ADDIS COLLEGE

DEPARTMENT OF CONSTRUCTION TECHNOLOGY MANAGEMENT

POSTGRADUATE PROGRAM

Title:

Assessment of performance measurement and management of the 20/80 Condominium housing projects in Addis Ababa.

BY: MESERET TEWOLDE

ADVISOR: - SEMERE YILMA (Ph.D. Candidate)

November, 2023

ADDIS ABABA, ETHIOPIA

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A Thesis submitted to Addis College school of post graduate in partial fulfillment of the requirements for the award of a master's degree in construction technology and management.

November, 2023

ADDIS ABABA, ETHIOPI

DECLARATION

I Meseret Tewolde declare that this research project, entitled Assessment of performance measurement and management of the 20/80 Condominium housing projects in Addis Ababa. was prepared by me, with the guidance of my advisor. The work submitted for the award of the Executive Master of construction technology and Management MSC at Addis collage. It has not been presented for the award of any MSC or other similar titles in any other institution of higher learning to the best of my knowledge, and all resources used have been duly acknowledged.

Author Name: Meseret Tewolde Abriha

Signature:…………………………………………………..

Date:……………………………………………………

CERTIFICATION

This is to certify that “Meseret Tewolde” had carried out her study on the topic entitled “**Assessment of performance measurement and management of the 20/80 Condominium housing projects in Addis Ababa.**”, under my supervision. The work is original and is appropriate for the award of the Master’s Degree in Construction Technology and Management.

Name of Advisor: **Semere Yilma (Ph.D. Candidate)** Signature **_________________**

Letter of Certificate

As members of the board of examiners, we examined this thesis entitled "Assessment of performance measurement and management of the 20/80 Condominium housing projects in Addis Ababa." By MESERET TEWOLDE.

This thesis work is original and suitable for the submission in partial fulfillment of the requirements for the award of Master of Science in construction technology management.

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ABSTRACT

- *Traditional approaches to performance measurement in organizations may not aid in improving the organization's performance. They fail to provide clear indicators of what needs to be changed in the way an organization is managed and operated. This research aims to provide insights into the performance measurement practices of building construction projects in Addis Ababa, focusing specifically on 20/80 condominium projects. The analysis aim to assess the current practice of performance management and measurement system, identify the key performance indicators relevant to the construction context and further categorize them using factor analysis to gain a better understanding of their interrelationships and potential impact. Hence, the literature reviewed several exemplary KPI from various markets and developed an initial set of 20 KPIs that are relevant to construct the proposed Ethiopian construction .To establish their significance to 20/80 condominium project a survey questionnaire was conducted a total 152 respondents from contracting and client firms participated in the study. The Frequencies and Descriptive statistic command in SPSS (Version 20) were, used to detect any out of range values. The reliability and validity of the data was, proven and the significance of each KPI was, assessed. The categorization of KPIs into distinct groups using factor analysis could reveal patterns and relationships among various performance indicators, potentially leading to a better understanding of how these factors interrelate and impact project outcomes accordingly all twenty different KPIs in the model that the participants were presented with deemed significant and classified into 6 groups based on the results of factor analysis using IBM SPSS Version 20.0. The research recommendations aim to improve project tracking and measurement practices, ensuring they align with the unique characteristics and challenges of the 20/80 condominium construction projects in Addis Ababa The identified KPIs where categorized and this can be used for the strategic allocation of resources, both in terms of financial investment and human capital, to address the various categories of KPIs identified through the factor analysis.Through a better understanding of the interrelationships among KPIs, the research could recommend improved decision-making processes, particularly in areas such as project planning, risk management, and resource allocation.*

Key Words: Performance measurement, Performance Indicators, Performance Management

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RI	Residual income
EVA	Economic value added
CSF`s	Critical success factors
RII	Relative Importance Index
SSL	Sums of Squared Loadings
EFA	Explanatory Factor Analysis
CFA	Confirmatory Factor Analysis
KPIs	Key Performance Indicators
IHDP	Integrated Housing Development Programme
MWUD	Ministry of Works and Urban Development
PMS	Performance measurement system
BSC	Balanced Score Card
BPR	Business Productive re-engineering
EFQM	European foundation quality management
CIDA	Construction Industry Development Authority
CIB	Construction Industry Development Board
CII	Construction Industry Institute
DCF	Discounted cash flow

CHAPTER ONE: INTRODUCTION

1.1 Back ground of the study

The construction industry plays a critical role in the socio-economic development of Ethiopia, providing employment opportunities, infrastructure, and housing for the growing population. However, the industry faces several challenges, including poor quality of construction, safety hazards, and delays in project completion. Performance evaluation is a crucial tool for addressing these challenges, but it has received limited attention in the Ethiopian context Any project's failure is often attributed to either controlled or uncontrollable factors.

