, construction, supervisor, managers at the top of their careers and who had many experiences on construction projects.

3.5.2 Interview

Interview is typically a face-to-face conversation between a researcher and a participant involving a transfer of information to the interviewer. According to Creswell, 2012) Interviews are primarily done in qualitative research and occur when researchers ask one or more participants general, open-ended questions and record their answers. In this study, a semi-structured interviews were used to obtain an in-depth based on respondent's position and experience the researcher purposefully selected eight interviewers from those who work in public construction project area mainly from consultant, contractor, client and regulatory body to increase the validity of the study.

3.6. Data Analysis

The data collected through questionnaires, as well as secondary data collection methods were analyzed using qualitative methods. The data were mainly analyzed using descriptive method of analysis. The analysis involved comparisons of data obtained from the data collected from primary sources with the data available from secondary sources such as reports of the project. Generalizations were also made based on the results of the study. The data collected will be coded, and analyzed through SPSS (statistical package for social sciences).

Data Collected by questionnaire survey was analyzed by using SPSS percentage. Questionnaire survey was designed for engineering professional engaged in Design, project contract administration and construction work. Frequencies and percentages are used to summarize background information about respondents. Frequencies, percentages and descriptive statistics (means and standard deviations) are used to summarize respondents' perceptions of the rank in order to identify the critical factor influencing the efficiency and effectiveness of public construction project, factor affecting performance of public project and the current performance state of public construction project in terms time and cost factors in general. The relative importance index method (RII) is used herein to determine owners', consultants' professionals

and contractors' perceptions of the relative importance of the identified performance factors. The RII was computed as (Cheung et al., 2004b).

$$II = \frac{}{}$$

Equation 3. 2 The relative importance index method (RII)

Where,

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

A = the highest weight = 5;

N = the total number of respondents

3.7. Validity and Reliability Test

Validity test indicates the degree to which an instrument measures what it is supposed to measure. There are different ways of testing validity of questionnaire. In the case of this research, content validity test is utilized. Content validity is the extent to which a measuring instrument provides adequate coverage of the topic under study. Validity in relation to questionnaires refers to the ability of questionnaire to measure what is intending it to measure. This presents with a problem as if the reality of what were measured is actually known (Saunders et al., 2009).

The researcher was conducted pilot study before the actual study to test the validity of the instrument. A pilot questionnaire was sent to ten (10) expert who have well-regarded experience on the research area to evaluate the quality of questionnaire to check whether the questions are relevant and easily understood by the respondents. The results of the pilot questionnaire significantly helped to improve the quality of the questions and augmented its clarity to be understood by all participants. Based on the obtained result of the pilot questionnaire it was amended and refined to come up with the actual situation of the case.

Reliability refers to consistency. Although for a questionnaire to be valid it must be reliable, this is not sufficient on its own. Respondents may consistently interpret a question in questionnaire in one way, when it means something else. As a consequence, although the question is reliable, it does not really matter as it has no internal validity and so will not enable the research question to be answered. Generally, to ensure the quality of research and make it credible; the researcher gave due care to both validity and reliability issues of the data. The questionnaires' reliability was

checked by the Cronbach ‘s alpha test coefficient using SPSS software. As reliability measures gives greater confidence that the individual variables are consistent in their measurement. The normal range of Cronbach's alpha value between 0.0 and + 1.0. The closer the Alpha is to 1, the greater the internal consistency of items in the instrument being assumed. The formula that determines alpha is fairly simple and makes use of the items (variables), k, in the scale and the average of the inter-item correlations, r: As the number of items (variables) in the scale (k) increases, the value of α becomes increases

The researcher calculated Cronbach‘s alpha with a commonly used value 0.70 to measure the reliability of all variables addressed on the questioner. Out of scores Cronbach‘s alpha 0.70 and more than 0.70 indicates that the instrument is reliable. Thus, the score supports the presence of good internal consistency among the items and promise the reliability and acceptability of the study items. To ensure the validity, the researcher made use of different literature for both the questionnaire and the interview questions. The instruments were developed after the researcher studied the literature on the research area.

3.7.1 Validity of the Research Instruments

Validity is questionably the maximum important measures for take a look at high-quality. The phrase validity tends to whether or not or now not the test measures what it claims to degree. Validity is the quantity of which an idea, deduction or dimension is nicely-originated and relates precisely to the real world (Brains et al, 2011). The time period "legitimate" is on account of the Latin phrase “Validus”, which means “sturdy”. The validity of a dimension tool is contemplated to be the degree to which the device measures what it asserts to measure; in this case, the validity is stated to be equal to accuracy, (Said EL Hajjar Ahlia, University, 2018).

3.7.2 Reliability of Research Instruments

Reliability refers to the consistency of a measure. If equal result time is achieved and again the measure is taken into consideration reliable. For example, “if an assessment is designed to measure a trait (consisting of introversion), then each time the assessment is run to a topic, the consequences need to be approximately the equal” (Cherry, 2013, p. 1). It isn't always viable to calculate reliability precisely, but it could be anticipated in numerous approaches. Cronbach’s Alpha- “Cronbach’s alpha is a version of internal consistency reliability based totally at the average inter-object correlation of a tool” (Rovai, Baker, and Ponton, 2014, p. 545), (Kelly, 2014)

For an exploratory or pilot study, it is suggested that reliability should be equal to or above 0.60 (Straub et al., 2004). Hinton et al. (2004) have suggested four cut-off points for reliability, which includes excellent reliability (0.90 and above), high reliability (0.70-0.90), moderate reliability (0.50-0.70) and low reliability (0.50 and below) (Hinton et al., 2004). Although reliability is important for study, it is not sufficient unless combined with validity. In other words, for a test to be reliable, it also needs to be valid (Wilson, 2010).

Cronbach's Alpha was computed as follow;

α = k/k-1*[1-$\sum$ (S2)/ $\sum$S2sum)]

Equation 3. 3 Cronbach's Alpha

Where;

α = Cronbach's Alpha

k=Number of Response items

$\sum$**S2=**Variance of individuals Items summed up

$\sum$**S2sum=** Variance of summed up scores

The following table 3.2 describes how different values of Cronbach's Alpha are usually interpreted in research data discussion.

Table 3. 2: Reliability Analysis of different values of Alpha Hinton et al. (2004)

Cronbach's Alpha	Internal Consistency
0.9 ≤α	Excellent
0.7 ≤α <0.9	high reliability
0.5 ≤α <0.7	moderate reliability
α <0.5	low reliability

Results in Table 3.3 clarifies that values in the range between 0.7 ≤α <0.9 which considered high; so, it can be said the result guarantees the reliability of the questionnaire. Cronbach's alpha nearest to 0.86 for the whole questionnaire, which shows as high reliability of the whole questionnaire.

Table 3. 3 Cronbach's Alpha for the questionnaire

Factors	Per factors	All field
Critical Factor Influencing the Efficiency and Effectiveness of Public Construction Projects.	0.674	**0.86**
Factor Affecting Performance of Construction Projects	0.995	

Assessing Current Performance State of Public Construction Projects in terms of Time and Cost	0.924	

3.8. Ethical Consideration

The goals of human research often include understanding real-world phenomena, finding effective treatments, researching behaviors, and improving life in other ways what you decide to study and how you conduct it involve key ethical considerations. These considerations relate to Protecting the Rights of Research Participants, Improve research validity and maintain scientific or academic integrity.(Bhandari, 2021)

The study was conducted by considering ethical responsibility and respects all ethical issue that means, all participants have the right to withdraw from, or leave, the study at any point without feeling an obligation to continue. To maintain the confidentiality of the information provided by the respondents, the respondents were instructed not to write their names on the questionnaire and assure of that the responses was used only for academic purpose and kept confidential. During data collection, each respondent was informed about the purpose, scope and expected outcome of the research, and appropriate written consents was taken from the respondents and Brief description of the central objectives or purpose of the study and the potential benefit of the research outcome to respondents are clearly given in the introductory part of the questionnaire so as to motivate them and participate in the study and provide pertinent information about the company under study. Anyone who was not willing to participate was excluded from the study. Finally, respondents are included in the study based on their free will.

CHAPTER FOUR

4. Data Analysis and Discussion

4.1 Introduction

This chapter deals with presentation, analysis and interpretation of data obtained through questionnaire, interview and document review. The results of the study are presented in the form of figures and tables by using Statistical Package for Social Science Version 16 (SPSS-16). The Questionnaires were distributed to 135 participants selected through stratified random sampling from consultant, contractor, client and regulatory body. 20 to client; 35 to consultants; and 55 to contractors and 25 to Regulatory body and 17 (12.5%) of the participants did not return the paper and 14 (10.37%) participant response were incomplete and thus rejected. Similarly, from consultant, contractor, client and regulatory body representatives is also interviewed to consolidate the findings.

4.2 Demographic Characteristics of Respondents

In this section the respondents' profile is presented. It includes gender, age, level of education, work experience and working positions. The total 104 respondents, 79 (76%) were male and 25 (24%) were female. This implies that the number of male respondents were greater than females' respondents who participated in the study. The basic cause of this is the participation or involvement of females as of engineering professionals and in the management team of projects is small as compared to males.

Table 4. 1 Gender

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
	10	8.8	8.8	8.8
Male	79	69.3	69.3	78.1
Female	25	21.9	21.9	100.0
Total	114	100.0	100.0	

Regarding age of respondents out of the total 104 respondents, 5 (4.8%) are within 20-30 years of age category, whereas 60 (57.7%) are in the range of 31-40 years of age and 34 (32.7%) are the range of 41-50 and the rest 5(4.8%) are the age greater than 50 years category. Majority of the

respondents 60 (57.7%) were in the range of 31- 40 years of age can easily understand their respective projects failure and success.

