# Addis Ababa University
# Collage of Business and Economics

**PERFORMANCE MANAGEMENT IN CONSTRUCTION: - FOCUS ON BUILDING CONSTRUCTION PERFORMANCE MANAGEMENT SYSTEM**

A thesis submitted to the Graduate program of the Department of Management and the college of Business and Economics, of Addis Ababa University

In partial fulfillment of the requirements for the degree

Master of Business Administration

In Management

By

Rewina Berhane (GSE/9751/10)

**Addis Ababa University**

Addis Ababa

June 2020


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Advisor: Dr. Tilahun Teklu

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## DECLARATION

I, the undersigned, declare that this thesis is my work and that all sources of used for the purpose of this study have been dully acknowledged.

Name: Rewina Berhane

Signature: _____

Date: _____

## LETTER OF CERTIFICATION

This is to certify that the thesis prepared by Rewina entitled: Performance Management in Construction:- Construction performance management framework submitted in partial fulfillment of the requirements for the degree of Degree of Master of Business Administration complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

Signed by the Examining Committee:

Examiner: _____ Signature: _____ Date: _____

Examiner: _____ Signature: _____ Date: _____

Advisor: _____ Signature: _____ Date: _____

## Abstract

*In Ethiopia & throughout the world, many industries have found Business process reengineering to be an effective approach in achieving dramatic improvements in production time and cost. Regardless little attention has been paid to its potential in the construction industry. This paper identifies the process gap that affects cost, time & quality as they are the three important key performance indicators to measure construction project performance on 63 respondents of ISO certified construction companies. The samples were drawn using convenient sampling techniques. Primary data was collected with the aid of questioners while secondary data is collected through reviewing related materials. The analysis is conducted using SPSS version 26. As per the contractor's response and familiarity with the idea business performance reengineering framework will be recognized that can lead to building a system for evaluation. Using Business Performance Reengineering the current state of construction processes is mapped by considering clients, consultants & contractors as stakeholders on their contribution in the construction phase. The existing process is understood, analyzed, and measured to baseline for future improvement.*



***Key Words***: Performance Management, Performance Indicators, Performance measurement system & framework, and BPR.

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## Acronyms/Abbreviations

BPR: - Business Performance Reengineering

# Chapter 1

## 1. Introduction

### 1.1. Background of the study

Performance management is a major issue in construction projects as a result of complex internal and external factors. It is a continuous process of identifying, measuring, and developing performance in organizations by linking each individual's performance and objectives to the organization's overall mission, vision, and goals. The problem seems complex, as many participants are involved in the project non-performance including the client, contractor, consultant, shareholders, government, and the general public. It also helps to see how things are working so that we can have timely warning of difficulties that might get in the way of accomplishing project objectives and so that remedial corrective measures are taken. It will also help to improve performance, change the way things are done, or else to be cautious for future projects.

To improve their performance numbers of industries have introduced new methods to alter their traditional paradigm. The difference among performance management and measurement is that "Performance management is seen as a closed-loop control system which deploys policy and strategy, and obtains feedback from various levels to manage the performance of the system" whereas the "performance measurement system is the information system which is at the heart of the performance management process and it is of critical importance to the effective and efficient functioning of the performance management system." Therefore, performance measurement is the process of determining how successful organizations or individuals have been in attaining their objectives and strategies" (Evangelidis, 1992). To achieve this, the outputs of organizational strategic and operational processes are measured, in a quantifiable form, to monitor the vital signs of an organization (Hronec, 1993).

Performance measurement is the consistent gathering and recording of data about the inputs, efficiency, and effectiveness of construction projects. Performance measurement is used to judge their project performances, both in terms of the financial and non-financial features, and to compare the performance with others, to improve program efficiency and effectiveness in their organizations. When assessing the success/failure of construction projects "a common approach is to evaluate performance on the extent to

which client objectives like cost, time and quality were achieved" (Ward et al, 1991) Construction projects potentially can have different sets of stakeholders and key performance indicators. For this paper; stakeholders are limited to the client, consultant & contractor, and cost, quality, and time are taken as indicators of project performance. Those are named 'the iron triangle'. (Project Management Institute, Inc. , 2017)

Regardless of the increased global interest in performance management in construction, Ethiopian construction companies have not shown any progress in this matter. "In Ethiopia, only 8.25% of projects have been finished to the originally targeted completion date the remaining 91.75% delayed." (Werku, 2016). Regarding cost, "the rate of cost overrun ranges from 0% to the maximum of 126% of the contract amount for individual projects". (Nega, 2008) Therefore, construction project performance recorded weak performance particularly with regards to the main performance indicators (cost, time). Delay in construction projects became a common Phenomenon which had negative effects on project performance and parties.

As stated above poor performance such as low quality, time delays, and cost overrun are common in the construction project in Ethiopia. Most construction companies share a common mission, vision & goals which are to be all stakeholders' first choice company, to be a company that will inspire the construction industry in Ethiopia, to build and maintain a dedicated team striving to exceed clients' expectation, to participate in the development endeavor of Ethiopia by bridging the construction technology and knowledge gap between Ethiopia and the rest of the world, strive to work hard to maximize the benefit of clients by delivering projects with quality, on time and at a competitive cost by adapting quality based workmanship and new technology in construction and becoming an internationally competitive contractor in Africa. The construction companies share three common objectives which are meeting quality, delivering on time, and within the allocated budget. To meet its mission, vision, and goal better performance management is a requirement.

Since the late eighties, performance measurement frameworks have possibly made the largest effect upon the performance management literature, with a plethora of ever-more complex framework models being developed in many fields. "The term framework refers to the active employment of particular sets of recommendations. Very few performance measurement systems have been academically developed in comparison to performance measurement frameworks. The basic requirements for a successful

performance measurement system are two frameworks - one structural, and one procedural; as well as several other performance management tools, such as lists of measures, etc. In the following descriptions of academically produced performance measurement systems, the procedural work of Bradley and Medori and Steeple may be the most indicative of how many companies are approaching the concept of performance measurement system design.

"Construction project management framework is a strategy that enterprise leaders make use to assign duties and techniques in an organization efficiently. The construction project management framework occasionally is known as a project control cycle because it lays out the plans for controlling all factors of the project from conceptualization to objective-placing, then the closing of a project. Construction Project management framework may be an aggregate of techniques, duties, and tools used to transform a project from beginning to the end. A view of a general process used by this framework is Initiation, Plans, Execution, Control, Tracking, and Termination. (Hira, 1998)"

There are three academic performance measurement systems as being representative of the available (Paul 2015). Which are the balanced scorecard performance measurement system, BPR performance measurement system, and Medori and Steeple's performance measurement system.

The BPR performance measurement system has been practiced in Ethiopia for decades. It has shown remarkable success in companies such as the Ethiopian Investment Commission, The ministry of trade and industry, and the Ethiopian Customs Authority. Therefore due to familiarity with the Ethiopian industry, BPR could be the best fit for the Ethiopian construction industry.

"Business Productive re-engineering (BPR) is an effective method in attaining a dramatic improvement in construction time and cost. The driving forces for the need of BPR in construction explore its applicability and discuss major issues of the current business process concerning the client, consultant, and contractor." (Sherif, 1996)

An effective performance management process ensures that the organization and all those who work with; and for the organization to work towards optimizing organizational goals. A good performance management system can play a crucial role in managing the performance of an organization.

In this study, it attempts to identify the process that affects cost, time & quality as they are the three important key performance indicators to measure construction project performance. Since the lists of factors are adapted from other studies done worldwide, checking if the process gap actually occurs in Ethiopia needed to be checked. Their probability of occurrence is measured to identify which factors occur frequently and as a result affect the strategic goals of the organization negatively. Next business performance reengineering framework will be established that can lead to building a system for evaluation, and guide to understanding management steps in general.

## 1.2. Statement of the problem

"Performance management is a major issue in construction projects as a result of complex internal and external factors. It is the process of planning, implementing, monitoring, and improving the efficiency and effectiveness of the organization, its agencies, and its internal units and individual staff. The objective of performance management is to improve the individual, team, and organizational performance" (Kaviya1 2015).

The performance of a successful project team is measured by three factors; which are meeting the project objectives; schedule & budget. Cost and time overrun are some of the problems challenging the construction industry in developing countries. Different factors usually result in cost and time overrun on a project and this varies from one place to the other. The impact of some of the factors varies depending on the nature of the project. Hence identifying the process gap and source of occurrence is always necessary to determine their severity. A manager needs to adopt performance management practices that will facilitate continuous review and ongoing development order to line with organizational mission & goal.

According to a recent study at the London School of Economics, "Construction management practice in Africa is poor as compared to Europe and North America. Ethiopia is the second from the last followed by Mozambique which indicates that the management practice in Ethiopia is far behind from those poor performing developing countries in Africa". The schedule slippage amount ranges from 61-80 %. (Tadesse Ayalew, 2016) And cost overrun ranges from 1-126% (Nega, 2008)

Therefore, the project manager needs to identify the process affecting the cost and time performance and employ resources efficiently to better project's financial success. The more efficient the project is in its use of resources; the minimum costs it will incur. For a project manager, it is a challenge to ensure that resources are used to their maximum efficiency, thus keeping the cost down. The goal of performance

management is to benefit all parties involved in the project from adequate distribution of resources which leads to on-time delivery, within budget, and meeting client satisfaction. Measuring and analyzing performance through performance management system will help construction companies to set priorities and manage performance systematically to achieve better-balanced performance.

This paper aims to quantitatively identify the process gap due to different factors. The probability occurrence in Ethiopian construction companies on the construction phase needs to be checked to minimize their effect on the overall performance management. Minimizing their influence beforehand creates a smooth interaction between the involved parties and aids the construction companies to meet their company objective. Once the process gap is identified, establishing a framework that can lead to building a system for evaluation is necessary. An effective performance measurement framework aids in attaining a dramatic improvement in construction time and cost.

## 1.3. Research Questions

Basic Research Questions

- What is the gap in the current construction process and which framework is suitable for better performance management?

    Sub-questions

    - What are the management practices and to what extent are they exercised?
    - What are the construction process gaps in Ethiopia?
    - Which performance measurement system & framework is applicable for construction in Ethiopia?

It is intended that the findings of this research will be used as a guideline for almost all building construction firms to evaluate their current construction performance management and can be used for correction on the shortcomings.

## 1.4. Scope of the Study

The purpose of the study is to focus on driving forces for the need for a performance management system. This research was limited to the performance management of ISO certified building construction companies in Addis Ababa. A business performance reengineering framework system is used. BPR has six consecutive steps which are

- Map the current state of your business processes
- Analyze them and find any process gaps or disconnects
- Look for improvement opportunities and validate them
- Design a cutting-edge future-state process map
- Operationalize opportunities and develop future changes
- Implement future state changes and be mindful of dependencies

Out of those the first three steps are covered in this paper. To evaluate process factors affecting time and cost of construction are considered since time and cost overrun is a measure issue in the construction projects.

## 1.5. Limitation

In conducting this research, the researcher faced some challenges in administering the data collection process. Some of the challenges faced include: Due to the repeated request of researchers the project managers got tired in filling questionnaires and refused to accept the questionnaires, questionnaires were not returned or were lost, delay of the respondents to return the questionnaires on time due to their work burden and some of them responded questionnaires were not properly filled. However, the researcher at most effort tried to overcome these challenges by redistributing the questionnaires and also by explaining the purpose of the research to the respective managers and respondents so that they take some minutes of their time to fill them.

This study is limited to, identifying and assessing the applicability of appropriate performance measurement framework for construction performance management. In this research, only the three contractual parties which are Client, consultants, and contractors participated out of the many project stakeholders. Due to time and budget constraints, it was not possible to address all the sites and workforce. Besides, the scope of the study was delimited to ISO certified building construction companies in Addis Ababa due to time, technical reasons, and to account for quality.

## 1.6. Significance of the study

An effective performance management process ensures that the organization and all those who work with; and for the organization work towards optimizing organizational goals. Performance management is a tool that aims at giving necessary information to identify a quality improvement opportunity that seeks on-time delivery with the allocated cost. The problem of project time overrun is an international concern, time

overrun is the extended completion date beyond planned. Cost is among the major considerations throughout the project management life cycle and can be regarded as one of the most important parameters of a project and the driving force of project success.

Construction companies share three common objectives which are meeting quality, delivering on time, and within the allocated budget. Constructions projects are regularly facing time and cost overrun which leads to construction companies not meeting their goal and objective. Multiple factors due to contractor, Consultant & Client contribute to the shortcoming. Knowing the limitations in the process beforehand contributes to the bettering of the system in the future. Therefore a good performance management system is needed for construction companies to work towards the improvement of the overall organizational performance for ensuring the achievement of the overall organizational ambitions and goals.

## 1.7. Hypothesis

The research carried out the test on the following hypothesis: The dependent variable is performance management in construction and the independent variables are factors that affect time & cost performance.

Ho1: Factors that affect completion time of a project doesn't affect the overall performance of construction projects.

Ho2: Factors that affect cost of a project doesn't affect the overall performance of construction projects.

# Chapter 2

# 2. Literature review

## 2.1. Introduction

Performance management is a control system that deploys policy and strategy to obtain feedback from various levels to manage the performance of the system. A performance management system's effectiveness highly depends on the performance metrics used to define the performance of the organization. A performance measurement system is the heart of the performance management process and it is important for the effective and efficient functioning of the performance management system. The common approach to evaluate the performance is on the extent to which client objectives like cost, time, and quality were achieved. There are three common academic performance measurement systems which are balanced scorecard framework, business process reengineering framework and, medori and steeple's framework.

The problem of project time overrun is an international concern, time overrun is the extended completion date beyond planned. Based on several studies different issues/factors causing time overrun are identified due to contractor, consultant & client. Cost is among the major considerations throughout the project management life cycle and can be regarded as one of the most important parameters of a project and the driving force of project success. Similarly, multiple factors contribute to cost overrun in the construction industry concerning projects being delivered within budget which are the goals of construction companies.

Business Process re-engineering (BPR) performance measurement systems are an effective method in attaining a dramatic improvement in construction time and cost (Hammer, 1993). BPR has been introduced in Ethiopia decades ago in different industries and has been proven successful. Applying BPR is easy since it is not a new concept for Ethiopia.