Bititci et al. (1997) explained the distinction 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 in order to manage the performance of the system.

A construction project is very complex by its nature and requires efficient project management practices to achieve its goal. Project management is a formalized and structured method of managing change in a rigorous manner. It requires the application of knowledge, skills, tools and techniques to project activities to achieve the required project outcome. In light with this, Project management is the art of directing and coordinating human and material resources throughout the life of the project by using modern management techniques to achieve predetermined objectives of scope, cost, time, quality, and participation satisfaction. (Yilak, 2013; CIB, 2004)

Performance measurement is an essential element in the management of construction companies. Performance measures indicate the priority factors of the organization and the way the employees should behave to give maximum outcome to the organization (Neely 2002).

Performance management is concerned with: aligning individual objectives to organizational objectives and encouraging individuals to uphold corporate core values; enabling expectations to be defined and agreed in terms of role responsibilities and accountabilities (expected to do), skills (expected to have) and behaviors (expected to be); providing opportunities for individuals to identify their own goals and develop their skills and competencies (Armstrong, 2009).

According to PMI (2013), Project management is the application of knowledge, skills, tools, and techniques to project activities to encounter the project requirements. Project management is a formalized and structured method of managing change in a rigorous manner. It requires the application of knowledge, skills, tools and techniques to project activities to achieve the required Project outcome (AIPM, 2008).

Performance can be considered as an evaluation of how well individuals, groups of individuals or organizations have done in pursuit of a specific objective (Ankrah and Proverbs, 2005).

performance measurement was associated with quality management as a natural component of evaluation, analysis and control (Abd Elhamid & Ghareeb, 2011). Performance measurement refers to the routine gathering and reporting of data regarding the inputs, effectiveness, and efficiency of construction projects. In order to increase program efficiency and effectiveness in their organizations, they use performance measurement to evaluate the results of their projects from both a financial and non-financial perspective, as well as to compare and contrast the performance with other projects.

Highly competitive and profound changes in the construction industry are forcing construction executives to; continuously improve the performance of their firms. Many researchers place strong emphasis on the importance of adopting the performance measurement methods to improve the current state of the construction industry (Latham, 1994; Egan, 1998). The majority of construction project performance measurements carried out after the project is completed. It is a lack of an up-to-date methodology to measure, construction project performance in the middle of the project implementation process rather than at the end.

Improvement cannot be gained without measurement (evaluation) of performance (Baldwin et. al., 2001). According to Osma (1999), measurement is the trigger for improvement. Like Rankin et. al., (2008).Thus one cannot improve what is not measured. The big question then is what is it that should be measured (evaluated) in a construction project that would bring about success in performance improvement.

Pillai et al. (2002) asserted that performance measurement on project could help evaluate the overall performance of a project at any point of time during its life cycle. Any project must include performance measurement because it serves as the foundation for ongoing performance improvement. According to Luu et al. (2008), ‘‘performance measurement is the heart of ceaseless improvement”. Depending on the nature of the project and the kind of work to be performed the measurement type and methodology determine what to measure and how to measure the performance of a given project. However, performance assessment may not always result in enhanced performance. These are methods for determining if a procedure has produced the desired outcome. Organizations can use performance measurement to identify areas of their operations that require improvement.

To improve performance, organizations should both measure their performance and compare with benchmark Performance measurement however does not automatically result in improved performance. These are approaches to determine if a process has obtained the desired result. Performance measurement enables organizations to identify areas in their operations where improvements are needed. Sharif (2002) argued that the perception and role of performance measurement have changed with the need to answer different organization’s objectives.

In the context of organizations, performance measurement refers to as “a systematic process for obtaining valid information about the performance of an organization and the factors that affect performance” (Yaghoobi and Haddadi, 2016, p.960), whereas performance management involves the use of the information generated through performance measurement (PM) to manage performance (Saunila, 2016).