Table 4. 2: Age

Age	Frequency	Percent	Valid Percent	Cumulative Percent
20-30	5	4.8	4.8	4.8
31-40	60	57.7	57.7	62.5
41-50	34	32.7	32.7	95.2
>50	5	4.8	4.8	100.0
Total	104	100.0	100.0	

With respect to educational level, respondents who have acquired Diploma/Level, BCS Degree, MSC are 12(11.5), 47 (45.2%), 45 (43.3%) respectively. This shows that the majority of the respondents 88.5% have degree and master level of education. The academic qualification of the respondents indicating that, the respondents are well qualified to understand and respond to the factors and issues under study. In addition, there shall be a good opportunity for the project to utilize the qualification of its staff to the realization of its objectives.

Table 4. 3: Educational background of the respondents

Educational level	Frequency	Percent	Valid Percent	Cumulative Percent
Diploma/Level	12	11.5	11.5	11.5
BSC Degree	47	45.2	45.2	56.7
MSC Degree	45	43.3	43.3	100.0
Total	104	100.0	100.0	

The total respondent sectors are client, consultant, contractor and public body and 16(15.4%), 31(29.8%), 39(37.5%) and18 (17.3%) respectively.

Table 4. 4: Sectoral background of the respondents

Respondent sector

Respondent sector	Frequency	Percent	Valid Percent	umulative Percent
Client	16	15.4	15.4	15.4
Consultant	31	29.8	29.8	45.2
Contractor	39	37.5	37.5	82.7
Regulatory body	18	17.3	17.3	100.0
Total	104	100.0	100.0	

In terms of work experience of respondents 11 (10.6%) have below 5 years of experience, 23(22.1) are 11-15 years of experience, 6(5.8%) are more than 15 years. However, the majority 64 (61.5%) have a work experience more than 6 years. As a result, it can be inferred that the projects have experienced staff that easily mention the factor affecting the project performance and factor influencing the efficiency and effectiveness of the project.

Table 4. 5: Experience of the respondents

Year of experience

Year of experience		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	< 5	11	10.6	10.6	10.6
	5-10	64	61.5	61.5	72.1
	11-15	23	22.1	22.1	94.2
	>15	6	5.8	5.8	100.0
	Total	104	100.0	100.0	

The current working positions of the respondents' shows that the project manager, site engineer and office engineer, construction engineer, approval engineer, structural engineer, surveyor, construction supervisor and others are 13.5%,13.5%,14.4%,13.5%,10.6%,9.6%,5.8%,11.5% and 7.7% respectively. This shows that the sample respondents are from different occupational level can better understand the performance of projects.

Table 4. 6: The Respondent's position

Respondent's position

Professional staff	Frequency	Percent %	Valid Percent %	Cumulative Percent

Valid	project Manager	14	13.5	13.5	13.5
	site Engineer	14	13.5	13.5	26.9
	office engineer	15	14.4	14.4	41.3
	construction engineer	14	13.5	13.5	54.8
	approvals engineer	11	10.6	10.6	65.4
	structural engineer	10	9.6	9.6	75.0
	Surveyor	6	5.8	5.8	80.8
	construction supervisor	12	11.5	11.5	92.3
	Others	8	7.7	7.7	100.0
	Total	104	100.0	100.0	

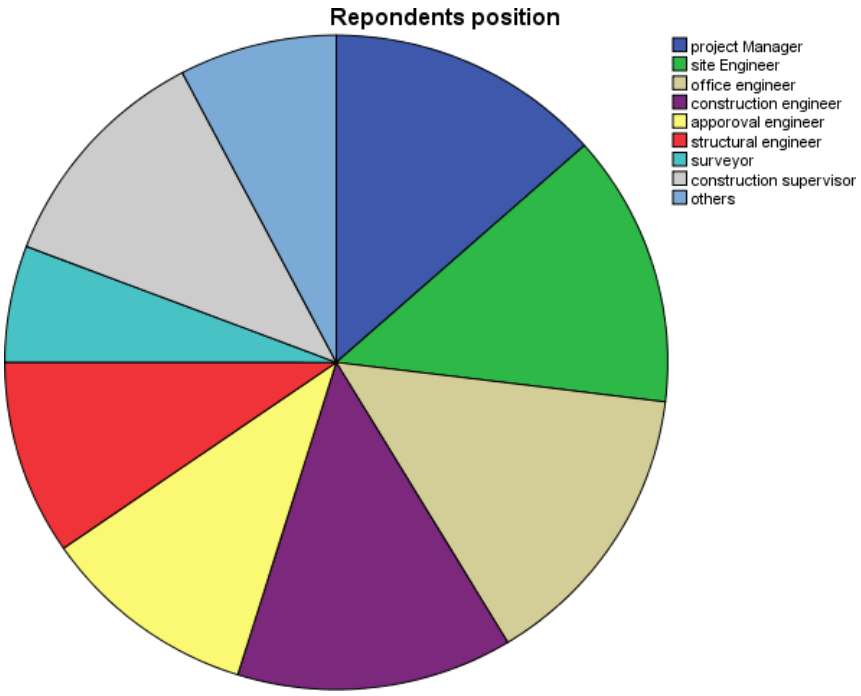


Figure 4. 1 Respondents position

4.3 Data analysis Approach

In the research questioner, it was tried to find out the critical factor influencing the efficiency and effectiveness of public construction project, factor affecting performance of public project and the current performance state of public construction project in terms time and cost factors in general. In addition to these, respondents are requested to indicate the degree of implementation (importance) and frequency of occurrence of success factors. The degree of implementation is

categorized into five scales. Before the start of the analysis, weightings have been assigned to each of the categories. For degree of its occurrence the weightings assigned are 5 for strongly Agree, 4 for Agree, 3 for Neutral, 2 for Disagree, and 1 for strongly Disagree.

4.4 The critical factor influencing the efficiency and effectiveness of public construction project

This part of the study delivers the results and analysis to meet the first objective of the thesis, which focused on the critical factor influencing the efficiency and effectiveness of public construction project. In order to achieve this objective, review of different literatures related to factors influencing public construction projects efficiency were done.

The literature review focused on the factor influencing the efficiency and effectiveness of public construction project was discussed and the results were presented in chapter two of this study. From the results identified literature review a total list of 5 different efficiency factors and 8 factors effectiveness were identified and involved in the questionnaire for further analysis. Table 4.7 below shows the identified factor influencing the efficiency and effectiveness of public construction project from the study.

Table 4. 7: The efficiency and effectiveness factors identified through literature review

No	**A. Efficiency Factor**
1	The projects are progressing within a budget and they are under the planned
2	The projects are running according to the schedule.
3	The quality of the project is as per design and specification
4	suitable work environment to the construction workforce in terms of health and safety provided
5	The construction project was positive impact to the environment
	B. Effectiveness Factor
6	The project outputs are sufficient to achieve desired objectives.
7	The projects have carried significant changes to the infrastructure development.
8	The projects are satisfactory, based on agreed strategic objectives.
9	The projects have created many job opportunities, as was defined.
10	The construction project Free from Defects as per the standard promised or expected by the client.

11	value for money improved in terms of cost reduction and higher quality thresholds, which lead to greater client satisfaction
12	The executed a project, managed through **Learning and exploitation or** through better knowledge and understanding.
13	The projects generate positive reputation by offering well defined services and delivering an expected product that fits the client's business objectives.

4.4.1 Analysis of the critical factor influencing the efficiency and effectiveness of public construction project

The efficiency and effectiveness are key features of good governance, with the public sector being responsible for finding ways to make the best use of resources (human, material, financial, etc.) to ensure the population needs coverage, in the best conditions. Efficiency refers to the relationship between the effects obtained and the efforts made for them, and the effectiveness expresses a relationship between the achieved result and the programmed one. While efficiency is in relation to quality, effectiveness is about the achievement of the ultimate result(Florina, 2017). In evaluating the performance of projects, these two performance measurement dimensions need to be considered as they are not necessarily correlated. For example, a project may well achieve its performance objectives but not necessarily achieve them efficiently, in comparison with other projects. A project may achieve its performance objectives in a relative efficient way in terms of the achievement degree and the effort consumed, but the achievement degree of its performance objectives may not be effective. As such, both performance effectiveness and performance efficiency play an important role in evaluating the overall performance of projects.(Xu & Yeh, 2011). Overall performance, construction efficiency and effectiveness were all strongly correlated with pure technical efficiency and not correlated with scale efficiency. The overall performance indicators were better correlated with the effectiveness indicators, which demonstrate the significance of enterprise management for construction industry performance.(Hu & Liu, 2018) Based on the research methodology described in chapter three, this part of the study is targeted to analyze the thirteen (13) of the identified factors to rank their importance. In this study, a list of the thirteen (13) potential factors influencing the efficiency and effectiveness of public construction project found from literatures were considered and presented to the respondents to rank and score them. The ranking of the factors were done based on rate of occurrence using relative importance index.(Sambasivan & Soon, 2007) used the RII method to determine the

relative importance of the various factors of affecting construction projects. The same method is adopted in this study. The Relative Importance Index (RII) for each potential factors of the efficiency and effectiveness of public construction project were calculated using the following formula

RII was computed as (Cheung et al., 2004b).

$$RII = \frac{\Sigma W}{AxN}$$

Equation 4. 1 Relative Importance Index (RII)

Where

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

A = the highest weight = 5;

N = the total number of respondents

Based on the ranks obtained from the analysis, the capabilities were categorized as advanced level, medium level or low level. These levels were agreed upon after having the panel discussion with the expert team at the value engineering work shop.(N et al., 2010)

Low Level (RII < 50%)

Medium Level (50% < RII < 70%)

High Level (RII > 70%)

A. Efficiency Factors

efficiency in the public sector is a problem which most governments have to face, and which is determined, mainly, by the existence of some major deficits, a bureaucracy that makes it hard to collect money to the budget and their redistribution as soon as possible, but also as a result of implementing some public programs which are based on some performance objectives (D. Mihaiu et al., 2010). Increasing efficiency in the public sector has to meet the growing and more diversified requirements of citizens, as an essential objective of public administration actions, to this end, determining the efficiency of the public sector, in different fields, making a contribution to the formulation of strategies of public funds management, aimed at the objectives fulfilment.(Florina, 2017)

Factors influencing the efficiency of public construction Project in construction projects consist of five (5) group. Table 4.8 summarizes and presents the efficiency factors and their associated RII and rank.