## 2.2. Management Practice

The first stage in studying performance management in construction projects is checking the availability of management practices. To manage the three performance indicators and make sure the project is completed within the approved budget, meeting the quality requirement, and ensure timely completion of the project certain processes are undertaken.

The processes under each indicator are stated as follows: -

- Project Time Management

a. Activity Definition
b. Activity Sequencing
c. Activity Duration Estimation
d. Schedule Development
e. Schedule Control

Project time management must address all project duration related issues and consider the effect of each step on the overall time management of a project.

- Project Cost Management

a. Resource Planning
b. Cost Estimating
c. Cost Budgeting
d. Cost Control

Project cost management is primarily concerned with the cost of the resource needed to complete project activities. However, project cost management should also consider the effect of project decisions on the cost of using the project's product. It should consider the information needs of the project stakeholders' different stakeholders that may measure project costs in different ways and at different times.

- Project Quality Management

a. Quality Planning
b. Quality Assurance
c. Quality Control

Project quality management must address both the management of the project and the product of the project.

## 2.3. Performance Measurement and Management

Due to complex internal and external factors, performance management is a major issue in construction projects. It is a process of identifying, measuring, and developing performance in organizations by linking

each individual's performance and objectives to the organization's overall mission, vision, and goals. Due to the involvement of many participants (client, contractor, consultant, shareholders, government, and the general public), the problem seems complex. Achieving project completion on time and within budget at specified quality standards is a major criterion of success of a project (Frefer, 2018)

A performance management system's effectiveness highly depends on the performance metrics used to define the performance of the organization. The metrics have to be designed to relate directly to the various perspectives that an organization decides to adopt. The relationship between the performance management system and its metrics is that if the metrics used do not relate to the strategic goals of the organization, an organization cannot claim to have an effective performance management system. This can usually occur when a large number of performance metrics are present in an organization where "everything is measured but little that matters." (Ghalayini, 1996) state that this is not only unnecessary but it is performed at a great expense to the organization, in terms of the efforts made to capture and manage the necessary data. (Michail 2001)

Undertaking projects in generating new buildings or refurbishing existing ones for a variety of clients is the core business of the construction industry. Therefore traditionally performance measurement in construction is approached concerning the product as a facility and creation of the product

Process whereby an organization establishes the factors within which programs, investments, and acquisitions are reaching the desired results is performance measurement. Neely et al. (2002) defined performance measurement as "the process of quantifying the efficiency and effectiveness of past actions", and a performance measure was defined as "a parameter used to quantify the efficiency and/or effectiveness of past actions". Bititci et al. (1997) explained the difference between performance management and measurement and defined the performance measurement as "the process of determining how successful organizations or individuals have been in attaining their objectives", while the performance management as "a closed-loop control system which deploys policy and strategy, and obtains feedback from various levels to manage the performance of the system". Performance measurement is usually determined by the metric of several indicators, which include both financial and non-financial indicators.

Based on the review of performance measurement studies in construction from 1998 to 2009, it can be concluded that research in this area has focused on three levels, including Project level, Organizational level, and Stakeholder level. (Ali, A., Rahmat, I., 2010)

"Performance measurement in construction focuses on project performance in terms of time, cost, and quality." (Ward et al., 1991) Performance measurement in the construction industry is developed over the past decade and the target has extended to the construction company level and the project stakeholder level. In recent year's additional indicators such as client satisfaction, business performance, health, safety, environment, and so on are included (Yu et al., 2007).

## 2.4. Performance indicators, measures, and measurements

"Performance indicators specify the measurable evidence necessary to prove that a planned effort has achieved the desired result. In other words, when indicators can be measured with some degree of precision and without ambiguity they are called measures. However, when it is not possible to obtain a precise measurement, it is usually referred to as performance indicators" (Mbuguaet al., 1999). Numerical or quantitative indicators are performance measures (Sinclair, 1995). On the other hand, it is a systematic way of evaluating the inputs and outputs in manufacturing operations or construction activity and tools for continuous improvements in performance measurement (Sinclair, 1995).

Therefore; Performance measurement is the consistent gathering and reporting of information about the inputs, efficiency, and effectiveness of construction projects. Performance measurement is used to judge their project performances, both in terms of the financial and non-financial aspects, and to compare and contrast the performance with others, to improve program efficiency and effectiveness in their organizations.

A performance measurement framework is a complete set of performance measures and indicators derived consistently according to a forward set of rules or guidelines. As performance measurement is developing the framework is becoming practicable and it is being applied in the construction industry. (Brown, 1997)

### 2.4.1 Performance Indicators

Working groups in the United Kingdom on Key Performance Indicators have identified certain parameters for benchmarking projects to achieve a good performance in response (Egan, 1998). Most indicators promote result-orientated thinking, such as construction cost, construction time, defects, client satisfaction with the product and service, profitability, and productivity, whereas others indicate process-orientated thinking such as predictability of design cost and time, and predictability of construction cost and time, and

safety. These studies also identified quality, time, and cost as the three most important indicators to measure construction project performance. (M.R.Lee, 2014)

It is important to identify parameters (performance indicators) for benchmarking projects at the project selection phase to achieve good project performance. 55% of all defects in R&D projects occur during requirement analysis and specification, earlier documented this position, whereas 43% of all defects are not found until after the testing stage (Posten, 1985). It is not surprising that the same situation applies to construction projects.

At a minimum, performance measures of a project are based on time cost and quality. However, meeting budget, schedule, and the quality of workmanship, stakeholder satisfaction, transfer of technology, health and safety, environmental performance, user expectation/satisfaction, actor's satisfaction, and commercial value can be considered as measuring criteria. (Ali, A., Rahmat, I., 2010)

"Contractor performance can be defined by the level and quality of projects delivered to clients" (M R Lee, 2014). Selecting the least cost bidder among competing contractors to perform the job has been a common practice. To ensure quality and guarantee international standards, predicting the performance of construction firms in such a situation is indispensable. If a construction project is managed efficient high performance and productivity is guaranteed. Therefore, contractors and construction firms need to be accustomed to the ways leading to estimate the performance of the construction project. (M R Lee, 2014)

One of the problems confronting the construction industry in developing countries is cost and time overrun. During the construction process; the priority of professionals and the construction parties is usually the progress of the project, therefore effective monitoring of the construction process is the concern of clients. However, cost and time overrun on a project is usually the result of different variable factors. The impact of the factors varies depending on the nature of the project therefore it is always necessary to identify the source of occurrence of the factors to determine their severity. For instance, twenty-six (26) factors contributing to cost and time overrun in Ghana considering the severity of their impacts were studied by Frimpong et al., (2012). According to the study, out of those factors, monthly payment difficulties from agencies, poor contract management, materials procurement, and escalation of material prices were the main factors identified among other factors. However, Azhar, Farouqui, and Ahmad (2008) documented some other factors such as; increase in material prices and wages, scarce construction material, construction

delay, and deficiency in cost estimates. To this end, this study addressed the issue of cost and time performance on construction projects within the context of developing economies. (Lekan, 2017)

The Project Management Institute explains that quality performance is the calculation of achievement used to measure and manage project quality. However, Ghanaian small scale contractors suggested that the perception of poor quality performance has turned out to be of great concern to stakeholders (Taskforce Report, 2007). Due to re-work and ultimately pushing the client's budget beyond reach, poor quality performance has potentially reduced the level of employment rate, influenced the completion time of projects. Factors affecting quality performance are unavoidable but steps would be taken to curb the menace when identified and their significance is known. Since improved contractor quality performance leads to increase client satisfaction, an improvement in the reputation of the contractor, and competitiveness in the market, contractor quality performance is critical to the success of any construction project (Xiao, 2003). "Quality Performance is a management tool which aims at giving necessary information to identify quality improvement opportunities which are geared towards cost reduction and quality improving" (Abdul, 2011).

The ability of a project manager to employ resources efficiently highly affects the financial success of a project. As efficiency in using resources decreases the cost the project incurs increases. Therefore to benefit all involved parties, the project manager needs to ensure that the resources are used to their maximum efficiency by keeping the cost down, which is a challenge.

Therefore; knowing performance-related problems and avoiding the problems beforehand will create a smooth interaction between the involved parties and aids on-time project completion which is a major problem in our country. For that reason, the impact of performance management on the construction industry is a major issue.

### *Quality*

Quality can be defined in terms of "conformance to the agreed requirements of the customer and terms of a product or service; it should be free of deficiencies". (Elshaer, 2012) In a research work "Assessing the Effect of Project Quality Management on Construction Performance" by (Gilberto, 2012), the author emphasized on the requirement to distinguish between product quality and process quality. He added that "Product Quality is the quality of elements directly related to the physical product itself while process quality deals with the quality of the process that causes the product to be either acceptable or not". For

instance, in the construction industry a product quality may refer to achieving a level of quality in the materials, equipment, and technology which will endure in the constructed facility; whereas process quality refers to achieving quality in the way the project is organized and managed during the three phases of planning and design, construction, and operation and maintenance (Project Management Institute, Inc. , 2017).

Throughout the world quality became one of the main focus of the business as a result of that various organizations started to practice standards and guidelines. ISO 9000 series since 1987 is becoming a worldwide quality management norm for organizations, regardless of their sizes and products. It is a series of guidelines for companies that establish their quality systems by focusing on procedures, control, and documentation. ISO 9000 standards are supposed to help companies identify mistakes, streamline their operations, and be able to guarantee a consistent level of quality (Kartha, 2002).

In the construction industry, "quality is defined as the totality of features required by a product or services to satisfy a given need, or fitness for purpose" (Parfitt, 1993). In other words, the emphasis on quality is a confirmation of the conventional requirement in the construction industry. The established characteristics of a product, process, or service as specified in the contractual agreement are the requirements and a characteristic is any specification that defines the nature of those products, processes, or services, which are determined initially by the client. Those expectations must be understood by all parties and be incorporated into the contract price and other contract documents to the extent possible, and commit in good faith to carry them out to achieve a completed project that meets the owner' s quality expectations (Ganaway, 2006).

A strong quality culture is an important prerequisite to the achievement of sustained competitive advantage through the continuous delivery of high-quality products and services as well as clients' satisfaction. The concept of quality management is perceived to be a relatively recent concept although the institute of quality assurance was established in 1919. Recently it is a requirement by most business organizations that their potential partners, suppliers, and vendor organizations operate a quality system.

All stages of the project starting from conception to termination are incorporated in a project quality assessment. Quality and cost requirements may be identified by focusing on the early feasibility and design stages. A project manager must pursue an efficient system of coordination of the project activity to achieve the desired quality without unnecessary costs.

The main guide to the company's approach to quality matters is quality policy. It clarifies the overall principles if the company's attitude towards, and handling of, quality management. All states in the quality policy must have the support and resources necessary for its achievement.

Applying a project-specific quality system involves determining the project size, team, identify the status of existing documentation, and determine compatibility with proposed project activities. The range of project activities within the specific project needs to be determined and the level of activities within the project needs to be identified and the method of work allocation must be kept in mind.

Developing and introducing a quality system has multiple advantages for the project managers.

- Through better management control system profits will increase
- Uniform quality levels would be accomplished throughout the project
- Materials will be stored and delivered safely
- Through higher productivity, and fewer defects and changes costs should be reduced
- Through faster and safer throughput capital utilization should be improved
- Clients will be satisfied

The quality cost can be either operating quality cost or external assurance quality costs. Operating costs are those incurred by a project to accomplish and confirm specified quality levels. "Quality costs, but lacks quality costs even more". The project manager is primarily concerned with controlling time, costs, and quality with the inclusion of a quality system. While the practice is not widespread the need to identify the cost of achieving quality is not new. To conclude the project management team's responsibility and commitment must be determined.

### *Cost*

"Cost is among the major considerations throughout the project management life cycle and can be regarded as one of the most important parameters of a project and the driving force of project success" (Azhar et al., 2008). The cost performance of different types of projects is evaluated using Earned Value Analysis (EVA). The three cost-related processes that interact among each other and with other scopes of construction projects are cost control, cost estimating, and cost budgeting

Besides that, Gido and Clements (2003) stated that "there are four cost-related measures in cost performance analysis which are used to analyze cost performance of a project. The measure is used to

evaluate the project whether the project is being performed within the budgeted cost or whether it is in line with the actual cost. The four cost-related measures are TBC (total budgeted cost), CBC (cumulative budgeted cost), CAC (cumulative actual cost), and CEV (cumulative earned value)".

To control the budget of a project, cost estimation is made before the project starts. Managing the cost of a project may be very simple or extremely complex. The cost need for all the project stakeholders must be considered in project management (Gido, 2003). "Cost studies of buildings consist of the application of the techniques and expertise of economics to construction projects. Also, it is to ensure available resources are used efficiently and to increase the rate of growth of construction work in the most efficient manner". (Ashworth, 1994)

Cost overrun is a very common phenomenon and majority projects in the construction industry are facing this problem. Cost overrun occurs when the original cost estimation is exceeded by the final cost or expenditure of the project Avots (1983). Angelo and Reina (2002) also pointed out that cost overrun is one of the main problems in the construction industry. The problem may found in both developing and developed countries. This problem is quite serious and further study on this issue is needed to reduce the problems to better the performance and meet the companies' strategies and goals. There are some factors contribute to cost overrun in the construction industry which is found from the researchers' study (A.S. Ali, 2010).

**Inaccurate or Poor Estimation of Original Cost: -** "is the biggest factor that contributes to the overruns of budget. Technical problem on how to estimate project costs and also not enough project information in the early stage of the project". (Peeters, 2008)

**Inflation of Project Costs: -** "cause increasing of costs. Inflation of materials, equipment, and labor costs may vary geologically, and contracts of subcontractors with suppliers may involve different inflation protection terms that agreed with a client. As inflation goes up, interest rates will go up and the costs will increase too" (Harrison, 1981)

**Improper Planning: -** The processes to produce a product take a longer period to complete the project". (Frimpong, 2003)

**Fluctuation in Price of Raw Materials: -** it is hard to estimate the cost accurately because it is objective price fluctuation causes cost overruns. This happens caused by high inflation of price in developing countries or the speculation of suppliers (Long et al., 2008).