It involves first determining what are the organizational goals and objectives towards the present and future performance of their building. Goals and objectives are then linked with strategies where project managers need focus on measuring critical factors in all categories of PM i.e. processes, financial and operational PM. Lack of clear focus and information may lead to measurement of facilities that do not need immediate attention and hence this may lead to poor performance of the building. Hence, without a strategic plan, clear goals and objective, the measurement process not provide result that benefits the development of organizational building performance.

The performance of these projects can be measured and evaluated against what was planned by using a wide variety of performance indicators. These include indicators related to time, cost, quality, client satisfaction, business performance, health, and safety, among others. However, experts in construction management further argue that time; cost and quality are the three main performance indicators in construction projects (Dilanthi & Baldry, 2002).

A using performance indicator measures an action that is essential to an organization's success. There are a variety of statistics used to assess how well a building project is working by implementing performance measurement metrics and identifying performance indicters. The goal of identifying and using performance indicters is to execute projects on schedule, on budget, defect-free, efficiently, safely and any other quality or system that could enhance the performance of a projects.

A Key Performance Indicator (KPI) is a metric that measures the effectiveness of an activity that is critical to a company's success. They are a collection of knowledge metrics that won't help you evaluate the efficiency of a building project (RobertF and Dar Ahrens 2003)

The construction sector in general is considered as one of the among the most inefficient and ineffective sectors (Beatham et al., 2004) mainly due to poor workmanship, materials unavailability, project changes during execution, lack of project information, equipment unavailability and faulty works (Vaverde-Gascueña et al., 2011).

The major performance indicators of a building construction project can vary depending on the specific project and its goals. However, some commonly used performance indicators include: Schedule performance, Cost performance, Quality performance, Safety performance, Environmental performance, Productivity performance and Stakeholder satisfaction thus by tracking these performance indicators, project managers can identify areas of strength and weakness, make informed decisions, and take proactive steps to improve project outcomes.

There are several performance indices that can be used to compare building construction projects. Some of the major ones include Cost Performance Index (CPI), Schedule Performance Index (SPI), Safety Performance Index (SPI), Environmental Performance Index (EPI) and Quality Performance Index (QPI) accordingly by comparing these performance indices across multiple building construction projects, stakeholders can gain insights into the relative strengths and weaknesses of each project and make more informed decisions about future projects.

1.2 Statement of the problem

Performance issues, whether they are, related to costs, timelines, or both, plague the majority of construction projects. Asmah (2014) study identified that the performance problem of projects are originated from inadequate funds for the project, suspension of work by owner or contractor, cash problem during construction, inadequate planning of projects before commencement, client delay in payment certificates, inadequate planning and uncompromising attitude between parties. The rapid urbanization in Addis Ababa has increased demand for buildings, but the lack of appropriate performance indicators that can be used to assess the quality of building constructions has led to poor-quality building projects that are not only unsafe but also have a negative impact on the environment. As a result, 20/80 condominium projects are facing similar difficulties, and it is necessary to assess the performance of these projects. The current process for rectifying defects within condominium construction project lacks efficiency, leading on delays and customer dissatisfaction. There is luck of comprehensive quality control and assurance measures, resulting in an increase in the number of defects identified during and after the construction phase. Lack of structured approach to risk management, leading to potential project delays, safety hazards and financial risks inadequate documentation and communication regarding identified defect. This problem statement can serve as a starting point for identifying specific areas within the condominium, project construction process that require attention and improvement.

1.3 Objective of the study

1.3.1 General Objective

The general objective of this study is to assess the performance measurement and management of the 20/80 Condominium housing projects in Addis Ababa.

1.3.2 Specific Objectives

1. To investigate the current performance measurement and management in the 20/80 condominium housing projects in Addis Ababa.
2. To identify the significant key performance measurement indictors in the 20/80 condominium housing projects in Addis Ababa.
3. To categorize the KPI's into distinct groups using factor analysis and suggest best practice

1.4 Research Questions

1. How is the process and procedure of the current performance management system of the Addis Ababa 20/80 condominium projects?
2. What are the key performance measurement indictors in the study area?
3. How can different KPI's are grouped and categorized together?

1.5 Scope of the Study

1.5.1 Thematic Scope

The study assesses the performance indicators that can be used to evaluate building construction in Addis Ababa. This include an analysis of the current performance state of building construction, identifying areas of improvement, and proposing recommendations for developing a comprehensive performance indicator.

1.5.2 Spatial Scope

The study focuses on building construction in Addis Ababa, specifically 20/80 condominium projects.