Table 4. 8 The Relative Importance Index (RII) and rank of efficiency factors

A. RII Value of Efficiency Factor	**RII**	**RANK**
The projects are progressing within a budget and they are under the planned	0.488	5
The projects are running according to the schedule.	0.542	2
The quality of the project is as per design and specification	0.510	4
suitable work environment to the construction workforce in terms of health and safety provided	0.513	3
The construction project was positive impact to the environment	0.546	1

According to table 4.8 above the respondents perceived the construction project are positive impact to the environment; RII=0.546, the projects are running according to the schedule; RII=0.542, suitable work environment to the construction workforce in terms of health and safety provided; RII=0.513 are the first three most critical factors that influence the efficiency of public construction project.

B. Effectiveness Factor

Effectiveness measures the extent to which the project managed to achieve its stated goals (Welde & Volden, 2018). In many cases, measuring the effectiveness of each supplier is as important as the efficiency measurement. The effectiveness addresses how much a company can meet its pre-determined goals.(Tavassoli et al., 2014)

Factors influencing the effectiveness of public construction project in construction projects the group consists of seven (7). Table 4.9 summarizes and presents the effectiveness factors and their associated RII and rank.

Table 4. 9: The Relative Importance Index (RII) and rank of effectiveness factors

B. RII Value of Effectiveness Factor	RII	RANK
The project outputs are sufficient to achieve desired objectives.	0.521	6

The projects have carried significant changes to the infrastructure development.	0.535	5
The projects are satisfactory, based on agreed strategic objectives.	0.550	2
The projects have created many job opportunities, as was defined.	0.565	1
The construction project Free from Defects as per the standard promised or expected by the client.	0.537	4
value for money improved in terms of cost reduction and higher quality thresholds, which lead to greater client satisfaction	0.548	3
The executed a project, managed through Learning and exploitation or through better knowledge and understanding.	0.496	7

According to table 4.9 above the respondents the projects have created many job opportunities, as was defined; RII=0.565, The projects are satisfactory, based on agreed strategic objectives; RII=0.55, value for money improved in terms of cost reduction and higher quality thresholds, which lead to greater client satisfaction; RII=0.548 are the first three most critical factors that influence the effectiveness of public construction project.

4.5 Factor affecting performance of public construction project.

This part of the study delivers the results and analysis to meet the second objective of the thesis, which focused on the factors affecting performance of public construction project. In order to achieve this objective, related to factors were identified from different literatures review. These factors include: project related factors, Contractual Relationship factors, Consultant Related Factors, Clients Related Factors, contractors Related Factors and Regulatory body Related Factors indicators. A total of 28 factors which affect performance of public construction project have been studied and discussed. The rank was based on relative importance index of the factors. Table 4.10 below shows the identified factor affecting performance of public construction project from the study.

Table 4. 10: factors affecting performance of public construction project identified literature review

No	Factors
	Project Related Factors
1	Complexity of project
2	Nature of project
3	Completion period given for the contract not okay
4	Type of project
5	Size of the project
	Contractual Relationship factors
6	Overall management actions
7	Communication system among project stockholders
8	Feedback capabilities between project participants
9	Control mechanism of the project activities
	Consultant Related Factors
10	Consultant not commitment to ensure construction work is done according to specification
11	Lack of cooperation to solve problems
12	Inadequacy of design and specification
13	Consultant not involved in monitoring the project progress
	Clients Related Factors
14	Delay in progress payment to Contractors
15	Clients' inability to brief the project objectives
16	Client inability to make project decision
17	the Client emphasis on quick construction instead of quality
	Contractors Related Factors
18	Insufficient supply of materials
19	Poor workmanship
20	Insufficient supply of materials
21	Quality control of materials

22	Project team leader experience
23	Technical skill of the project team leader
24	Project team leader not committed to meet cost, time and quality
	Regulatory Body Related factors
25	Delay in Approval of payment to Contractors
26	Delay in Approval design and specification
27	Regulatory body inability to make project decision and give feed back
28	Regulatory body not commitment to ensure construction work on time

4.5.1 Analysis of the Factor affecting performance of public construction project

This part of the study is targeted to analyze the twenty-eight (28) of the identified factors to rank their importance. In this study, a list of the twenty-eight (28) affecting performance of public construction project found from literatures were considered and presented to the respondents to rank and score them. The ranking of the factors were done based on rate of occurrence using relative importance index.(Sambasivan & Soon, 2007) used the RII method to determine the relative importance of the various factors of affecting performance of public construction projects. The Relative Importance Index (RII) for each potential factors Factor affecting performance of public construction project were used by using Relative Importance Index (RII) formula.

A. Project Related Factors

The group consists of five 5 factors of affecting performance of public construction projects.

Table 4.11 summarizes and presents the Project related factors and their associated RII and rank.

Table 4. 11: The Relative Importance Index (RII) and rank of Project related factors

A. RII Value of Project Related Factors	**RII**	**RANK**
Complexity of project	0.523	5
Nature of project	0.581	4
Completion period given for the contract not okay	0.687	1
Type of project	0.610	3

Size of the project	0.619	2

According to table 4.11 above the respondents perceived regarding to Project Related Factors, the Completion period given for the contract not okay; RII=0.687, the Size of the project; RII=0.542, Type of project; RII=0.610 are the first three most Project related factors that affect performance of public construction projects.

B. Contractual Relationship factors

The group consists of four 4 factors of affecting performance of public construction projects. Table 4.12 summarizes and presents the Contractual Relationship factors and their associated RII and rank.

Tabel 4. 12: The Relative Importance Index (RII) and rank of Contractual relationship factors

B. RII Value of Contractual Relationship factors	RII	RANK
Overall management actions	0.727	2
Communication system among project stockholders	0.783	1
Feedback capabilities between project participants	0.692	3
Control mechanism of the project activities	0.681	4

According to table 4.12 above the respondents perceived regarding to Contractual Relationship factors, Communication system among project stockholders; RII=0.783, Overall management actions; RII=0.727, Feedback capabilities between project participants; RII=0.692 are the first three most Contractual Relationship factors that affect performance of public construction projects.

C. Consultant Related Factors

The group consists of four (4) factors of affecting performance of public construction projects. Table 4.13 summarizes and presents the Consultant related factors and their associated RII and rank.

Table 4. 13: The Relative Importance Index (RII) and rank of Consultant Related Factors

C. RII Value of Consultant Related Factors	**RII**	**RANK**
Consultant not commitment to ensure construction work is done according to specification	0.598	3
Lack of cooperation to solve problems	0.629	2
Inadequacy of design and specification	0.669	1
Consultant not involved in monitoring the project progress	0.579	4

According to table 4.13 above, the respondents observed regarding to Consultant Related Factors, Inadequacy of design and specification: RII=0.669, Lack of cooperation to solve problems; RII=0.629, Consultant not commitment to ensure construction work is done according to specification; RII=0.598, are the first three most Consultant Related Factors that affect performance of public construction projects.

D. Clients Related Factors

The group consists of four (4) factors of affecting performance of public construction projects. Table 4.14 summarizes and presents the Clients Related Factors and their associated RII and rank.

Table 4. 14: The Relative Importance Index (RII) and rank of Client Related Factors

D. RII Value of Clients **Related Factors**	**RII**	**RANK**
Delay in progress payment to Contractors	0.690	2
Clients' inability to brief the project objectives	0.629	3
Client inability to make project decision	0.748	1
the Client emphasis on quick construction instead of quality	0.575	4

According to table 4.14 above, the respondents observed regarding to Clients Related Factors, Client inability to make project decision: RII=0.748, Delay in progress payment to Contractors; RII=0.69, Client's inability to brief the project objectives; RII=0.629, are the first three most Clients Related Factors that affect performance of public construction projects respectively.

E. Contractor Related Factors

The group consists of four (4) factors of affecting performance of public construction projects. Table 4.15 summarizes and presents the contactor related factors and their associated RII and rank.

Table 4. 15: The Relative Importance Index (RII) and rank of contractor related factors

E. RII Value of Contractor Related Factors	**RII**	**RANK**
Insufficient supply of materials	0.613	6
Poor workmanship	0.621	5
Insufficient supply of materials	0.629	4
Quality control of materials	0.583	7
Project team leader experience	0.658	3
Technical skill of the project team leader	0.665	2
Project team leader not committed to meet cost, time and quality	0.669	1

According to table 4.15 above, the respondents observed regarding to contractor related factors, Project team leader not committed to meet cost, time and quality: RII=0.669, Technical skill of the project team leader; RII=0.665, Project team leader experience; RII=0.658, are the first three most contractor related factors that affect performance of public construction projects respectively.

F. Regulatory body Related Factors

The group consists of four (4) factors of affecting performance of public construction projects. Table 4.16 summarizes and presents the regulatory body related factors and their associated RII and rank.

Table 4. 16: The Relative Importance Index (RII) and rank of regulatory body Related Factors

F. RII Value of regulatory body Related Factors	**RII**	**RANK**
Delay in Approval of payment to Contractors	0.502	4
Delay in Approval design and specification	0.546	2
Regulatory body inability to make project decision and give feed back	0.562	1
Regulatory body not commitment to ensure construction work on time	0.542	3

According to table 4.16 above, the respondents observed regarding to regulatory body related factors, Regulatory body inability to make project decision and give feedback: RII=0.562, Delay in Approval design and specification; RII=0.546, Regulatory body not commitment to ensure construction work on time; RII=0.542, are the first three most regulatory body related factors that affect performance of public construction projects respectively.