**Poor Project Management -** is due to poor site supervision and management and poor project management assistance. Weakness and incompetency of contractors are reflected by the poor of site management. Skillful and experience human resource is not enough in site management (Long et al., 2008).

**Lack of Experience: -**especially in financial management most of the contractor's problem. If distributions of the costs are not planned well in the projects it might because costs over-budgeted. (Chan and Park, 2005)

**Obsolete or Unsuitable Construction equipment and Methods: -** Some countries try to import or transfer modern technology into their countries because the progress of construction works becomes slower. However, due to the lack of skillful human to operate the technology method is usually unsuccessful (Long et al., 2004).

**Unforeseen Site Conditions: -** Nega (2008) found that "actual site conditions of a project are not usually determined until the excavation is completed. It is sometimes possible that site conditions are overlooked by the initial review or conditions have changed due to changes in weather conditions or subsoil conditions. The unexpected conditions on the subsurface sometimes require a fundamental redesign of projects with high expenses. Changes in site conditions become a problem for machinery and supplies to move in and out of the site. This also increases the costs required".

**A mistake in Design: -** "mistakes in design or poor design are caused by the low competence designer. The approval design or drawing process becomes low quality and ineffective especially for those with government-funded projects. The unrealistic design which found after the start the construction projects has to change and it could lead to cost overrun". (Long et al., 2008)

**Insufficient Fund: -** "delay of the projects followed by cost increasing to cover all the expenses during construction. Owners are not preparing sufficient funds for the project and pay on time as shown in the contract agreement to the contractor." (Long et al., 2008)

**Poor Contract Management:** - in developing countries many contractors have organizes their commercial undertaking. Since they are familiar with the business of making money they are good at managing expenses. They pay low wages, submit low bids, and low ability to plan and organize contracts. They do not follow the agreement stated in the contract. (Ogunlana, 1989)

**High Cost of Machinery:** - one of the market-related problems is the high cost of machinery. The construction industry is mainly market-driven where it is influenced by the existing market style. For example, oil to run machinery is increasing, the rental of machinery also increasing. (Chan, 2005)

**Construction Cost Underestimation:** - To get approval for the project, some parties deliberately underestimate the costs for their project. (Nega, 2008)

**Measures to Control Construction Cost:** - There are some measures which are found from the researchers' study to control the construction costs or to overcome the problems of cost overruns. The researchers have their own opinion on how to solve the problems.

**Proper Project Costing and Financing:** - "delays of schedule may occur caused by delay in payments due to complex financial processes in client organizations. Delay in payment would cause financial difficulties to contractors and subsequently delay the schedule to complete the activities on site. The interest could be charged on delayed payments hence inducing cost overruns in the project". (Kaliba et al., 2009)

**Competent Personnel**: - to manage their projects efficiently contractors, consultants, and clients should have the right personnel with appropriate qualifications. It is better if the construction manager has experience and qualifications in project or construction management. (Kaliba et al., 2009)

**Appropriate Scope Definition:** - only concern on the works required completing the project successfully. To avoid frequent changes, guard against incomplete identification of scope is important. Also, to avoid unnecessary works do not incorporate the works out of scope. (Nega, 2008)

**Proper Cost Control:** - "one of the client's requirements in respect of construction project is the assessment of its expected cost". As it is the general trend towards greater cost-effectiveness and ensures construction costs not solely in the context of initial costs, but in terms of life-cycle costs or total cost appraisal, proper cost control is important. (Ashworth, 1994)

**Risk Management during Project Execution: -** some approach to avoid cost overruns. In any project development, a certain amount of risk occurs. Therefore, a project manager needs to determine and reduce the risks and perform risk management functions. Minimizing any risk that might fail to meet the project requirements is the aim of risk management. **(**Peeters, 2008)

**Appropriate Contractual Framework: -** "once the objective of cost has been estimated, it is followed by choosing an appropriate contract model where there are techniques to make a relationship between the initial estimate and final price". (Peeters, 2008)

**Increase Supply of Materials: -** there should prepare adequate allowance for any emergency case to cover increasing in material cost due to inflation. (Frimpong et al., 2003)

**Realistic Cost Estimation: -** The initial cost estimates should be as precise as possible. Accuracy of cost estimation allows clients to check and determine the required funds for executing the project are made available when required (Kaliba et al., 2009).

**Efficient Management: -** Gould (2002) stated that "efficient management is important to produce a productive and cost-efficient site". Due to inadequate planning and feasibility studies scope may changes. The project manager must follow up on the schedule to avoid additional costs and ensure the building can be occupied on time as planned. The techniques to overcome the problems of cost overrun are found by the literature study. (A.S. Ali, 2010)

It is not uncommon to see a construction project failing to achieve its objectives within the specified cost. Cost overrun is a very recurrent phenomenon and is almost related with nearly all projects in the construction industry (Remon, 2012). To alleviate this issue in the future the problem of cost overruns is critical and need to be studied more. (Raj, 2016)

In developing countries, the trend is more severe where these overruns sometimes exceed 100% of the anticipated cost of the project. Several factors affect the construction cost and various studies have been conducted to address these factors.

The zero difference between the budgeted/original cost estimate of the project is cost performance and in some cases spending below the estimated cost of the project. When there is an excess of actual cost over budget or below budget cost variance occurs. Throughout project management, life cycle cost is among the

major consideration and can be regarded as one of the most important parameters and driving force of project success. (Essays. UK, 2020)"Cost performance is defined as the degree to which the general conditions promote the completion of a project within the estimated budget". (Project Management Institute, Inc. , 2017)

The function of comparison between an individual's perception of an outcome and its expectation for that outcome is regarded as the client's satisfaction. In the construction industry, the client's satisfaction has continued to be an elusive and puzzling issue for some significant time. The dissatisfaction of clients of the construction sector may be caused by many aspects but is largely attributable to overrunning project costs, delayed completion, inferior quality and incompetent service providers including contractors and consultants (Ali. A, 2010)

### *Time*

One of the most significant issues being faced by the construction industry today is time overrun. Time overrun is due to various factors which require serious attention to understand and address to achieve successful completion of projects on time. Serious attention is given due to its great impact on construction cost which can never be recovered.

The problem of project time overrun is an international concern. According to Kaming et al. (1997) and Trigunarsyah (2004), time overrun is the extended completion date beyond planned which is usually traceable to contractors. Elinwa and Joshua (2001) defined it as the time-lapse between the actual and agreed estimation of completion. Bramble and Callahan (1987) describe time overrun as due to an unanticipated circumstance project is completed beyond the project completion date or not performed as planned.

Al-Momani (2000) analyzed 130 public projects in Jordan and found delays that occurred in 106 (82%). Frimpong et al. (2003) observed that 33(70%) out of 47 projects in Ghana were delayed. Ogunlana et al.'s (1996) study in Thailand and Kaming et al.'s (1997) study in Indonesia found that the responsibility for most project delays was laid on the contractor. Abd. Majid and McCaffer (1998) found that 50% of the delays can be considered as non-excusable delays, for which the contractors were responsible.

"Time overrun affects all parties involved such as the project owners, contractors, and other project participants. Project owners may be affected through lost benefits that could have accrued from the

completed facility, while contractors may have to spend more on labor and plant, pay penalties as per the contract or even lose other profitable contracts because resources for the next job are tied up on delayed projects".(Oko,2011)

During the planning stages of project development, delays, and cost overruns of construction projects occur. The project owners may be responsible for the time overrun when delays, suspensions or interruptions to all or part of the work are caused by an act or failure to act by the owner resulting from breaches of owner's obligations, stated or implied in the contract (Chalabi 1984). These include the failure of the owner or his representative (consultants) to furnish the contractor with relevant information, details, etc. for which the contractor has specifically requested in writing. Rowlinson (1988) referring to the finding of Bromilow (1974) says that "project owners were responsible for delays in issuing approvals, signing contracts and allowing site access". The finding also indicated that the largest proportions of variations were the responsibility of the owners, all of which have time and cost consequences. Effective control of construction was dependent on the promoter's decision on the authority vested in his project team (Chalabi 1984). Whilst authority needs to be delegated to a member or members of the building team, it must not be forgotten that the client should provide an individual with the authority to make decisions without reference back. The contractor, on the other hand, bears the risk associated with time overrun on matters related to low labor productivity, inadequate scheduling or mismanagement, construction mistakes, weather, equipment breakdowns, staffing problems, etc. There are, however, time overrun caused by events beyond the control of either the owner or the contractor. Such delays may arise as a result of force majeure, exceptionally inclement weather, civil commotion, industrial unrest, just to mention but a few.

In the construction industry, one of the basic goals is to achieve timely completion of projects within the stipulated budget and required quality. Each day overrun in the completion of any project has a direct impact on the cost of the project. Various strategies need to be adopted to manage and control construction projects (Ofori, 1990).

Time performance is one of the most important features to be benchmarked in construction project performance management. It is defined as "meeting the duration baseline in the initial planning process of the project". When there is an extension of time beyond planned completion dates traceable to the major stakeholders, time overruns occur. In general, project delays occur as a result of both external and internal

cause and effect relationship [Essays 2018]. Choudhry (2004) and Chan (2001) define time overruns as "the differentiation between the actual completion time and the estimated completion time". (Abebit, 2013)

One of the many challenges for project participants is monitoring project time. Time monitoring highly relates to how well the project adheres to the planned schedule over some time. "Time performance is very important for construction projects to be completed on time, as the clients, users, stakeholders and the general public usually looks at project success from the macro view where their first criterion for project success appeared to be the completion time". (Project Management Institute, Inc. , 2017) Project performance of construction can be assessed by time variance. Time could indicate to project managers that the project was not running based on the schedule. Furthermore, making sure a project is delivered on time is one of the important needs of clients of the construction industry and the goal of construction companies. (Ali, A., Rahmat, I., 2010)

The construction industry is one of the most complex, fragmented, schedule, and resource-driven industries. Time overrun is any delay beyond the baseline construction schedule. The main goal of managing a construction project is minimizing the time and cost of the project to meet the overall goal of the construction firm. However, time delay regularly occurs in all phases of a construction project and the total project duration consequently increases (Yang and Ou, 2008). Very rarely projects are completed on time (Assaf and Al-Hejji, 2006).

As each day of delay contributes a significant amount of revenue which are hardly recovered project managers need to pay serious attention to control construction time. Based on several studies different factors causing time overrun are identified.

In **Indonesia** (Kaming et al., 1997) studied influencing factors on 31 high-rise projects and found out that design changes, poor labor productivity, inadequate planning and, resource shortages are the most important factors causing time overrun.

Through a comparative study of causes of time overruns in construction projects in **Hong Kong** (Chan and Kumaraswamy, 1997) found 5 principal causes of delays including poor site management, unforeseen ground condition, low speed of decision making, client-initiated variation, and necessary variations of works.

In **Ghana**, (Frimpong et.al., 2003) studied groundwater projects and illustrated that owners, contractors, and consultants ranked Poor contractor management, Monthly payment difficulties from agencies, Material procurement, Poor technical performances, and Escalation of material prices as major factors that can cause time overrun.

Similarly (Mansfield et al., 1994) showed that the most significant factors affecting construction schedules were financing and payment for completed works, Poor contract management, Changes in site conditions, Shortage of materials, and Improper planning.

According to (Assaf and Al-Hejji, 2006) 70% of projects experienced time overrun. The average time delay ranges from 10% to 30% of the original duration of the project. The study identified 6 main causes including change order, delay in progress payment, ineffective planning and scheduling of project by the contractor, poor site management and supervision by contractor, shortage of labors, and difficulties in financing projects by the contractor as most critical factors responsible for this time overrun.

According to **Zambian** road construction industry Delayed payment, Protracted financial processes in client organizations, Financial difficulties that accompany the delayed release of funds by client organizations, contract modification, material procurement and changes in drawings, staffing problems, equipment unavailability, poor supervision, construction mistakes, poor coordination on site and changes in specifications and unforeseen site conditions were found the most prominent cause of schedule delay affecting total project duration and cost of the project

Makulsawatudom et al. (2004) established 10 most significant factors affecting construction productivity in **Thailand** and they include lack of materials, incomplete drawings, incompetent supervisors, lack of tools and equipment, absenteeism, poor communication, instruction time, poor site layout, inspection delay, and rework.

Enshassi et al.'s (2007) studying the **Gaza** Strip identified the five most important factors that impact negatively labor productivity as Material shortages, Lack of experience of labor, Lack of labor surveillance, and Alteration of drawings/specification during execution.

Ameh and Odusami (2002) in **Nigeria** identified Low wages, lack of materials, and an Unfriendly working atmosphere as having a key impact on the productivity of craftsmen involved in the in-situ concrete operation in single-story building projects.

Based on several studies different issues/factors causing time overrun are identified. All the listed factors directly or indirectly affect the project delivery time. Each factor is caused due to multiple stakeholders and all affect the construction phase. Identifying which factor occurs more frequently is getting one step closer to solving the problem and it also helps to avoid the problem beforehand. Understanding the gap aids in building a framework to better the construction time performance in the future.

## 2.5. Performance Measurement System & Framework

Performance Measurement frameworks refer to the active employment of particular sets of recommendations. The two types of the framework are structural & procedural which specifying a typology and a step-by-step process for developing performance measures from strategy respectively. "A framework provides us with more information about performance measurement than a recommendation, but less about the actual performance measurement process than a system". (Folan, 2015) "A performance measurement framework assists in the process of performance measurement system building, by clarifying performance measurement boundaries, specifying performance measurement dimensions or views and may also provide initial intuitions into relationships among the performance measurement dimensions. "(P. Rouse, 2003).

A performance measurement system refers to the measurement system implemented by a company, while a performance measurement framework is a general theoretical framework developed in research, which can act as the basis for a company's performance measurement system (Bassioni et al., 2004). There are very few performance measurement systems in existence that have been academically developed in comparison to performance measurement systems.

Performance measurement systems provide a mechanism to focus on wider business performance measures, which enable organizations to implement business improvement. The drive for implementing performance measurement models is gaining momentum as a result of market conditions forcing organizations to change, clients, investors, and other stakeholders demanding continuous improvement (Robinson et al., 2005).