1.6 Limitation of the Study

This study was, conducted with an objective of the performance measurement and management of the 20/80 Condominium housing projects in Addis Ababa. Despite the number of construction projects in Addis Ababa, this study has used only condominium projects in Addis Ababa. Although different condominium projects were, constructed in the city, this study has used only projects that are currently under-construction to, easily access the targeted respondents. Other limitation of this study is using questionnaire as a only instrument to collect the study data.

1.7 Significance of the study

Performance measurement can be used as a tool to identify areas of improvement in the construction process, such as material quality, workmanship, and adherence to standards and regulations. Addressing these concerns can enhance overall construction quality, resulting in better buildings that are more durable, safe, and comfortable for inhabitants.

1. for the government, consultants and contractors:

- ✓ Efficient resource allocation: Performance measurement can help the government and contractors allocate resources effectively by identifying areas where resources are being underutilized or misallocated. This can lead to cost savings, improved productivity, and timely project completion.
- ✓ Enhanced project management: Performance measurement provides valuable insights into project progress, allowing the government and contractors to monitor and manage construction projects more effectively. This can help mitigate delays, reduce risks, and ensure the successful delivery of projects.
- ✓ Improved decision-making: Performance measurement enables data-driven decision-making for the government and contractors. By analyzing key performance indicators, they can make informed decisions regarding project planning, resource allocation, and risk management, leading to better outcomes.

2. For the scientific world:
    - ✓ Advancement of knowledge: A study on performance measurement management in building construction in Addis Ababa can contribute to the existing body of knowledge by exploring new methodologies, frameworks, and approaches specific to the context of Addis Ababa. This can enrich the scientific understanding of performance measurement in the construction industry.
    - ✓ Identification of best practices: Through rigorous research, the study can identify best practices in performance measurement management that can be applied not only in Addis Ababa but also in other similar contexts. This can help researchers and practitioners improve construction project management globally.
3. For the Researcher :
    - ✓ Personal and professional growth: Conducting a study on performance measurement management in building construction in Addis Ababa can enhance your knowledge and expertise in this field. It can provide you with valuable research experience, improve your analytical skills, and contribute to your professional development.
    - ✓ Contribution to society: By conducting research on performance measurement management, you can make a positive impact on the construction industry in Addis Ababa. Your findings and recommendations can help improve the

efficiency, quality, and sustainability of building projects, benefiting the community and the environment.

1.8 Organization of the Thesis

The report is organized in five chapters:

Chapter 1 gives the background of the study, problem statement and states the most important objectives of the study. Chapter 2 includes literatures review of performance measurement practice for building construction projects and stating what similar studies findings. Chapter 3 gives the description of the methodology used in the study, data collection mechanism and way of study on performance measurement methods used for building construction projects. Chapter four presents the findings on data analysis and discussion related performance measurement practice in Addis Ababa 20/80 projects. Chapter 5 contains the, conclusions and recommendations on performance measurement methods for building construction projects.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter provides a comprehensive review of the literature on assessment of performance measurement in the building construction industry. The chapter starts by defining performance measurement terminologies, followed by a discussion of the development of performance measurement in construction industry, Condominium, Condominium housing, performance improvement initiatives in the construction industry, and the application of performance measurement to construction projects and businesses. The chapter then discusses the factors critical to the success of projects and organizations before looking at the shortfalls and knowledge gaps of existing performance measurement models in the construction industry.

The operating environment for construction organizations continues to change quickly all over the world. The construction industry plays an important role in the growth and development of a country. Construction project development involves numerous parties, various processes, different phases and stages of work and a great deal of input from both the public and private sectors, with the major aim being to bring the project to a successful conclusion (Takim and Akintoye, 2002).

2.2 Definition of key terms

2.2.1 Performance

Lebas (1995) defined performance as 'the potential for future successful implementation of actions in order to reach the objectives and targets'. Laitinen (2002) provided a similar definition: 'the ability of an object to produce results in a dimension determined a priori, in relation to a target'. Zeglat et al. (2012) stated that performance is an actual work or output produced by a specific unit or entity. By combining these definitions, performance can be considered as the actual outputs produced by a specific organization, unit, project, or individual against an envisaged target/objective Performance of construction projects in general is not satisfactory and therefore it is important to understand performance metrics affecting project performance.