4.6. Assessing the current performance state of public construction projects in terms of time and cost in Shashemene City

(*Iyer and Jha (2005*) remarked that the factors affecting cost performance are: project manager's competence; top management support; project manager's coordinating and leadership skill; monitoring and feedback by the participants; decision making; coordination among project participants; owners' competence; social condition, economical condition and climatic condition. Coordination among project participants was identified as the most significant of all the factors having maximum influence on cost performance of projects. (*Chan and Kumaraswamy (2002)*) proposed specific technological and managerial strategies to increase speed of construction and so to upgrade the construction time performance. Since most of the current performance indicators have been product and outcome focused, there is a skeptical attitude towards key performance indicators. However, in recent years, performance indicators related to processes have started to emerge. These indicators include: time ,cost, waste, safety and quality process improvement, Habanova and Al-Jibouri (2009) .

Time and cost performance is the fundamental criteria for success of any project. Unfortunately construction industry in Malaysia has been regarded as industry facing poor performance leading to failure in achieving effective time and cost performance. As a consequence most of the projects face huge amount of time and cost overrun.(Rahman et al., 2012)

This study assessed current performance state of public construction projects in shashemene city in terms of time and cost parameters. To assess time performance of project, scheduled duration and actual duration of project were used. There are also two common elements to evaluate cost performance of project. These are budgeted cost and actual cost of project and each project cost and time deviations were identified.

Performance can be measured by both variance and performance index. Performances indicate whether the project is under or over the budgeted cost and time but it doesn’t show the extent of deviation. In most cases it is used to check whether the project is ahead or behind the schedule at

some point in a time. But cost or time variance shows the magnitude of variation between the budgeted and actual cost and duration of project in terms of birr and days.

4.6.1. Project Cost performance

Construction cost performance is one of the major criteria by which success of public projects are measured. However, numerous factors were reported by researchers to be responsible for extreme poor cost performance, among which is inaccurate cost estimate and cost overrun. Numerous factors as reported by many researchers were responsible for cost overrun which basically result to poor cost performance of building construction projects. Shehu, Endut, Akintoye, and Holt (2014) stated that cost overrun is the negative cost variance such that final project cost exceeds contract sum

According to (Rahman et al., 2012) In terms of cost performance only 11% of respondents mentioned that normally their projects are finished within the budgeted cost while 89% of respondents agreed that their projects were facing the problem of cost overrun with average overrun at 5-10% of contract price. The major contributors of this poor performance include design and documentation issues, financial resource management and project management and contract administration issues.

In this research the result of analysis shows most of the projects are facing the problem of cost problem of cost overrun varies project to project.in survey of cost overrun it was notably found that only 21.2 % of respondents mentioned that normally their projects are finished within the budgeted cost while 78.8% of respondents agreed that mostly the projects are overrun compared to budgeted cost. The results of cost overrun are presented in figure 4.2

Figure 4.2 shows that majority of respondent (39 of 104) mentioned that normal range of cost overrun is 1-15% followed agreed by 26 (25%) respondents. This shows that cost overrun is common phenomenon in construction industry. However, the amount of this overrun varies from project to project. This lead to need of serious attention to be paid on cost control.

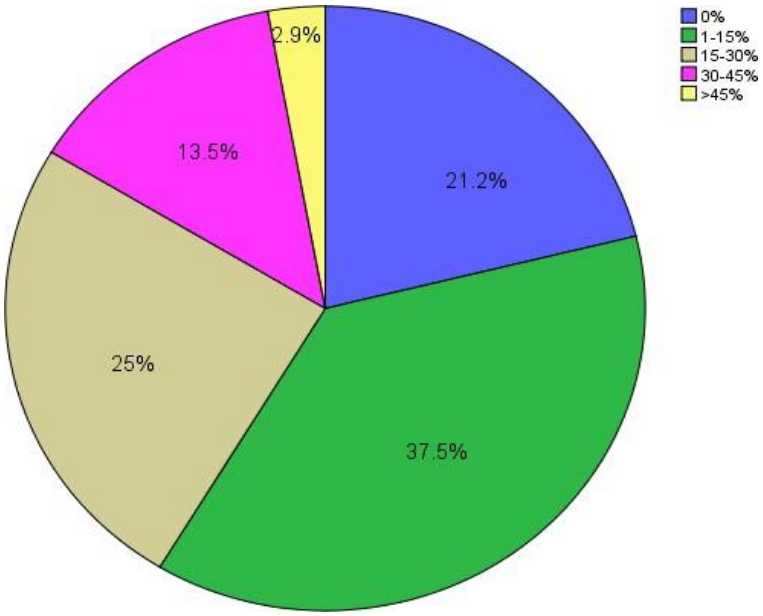


Figure 4. 2 Cost performance of Shashemene City Public project

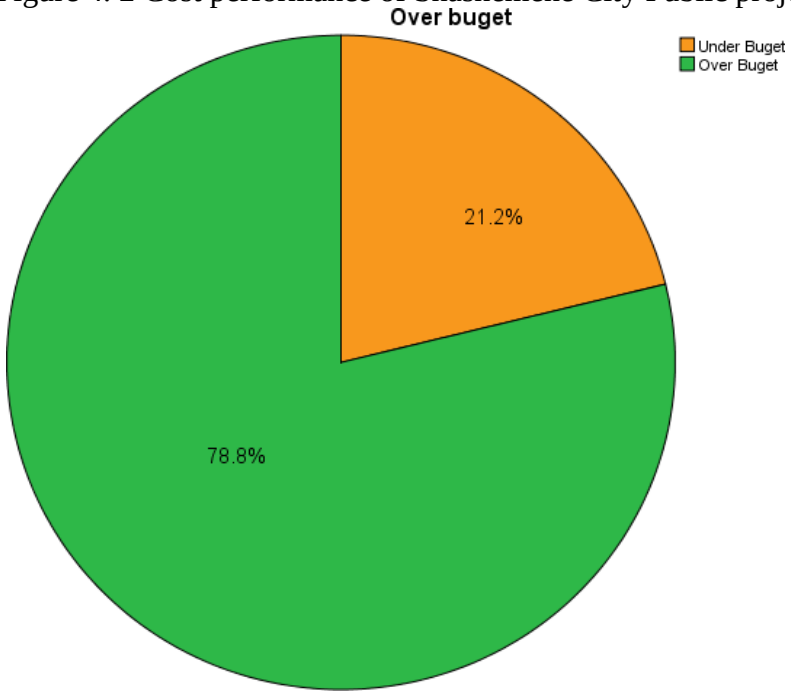


Figure 4. 3 Total percentage of cost Over budget and Under budget of shashemene City Public project

Table 4. 17: The performance state of public construction projects in terms of cost overrun

Percentage of cost overrun		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0%	22	21.2	21.2	21.2
	1-15%	39	37.5	37.5	58.7
	15-30%	26	25.0	25.0	83.7
	30-45%	14	13.5	13.5	97.1
	>45%	3	2.9	2.9	100.0
	Total	104	100.0	100.0	

The Above table indicates the general cost performance of public construction projects in shashemene city. 21.2 % of projects were completed under budget and the remaining 78.8% project were completedwith more than planned budget.

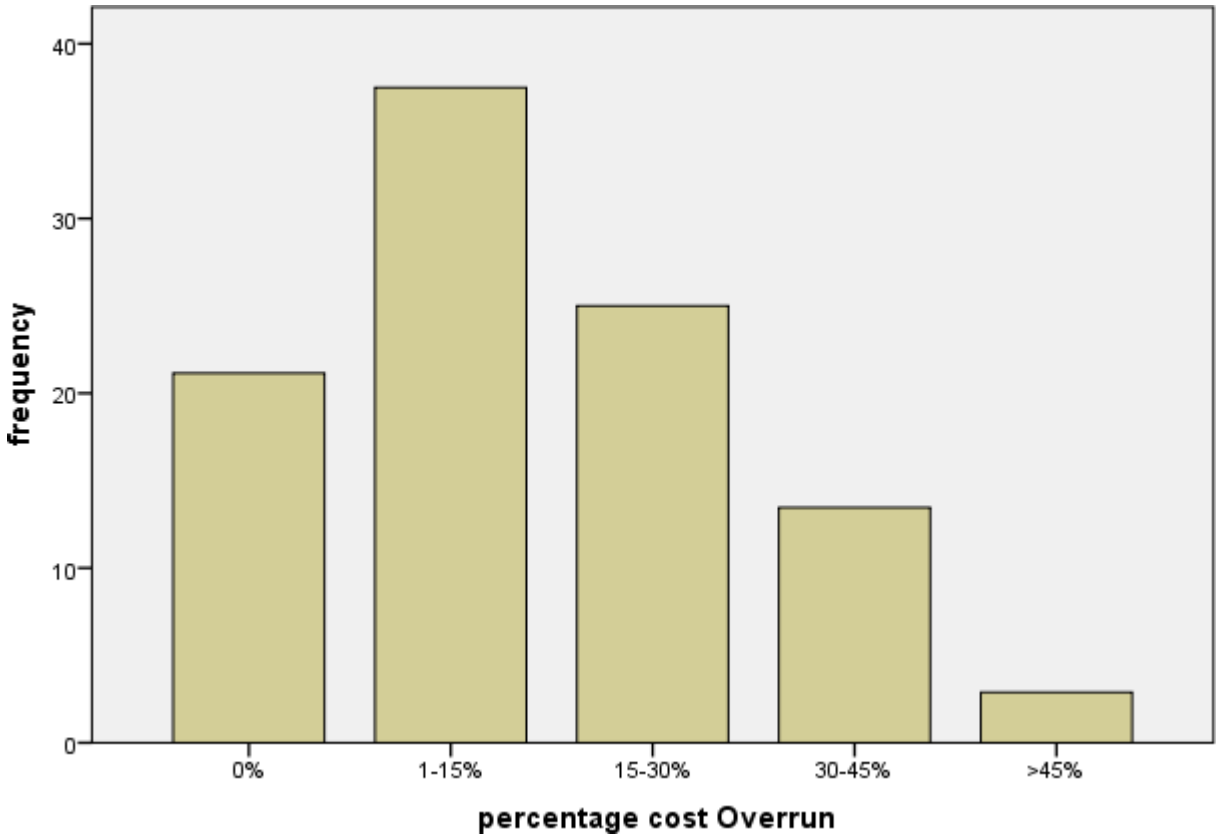


Figure 4. 4 Total percentage of cost over budget and Under budget of shashemene City Public project

The research result of(Ahsan & Gunawan, 2010) exhibited that all projects under the research were under budget. International construction projects in Bangladesh, China, India and Thailand were performed under budget with percentage of 8.44%, 5.41%, 26.14% and 24.95% consecutively. The result of the study conducted by Ahsan and Gunawan (2010) showed all projects were completed under budget whereas the result of this research showed 26 Projects (74.3%) are under budget.