Performance measurement systems aim to "integrate organizational activities across various managerial levels and functions" (McNair et al., 1990). The need for integration is supported by (Hronec, 1993), who defines a performance measurement system as a "tool for balancing multiple measures (cost, quality, and time) across multiple levels (organization, processes, and people)".

Three academic performance measurement systems are examined here the balanced scorecard framework, business process reengineering framework and medori and steeple's framework

## The Balanced Scorecard Framework

The Balanced Scorecard Framework approach is viewed by researchers as a strategic management tool in developing a performance management system and has been widely adopted by many companies. The traditional financial measures do not predict an organization's future performance as financial measures are lagging indicators that are targeted at past performance. BSC attempts to provide managers with more relevant financial and non-financial measures about activities they are currently managing.

It suggests organizations future value will be driven by four major perspectives

- Financial perspective;
- Customer perspective;
- Internal business perspective;
- Learning and Growth perspective.

The framework has four stages:

- Translating the vision
- Communicating and linking
- Business planning
- Feedback and learning

Finally, the Strategy Map is suggested, which emphasized the linkages among these four perspectives. A strategy map embeds the different items on an organization's BSC into a cause-and-effect chain, connecting the desired outcomes with the drivers of those results.

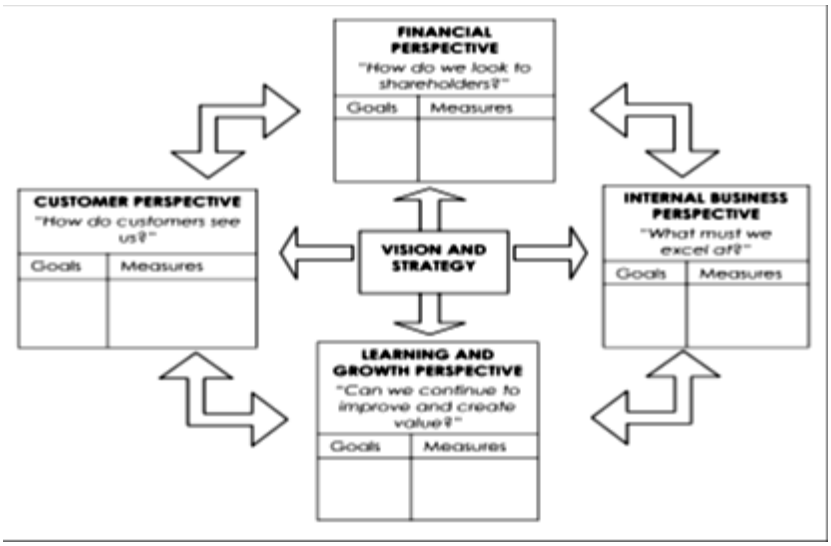


Figure 1 Balance score card framework

## Medori and Steeple's Framework

Medori and Steeple's framework embraces both the design and auditing of performance measurement systems. Their framework, in reality, operates as a system: by replacing the requirement for a structural performance measurement framework with the stipulation that they are measuring in areas related to six competitive priorities which are quality, cost, flexibility, time, delivery, and future growth. Introducing a specially-designed procedural framework for performance measurement system design; they are effectively detailing the components of a system. The procedural performance measurement framework follows six stages:

a. A company's manufacturing strategy and it's been identified;

b. Strategic requirements are matched against competitive priorities;

c. Measures are selected from a pre-defined list of performance measures

d. Audit – The existing set of measures is listed down and compared with the new measures. Three rules are applied:

- Existing measures that are compatible with new measures are kept and used;
- Existing measures that are different with the new selected measures are scrapped;
- New measures selected that do not tie with existing measures are implemented and gaps in the system.
- If no "gaps" are identified then stage 5 (next) is omitted.

a. Implementation of measures – An eight-step plan is provided for company implementation of the new measures;

b. Periodic maintenance – The last stage of the system revolves around periodically reviewing a company's performance measurement system.

Medori and Steeple proceed to illustrate their performance measurement system in doing so two problems with the system are identified:

- Difficulties can be found in relating a company's strategy to the performance measurement grid's competitive priorities;
- The separate pre-defined list of performance measures may become dated.

Both of these points are similar to the problems faced by the performance measurement system proposed by Bradley

### Business Process Reengineering framework (BPR)

"Business Process Reengineering is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, and speed" (Hammer & Champy, 1993). Business Process Re-engineering is one of the rising and best-growing management tools that aim at optimizing organizational resources for the most excellent result (Rigby, 2013). It is business processes redesign and the associated systems and organizational structure to achieve dramatic progress in business performance (Saleem, 2012; Goksoy et al., 2012). "The business reasons for making such changes could include poor financial performance, external competition, and erosion of market share, emerging market opportunities, global competition, or some other pressing business issue" (Hari L. 2017). BPR is an effective approach to achieving dramatic improvements in production time and cost in many industries worldwide. Yet little attention has been paid to its potential in the construction industry. BPR is the inspection and alteration of five major components of the business (Davenport, T. H., 1995).

- **Strategy**: The Future direction of the business must be taken into account while embarking on a reengineering effort. Before reengineering can be done the organizations' strategies should be known to select the right process for reengineering and sets how and by how much to reengineer (Wachira, 2013).

- **Process**: The target of reengineering is Processes in BPR (Grant, 2002). "Process is a self-contained workflow pattern where there is an input of a series of actions and outputs" (Draheim, 2010; Dickerhof et al., 2002). Therefore the business process is a group of related tasks that collectively create value for a customer. BPR focuses on the whole process, from product conceptual stage to product design (Srinivasan, 2011; Bhaskar, 2016).

- **Enabling Tool (Technology)**: In BPR Information Technology plays a central role by providing the way to achieve breakthrough performances in organizational systems, but it can be easily misplaced (Bhaskar, 2014). In fact, "the misuse of technology can block reengineering altogether by reinforcing old ways of thinking and old behavior patterns" (Morabito, 2013; Amanquah & Adjei, 2013).

- **Organization: "**A reengineering effort triggers changes that are of multidirectional. Job designs, organizational structures, management systems – everything associated with the process must be refashioned to maintain a coherent business system" (H.L. Bhaskar, 2018)

- **Culture**: Within the re-engineered processes people require some reason to perform well within the reengineered processes. Putting new processes in place is not enough; managers must motivate employees to rise to the challenge of the processes by supporting the new values and beliefs the processes demand (Gutierrez, 2001). In other words, management must pay attention to what goes on in people's minds as well as what happens in their workplace. This includes motivation, empowerment, training, etc.

The process is a key work in reengineering. This word is the most important in the definition. The process of a business is a collection of activities that takes one or more input and creates an output that is of value to the customer. Most business people are not "process-oriented"; rather focused on tasks, jobs, people, structure, but not on process task-based thinking that is the fragmentation of work into its simplest components and their task to specialist workers, has influenced the organizational design of companies for the last two hundred years. The time has come to shift to process-based thinking, and Business Process Reengineering promises to deliver just that. According to Hammer & Champy (1993), there are three kinds of companies that undertake business process reengineering

To keep the business process reengineering fair, transparent, and efficient, stakeholders need to get a better understanding of the six essential key steps involved in it. Although the process can differ from one organization to another, these steps listed below succinctly summarize the process:

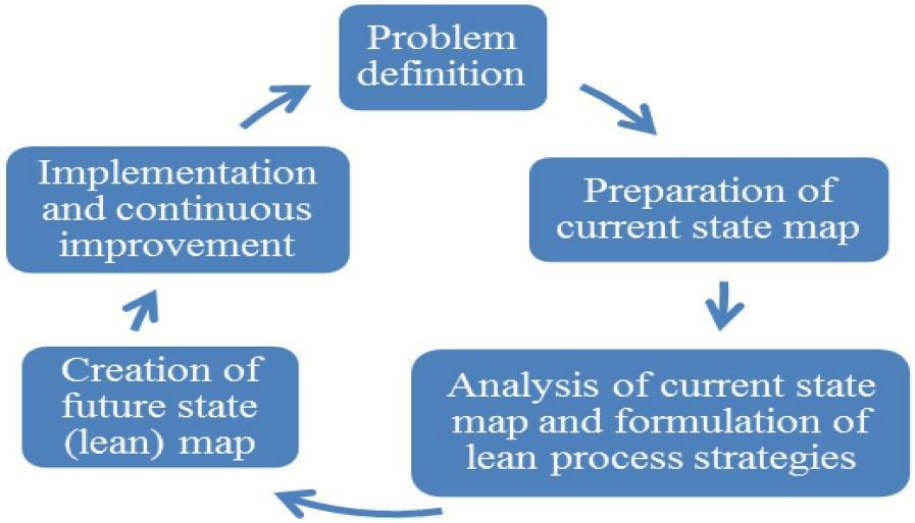


Figure 2 Business Process Reengineering Framework

Before a company decides to adopt BPR for its functional reshuffling, they usually answer the following questions:

1. Who are our customers? What values are we offering them?
2. Are the current processes delivering expected values?
3. Do the processes need to be redefined or redesigned?
4. Are the processes in sync with our long-term mission and goals?
5. How would we handle the existing processes if we were a new company?

If a company concludes that it is operating on complacent grounds, it has to identify the right kind of solution to address the problem or consider BPR for a total overhaul. Done well, BPR's radical approach yields dramatic results for a company in terms of improved cycle times, product quality, productivity, and so on.

Therefore, before adopting a BPR framework answering the above question is necessary. In construction the customers vary depending on what project you are bidding on but as project management books define clients as, "clients are an entity, individual or organization commissioning and funding the project, directly or indirectly. The current process in delivering expected values from the contractor's perspective has five

phases which include multiple processes under them. The phases are initiation, planning, execution, monitoring & controlling, and closing. The process under each phase needs to be redesigned since it's not in sync with the long-term mission and goals. Therefore, if we were a new company the process that is currently in action needs to be redesigned. Hence BPR can be applied to the construction industry.

## 2.6. Construction Process

The construction process is a combination of different phases. Based on the stakeholders in consideration there are different phases. A standard construction project based on contractor follows five major phased

1. Initiation: - It is the first phase in the project management lifecycle and involves starting up a new project. During this phase objectives, scope, purpose, and deliverables are produce and contract is signed between the stakeholders.
2. Planning: - In this phase detail project scope is established, budget is set, by analyzing the construction site schedules are prepared and procurement of necessary materials is carried out.
3. Execution: -This is the longest phase of the project. In this phase, the final product or service is developed and the final product to the customer is presented.
4. Monitoring & Controlling: - Monitoring helps project managers to understand whether the projects are progressing following the schedule and to ensure that project inputs, activities, outputs, and external factors are proceeding as planned.
5. Closing: - this is the last phase it involves handing over the project to clients. It involves some contractual processes.

## 2.7. Conclusion

Successful construction project performance is achieved, when stakeholders meet their requirements, individually and collectively. Construction project hinges on the ability of the construction project manager to effectively perform his job functions with the intended efficacy. Project performance can be evaluated based on project management actions, project-related factors, external environment, project procedure, and human-related factors that have more sub-factors under them. The common assessment of the success of construction projects is that they are delivered on time, to budget, to the technical specification and to meet client satisfaction.

Performance management is a continuous process of identifying, measuring, and developing performance in organizations by linking each individual's performance and objectives to the organization's overall mission, vision, and goals. Many participants are involved in the project non-performance including the client, contractor, consultant, shareholders, government, and the general public. It also helps to see how things are working so that we can have timely warning of difficulties that might get in the way of accomplishing project objectives and so that remedial corrective measures are taken.

Performance measurement is the consistent gathering and recording of data about the inputs, efficiency, and effectiveness of construction projects. Performance measurement is used to judge their project performances, both in terms of the financial and non-financial features, and to compare the performance with others, to improve program efficiency and effectiveness in their organizations. When assessing the success/failure of construction projects a common approach is to evaluate performance on the extent to which client objectives like cost, time, and quality were achieved.

Most construction companies share common mission, vision & goals which are to be the first choice, inspire the construction industry, exceed clients' expectation, bridging the construction technology and knowledge gap, maximize clients, delivering projects with quality, on time and at a competitive cost by adapting technology in construction and becoming an internationally competitive contractor. The construction companies share three common objectives which are meeting quality, delivering on time, and within the allocated budget.

Regardless of the increased global interest in performance management in construction and the company's vision, mission & goals, Ethiopian construction companies have not shown any progress in the matter of meeting budget and scheduled time. More than 90% of projects are delayed in time and cost overrun goes up to 126%. Different factors contribute to the delay and overrun of project time & cost.

Performance measurement frameworks have possibly made the largest effect upon the performance management literature. The term framework refers to the active employment of particular sets of recommendations. Very few performance measurement systems have been academically developed in comparison to PM frameworks. Three academic PM systems are examined here which are Balanced Scorecard, BPR & Medori, and Steeples.

“Business Process Reengineering is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, and speed” (Hammer & Champy, 1993). The process is a keyword in reengineering. This word is the most important in the definition. The process of a business is a collection of activities that takes one or more input and creates an output that is of value to the customer. BPR is an effective approach to achieving dramatic improvements in production time and cost in many industries worldwide. Construction project performance management is process-based management.

This paper identifies in detail the driving forces for the need for business process reengineering in construction, explores its applicability, and discusses major issues of current business processes concerning clients, Consultants, and contractors. It is presented as a means rather than a goal to facilitate creating wider objectives for contractors in the construction industry.

# Chapter 3

## 3. Research Methodology

The purpose of this chapter is to describe the research methodology and techniques that were used to conduct the study. Thus far, the problems to be studied have been clearly defined, the research objectives set, and justifications of the research were provided in the introductory chapter.

Furthermore, previous research concerning performance management in the construction industry and specifically by ISO certified construction contractors, in particular, was examined in the literature review section in the previous chapter. Journal publications, books, working papers, and reports were used to develop the literature review.

In this chapter, the research methodology is discussed. This section includes are research design, research method, Target population, sample size, sample technique, data source and type, data collection and instrument, validity and reliability, data collection procedures, ethical consideration, and data analysis method.