Generally performance Means carrying out a task, the progress of which can be measured and compared using a set of stated requirements. According to Salaheldin (2009), efficient implementation of performance measurement and benchmarking systems by contractors can ensure them a continuous improvement of performance.

2.2.2 Condominium

It is a Single, individually owned housing unit in a multi-unit building. The condominium owner holds sole title to the unit, but owns land and common property (elevators, halls, roof, stairs, etc.) jointly with other unit owners, and shares the upkeep expenses on the common property with them. Unit owner pays property taxes only on his or her unit, and may mortgage, rent, or sell it just like any other personal property. In addition, the word condominium divides in to the prefix "con" means sharing and "dominium" which means, owner ship. It is simply means sharing with others. A condominium is not particular kind of building rather; it is a legal arrangement. It refers to a form of owner ship (Condominium Proclamation No. 370/2003).

2.2.3 Condominium housing

Is a name given to the form of housing tenure where each resident household owns their individual unit, but equally shares ownership and responsibility for the communal areas and facilities of the building, such as hallways, heating systems, and elevators. There is no individual ownership over plots of land. All of the land on a condominium site is owned by all homeowners (UN-Habitat, 2011).

The prominent current government approach to solving the low-cost housing challenge is the Integrated Housing Development Programme (IHDP), initiated by the Ministry of Works and Urban Development (MWUD) in 2005. The Programme is a continuation of the 'Addis Ababa Grand Housing Programme', which supported the endeavors of the Ethiopian Government in their implementation of the plan for accelerated and sustained development to end poverty. The IHDP aims to:

- ✓ Increase housing supply for the low-income population
- ✓ Recognize existing urban slum areas and mitigate their expansion in the future

- ✓ Increase job opportunities for micro and small enterprises and unskilled laborers, which will in turn provide income for their families to afford their own housing

- ✓ Improve wealth creation and wealth distribution for the nation

2.2.4 Performance measurement

Sinclair and Zairi (1995) define that performance measurement as a process for assessing how successful organization or individuals have been realized their objectives. Neelyet al. (2002) also defined performance measurement as ‘the process of quantifying the efficiency and effectiveness of past actions He also further explains there are three general approaches for measuring performance:

- ✓ Individual performance, which is based on personal experience and proficiency.
- ✓ Performance measurement systems, which includes a set of metrics and standards.
- ✓ Relating the performance measurement system to the working environment.

To quote Neely et al. (1997), “Performance measurement can be defined as the process of quantifying the efficiency and effectiveness of actions.” Similarly, Ghobadian and Ashworth (1994) propose that performance measurement has already exerted to enhance effectiveness and Efficiency in the projects. More specifically, Mbugua et al. (1999) define the performance Measurements as the process for systematically gathering and assessing the information about Inputs, effectiveness, and efficiency of the construction projects’ actions.

Some authors define project performance measurement from the perspective of application value. Measuring performance is to measure the ability of previous performance in evaluating the prospective performance (Lebas, 1995).

As a construction project is usually complicated and unique, and involves many stakeholders, performance measurement would receive different assessments when judging on different processes, aspects, environment and standpoints of different participants (Liu and Walker, 1998).

Performance is measured at various levels including construction industry, firm, and activity and, in Project-based industries; project level at the industry level, productivity is one of the most frequent measures of performance.

Performance measures are vital signs of an organization, which helps to recognize whether the activities of a process or the outputs of the process achieve the specified objectives. Horonec, (1993). The need to improve performance in construction industries worldwide has become topical Simon (1944). In the US construction industry, rework (defect) contributes significantly to cost performance problems and accounts for an average of 5% of the total construction cost Miles, M.B. & Huberman, A.M.(1994).

It is obvious that performance is only one of the contributing factors to the performance improvement process of an organization since performance measurement of Construction Projects is the backbone of construction companies and their well-being and health in one way or the other, directly or indirectly related to it. Project Performance assessment is important for improving performance of construction industry.

Generally, Project performance metrics evaluate and compare planned and actual performance in construction projects. Performance measurement collects and reports information to assess financial and non-financial aspects, comparing performance with others, and improving efficiency and effectiveness, building performance evaluation can be described as a systematical compassion between the actual Performance of buildings, places and systems to explicitly documented criteria for their expected performance and project performance is measured for many reasons such as benchmarking, rewarding and monitoring whether the firm's strategy is working well at all levels of the organization.