A comparative study conducted by (*Akinsiku and Iyagba 2014)*) exhibited in both Malaysia and Nigeria projects were cost overrun. Cost overrun in Malaysia ranges from 11 to 31 percent whereas in Nigeria it ranges from 3 to 47 percent. (*Auma 2014*)) Also indicated with his research construction projects in Kenya are also have the same trends. 50% percent of projects are facing problem of cost overrun with more than 20%.

4.6.2. Project Time performance

According to (Rahman et al., 2012) the construction project time performance shows 92% of construction projects were time overrun and only 8% of project could achieve completion within contract duration. The amount of time overrun was in between 5-10% as agreed by respondents.

In this research the respondents were asked about the performance of construction projects in terms of extent of time overrun measuring the approximate % age of time overrun for the projects they were involved in past five years. The results are summarized in table II.

Table 4. 18 The performance state of public construction projects in terms of cost overrun

Percentage of cost overrun		Frequency	Percent (100%)	Valid Percent	Cumulative Percent
Valid	0%	16	15.4	15.4	15.4
	1-15%	11	10.6	10.6	26.0
	15-30%	27	26.0	26.0	51.9
	30-45%	37	35.6	35.6	87.5
	>45%	13	12.5	12.5	100.0
	Total	104	100.0	100.0	

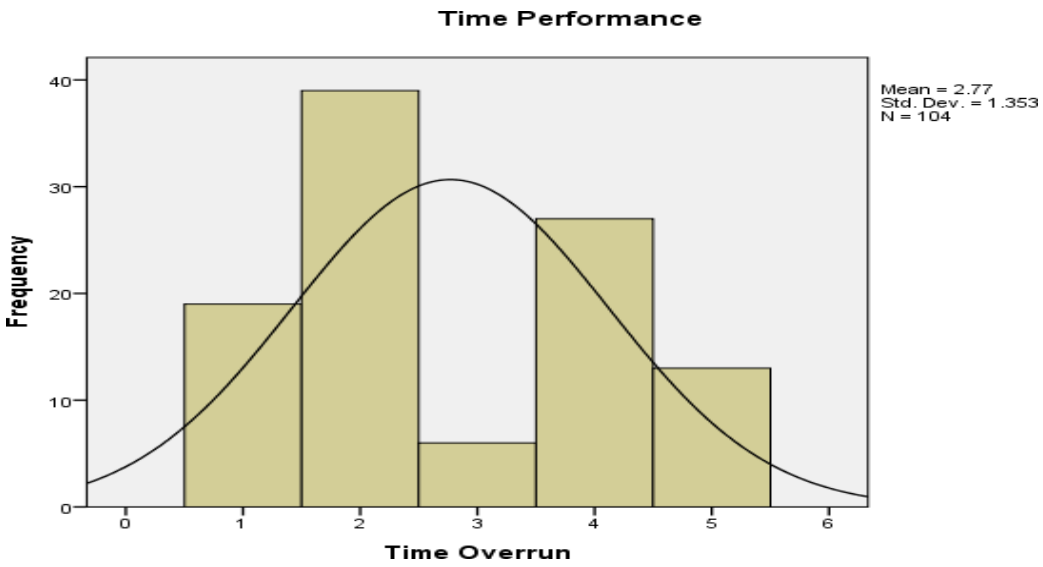


Figure 4. 5 Time performance of shashemene City Public project

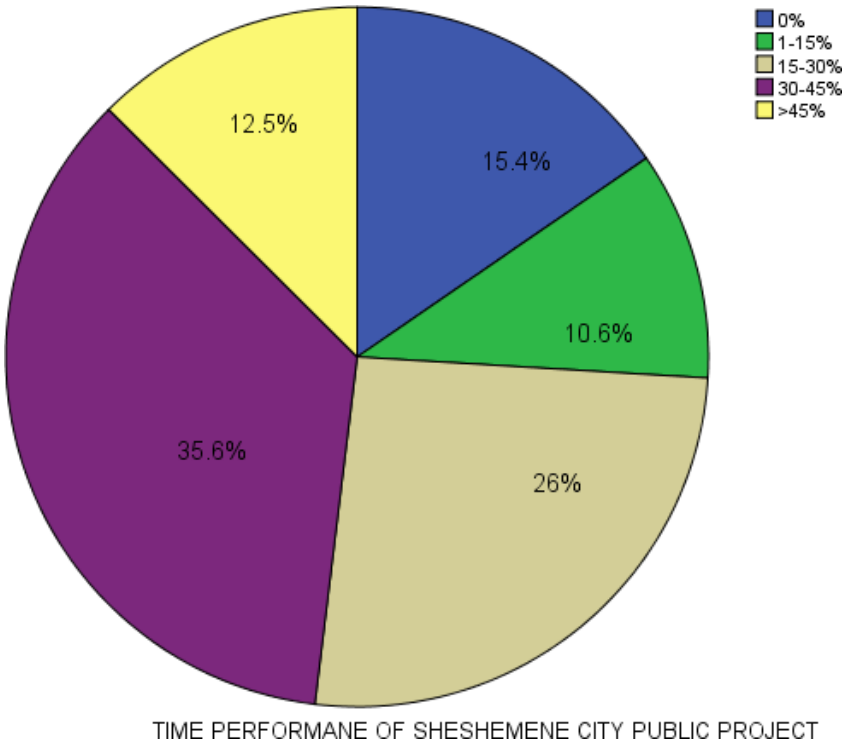


Figure 4. 6 Time performance of shashemene City Public project

4.7 Developing Conceptual frameworks for performance measurement of public construction project

Performance in the construction project context and the need for its measurement are examined in this review of literature. It is shown that despite the inherent benefits of performance measurement in helping identify unnecessary causes of waste so that remedial actions can be taken, performance measurement is not extensively implemented because of the inadequacy of measures, complexity of measurement, time consuming and costly nature of performance measurement, and project-oriented nature of the industry. Where performance measurement is implemented, various frameworks are available, some targeting project performance whilst others focus on overall business performance.(Ankrah & Proverbs, 2005) The criteria for these various frameworks are contrasted and assessed in terms of their suitability for on-going research into the impact of organizational culture on construction project performance. Following this assessment, the key requirements of suitable performance measures and measurement frameworks are identified as including, having a few but relevant measures, being linked with critical project objectives,

providing accurate information, and comprising financial and non-financial measures.

4.7.1 The performance measurement process conceptual framework

The previous sections of the paper have identified the various elements that one needs to consider when developing a performance management/measurement framework. This was achieved by looking at an appropriate framework such as the balanced scorecard and by identifying a number of limitations in its implementation. Furthermore, the state of performance measurement in the construction industry has been identified briefly. This section introduces the performance measurement process conceptual framework (PMPF). The main aim of the framework presented is to present a holistic performance management/measurement process framework, developed from the concept show, in that it satisfies the need to represent the input, process and output.

The theoretical framework of the performance evaluation of construction projects based on six key performance indicators (KPIs) namely time, cost, quality, safety, minimum site disputes and environmental impact. These KPIs were identified through literature review and discussions with project management professionals. For evaluating the performance on the above KPIs, several characteristic features pertaining to the project, project environment and the stakeholders associated with the project have been identified through an extensive literature review (Ngacho & Das, 2015). These characteristic features, termed as critical success factors (CSFs), have been

suitably classified under six broad heads based on their commonalities and unique features. The six CSFs are named as project-related, client-related, consultant-related, contractor-related, contractual related and regulatory body-related factors.

4.7.2 Performance measurement framework

Performance measurement in the public sector, namely in public using performance evaluation systems is a step in public administration reform that brings innovativeness, objectivity and transparency of these structures. (Leoveanu, 2016)The idea of performance in public administration involves a high level of service provided by it, namely their continuous improvement in terms of effectiveness and efficiency, and satisfaction and expectations of citizens. Design assumptions and constrains: - Before the design stage, having applied literature study and desk research, the following assumptions and constrains related to elaborated framework were made by (Ankrah & Proverbs, 2005)

- Operational activities of Project-Based Organizations differ from other entities, therefore to increase their effectiveness and efficiency performance system should be developed; -
- Project-Based Organizations aims at improving the project maturity level that includes assessment of project and its context at program, portfolio and mother organization levels;
- Project performance measurement should consider various types of inputs and outputs occurring on each level;
- Set of performance measurement should encompass of financial and non-financial indicators; the presented approach follows the concepts of organization sustainable development which is promoted in the market;
- Measurement process should consider monitoring and control of direct inputs and outputs related to project and indirect inputs and outputs occurring on program, portfolio or permanent organizational levels.