### 3.1. Research Design and Approach

This research takes on a quantitative, descriptive and inferential approach in assessing the subject of performance management practices in the construction industry, specifically by ISO certified contractors. (Saunders, Lewis, & Thornhill, 2007) defines quantitative research as a method that emphasize on objective measurements that uses any data collection technique (such as a questionnaire) or data analysis procedure (such as graphs or statistics) that generates or uses numerical data. Quantitative research helps to determine the relationship between set of variables. "According to Dr. Y.P. Aggarwal (2008) descriptive research is devoted to the gathering of information about prevailing conditions or situations for description and interpretation. This type of research design is not simply amassing and tabulating facts but includes proper analyses, interpretation, comparisons, identification of trends and relationships." (Neeru S, 2012). To reach conclusion that extends beyond the immediate data inferential statistics is used. "Random sample of data taken from a population to describe and make inferences about the population are used in inferential statistics. Inferential statistics are valuable when examination of each member of an entire population is not convenient or possible" A Banrjee (2010).

This study used quantitative approach to determine the performance management of construction projects using the three indicators which are cost, quality and time. "Quantitative Research is used to quantify the problem by way of generating numerical data or data that can be transformed into usable statistics. It is used to quantify attitudes, opinions, behaviors, and other defined variables – and generalize results from a larger sample population. Quantitative Research uses measurable data to formulate facts and uncover patterns in research." A Banrjee (2010).

## 3.2. Data Collection Method and Design

Both primary, as well as secondary data sources were used in this research. First, the secondary data obtained from published journals, books, working papers, reports, theses, and the internet was used to identify actors that affect cost and schedule overruns. Secondly, primary data was collected through an adapted questioner. The collected data is directly from the respondents in a natural setting using questionnaires.

The questionnaire was designed to consist of three parts. The 1st section consisted of questions of general background information regarding the respondents and their enterprises respectively. The 2nd & 3rd section questions have been measured by a six-point Likert scale. The 2nd part covers factors affecting time & cost performance while the last part deals with the management practice. The rating scales from strongly Agree to strongly disagree and from no exercise to strongly exercise. As a final point, the result has been summarized, tabulated and interpreted appropriately and lastly, conclusions and recommendations have also been forwarded.

## 3.3. Sample Technique, Target Population and Sample size

### Sampling Technique

Once the sample size was determined the next step was determining the number of respondents that were going to be selected from the project managers working at the ISO-certified construction companies. In Ethiopia, there are 12 ISO Certified companies certified by ECAE, ISO QAR, DQS, PJR, and ZDH with 75 projects under them.

**Table 1 Sampling Technique**

| No | Strata | Total Strata Size | Sample Size |
|---|---|---|---|
| 1. | Project Managers under ISO Certified construction Company | 75 | 63 |

Source : Own Survey, 2020

Once the project managers are identified, the questionnaires were distributed randomly.

### Target population

In Ethiopia registered contractors are categorized as General Contractors, Building Contractors, and Road contractors. This research is aimed at assessing performance management in building construction so the total population of the study was building contractors in Addis Ababa. It is known that construction management is project-based; therefore inputs from project managers were used to conduct the research. Though incorporating all

project managers' ideas on the analysis would have been better for conclusion and generalization, economically and operationally it would be very difficult to contact all in the research. Therefore, taking a respective sample of the population of the employees has found to be feasible.

The scope of the research is limited to projects under ISO certified contractors involved in building projects. Building is considered due to the housing issues currently seen in Ethiopia. As discussed above BPR performance management framework is used. Based on the company's mission, vision and goals, and current proven shortcomings in the construction industry factors related to time & cost are given more attention. Performance management is important for all companies regardless of nature.

Quality is one thing that can't be compromised at any cost since poor quality leads to failure of the structure. Therefore to evaluate quality, using internationally accepted standards is preferred. It is known that there are different internationally accepted standards for quality measurement but for this study ISO 9001 certified companies are taken. ISO 9001 is defined as "the international standard that specifies requirements for a quality management system (QMS). Organizations use the standard to demonstrate the ability to consistently provide products and services that meet customer and regulatory requirements."

### Sample Size

After determining the target population, the researcher has tried to calculate the sample size. Yamane (1967) sample size determination is used to draw the sample form population. Total sample size formula used is as follows

$$n = \frac{N}{[1 + N(e)^2}$$

Where n is the sample size, N is the population size, and e is the level of precision. With the level of precision e= 5% and N= 75. Since the population size is small it was not necessary to take sample size regardless it was impossible to reach all the participants therefore to meet the minimum requirement the calculation of n was conducted.

$$n = \frac{75}{[1 + 75(0.05)^2}$$

n= 63

Based on the above formula samples of 63 project Managers were selected from the target population.

## 3.4. Data Collection procedures

As discussed by Rose (cited in Asrat, 2013), "sample sizes larger than 30 and less than 500 are appropriate for most research". For this reason, the study included 72 project managers from ISO certified construction companies in Addis Ababa. All respondents were randomly selected for the study to give equal chance for all.

Questionnaires were hand-delivered or emailed to selected contractors. Respondents were given at least a week, to complete and submit the questionnaire. Respondents thus had the chance to express their propositions in a stress-free condition and relatively relaxed timeframe which is expected to contribute in sourcing quality response. Responses were collected similarly, either collected in person or emailed.

## 3.5. Method of Data Analysis

Data collected through questionnaires were analyzed using quantitative descriptive and inferential statistics with the help of IBM SPSS Statistics version 26 statistical computer software correlation and regression analysis was carried out. Descriptive analysis is used to reduce raw data collected through questioner into a meaningful summary and graph. While inferential analysis is used to make inferences about the larger population from the sample data collected. Mean is a descriptive method used to explain a set of data in a single number.

Correlation analysis was carried out to check the relationship between dependent and independent variables. The correlation result ranges between -1 and 1 while zero indicates no correlation. (Mukaka, 2012)

Multi-linear regression analysis was performed for estimating the relationship between variables. In the case of the study, multi-linear regression was used to quantify the tendency of the dependent variable (Performance of construction projects) to vary systematically with the independent variables (Factors affecting cost performance & Factors affecting time performance).

The analysis enabled the researcher to primarily check if the problem exists, rank the effect of the process factors that affect cost & time performance in the construction industry of the country as well as the effect of time, cost & quality management practices on the overall performance of construction projects.

Data presentation is done by tabularization including interpretation using frequency tables, graphs, and percentages. In the discussion and summary part of the study, the data gained from the questionnaire will be analyzed against the pieces of literature. Conclusion and recommendations were made based on the results of the study and the basis of the analyzed data.

## 3.6. Validity and Reliability

Questioners in research are used as a means of collecting relevant and reliable in a valid manner. Thus, the validity and reliability of the questioner/ survey are essential. Validity assures the area of investigation is explained by the collected data while reliability checks whether the questioner provides a stable and consistent result. Therefore, the reliability of the questioner was checked before any analysis was done.

Cronbach's alpha (α) is the most common measure used to check the reliability of a Likert scale question. The Cronbach's alpha, for the questioner used in this research, was determined by running reliability analysis in SPSS.

## 3.7. Ethical Issues

Before going out to conduct the study, research permission is secured from Addis Ababa University. Throughout the research understating there would be ethical considerations, the researcher holds as non-negotiable with regard to information obtained from research participants. All of the participants involved in the research were properly informed about the purpose of the research. Their identity and organization have been kept confidential. Additionally, all the secondary data used in this paper have been properly cited all the information collected throughout this research will only be used for the purpose of this study.

# Chapter 4

# 4. Results and Discussions

## 4.1. Introduction

This chapter presents and analyzes the result obtained from the questionnaire survey. The first demographic characteristics of the respondents are presented. It follows with a summary respondent's reply on various variables presented to them. Then it follows with a description of the data gathered, discussed, and analyzed the findings carefully in order to assess the effect of various independent variables with the depend on variable of findings has been organized in accordance with the study objectives.

Consequently, this chapter presents the results and findings of the research. The chapter mainly includes data results from the statistical tests conducted on the gathered primary data. The research mainly emphasized was to examine the effect of cost, quality, and time management on the overall performance of building construction projects. Descriptive analysis and inferential analysis of the study are presented respectively. Sixty-four questionnaires were distributed and collected to the respondents and out of these questionnaires; sixty were collected that accounts 94% response rate. Accordingly, the analysis of this study is based on the number of questionnaires collected. Here the statistical program used for the analysis and presentation of data in this study is the Statistical Package for the Social Sciences (SPSS) version 23. First, the reliability of the questionnaires was presented below.

## 4.2. Results

Before the analysis, the reliability of the questioner was checked by checking the Cronbach's alpha in SPSS. Cronbach's alpha (α) is the most common measure used to check the reliability of a Likert scale question. The Cronbach's alpha, for the questioner used in this research, was determined by running reliability analysis in SPSS. According to (Taber, 2018) alpha value between 0.45 & 0.98 is satisfactory which makes this questioner reliable. As shown in the tables below, the alpha value of the reliability analysis is in the range between 0.607 & 0.882.

### 4.2.1. Reliability of the Questionnaire

**Table 2 Reliability of Questionnaire (a)**

| Sub – Scale | Number of item | Cronbach's Alpha |
|---|---|---|
| Consultant | 5 | 0.607 |
| Contractor | 12 | 0.865 |
| Client | 3 | 0.612 |

Source: Own Survey, 2020

Reliability is acceptable if greater than 0.5 if number of variables is below 10 and for those with items more than 10 it should be greater than 0.7 which is fulfilled as seen in the above table.

**Table 3 Reliability of Questionnaire (b)**

| Sub – Scale | Number of item | Cronbach's Alpha |
|---|---|---|
| Consultant | 11 | 0.809 |
| Contractor | 18 | 0.882 |
| Client | 7 | 0.768 |

Source: Own Survey, 2020

Reliability is acceptable since all are above 0.7

### 4.2.2. Respondents General Information

**Table 4 Experience of Respondents**

| Experience of the project Manager | Frequency | Percent |
|---|---|---|
| 0-5 Years | 0 | 0 |
| 5-10 Years | 48 | 80 |
| Above 10 Years | 12 | 20 |

Source: Own Survey, 2020

Regarding the experience of project managers, the majority of them 48(80%) were with 5-10 years' experience while the remaining 12(20%) were with experience greater than 10 years.

Table 5 Education Level

| Education Level | Frequency | Percent |
|---|---|---|
| Diploma | 0 | 0 |
| Degree | 45 | 75 |
| Masters | 15 | 25 |

Source: Own Survey, 2020

Regarding the education level, the majority of the respondents 45 (75%) are degree graduates while the remaining 15(25%) are master's degree holders.

Table 6 Management Training

| Project Management Training | Frequency | Percent |
|---|---|---|
| Yes | 43 | 71.7 |
| No | 17 | 28.3 |

Source: Own Survey, 2020

As it comes to project management training, 43(71.7%) of the respondents have taken some form of project management training while the remaining 17(28.3%) of the respondents haven't. This shows that all of the respondents are capable of answering the questions in a way which it can be a great contribution to the conclusion.

### 4.2.3. Descriptive Statistics Result

In this part the responses of the respondents for the variables indicated below were measured on six points two types Likert scale with: 0= No Exercise 1= Very Low Exercise, 2= Low Exercise, 3 = Exercise, 4= Highly Exercise and 5= Very Highly Exercise and 0= No Probability 1= Very Low Probability, 2= Low Probability, 3 = Probability, 4= High Probability and 5= Very High Probability. The descriptive statistics which are in the form of mean and standard deviation were presented . However, while making interpretation of the results of mean the scales were reassigned as follows to make the interpretation easy and clear.

To determine where the most answer lies, we calculate the mean value of the data. A formula adopted from (Vichea, 2005) was used to break the range distance in measuring the variables.

$$(n-1)/n = (5-1)/5=0.8$$

Therefore, mean values falling within

- 4.2 – 5.00 are going to be taken as very high probability / Exercise
- 3.4 – 4.19 are going to be taken as high probability / Exercise
- 2.6 – 3.39 are going to be taken as probability / Exercise
- 1.8 – 2.59 are going to be taken as low probability /Exercise
- 1 - 1.79 are going to be taken as very low probability / Exercise
- 1.79 - 0 are going to be taken as no probability / Exercise

## 4.3. Management Practice

### *Quality Management Practice*

Regarding the quality management practice in the selected ISO certified construction companies, the following descriptive result obtained

**Table 7 Quality Management Practice**

| Items | N | Mean | | Std. Deviation |
|---|---|---|---|---|
| | Statistic | Statistic | Std. Error | Statistic |
| Quality Planning | 60 | 3.87 | 0.16 | 1.22774 |
| Quality Assurance | 60 | 3.82 | 0.16 | 1.26881 |
| Quality Control | 60 | 3.92 | 0.16 | 1.21141 |

Source: Own Survey, 2020

As presented in the above table on quality management practice, items all fall in the range of highly exercised. This implies the companies highly exercised the all the quality management practices.

### *Time Management Practice*

Regarding the time management practice in the selected ISO certified construction companies, the following descriptive result obtained

**Table 8 Time Management Practice**

| Items | N | Mean | | Std. Deviation |
|---|---|---|---|---|
| | Statistic | Statistic | Std. Error | Statistic |
| Activity Definition | 60 | 4.2833 | 0.0633 | 0.4903 |
| Activity Sequencing | 60 | 4.1167 | 0.0633 | 0.4903 |
| Activity Duration estimating | 60 | 4.3167 | 0.06056 | 0.4691 |
| Schedule Development | 60 | 4.3333 | 0.08787 | 0.68064 |
| Schedule Control | 60 | 4.45 | 0.08378 | 0.64899 |

Source: Own Survey, 2020

As presented in the above tables on time management practice, all items fall in Very highly exercised agreement range except the item which asks whether the companies exercise activity sequencing with mean of 4.12 and standard deviation 0.49.

The result implies even though the time management practice is Very highly exercised a little lower attention is given to a certain item which is Activity Sequencing.