2.3 Objectives of Performance measurement and Performance Management

Performance measurement is an essential element in the management of construction companies. Performance measures indicate the priority factors of the organization and the way the employees should behave to give maximum outcome to the organization (Neely 2002). It provides the necessary information for process control, and enables the establishment of challenging and feasible goals. It is also necessary to support the implementation of business strategies. It is obvious that performance measurement is only one of the contributing factors to the performance improvement process of an organization. Performance measurement is used as a systematic way of judging project performance by evaluating the inputs, out puts and the final project outcomes.

The objective of construction performance measurement includes planning and controls, which is a core project management function that ensures a well-coordinated and successful project. The establishment of objectives is a fundamental component of planning. The goals will guide the various decisions made over the course of the project. These choices entail trade-offs between scheduling, cost, quality, and other performance characteristics. Effective construction project progress monitoring necessitates the integration and measurement of multiple factors of performance. Completion time, cost, and quality are the performance metrics in the construction sector. Niven (2002) Stated that the performance measurement methods were widely adopted in many industries and they had received more and more attention.

According to Armstrong,(2006) the overall aim of performance management is to establish a high performance culture in which individuals and teams take responsibility for the continuous improvement of business processes and for their own skills and contributions within a framework provided by effective leadership. Specifically, performance management is about aligning individual objectives to organizational objectives and ensuring that individuals uphold corporate core values. Steven et al. (1996) supported this idea sating performance measurements are needed to tract, forecast, and ultimately control those variables that are important to the success of a project, and this has been agreed by many researchers and practitioners

2.4 Performance measurement system

A performance measurement system (PMS) is a systematic way of evaluating the inputs, outputs and productivity of an operation (Globerson, 1985). A PMS is used to describe the actual implementation of a performance measurement framework/model in an organization (Kagioglou et al., 2001). Performance measurement systems aim to “integrate organizational activities across various managerial levels and functions” (McNair et al., 1990).

As the construction industry rapidly evolves, it is necessary to continuously improve the systems to measure the performance of construction contracts. However very few companies systematically measure their performance in a holistic way Moreover, the existing systems tend to focus more on product and less on process and design.

The measurement has 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 measurements used do not relate to the strategic goals of the organization, an organization cannot claim to have an effective performance management system.

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 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.

"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 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)

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

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.

2.5 Performance management in Construction industries

The construction industry has long been criticized for its underperformance (Lee et al., 2000; Kagioglou et al., 2001; Smith, 2001). Under construction industries, building construction is one of the major classifications. Buildings are constructed, altered, upgraded, restored or demolished for a variety of reasons. Whether the aim is simply to provide more space or to make a financial gain from speculative development, all building projects need to fulfill a function and meet set performance requirements (Bennett, 2003).

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).

Performance management is concerned with: aligning individual objectives to organizational objectives and encouraging individuals to uphold corporate core values; enabling expectations to be defined and agreed in terms of role responsibilities and accountabilities (expected to do), skills (expected to have) and behaviors (expected to be); providing opportunities for individuals to identify their own goals and develop their skills and competencies (Armstrong, 2009). Thus, performance management is a planned management process that includes communication among all working groups, task agreement, cooperative work design, output assessment, feedback, and positive reinforcement.

The introduction of the concept of performance management system created a shift in organizational processes from purely measurement and control to integration of measurement and management (Neetu and Mahim, 2013). Different PMSs have been developed based on the KPI framework, BSC, and the EFQM excellence model (Robinson, 2005, Huan et al., 2010), in which researchers have operationalized performance as multi-dimensional measures (Suk et al., 2012, Gudienė et al., 2014, Zavadskas et al., 2014, Ofori-Kuragu et al., 2016).

Despite the differences in these models, their common objective is to develop KPIs that measure and improve performance (Beatham et al., 2004, Suk et al., 2017).

A performance management system is a continuous process of communication between a supervisor and an employee that happens throughout the year in support of the organization's strategic objectives and when utilized appropriately, performance management is a systematic examination and measurement of worker performance (including communication of that evaluation to the person) that we use to enhance performance over time.

Bititci et al. (1997) explained the distinction 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 in order to manage the performance of the system.

Performance measurement is integral to performance management and provides a basis for performance improvement programs.

2.6 Performance management in Ethiopia Construction

Performance management is a major issue in construction projects because 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.

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. Like the construction industry in other developing countries, the construction industry in Ethiopia was plagued by many problems (Abadir, 2011).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) In addition, cost overrun ranges from 1-126% (Nega, 2008).