4.8.3 Conceptual framework for public Construction Project Performance

Performance t frameworks have been proposed where project success is divided into dimensions, and where project success is considered during the different stages of a project as well as from various perspectives (Chan; 2004)

Through reviewing the knowledge, methods, frameworks, measurement systems and indicators, a hierarchical frame work for public construction performance measurement was structured. The framework may fill the gap in knowledge and practice for accurately and flexibly measuring

construction project performance. After critically reviewing and discussing the project success, project performance and project measurement indicators efficiency and effectiveness, the Conceptual framework was adopted in this research. The Conceptual framework for public Construction project performance measurement and public construction performance evaluation system was developed as following.

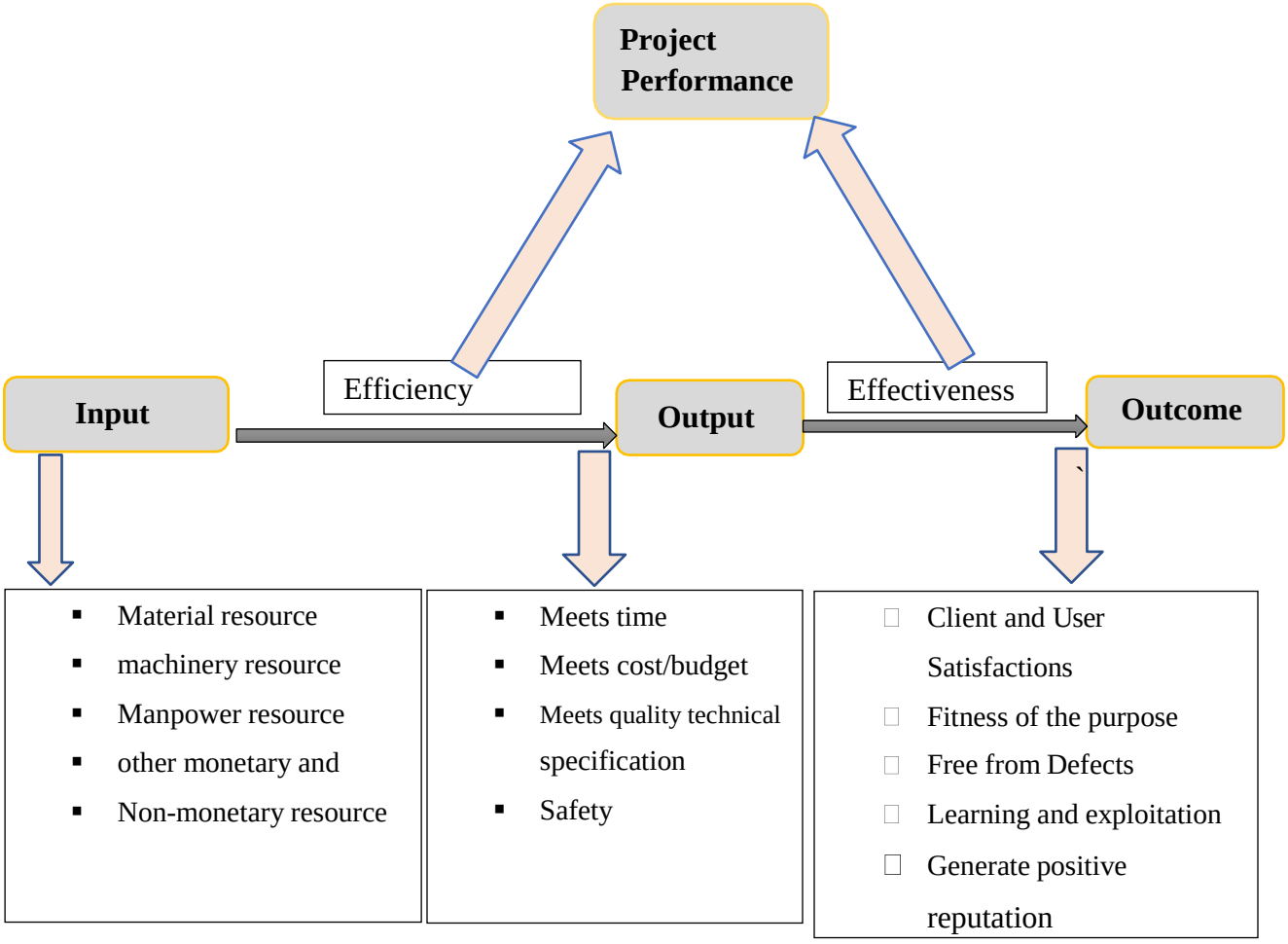


Figure 4. 7 Conceptual frameworks for performance measurement of public construction project

CHAPTER FIVE

5. Conclusion and Recommendation

This section forwards the conclusions of the research based on the major findings stated in the previous chapter data analysis and discussion. Brief conclusions are summarized to the findings and finally helpful recommendation for the research problems will also be forwarded.

5.1. Conclusion

This study is focused on evaluation of performance efficiency and effectiveness of public constructions projects in Shashemene City. Based on the results of the analysis of respondents' responses the following conclusions are drawn.

- The first objective was to measure the critical factor influencing efficiency and effectiveness of public constructions projects in Shashemene City. In this study, a list of the thirteen (13) potential factors influencing the efficiency and effectiveness of public construction project found from literatures were considered and presented to the respondents to rank and score them. The ranking of the factors were done based on rate of occurrence using relative importance index.(Sambasivan & Soon, 2007) used the RII method to determine the relative importance of the various factors of affecting construction projects. The same method is adopted in this study. From the results identified in literature review a total list of 5 different efficiency factors and 8 factors effectiveness were identified and involved in the questionnaire for further analysis. According to the respondents responses the construction project are positive impact to the environment; RII=0.546, the projects are running according to the schedule; RII=0.542, suitable work environment to the construction workforce in terms of health and safety provided; RII=0.513 are the first three most critical factors that influence the efficiency of public construction project and whereas the projects have created many job opportunities, as was defined; RII=0.565, The projects are satisfactory based on agreed strategic objectives; RII=0.55, value for money improved in terms of cost reduction and higher quality thresholds, which lead to greater client satisfaction; RII=0.548 are the first three most critical factors that influence the effectiveness of public construction project.
- The second specific objective was to identify the factor affecting performance of public construction project in the shashemene. To identify the factor affecting performance of public

construction project, a questionnaire survey containing 28 factors which affect performance of public construction project were identified from literatures and ranked by respondents based on the relative importance index value of frequency of occurrence. These factors include: project related factors, Contractual Relationship factors, Consultant Related Factors, Clients Related Factors, contractors Related Factors and Regulatory body Related Factors indicators. A total of 28 factors which affect performance of public construction project in shashemene city have been studied and discussed. The result showed that Contractual Relationship factors, Clients Related Factors and project related factors RII=0.783, R=0.748 and R=0.687 affect performance of public construction project respectively.

- The third specific objective was to assess the current performance state of public construction projects in terms of time and cost in Shashemene City. Performance can be measured by both variance and performance index. Performances indicate whether the project is under or over the budgeted cost and time. In most cases it is used to check whether the project is ahead or behind the schedule at some point in a time. Most of the public projects are facing the problem of cost overrun varies project to project.in survey of cost overrun it was notably found that only 21.2 % of respondents mentioned that normally their projects are finished within the budgeted cost while 78.8% of respondents agreed that mostly the projects are overrun compared to budgeted cost. The majority of respondent (39 of 104) mentioned that normal range of cost overrun is 1-15% followed agreed by 26 (25%) respondents. This shows that cost overrun is common phenomenon in construction industry. This lead to need of serious attention to be paid on cost control.
- Project time performance indicates that the Respondents were asked about the time performance of public construction projects to assess the **%age** of time overruns for the projects they were involved in past five years. The result shows that majority of the public projects are facing the problem of time overrun which are varies from project to project and only 15.4 % of respondents mentioned that normally the projects finished within the schedule while 84.8% of respondents agreed that mostly the projects are time overrun.
- The last specific objective was to develop a framework for performance measurement of public construction project in shashemene town. The main aim of the framework presented is to present a holistic performance management/measurement process framework, developed from the concept show, in that it satisfies the need to represent the input, process and output.

Through reviewing the knowledge, methods, frameworks, measurement systems and indicators, a hierarchical frame for construction performance measurement is structured. After that, every indicator framework for performance measurement of public construction project is measured and normalized to further develop an integrated construction project performance framework. It fills the gap in knowledge and practice for accurately, flexibly, dynamically measuring construction project performance. After critically reviewing and discussing the project performance methods, frameworks, systems, measurement indicators adopted in this research, the conceptual frame for construction project performance measurement are developed.

5.2 Recommendation

Based on the findings of the research, the following suggestions are recommendations to improve the performance efficiency and effectiveness of public constructions projects in Shashemene City.

- Regulatory body of the construction industry is the most top responsible government representative for development of construction industry. Accountable for preparation, improvement and follow up of declarations, policies, manual and overall performance by approving the effectiveness and efficiency of the overall construction environment for the success of public projects. It is recommended to have proper and continuous training programs about construction projects efficiency to improve performance of public construction projects. In addition, it is preferred to develop capacity building programs for professionals and for firms on the construction industry in the areas of managerial skills, construction project management techniques and processes in order to improve efficiency of construction projects
- It is recommended that the client should facilitate timely payment to contractors in order to overcome delay, disputes and claims. All managerial levels should be participated with sensitive and important decision-making. Continuous coordination and relationship between project participants are required through project life cycle in order to solve problems and develop project efficiency and effectiveness.
- Client should develop well defined scope of the project before the design work is commenced. Scope affects the budget to be allocated and consequently the design work of a project. Good scope definition reduces the amount of variation that will occur during construction stage. It is vital for completion of projects with in the scheduled and on budget enabling the client to allocate sufficient budget and to determine project duration.