### *Cost Management Practice*

Regarding the cost management practice in the selected ISO certified construction companies, the following descriptive result obtained

**Table 9 Cost Management Practice**

| Item | N | Mean | | Std. Deviation |
|---|---|---|---|---|
| | Statistic | Statistic | Std. Error | Statistic |
| Resource Planning | 60 | 4.25 | 0.12265 | 0.95002 |
| Cost Estimating | 60 | 4.2667 | 0.10047 | 0.77824 |
| Cost Budgeting | 60 | 4.1667 | 0.13689 | 1.06033 |
| Cost Control | 60 | 4.2 | 0.13404 | 1.03825 |

Source: Own Survey, 2020

As presented in the above tables on cost management practice, all items fall in Very highly exercised agreement range except the item which asks whether the companies exercise cost budgeting with mean of 4.16 and standard deviation 0.14.

The result implies even though the cost management practice is Very highly exercised a little lower attention is given to a certain item which is cost budgeting.

## 4.4. Time & Cost Performance Factors

Regarding the factors affecting time & cost performance in the selected companies the matter is treated in three categories based on their involvement with the items listed based on Twana A, 2015. The three categories chosen are Consultant, Contractor and Client. The following descriptive result obtained

## *Time Performance*

**Consultant**

Table 10 Descriptive; Consultant Time Performance Factors

| Item | N | Mean | | Std. Deviation |
|---|---|---|---|---|
| | Statistic | Statistic | Std. Error | Statistic |
| Design delays | 60 | 4.5833 | 0.06844 | 0.53016 |
| Design changes | 60 | 4.5667 | 0.07275 | 0.56348 |
| Change order | 60 | 3.6333 | 0.11391 | 0.88234 |
| Changes in specifications | 60 | 3.5333 | 0.11757 | 0.9107 |
| Incomplete drawings | 60 | 3.7167 | 0.11906 | 0.92226 |
| Incompetent supervisors | 60 | 4.5833 | 0.07625 | 0.59065 |
| Inspection delay | 60 | 3.5833 | 0.1412 | 1.09377 |
| Poor communication | 60 | 3.55 | 0.11985 | 0.92837 |
| Poor supervision | 60 | 3.15 | 0.13197 | 1.02221 |
| Necessary variations of works | 60 | 3.7833 | 0.12598 | 0.97584 |
| Poor contract management | 60 | 4.0333 | 0.13012 | 1.00788 |

Source: Own Survey, 2020

As indicated in the above table, the probability of occurrence of different items varies. Based on the agreed range poor supervision (Mean 3.15 & SD 1.022) lays in the probability of occurrence and design delay (Mean 4.58 & SD 0.53), design change (Mean 4.56 & SD 0.56) and incompetent supervisors (Mean 4.58 & SD 0.59) are items that lay in the very high probability off occurrence range. The remaining items which are Change in order (Mean 3.633 & SD 0.882), Change in specification (Mean 3.53 & SD 0.911), incomplete drawing (Mean 3.71 & SD 0.922), Inspection delay (Mean 3.58 & SD 1.09), Poor communication (Mean 3.55 & SD 0.928), Necessary variation of works (Mean 3.78 & SD 0.975) and Poor contract management (Mean 4.03 & SD 1.00) have high probability of occurrence.

This indicates that based on the responses when ranging the items on the probability of their occurrence, first comes design delay, design change and incompetent supervisors while Change in order, Change in specification, incomplete drawing, Inspection delay, Poor communication, Necessary variation of works and Poor contract management follows and lastly comes poor supervision based on their probability of occurrence.

**Contractor**

Table 11 Descriptive; Contractor Time Performance Factors

| Item | N | Mean | | Std. Deviation |
|---|---|---|---|---|
| | Statistic | Statistic | Std. Error | Statistic |
| Inadequate planning | 60 | 3.4167 | 0.14319 | 1.10916 |
| Equipment unavailability | 60 | 3.3167 | 0.14937 | 1.15702 |
| Shortage of labors | 60 | 3.5333 | 0.14354 | 1.11183 |
| Poor site management | 60 | 3.4667 | 0.16027 | 1.24147 |
| Poor contractor management | 60 | 3.8833 | 0.13039 | 1.00998 |
| Poor labor productivity | 60 | 3.5667 | 0.1601 | 1.2401 |
| Staffing Problem | 60 | 3.3667 | 0.12793 | 0.99092 |
| Difficulties in financing project | 60 | 4.6 | 0.06806 | 0.52722 |
| Resource shortages | 60 | 3.6833 | 0.15855 | 1.22808 |
| Rework | 60 | 3.8 | 0.13404 | 1.03825 |
| Poor technical performances | 60 | 3.25 | 0.17078 | 1.32288 |
| Material procurement | 60 | 3.7667 | 0.1046 | 0.81025 |
| Escalation of material | 60 | 3.8333 | 0.14684 | 1.13745 |
| Construction mistakes | 60 | 3.3167 | 0.13549 | 1.04948 |
| Poor coordination on site | 60 | 3.4 | 0.12844 | 0.9949 |
| Poor site layout | 60 | 3.1667 | 0.12159 | 0.94181 |
| Unfriendly working atmosphere | 60 | 3 | 0.16295 | 1.26223 |
| Unavailability of resources | 60 | 3.4 | 0.09267 | 0.71781 |

Source: Own Survey, 2020

As indicated in the above table, the probability of occurrence of different items varies. Based on the agreed range difficulties in financing project (Mean 4.6 & SD 0.527) has a very high probability of occurrence, poor site layout (Mean 3.16 & SD 0.941) & Unfriendly working atmosphere (Mean 3 & SD 1.262) have probability of occurrence while all the rest lays in the range of high probability of occurrence (Mean ranges 3.25-3.88 & SD ranges 0.717-1.322) .

This indicates that based on the responses when ranging the items on the probability of their occurrence, first comes difficulties in financing project while Inadequate planning, equipment unavailability, Shortage of labors, Poor site management, Poor contractor management, Poor labor productivity, Staffing Problem, Resource shortages, Rework, Poor technical performances, Material procurement, Escalation of material, Construction mistakes, Poor coordination on site and Unavailability of resources lastly comes Poor site layout and Unfriendly working atmosphere.

**Client**

Table 12 Descriptive; Client time performance Factors

| Item | N | Mean | | Std. Deviation |
|---|---|---|---|---|
| | Statistic | Statistic | Std. Error | Statistic |
| Slowness in decision making | 60 | 3.3167 | 0.1396 | 1.0813 |
| Delay in payment | 60 | 3.5333 | 0.16717 | 1.29493 |
| Client-initiated variation | 60 | 4.4667 | 0.08723 | 0.67565 |
| Unforeseen ground condition | 60 | 4.0167 | 0.12687 | 0.98276 |
| Changes in drawings | 60 | 4.0833 | 0.09594 | 0.74314 |
| Changes in site conditions | 60 | 3.55 | 0.14734 | 1.14129 |
| Monthly payment difficulties from agencies | 60 | 4.2167 | 0.12372 | 0.95831 |

Source: Own Survey, 2020

As indicated in the above table, the probability of occurrence of all the items listed lays in high probability of occurrence (Mean ranges 3.31-4.46 & SD 0.675-1.294) except Monthly payment difficulties from agencies (Mean 4.21 & SD 0.958) which has a very high probability of occurrence.

## *Cost Performance*

**Consultant**

Table 13 Descriptive; Consultant Cost Performance Factors

| Item | N | Mean | | Std. Deviation |
|---|---|---|---|---|
| | Statistic | Statistic | Std. Error | Statistic |
| Inaccurate or Poor Estimation of Original Cost | 60 | 4 | 0.13019 | 1.00844 |
| Mistake in Design | 60 | 3.65 | 0.15735 | 1.21885 |
| Inappropriate scope definition | 60 | 3.35 | 0.14027 | 1.08651 |
| Inappropriate contractual framework | 60 | 3.5667 | 0.13934 | 1.07934 |
| Poor contract management | 60 | 3.45 | 0.11747 | 0.90993 |

Source: Own Survey, 2020

As indicated in the above table, the probability of occurrence of all the items listed lays in high probability of occurrence (Mean ranges 3.35-4.0 & SD 0.909-1.218).

**Contractor**

Table 14 Descriptive; Contractor Cost Performance Factors

| Item | N | Mean | | Std. Deviation |
|---|---|---|---|---|
| | Statistic | Statistic | Std. Error | Statistic |
| Obsolete or Unsuitable Construction Equipment and Methods | 60 | 3 | 0.14844 | 1.1498 |
| High Cost of Machineries | 60 | 3.1667 | 0.14491 | 1.12245 |
| Inefficient management | 60 | 3.9167 | 0.12864 | 0.99646 |
| Improper Project Costing and Financing | 60 | 3.65 | 0.16945 | 1.31259 |
| Improper planning | 60 | 3.8 | 0.13404 | 1.03825 |
| Fluctuation in Price of Raw Materials | 60 | 4.4667 | 0.09041 | 0.70028 |
| Poor project management | 60 | 3.6333 | 0.12793 | 0.99092 |
| Lack of Experience | 60 | 3.1833 | 0.13125 | 1.01667 |
| Measures to Control Construction Cost | 60 | 3.4333 | 0.1373 | 1.06352 |
| Incompetent personnel | 60 | 3.7 | 0.13298 | 1.03006 |
| Proper cost control | 60 | 3.5167 | 0.13549 | 1.04948 |
| Risk Management during Project Execution | 60 | 3.5167 | 0.12463 | 0.96536 |

Source: Own Survey, 2020

As indicated in the above table, the probability of occurrence of items are listed, Fluctuation in Price of Raw Materials (Mean 4.46 & SD 0.090) has a very high probability of occurrence, Inefficient management, improper Project Costing and Financing, improper planning, Poor project management, Lack of Experience, Measures to Control Construction Cost, Incompetent personnel, Proper cost control and Risk Management during Project Execution (Mean ranges 3.31-4.46 & SD 0.675-1.294) have high probability of occurrence while Obsolete or Unsuitable Construction Equipment and Methods (Mean 3 & SD 1.149) and High Cost of Machineries (Mean 3.16 & SD 1.122) have probability of occurrence.

This indicates that based on the responses when ranging the items on the probability of their occurrence, first comes Fluctuation in Price of Raw Materials while Inefficient management, improper Project Costing and Financing, improper planning, Poor project management, Lack of Experience, Measures to Control Construction Cost, Incompetent personnel, Proper cost control and Risk Management during Project Execution, lastly comes Obsolete or Unsuitable Construction Equipment and Methods and High Cost of Machineries.

## Client

Table 15 Descriptive; Client Cost Performance Factors

| Item | N | Mean | | Std. Deviation |
|---|---|---|---|---|
| | Statistic | Statistic | Std. Error | Statistic |
| Unforeseen site conditions | 60 | 3.3667 | 0.10884 | 0.84305 |
| Insufficient fund | 60 | 3.5 | 0.1436 | 1.11233 |
| Inflation of Project Costs | 60 | 4.35 | 0.09152 | 0.7089 |

Source: Own Survey, 2020

As indicated in the above table, the probability of occurrence of all the items listed lays in high probability of occurrence (Mean ranges 3.36-4.35 & SD 0.708-1.112).

### *General Information*

Regarding the general information of the of the building construction project. The following descriptive result obtained

Table 16 Descriptive; General Information

| Item | N | Mean | | Std. Deviation |
|---|---|---|---|---|
| | Statistic | Statistic | Std. Error | Statistic |
| Project not being delivered on time | 60 | 3.85 | 0.08174 | 0.63313 |
| Project not being delivered within budget | 60 | 3.55 | 0.10203 | 0.7903 |
| Unsatisfied Customer | 60 | 3.65 | 0.0745 | 0.57711 |

Source: Own Survey, 2020

As indicated in the above table, the probability of occurrence of all the items listed lays in high (Mean ranges 3.55-3.85 & SD 0.577-0.790).

## 4.5. Inferential Statistics Results

In order to prove or disprove our hypothesis in the proposed study correlation between dependent and independent variables is carried out with the help of IBM SPSS Statistics version 26, statistical computer software

### 4.5.1. Correlation results

*Time Performance Factors*

Consultant Related Time Factors

**Table 17 Correlation; Consultant Time Performance Factors**

| **Project not being delivered on time** | Pearson Correlation | Sig. (2-tailed) | N |
|---|---|---|---|
| Design delays | .467** | 0 | 60 |
| Design changes | .385** | 0.002 | 60 |
| Change order | .264* | 0.042 | 60 |
| Changes in specifications | .317* | 0.013 | 60 |
| Incomplete drawings | .390** | 0.002 | 60 |
| Incompetent supervisors | 0.057 | 0.667 | 60 |
| Inspection delay | .520** | 0 | 60 |
| Poor communication | .431** | 0.001 | 60 |
| Poor supervision | .559** | 0 | 60 |
| Necessary variations of works | .385** | 0.002 | 60 |
| Poor contract management | .353** | 0.006 | 60 |

Source: Own Survey, 2020

Based on the above co relational metrics results, all the independent variables are significantly related with the dependent variable (project not being delivered on time) at p value <0.05 except incompetent supervisor. In Ethiopian construction practice, supervisors assigned to projects must be qualified to the position prior to starting the construction phase. The consulting firm is responsible for the appointed personnel. If the supervisor is incompetent, the contractor can overpass his/her decision and discuss with the superiors. The contractor can also ask to replacement therefore it can't be considered as a determinant factor.

## Contractor Related Time Factor

Table 18 Correlation; Contractor Time Performance Factors

| **Project not being delivered on time** | Pearson Correlation | Sig. (2-tailed) | N |
|---|---|---|---|
| Inadequate planning | .573** | 0 | 60 |
| Equipment unavailability | .621** | 0 | 60 |
| Shortage of labors | .621** | 0 | 60 |
| Poor site management | .587** | 0 | 60 |
| Poor contractor management | .396** | 0.002 | 60 |
| Poor labor productivity | .628** | 0 | 60 |
| Staffing Problem | .467** | 0 | 60 |
| Difficulties in financing project | 0.223 | 0.086 | 60 |
| Resource shortages | .614** | 0 | 60 |
| Rework | .521** | 0 | 60 |
| Poor technical performances | .673** | 0 | 60 |
| Material procurement | .327* | 0.011 | 60 |
| Escalation of material | .530** | 0 | 60 |
| Construction mistakes | .379** | 0.003 | 60 |
| Poor coordination on site | .447** | 0 | 60 |
| Poor site layout | .327* | 0.011 | 60 |
| Unfriendly working atmosphere | 0.191 | 0.144 | 60 |
| Unavailability of resources | .545** | 0 | 60 |

Source: Own Survey, 2020

Based on the above co-relational metrics results, all the independent variables are significantly related with the dependent variable p value <0.05 except difficulties in financing project & Unfriendly working atmosphere.