- Consultant who prepares design of projects and bill of quantities should avoid inflation of quantities to minimize variation of work. In addition, Consultants are recommended to check on the master plan and provide quick orders delivered to contractors to obtain time efficient and to minimize disputes and claims.
- Contractor should develop well studied organizational structures that enhance its' efficiency and effectiveness to manage the overall activities of the project. Contractors are recommended to use planned time through project implementation in order to improve time efficiency. They should minimize average delay in claiming to overcome disputes, time and cost efficiency problems. Contractors are also recommended to be more interested with sequencing of work according to schedule. Contractors are recommended to have specific strategies for minimizing wastage of material with proper handling and management of materials on construction sites. Contractors should consider business environment risk in their cost estimation in order to overcome delay because of cash flow of project. There should be adequate contingency allowance in order to cover increase in material and equipment cost. Proper motivation systems and training should be established for improvement skill and labor performance of public construction projects in the in shashemene city.

Further study should be conducted to cover private sector of construction project in order to improve the performance efficiency and effectiveness of private construction projects in shashemene city.

Reference

Adam, A. (2020). Sample Size Determination in Survey Research. *Journal of Scientific Research and Reports*, *26*, 90–97.

Ahsan, K., & Gunawan, I. (2010). Analysis of cost and schedule performance of international development projects. *International Journal of Project Management*, *28*(1), 68–78. https://doi.org/10.1016/j.ijproman.2009.03.005

Akinsiku and Iyagba (2014). (n.d.). Bing. Retrieved January 18, 2024, from https://www.bing.com/search?q=Akinsiku+and+Iyagba+%282014%29&qs=ds&form=QBRE

Ankrah, N. A., & Proverbs, D. (2005). *A FRAMEWORK FOR MEASURING CONSTRUCTION PROJECT PERFORMANCE: OVERCOMING KEY CHALLENGES OF PERFORMANCE MEASUREMENT*.

Asmild, M., Paradi, J. C., Reese, D. N., & Tam, F. (2007). Measuring overall efficiency and effectiveness using DEA. *European Journal of Operational Research*, *178*(1), 305–321. https://doi.org/10.1016/j.ejor.2006.01.014

Auma (2014. (n.d.). Bing. Retrieved January 18, 2024,

Baurina, S. B., Savchenko, E. O., & Nazarova, E. V. (2020). Methodology of Evaluation the Efficiency of Road Operation and Construction. *IOP Conference Series: Materials Science and Engineering*, *753*(5), 052071.

Bhandari, P. (2021, October 18). *Ethical Considerations in Research | Types & Examples*. Scribbr.

Chan, A. P. C., & Chan, A. P. L. (2004). Key performance indicators for measuring construction success. *Benchmarking: An International Journal*, *11*(2), 203–221. https://doi.org/10.1108/14635770410532624

Chan andKumaraswamy (2002). (n.d.). Bing. Retrieved February 16, 2024, from https://www.bing.com/search?q=Chan+andKumaraswamy+%282002%29+&qs=n&form=QBRE&sp=-

Cheung, S. O., Suen, H. C. H., & Cheung, K. K. W. (2004a). PPMS: A Web-based construction Project Performance Monitoring System. *Automation in Construction*, *13*(3), 361–376.

Cheung, S. O., Suen, H. C. H., & Cheung, K. K. W. (2004b). PPMS: A Web-based construction Project Performance Monitoring System. *Automation in Construction*, *13*(3), 361–376. https://doi.org/10.1016/j.autcon.2003.12.001

Chiou, Y.-C., Lan, L. W., & Yen, B. T. H. (2010). A joint measurement of efficiency and effectiveness for non-storable commodities: Integrated data envelopment analysis approaches. *European Journal of Operational Research*, *201*(2), 477–489. https://doi.org/10.1016/j.ejor.2009.03.005

Collins, M. (2002). *Discriminative Training Methods for Hidden Markov Models: Theory and Experiments with Perceptron Algorithms*. 1–8. https://doi.org/10.3115/1118693.1118694

Cooke-Davies, T. (2002). The "real" success factors on projects. *International Journal of Project Management*, *20*(3), 185–190.

Crawford, P., & Bryce, P. (2003). Project monitoring and evaluation: A method for enhancing the efficiency and effectiveness of aid project implementation. *International Journal of Project Management*, *21*(5), 363–373.

Deneke, T. (2020). *Addis Ababa University School of Commerce*.

Deng, F., Smyth, H. J., & Anvuur, A. M. (2012). *A critical review of PMS in construction: Towards a research agenda* [Proceedings paper]. In: Smith, SD, (Ed.) Proceedings of the 28th ARCOM Conference, Edingburgh, September 2012. (Pp. 807 - 816). Association of Researchers in Construction Management: Reading, UK. (2012); Association of Researchers in Construction Management. http://www.arcom.ac.uk/res-publications.php

Drucker, P. F. (1995). *People and Performance: The Best of Peter Drucker on Management*. Routledge.

Florina, P. (2017). *Elements on the Efficiency and Effectiveness of the Public Sector*. *2*.

Gadisa, A., & Zhou, H. (2019, January 1). *A Study on Critical Factors Affecting Public Infrastructures Project Performance in Ethiopia*. https://doi.org/10.2991/aemh-19.2019.41

Grünberg, T. (2004). Performance improvement: Towards a method for finding and prioritising potential performance improvement areas in manufacturing operations. *International Journal of Productivity and Performance Management*, *53*(1), 52–71. https://doi.org/10.1108/17410400410509969

Gudeta, E. D. (2020). *THE CONTRIBUTION OF CONSTRUCTION INDUSTRY TO THE ECONOMIC GROWTH OF ETHIOPIA*.

Hookana, H. (2011a). Measurement of Effectiveness, Efficiency and Quality in Public Sector Services: Interventionist Empirical Investigations. *MIC 2011: Managing Sustainability? Proceedings of the 12th International Conference, Portorož, 23–26 November 2011 [Selected Papers]*, 491–510.

Hookana, H. (2011b). Measurement of Effectiveness, Efficiency and Quality in Public Sector Services: Interventionist Empirical Investigations. *MIC 2011: Managing Sustainability? Proceedings of the 12th International Conference, Portorož, 23–26 November 2011 [Selected Papers]*, 491–510.

Hu, X., & Liu, C. (2018). Measuring efficiency, effectiveness and overall performance in the Chinese construction industry. *Engineering, Construction and Architectural Management*, *25*, 780–797.

Ika, L. A. (2012). Project Management for Development in Africa: Why Projects are Failing and What Can be Done about It. *Project Management Journal*, *43*(4), 27.

Iyer and Jha (2005. (n.d.). Bing. Retrieved February 16, 2024, from

Kaplan and Norton—2001—Transforming the Balanced Scorecard from Performan.pdf. (n.d.). Retrieved July 15, 2023

Kylili, A., Fokaides, P. A., & Lopez Jimenez, P. A. (2016). Key Performance Indicators (KPIs) approach in buildings renovation for the sustainability of the built environment: A review. *Renewable and Sustainable Energy Reviews*, *56*, 906–915.

Leong, T. K., Zakuan, N., Mat Saman, M. Z., Ariff, M. S. M., & Tan, C. S. (2014a). Using Project Performance to Measure Effectiveness of Quality Management System Maintenance and Practices in Construction Industry. *The Scientific World Journal*, *2014*, e591361. https://doi.org/10.1155/2014/591361

Leong, T. K., Zakuan, N., Mat Saman, M. Z., Ariff, Mohd. S. Md., & Tan, C. S. (2014b). Using Project Performance to Measure Effectiveness of Quality Management System Maintenance and Practices in Construction Industry. *The Scientific World Journal*, *2014*, 1–9.

Leoveanu, A. (2016). *PERFORMANCE EVALUATION SYSTEMS IN THE PUBLIC SECTOR*.

Mbugua, L. M., Harris, P., Holt, G. D., & Olomolaiye, P. O. (1999). *A FRAMEWORK FOR DETERMINING CRITICAL SUCCESS FACTORS INFLUENCING CONSTRUCTION BUSINESS PERFORMANCE*.

Mihaiu, D. M., Opreana, A., & Cristescu, M. P. (2018). 10. EFFICIENCY, EFFECTIVENESS AND PERFORMANCE OF THE PUBLIC SECTOR. *Romanian Journal of Economic Forecasting*.

Mihaiu, D., Opreana, A., & Cristescu, M. (2010). Efficiency, Effectiveness and Performance of the Public Sector. *Journal for Economic Forecasting*, *13*, 132–147.

Mohamed, S. (1996). Benchmarking and improving construction productivity. *Benchmarking for Quality Management & Technology*, *3*(3), 50–58. https://doi.org/10.1108/14635779610149151

N, E., V, S., L, C., & K, F. (2010). *Impacts of climate change on water resources and agriculture in Sri Lanka: A review and preliminary vulnerability mapping.* IWMI.

Ngacho, C., & Das, D. (2015a). A performance evaluation framework of construction projects: Insights from literature. *International Journal of Project Organisation and Management*, *7*(2), 151.

Ngacho, C., & Das, D. (2015b). A performance evaluation framework of construction projects: Insights from literature. *International Journal of Project Organisation and Management*, *7*(2), 151.

Pekuri, A., Haapasalo, H., & Herrala, M. (2011). Productivity and performance management—Managerial practices in the construction industry. *International Journal of Performance Measurement*, *1*, 39–58.

Profiroiu, A., & Profiroiu, M. (2007). Cadrul de analiză a performanţelor sectorului public. *Economie Teoretica Şi Aplicată*, *1*(506), 41–50.

Rahman, I. A., Memon, A. H., Nagapan, S., Latif, Q. B. A. I., & Azis, A. A. A. (2012). Time and cost performance of costruction projects in southern and cenrtal regions of penisular Malaysia. *2012 IEEE Colloquium on Humanities, Science and Engineering (CHUSER)*, 52–57. https://doi.org/10.1109/CHUSER.2012.6504280

Saleh, K. A. (2009). *Software Engineering*. J. Ross Publishing.

Sambasivan, M., & Soon, Y. W. (2007). Causes and effects of delays in Malaysian construction industry. *International Journal of Project Management*, *25*(5), 517–526. https://doi.org/10.1016/j.ijproman.2006.11.007

Samset, K., & Christensen, T. (2017). Ex Ante Project Evaluation and the Complexity of Early Decision-Making. *Public Organization Review*, *17*(1), 1–17. https://doi.org/10.1007/s11115-015-0326-y

Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students*. Pearson education.

Sundqvist, E., Backlund, F., & Chronéer, D. (2014). What is Project Efficiency and Effectiveness? *Procedia - Social and Behavioral Sciences*, *119*, 278–287. https://doi.org/10.1016/j.sbspro.2014.03.032

Tabish, S. Z. S., & Jha, K. N. (2011). Identification and evaluation of success factors for public construction projects. *Construction Management and Economics*, *29*(8), 809–823. https://doi.org/10.1080/01446193.2011.611152

Takim, R., & Adnan, H. (2009). Analysis of Effectiveness Measures of Construction Project Success in Malaysia. *Asian Social Science*, *4*(7), p74. https://doi.org/10.5539/ass.v4n7p74

Takim, R., Akintoye, A., & Kelly, J. (2003). Performance measurement systems in construction. *19th Annual ARCOM Conference*, *1*, 423–432.

Tavassoli, M., Faramarzi, G. R., & Saen, R. F. (2014). A joint measurement of efficiency and effectiveness for the best supplier selection using integrated data envelopment analysis approach. *International Journal of Mathematics in Operational Research*, *6*(1), 70. https://doi.org/10.1504/IJMOR.2014.057861

Tsolas, I. E. (2011). Modelling profitability and effectiveness of Greek-listed construction firms: An integrated DEA and ratio analysis. *Construction Management and Economics*, *29*(8), 795–807.

Upton, N., Teal, E. J., & Felan, J. T. (2001). Strategic and Business Planning Practices of Fast Growth Family Firms. *Journal of Small Business Management*, *39*(1), 60–72. https://doi.org/10.1111/0447-2778.00006

Von Wangenheim, C. G., Silva, D. A. D., Buglione, L., Scheidt, R., & Prikladnicki, R. (2010). Best practice fusion of CMMI-DEV v1.2 (PP, PMC, SAM) and PMBOK 2008. *Information and Software Technology*, *52*(7), 749–757.

Wedajo, D., & Serbeh-Yiadom, K. C. (2014). *Development Project Management: Experiences of Urban Local Governments in Oromia-Ethiopia*.

Welde, M., & Volden, G. (2018a). Measuring efficiency and effectiveness through ex-post evaluation: Case studies of Norwegian transport projects. *Research in Transportation Business and Management*, *28*.

Welde, M., & Volden, G. (2018b). Measuring efficiency and effectiveness through ex-post evaluation: Case studies of Norwegian transport projects. *Research in Transportation Business and Management*, *28*.

World Trade Summary 1995 | WITS | Text. (1995).

Wubetu, L. T. (2016). *Jimma University Jimma Institute of Technology School of Civil and Environmental Engineering Construction Engineering and Management Chair*.

Xiahou, X., Tang, Y., Yuan, J., Chang, T., Liu, P., & Li, Q. (2018). Evaluating Social Performance of Construction Projects: An Empirical Study. *Sustainability*, *10*(7), Article 7. https://doi.org/10.3390/su10072329

Xu, Y., & Yeh, C.-H. (2011). Evaluating the performance effectiveness and efficiency of projects. *2011 6th IEEE Conference on Industrial Electronics and Applications*, 1090–1094.

Yada, A. L., & Yadeta, F. T. (2016). Factors Affecting the Performance of Construction Project under Oromia Industry and Urban Development Bureau, Ethiopia. *ABC Research Alert*.

Yohannes, A. (2017). *Performance Assessment of Public Building Construction Projects in Addis Ababa* [Thesis, Addis Ababa University]. http://etd.aau.edu.et/handle/123456789/5290

Appendix A Questionnaire

RESEARCH QUESTIONNAIRE

Dear Respondents

My name is Jemal Burka Jeldo. I am a postgraduate student at Adama Science and Technology University; Department of Civil Engineering with a Master of Science Degree in Civil Engineering (Specialization in Construction Engineering and Management). I am conducting research on the title **"Evaluation of performance Efficiency and Effectiveness of Public Constructions Projects in Case of Shashemene City**". The purpose of this study is to evaluate efficiency and effectiveness of public construction project in the Shashemene City. The information you provide is used for research purpose only, and will be kept confidential at all levels. Considering your experience in project works, your participation in this survey will significantly contribute to the accuracy and usefulness of the research outcome. I appreciate taking your time to complete the survey. I kindly request you to remember that the quality of this work is completely dependent up on your frank opinions. Please consider each statement carefully before you give it an evaluation. If you have any question, please do not hesitate to contact me. I am available at your convenience through Tel. +251911411276

Please DO NOT write your name on this questionnaire paper. Your participation is entirely voluntarily.

SECTION 1: GENERAL INFORMATION ABOUT THE RESPONDENTS

1.1 Demographic Characteristics of Respondents (Tick only one box that you select)

1. What is your gender?

   Male ☐ Female ☐

2. Age group

   Below 20 ☐ 20-30 ☐ 31-40 ☐ 41-50 ☐ above 60 years ☐

3. What is your Educational Level?

   Certificate ☐ Diploma/Level ☐ BSc. Degree ☐ MSc. Degree ☐ PHD ☐

4. Which of the following describes your company? description Tick only one box

   4.1 Contractor ☐ 4.3 Client ☐

   4.2 Consultant ☐ 4.4 Regulatory Body ☐

5. How many years of Experience do you have?

Below 5 years ☐ 5-10 years ☐ 11-15 years ☐ above 15 years ☐

6. What is your current position in your organization?

Project Manager ☐ design Approval Engineer ☐ Office Engineer ☐

Construction Engineer ☐ Structural Engineer ☐ Surveyor ☐

Construction Supervisor ☐ General Forman ☐ Hydrologist ☐ others ☐

SECTION 2: To measure the critical factor influencing efficiency and effectiveness of public constructions projects in Shashemene City.

The following are list of factors that influences the efficiency and effectiveness of public constructions projects in Shashemene City. From your experience, please express your opinion on the importance of the following factors that influence efficiency and effectiveness of public constructions projects in Shashemene City. Please put a tick mark in the appropriate column according to their degree of rank)

1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree and 5= Strongly Agree.

	Factor	**degree of rank**				
No	**C. Efficiency Factor**	**1**	**2**	**3**	**4**	**5**
2.1	The projects are progressing within a budget and they are under the planned					
2.2	The projects are running according to the schedule.					
2.3	The quality of the project is as per design and specification					
2.4	suitable work environment to the construction workforce in terms of health and safety provided					
2.5	The construction project is positive impact to the environment					
	D. Effectiveness Factor					
2.6	The project outputs are sufficient to achieve desired objectives.					
2.7	The projects have carried significant changes to the infrastructure development.					
2.8	The projects are satisfactory, based on agreed strategic objectives.					

2.9	The projects have created many job opportunities, as was defined.					
2.10	The construction project Free from Defects as per the standard promised or expected by the client.					
2.11	value for money improved in terms of cost reduction and higher quality thresholds, which lead to greater client satisfaction					
2.12	The executed a project, managed through **Learning and exploitation or** through better knowledge and understanding.					
2.13	The projects generate positive reputation by offering well defined services and delivering an expected product that fits the client's business objectives.					

SECTION 3: Factor affecting performance of public construction project

From your experience measure the level of Factor affecting performance of public construction project, indicate how frequently these resulted in the following: Please put this mark **(√)** in the table below for the **degree of rank** corresponding to each of them.

1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree and 5= Strongly Agree

		Degree of Rank				
No	**Factors**	**1**	**2**	**3**	**4**	**5**
Project Related Factors						
3.1	Complexity of project					
3.2	Nature of project					
3.3	Completion period given for the contract not okay					
3.4	Type of project					
3.5	Size of the project					
Contractual Relationship factors						
3.6	Overall management actions					

3.7	Communication system among project stockholders					
3.8	Feedback capabilities between project participants					
3.9	Control mechanism of the project activities					
	Consultant Related Factors					
3.10	Consultant not commitment to ensure construction work is done according to specification					
3.11	Lack of cooperation to solve problems					
3.12	Inadequacy of design and specification					
3.13	Consultant not involved in monitoring the project progress					
	Clients Related Factors					
3.14	Delay in progress payment to Contractors					
3.15	Clients inability to brief the project objectives					
3.16	Client inability to make project decision					
3.17	the Client emphasis on quick construction instead of quality					
	Contractors Related Factors					
3.18	Insufficient supply of materials					
3.19	Poor workmanship					
3.20	Insufficient supply of materials					
3.21	Quality control of materials					
3.22	Project team leader experience					
3.23	Technical skill of the project team leader					

3.24	Project team leader not committed to meet cost, time and quality					
	Regulatory Body Related factors					
3.25	Delay in Approval of payment to Contractors					
3.26	Delay in Approval design and specification					
3.27	Regulatory body inability to make project decision and give feed back					
3.28	Regulatory body not commitment to ensure construction work on time					

SECTION 4: Assessing the current performance state of public construction projects in terms of time and cost in Shashemene City

From your experience, please express your opinion on the current performance state of public construction projects in terms of time and cost in Shashemene City

A. Cost performance

Please tick (√) in the appropriate box:

1. In what state you measure the current performance state of public construction projects in terms of extent of approximate %age of time overrun for the projects you were involved in past of your experience?

   0% ☐ 1-15 % ☐ 15-30 % ☐ 30-45 % ☐ More Than 45% ☐

B. Time performance

Please tick (√) in the appropriate box

2. How the performance state of public construction projects you perceived in terms of cost overrun while comparing with the budgeted cost, approximate in percentage (%).

   0% ☐ 1-10 % ☐ 10-20 % ☐ 20-30 % ☐ More Than 30% ☐