Projects are given to contractors based on their abilities to construct by checking their annual turnover. Certain advance payments are paid at the beginning to facilitate the construction and if payment is released at the appropriate time difficulties in financing projects is not an issue for the contractor.

Working atmosphere highly relates to interaction with superiors and coworkers during the working hours. The Construction companies are ISO certified therefore they have well established company structure and all the employees have defined job description. This proves that the issue that arises due to conflicts on the job is solved therefore unfriendly working Atmosphere doesn't have major contribution for projects not being delivered on time.

## Client Related Time Factors

**Table 19 Correlation; Client Time Performance Factors**

| **Project not being delivered on time** | Pearson Correlation | Sig. (2-tailed) | N |
|---|---|---|---|
| Slowness in decision making | .665** | 0 | 60 |
| Delay in payment | .430** | 0.001 | 60 |
| Client-initiated variation | 0.206 | 0.114 | 60 |
| Unforeseen ground condition | .467** | 0 | 60 |
| Changes in drawings | .603** | 0 | 60 |
| Changes in site conditions | .538** | 0 | 60 |
| Monthly payment difficulties from agencies | .362** | 0.005 | 60 |

Source: Own Survey, 2020

Based on the above co relational metrics results, all the independent variables are significantly related with the dependent variable (project not being delivered on time) at p value <0.05 except difficulties in client initiated variation. When clients initiate variation it is a default that time extension is given without complaint from the clients side. Therefore, client-initiated variation is not a factor for unsatisfied customers due to delay in delivery time.

## *Cost Performance Factors*

### Consultant related cost factors

**Table 20 Correlation; Consultant Cost Performance Factors.**

| **Project not being delivered within budget** | Pearson Correlation | Sig. (2-tailed) | N |
|---|---|---|---|
| Inaccurate or Poor Estimation of Original Cost | .362** | 0.005 | 60 |
| Mistake in Design | .573** | 0 | 60 |
| Inappropriate scope definition | .522** | 0 | 60 |
| Inappropriate contractual framework | .383** | 0.002 | 60 |
| Poor contract management | .687** | 0 | 60 |

Source: Own Survey, 2020

Based on the above co relational metrics results, all the independent variables are significantly related with the dependent variable (project not being delivered on budget) at p value <0.05. This result implies that the consultant related time factors have direct relation with project being delivered on budget.

## Contractor Related Time Factor

Table 21 Correlation; Contractor Time Performance Factors

| **Project not being delivered within budget** | Pearson Correlation | Sig. (2-tailed) | N |
|---|---|---|---|
| Obsolete or Unsuitable Construction Equipment and Methods | .616** | 0 | 60 |
| High Cost of Machineries | .545** | 0 | 60 |
| Inefficient management | .576** | 0 | 60 |
| Improper Project Costing and Financing | .646** | 0 | 60 |
| Improper planning | .570** | 0 | 60 |
| Fluctuation in Price of Raw Materials | .600** | 0 | 60 |
| Poor project management | .478** | 0 | 60 |
| Lack of Experience | .611** | 0 | 60 |
| Measures to Control Construction Cost | .538** | 0 | 60 |
| Incompetent personnel | .539** | 0 | 60 |
| Proper cost control | .408** | 0.001 | 60 |
| Risk Management during Project Execution | .577** | 0 | 60 |

Source: Own Survey, 2020

Based on the above co relational metrics results, all the independent variables are significantly related with the dependent variable (project not being delivered on budget) at p value <0.05. This result implies that the contractor related time factors have direct relation with project being delivered on budget.

## Client Related time Factor

Table 22 Correlation; Client Time Related Factors

| **Project not being delivered within budget** | Pearson Correlation | Sig. (2-tailed) | N |
|---|---|---|---|
| Unforeseen site conditions | .430** | 0.001 | 60 |
| Insufficient fund | .627** | 0 | 60 |
| Inflation of Project Costs | .498** | 0 | 60 |

Source: Own Survey, 2020

Based on the above co relational metrics results, all the independent variables are significantly related with the dependent variable (project not being delivered on budget) at p value <0.05. This result implies that the client related time factors have direct relation with project being delivered on budget.

### *Discussion of the correlation results*

The correlation was done between the dependent and independent variables for all processes that affect construction phase due to client, contractor & consultant time & cost factors. Based on the above correlational results, all the independent variables (factors that affect cost & time) are significantly related with the dependent variable (projects not being delivered within budget & time) at p value <0.05 except for except four variables. The variables are correlation between Project not being delivered on time and probability of occurrence of incompetent supervisor (Consultant time factors), financing project & unfriendly working atmosphere (Contractor time factors) and difficulties in client initiated variation (Client Time Factors) and the effect it have on project time performance. The 2-tailed value of these four variables is greater than 0.05 which indicates that there is no significant correlation between the dependent and independent variables.

### 4.5.2. Regression Result

Regression is the next step up after correlation. It is used when to predict the value of a variable based on the value of another variable. In this paper, we are trying to check the hypothesis that performance of construction projects (dependent variable) is affected by factors affecting cost performance & factors affecting time performance (independent variable). Based on this model we will have one models that explain relation between the independent and dependent variables.

The first step in this analysis is to determine which type of regression analysis is suitable for the type of data collected. In this case, as shown in the graph below, the relationship between probability of occurrence of risk and its effect on project cost and the relationship between probability of occurrence of risk and its effect on project completion time is linear. Since, there is one independent variable that explains the dependent variable; the regression technique used in this paper is simple Multi linear regression.

***Linearity***

The linearity of the relationship between the dependent and independent variable represented the degree to which the change in the dependent variable is associated with the independent variable. Check the P-P Plot the points have to lie close to the line (reasonably a straight line) and on scatter plot we have to be

able to draw a rectangle around it (shouldn't be systematically aligned).To determine number of independent variables and associate with critical value of K square. df Critical value for two variables should be less than 13.83

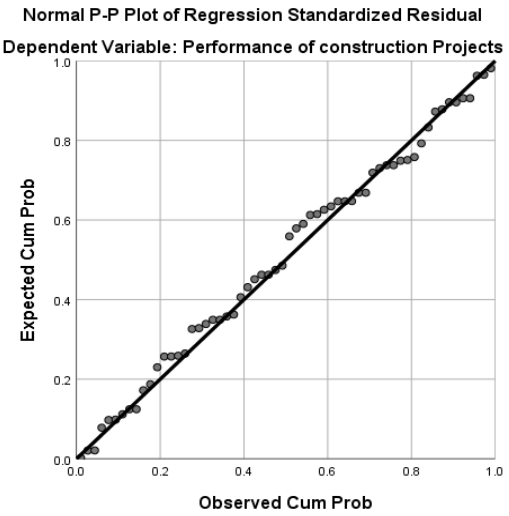


Figure 3 Linearity; P-P Plot

The figure shows that the data used for this study is normal since the line follows the Normality line, only a slight deviation is observed. This means the data used in this study meets the linearity assumption

## Residuals Statistics [a]

Table 23 Regression Linearity; Residual Statistics

| | Minimum | Maximum | Mean | Std. Deviation | N |
|---|---|---|---|---|---|
| Predicted Value | 2.4016 | 4.7434 | 3.6767 | 0.52023 | 60 |
| Std. Predicted Value | -2.451 | 2.050 | 0.000 | 1.000 | 60 |
| Standard Error of Predicted Value | 0.005 | 0.019 | 0.008 | 0.003 | 60 |
| Adjusted Predicted Value | 2.4019 | 4.7477 | 3.6769 | 0.52024 | 60 |
| Residual | -0.07274 | 0.08825 | 0.00000 | 0.03669 | 60 |
| Std. Residual | -1.948 | 2.364 | 0.000 | 0.983 | 60 |
| Stud. Residual | -1.977 | 2.387 | -0.003 | 1.006 | 60 |
| Deleted Residual | -0.07656 | 0.09002 | -0.00024 | 0.03850 | 60 |
| Stud. Deleted Residual | -2.031 | 2.494 | -0.003 | 1.021 | 60 |
| Mahal. Distance | 0.006 | 13.800 | 1.967 | 2.601 | 60 |
| Cook's Distance | 0.000 | 0.125 | 0.017 | 0.027 | 60 |
| Centered Leverage Value | 0.000 | 0.234 | 0.033 | 0.044 | 60 |

Source: Own Survey, 2020

a. Dependent Variable: Performance of construction Projects

**Outliner**: is an observed data point that has dependent variable that is very different than that is predicted by the regression model. These values can reduce the fit of the regression equation to predict the value of the dependent variable. Therefore, there should be no significant outliers in the collected data. In SPSS, the existence of outliner in the data is distinguished by checking the value of Standardize residual. If the minimum value is greater than -3.29 and the maximum less than 3.29, that means the data have no outliner. As shown in the table below this assumption is satisfied in both models.

When checking the Mahal. Distance Maximum it is equal to 13.80 which is lower than 13.83. Therefore it passed the linearity test.

**Homoscedasticity**: which is the distance between the scatter of the data points from the model is similar. The following scatter plot graphs can show the homoscedasticity of the data collected for both models. As shown in the figure bellow there is no observable pattern the points seem to be distributed fairly above and below zero on the X axis and to the left and right of zero on the Y axis showing that the data is homoscedastic.

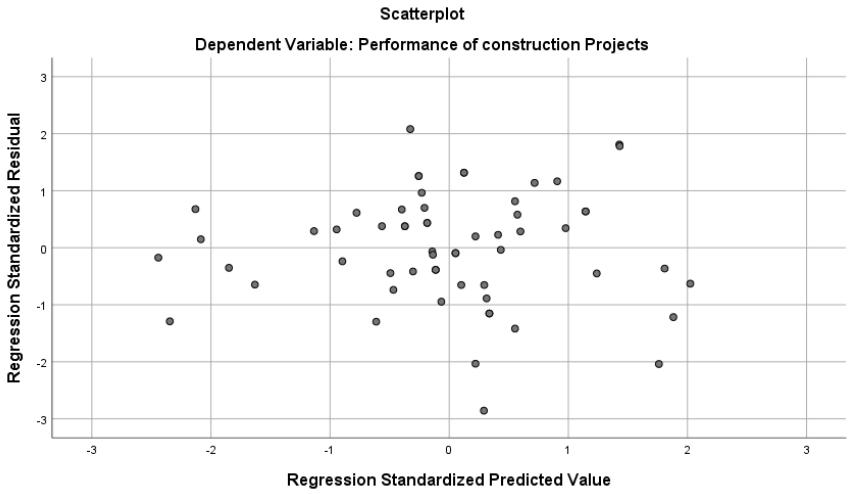


Figure 4 Homoscedastic; Scatter Plot

*The Assumption of Normality:* A check for normality of the error term is shown by a histogram of the normal probability plots of the residuals. The normality probability plots were plotted to assess normality. The P-P plots were approximately a straight line instead of a curve. Accordingly, the residuals were deemed to have a reasonably normal distribution, as suggested by Hair et al. (1996). The result showed that the assumption of normality has been met.

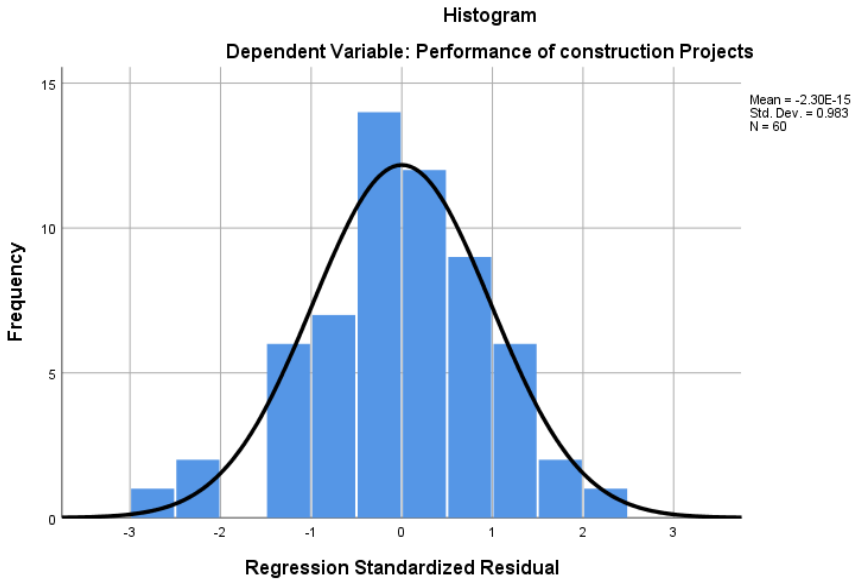


Figure 5 Normality

## *Multi Co-Linearity*

### Coefficients

Table 24 Regression; Multi Co-Linearity Coefficient

| | Unstandardized Coefficients | | Standardized Coefficients | | | 95.0% Confidence Interval for B | | Correlations | | | Co-linearity Statistics | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | Std. Error | Beta | T | Sig. | Lower Bound | Upper Bound | Zero-order | Partial | Part | Tolerance | VIF |
| (Constant) | 0.001 | 0.035 | | 0.029 | 0.977 | -0.069 | 0.071 | | | | | |
| Factors Affecting time performance | 0.627 | 0.014 | 0.631 | 44.216 | 0.000 | 0.599 | 0.656 | 0.957 | 0.986 | 0.412 | 0.427 | 2.344 |
| Factors Affecting cost performance | 0.368 | 0.012 | 0.431 | 30.182 | 0.000 | 0.344 | 0.393 | 0.908 | 0.970 | 0.281 | 0.427 | 2.344 |

Source: Own Survey, 2020

a. Dependent Variable: Performance of construction Projects

According to the coefficients outputs of co-linearity statistics, obtained Tolerance and Variance Inflation Factors (VIF) values showed that the obtained values for tolerance = 0.281 & 0.412 which is greater than 0.10 and VIF = 2.344 which is less than 10 therefore we can conclude that there is no multi co-linearity symptoms.

There is additional information found from this table which is checking which independent variable contributes the most to the outcome by checking the standardized Coefficients Beta. From the above table we can see that variable factors affecting time performance has greater contribution to affecting performance of construction projects which is our dependent variable.

### *Hypothesis*

Time & Cost performance factors affect the overall performance of building construction projects; it is shown by unfulfilled clients due to the fact that projects are not delivered on time and within budget.

**Model Summary** [b]

**Table 25 Regression Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
|---|---|---|---|---|---|
| 1 | .998[a] | 0.995 | 0.995 | 0.03733 | 2.406 |

Source: Own Survey, 2020

a. Predictors: (Constant), Factors Affecting cost performance, Factors Affecting time performance
b. dependent Variable: Performance of construction Projects

**ANOVA** [a]

**Table 26 Regression; ANOVA**

| Model | | Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 15.968 | 2 | 7.984 | 5728.350 | .000[b] |
| | Residual | 0.079 | 57 | 0.001 | | |
| | Total | 16.047 | 59 | | | |

a. Dependent Variable: Performance of construction Projects

b. Predictors: (Constant), Factors Affecting cost performance, Factors Affecting time performance

Source: Own Survey, 2020

**Durbin Watson** test of value of 2 indicates no auto correlation 2.4 is close to 2 therefore we can conclude that there is no auto correlation.

**R & $R^{2:}$** Performance of construction projects with R square and adjusted R square value of the simple linear regression is given by .995 and .995, respectively. This is interpreted as 99% of variance in performance management projects is explained by factors affecting cost performance & factors affecting time performance, while the remaining of variation in can be attributed to other variables which are not considered in this study.

Besides, the F-statistic value of 5728.35 at 2 and 57 degrees of freedom is statistically significant at 99% confidence level; which implies the variation in performance management projects that is explained by factors affecting cost performance & factors affecting time performance expressed by R square is statistically significant.

Based on the above result, **the regression equation** can be present as:

Performance of construction projects = 0.001 + 0.627 (Factors that affect time performance) + 0.368 (Factors that affect cost performance)

## 4.6. Discussion

For this research experienced project managers were selected due to the reason that the research is focused on project management. Project management training is essential for familiarity with the topic at hand and on what to do's while managing a certain project. Therefore the fact that the majority of project managers have taken the training and are experienced will make the input a great contribution.

The primary question was is there a management practice regarding cost, time & quality. It is observed that quality management practice needs more attention than time and cost management practices. Regarding time & cost management practice all are highly exercised. Regardless of the existence and practice of management systems, there is still a gap in delivering a project within schedule and at the allocated budget. Therefore, checking which process is failing and fixing the problem from the source should be the next step. To substantially make a difference in the industry introducing a certain framework is necessary.

From prior researches done around the world, certain factors are listed, as they affect the construction time & cost overrun. Stakeholder such as consultants, contractors & clients all has their contribution to the construction phase for a project not being delivered on time and within budget. Those processes are listed as factors and their contribution is checked in the current construction in Ethiopia as a probability of

occurrence. Currently, the result has shown that projects are not being delivered on time, within budget, and as a result, clients are not satisfied and the reason for this needs to be given enough attention. The probability of occurrence of the factors is checked as it gives as direction to what lead to this negative outcome at the end.

Quality is a must meet factor, if compromised it leads to the structure failing or not deliver the intended purpose. Therefore choosing ISO certified companies grants that there is a consistent checking for quality and the existence of structure in the company.

When coming to cost and time performance factors it is seen that all factors from previous studies occur in Ethiopian construction projects and all except four (incompetent supervisor, difficulties in financing projects, unfriendly working atmosphere, a client-initiated variation which are time-related factors) are related to the undelaying factor which is delivery time & budget. Therefore improving the listed processes betters the performance of construction projects.

Consequently, there is enough evidence to accept the hypothesis which states time & cost performance factors affect the overall performance of building construction projects.

Table 27 Hypothesis

| No. | Hypothesis | Test result |
|---|---|---|
| 1 | Time & Cost performance factors affect the overall performance of building construction projects; it is shown by unsatisfied clients due to the fact that projects are not delivered on time and within budget. | **Fail to reject** |

As discussed in the literature review, after identifying the factors that affect cost & time and identifying which factor has high probability of occurrence in Ethiopian construction projects, the next step is developing a performance framework that helps minimize the negative effects of the processes.

# Chapter 5

## 5.1. Conclusion

Based on the finding of the study the following conclusions are drawn. This study found that all the ISO certified companies involved in the research exercise quality, time, and cost management practices. Some practices are given more attention when considering each individual. When considering cost & time management practices they are more exercised than quality but a little more attention should be given to cost budgeting and activity sequencing.

Construction companies in Ethiopia have a common mission, vision & goal. Which are; to be a first choice construction company, inspire the construction industry, exceed clients' expectations, bridging the construction technology and knowledge gap, maximize clients, delivering projects with quality, on time, and at a competitive cost by adapting technology in construction and becoming an internationally competitive contractor. The construction companies share three common objectives which are meeting quality, delivering on time, and within the allocated budget.

Qualitative analysis of general information about current practice regarding accomplishing the stated mission and goal of the construction companies is performed. It is indicated that there is a high probability that projects are not delivered on time and within budget and customers are not satisfied. This indicates that the goal of the company is not being accomplished. Therefore, a certain framework needs to be introduced.

Construction can be managed by managing the process that leads to product delivery. The process is the key to business process reengineering. As mentioned above the mission and goal of the companies are not achieved therefore construction process needs to be redesigned. By analyzing the current process in action it was determined that there exists a process gap caused by different contractual parties which are client, consultants, and contractors on project budget & schedule.

Based on the correlation results performance of construction projects is related to cost & time management practices. For the fact that projects are not delivered on the allocated time & upon primarily agreed cost the processes are listed as factors under each stakeholder to determine their contribution. In the current practice, it is a trend that projects don't meet their schedule and budget which leads to unsatisfied clients. If budget and time are not met the overall performance of projects is compromised.

Therefore; first project managers should be aware of the process and factors that contribute to the outcome. The factors that have high contribution are listed below under time & cost performance.

**Time Performance**: - the factors are correlated to the fact that projects are not delivered on time and all have a high probability of occurrence in the current practice.

- Due to consultant the common factors are design delays & changes, change in order and specifications, incomplete drawings, inspection delay, poor communication, poor supervision and necessary variations of works & poor contract management
- Due to contractor, the common factors are inadequate planning, equipment unavailability, shortage of labors, poor site management, poor contractor management, poor labor productivity, staffing, problems, resource shortages, rework, poor technical performances, material procurement, escalation of material, construction mistakes, poor coordination on-site, poor site layout and unavailability of resources.
- Due to the client, the common factors are slowness in decision making, delay in payment, unforeseen ground condition, changes in drawings and changes in site conditions & monthly payment difficulties from agencies.

**Cost Performance**: - the factors are correlated to the fact that projects are not delivered on agreed budget and all have a high probability of occurrence

- Due to consultant, the common factors are an inaccurate or poor estimation of the original cost, a mistake in design, inappropriate scope definition, and inappropriate contractual framework & poor contract management.
- Due to contractor the common factors are obsolete or unsuitable construction equipment and methods, high cost of machinery, inefficient management, improper project costing and financing, improper planning, fluctuation in the price of raw materials, poor project management, lack of experience, measures to control construction cost, incompetent personnel, and proper cost control & risk management during project execution.
- Due to the client, the common factors are unforeseen site conditions, insufficient funds, and inflation of project costs.

Therefore, keeping in mind the above-stated process gap from a contractor's perspective improvement opportunities needs to be formulated.

## 5.2. Recommendation

Primarily the project manager needs to be aware of the current process gap and make a clear schedule that all the stakeholders are on the same page about issues and talk about their concern. Make realistic assumption about resource availability and deadlines to achieve quality results. Proper communication flow needs to be developed so that all members are informed. Although it is impossible to predict every potential negative occurrence, strategic planning and collection of information beforehand will help to anticipate which part of project is likely to fail and develop control measures accordingly.

Business process reengineering can be applied to any organization. Its successful implementation improves competitiveness of the organization and provides undeniable opportunities. Where there is no process definition, it would introduce a set of process for continuous improvement. BPR success is better if process improvement is applied in incremental bases. Applying the framework work would need the support of all stakeholders.

This study is limited to, identifying and assessing the applicability of appropriate performance measurement framework for construction performance management which is business process reengineering (BPR). In Addition only the three contractual parties which are client, consultants and contractors participated out of the many project stakeholders. Therefore, future researches should include other stakeholders and concentrate on creation of future state map and implementation of the system.

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# Appendix

## Questionnaire

ADDIS ABABAUNIVERSITY

SCHOOL OF POST GRADUATES

DEPARTMENT OF MBA

Dear Respondent

My name is Rewina Berhane, a student of Addis Ababa University pursuing Masters of Business Administration.

In partial fulfillment of the requirements, I am carrying out a research on "Performance Management of Construction Projects". I am kindly requesting you to take a few moments to respond to the questions. Your response will be of great help to both my study and the understanding of issues connected to the topic. I therefore assure you that no source will be identified.

Thanks in advance

**Part 1: General Question**

Name of the company _____

Grade of the company _____

Year of Establishment _____

ISO Certified Yes ☐ NO ☐

Experience of the project Manager under 2 years ☐ 2-5 years ☐ 5-10 years ☐ above 10 years ☐

Educational level Diploma ☐ Degree ☐ Masters ☐ Other ☐

Project management trainings Yes ☐ NO ☐

Type of projects involved in Building ☐ Road ☐ Other ☐

Number of total projects involved in _____

**Part 2: Time, Cost & Quality Management Practices**

Rate to which extent the company exercises the following practices

The rating is from 0-5, 0 No Exercise and 5 Strongly exercise

| **Rating** | | **0** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|---|---|
| **I** | **Quality Management Practice** | | | | | | |
| 1 | Quality Planning | | | | | | |
| 2 | Quality Assurance | | | | | | |
| 3 | Quality Control | | | | | | |
| **II** | **Time Management Practice** | | | | | | |
| 1 | Activity Definition | | | | | | |
| 2 | Activity Sequencing | | | | | | |
| 3 | Activity Duration estimating | | | | | | |
| 4 | Schedule Development | | | | | | |
| 5 | Schedule Control | | | | | | |
| **III** | **Cost Management Practice** | | | | | | |
| 1 | Resource Planning | | | | | | |
| 2 | Cost Estimating | | | | | | |
| 3 | Cost Budgeting | | | | | | |
| 4 | Cost Control | | | | | | |

**Part 3: Factors that affect time & Cost performance**

Rate to which extent the following factors under different categories affect

The rating is from 0-5, 0 being no Probability and 5 being very high Probability

| **Rating** | | **0** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|---|---|
| **Factors that affect time Performance** | | | | | | | |
| | **Consultant** | | | | | | |
| | Design delays | | | | | | |
| | Design changes | | | | | | |
| | Change order | | | | | | |
| | Changes in specifications | | | | | | |
| | Incomplete drawings | | | | | | |
| | Incompetent supervisors | | | | | | |
| | Inspection delay | | | | | | |
| | Poor communication | | | | | | |
| | Poor supervision | | | | | | |
| | Necessary variations of works | | | | | | |
| | Poor contract management | | | | | | |
| | **Contractor** | | | | | | |
| | Inadequate planning | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Equipment unavailability | | | | | | |
| | Shortage of labors | | | | | | |
| | Poor site management | | | | | | |
| | Poor contractor management | | | | | | |
| | Poor labor productivity | | | | | | |
| | Staffing problems | | | | | | |
| | Difficulties in financing project | | | | | | |
| | Resource shortages | | | | | | |
| | Rework | | | | | | |
| | Poor technical performances | | | | | | |
| | Material procurement | | | | | | |
| | Escalation of material | | | | | | |
| | Construction mistakes | | | | | | |
| | Poor coordination on site | | | | | | |
| | Poor site layout | | | | | | |
| | Unfriendly working atmosphere | | | | | | |
| | Unavailability of resources | | | | | | |
| | **Client** | | | | | | |
| | Slowness in decision making | | | | | | |
| | Delay in payment | | | | | | |
| | Client-initiated variation | | | | | | |
| | Unforeseen ground condition | | | | | | |
| | Changes in drawings | | | | | | |
| | Changes in site conditions | | | | | | |
| | Monthly payment difficulties from agencies | | | | | | |
| **Factors that affect Cost Performance** | | | | | | | |
| | **Consultant** | | | | | | |
| | Inaccurate or Poor Estimation of Original Cost | | | | | | |
| | Mistake in Design | | | | | | |
| | Inappropriate scope definition | | | | | | |
| | Inappropriate contractual framework | | | | | | |
| | Poor contract management | | | | | | |
| | **Contractor** | | | | | | |
| | Obsolete or Unsuitable Construction Equipment and Methods | | | | | | |
| | High Cost of Machineries | | | | | | |
| | Inefficient management | | | | | | |
| | Improper Project Costing and Financing | | | | | | |
| | Improper planning | | | | | | |
| | Fluctuation in Price of Raw Materials | | | | | | |
| | Poor project management | | | | | | |
| | Lack of Experience | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Measures to Control Construction Cost | | | | | | |
| | Incompetent personnel | | | | | | |
| | Proper cost control | | | | | | |
| | Risk Management during Project Execution | | | | | | |
| | **Client** | | | | | | |
| | Unforeseen site conditions | | | | | | |
| | Insufficient fund | | | | | | |
| | Inflation of Project Costs | | | | | | |

.

**Part 4: General Information**

Rate to which extent the following factors under different categories affect

The rating is from 0-5, 0 being no Probability and 5 being very high Probability

| **Rating** | | **0** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|---|---|
| 1 | Project not being delivered on time | | | | | | |
| 2 | Project not being delivered within budget | | | | | | |
| 3 | Unsatisfied Client | | | | | | |

**End of the questionnaire**

**Thank you for your kind cooperation!**