In Ethiopia construction project performance problems appears through different directions. Due to several reasons’ construction projects in Ethiopia faces challenges in their performance instead of achieving their planned goals. Habenom (2017). Abadir, 2011 explained that generally the current state of the construction industry was characterized by:

- ✓ An inadequate capital base,
- ✓ utilization of old equipment and low levels of availability,
- ✓ Severe shortage of construction materials,
- ✓ Low level of management, especially project management knowledge and
- ✓ practice (Low level of Contract administration, Project planning and Project Monitoring capabilities),
- ✓ Deficiencies in technical, financial management and entrepreneurial skills,
- ✓ Small-scale local contractors which lack experience in construction Management,
- ✓ Outdated technology (insufficient and ineffective labor-based construction Technology),
- ✓ Inadequate and inappropriate project organization structures, which lead to
- ✓ Problems of authority, responsibility, communication and coordination, etc.

Yimam (2011) in Ethiopia many construction projects are suffering with different problems such as delay, cost overrun and quality issues. One of the mega construction projects running in the nation are the construction of condominium houses in Addis Ababa.

According to Abraham (2007), shortage of housing is one of the major problems that call for immediate action. Even the majorities of houses in Ethiopia are below qualitative standard and lack adequate space.

2.7 Development of performance measurement

The concept of performance measurement originally developed in mainstream business disciplines and was subsequently adopted by other disciplines like construction.

Performance measurement dates back to the 1860s and 1870s when planning and control procedures were employed by the U.S. railroad (Chandler 1977; Kaplan 1984).

The concept of performance measurement existed in early 1880s to 1980s where organization used traditional performance measurement to measure their performance (Banks and Wheelwright, 1979). Performance measurement involves the process of quantifying the efficiency and effectiveness of building actions (Neely, 1998).

2.8 Performance improvement initiatives in the construction industry

Over the last two decades, many initiatives across different countries have sought to improve the performance of the construction industry.

Some of these include.

- ✓ Industry reports, such as the Latham (1994) and Egan (1998) reports in the UK.
- ✓ long-term plans, like the Australian Procurement and Construction Council, and the Construction 21 exercise in Singapore (Ofori, 2001a);
- ✓ dedicated agencies and clubs, such as the Construction Industry Board, Construction Excellence, and the Benchmarking Club in the UK, and the benchmarking program of the Construction Industry Institute (CII) in the United States (Beatham et al., 2004, Suk et al., 2012); and
- ✓ Industry Development Board of Malaysia, the Institute of Construction Training and Development and the Construction Industry Development Authority (CIDA) in Sri Lanka (Ofori, 2001a, CIDA, 2015), and the Construction Industry Development Board in South Africa (CIB, 2011).

These initiatives operate at industry level and aim to raise the overall performance of construction projects and businesses in the relevant countries and regions.

There are so many reasons that adds weight to the importance of measuring performance at both project and organizational levels (Alarcón and Serpell, 1996, Ofori, 2005, Deng et al., 2012), and most construction companies took the inactive to have 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.

2.9 Organizational performance measurement

Performance measures are vital signs of an organization, which helps to recognize whether the activities of a process or the outputs of the process achieve the specified objectives. Performance measures indicate the priority factors of the organization and the way the employees should behave to give maximum outcome to the organization (Neely 2002).

This now of days projects are becoming more complex thus the way we measure performance of a given project is becoming more complex as well according to Maylor H (2003) project performance are becoming more complex due to

The simpler ideas have been exploited first and the need for innovation is vital

- ✓ The allowable time to market is reducing, which affects one of the important constraints of all projects.
- ✓ Businesses are becoming more complex
- ✓ Projects are also moving towards turnkey contracts, where the end user does not get involved with the interface between the parts of a system,

Organizational performance measurement in construction has traditionally relied on financial KPIs such as return on investment and profitability, and aggregated project KPIs such as cost, time, and quality (Love and Holt, 2000, Chen, 2009, Tsolas, 2011, Deng and Smyth, 2013). Love and Holt (2000) added Organizational performance measurement in construction has traditionally relied on efficiency, return on capital, and profitability, which have been criticized as narrow, reactive, and mostly financial. A longer-term and broader focus is needed that considers corporate strategy, business processes, and stakeholder needs.

According to Barkley and Saylor, (1994) at a minimum, performance measures of a project are based on time cost and quality. These traditional criteria have faced criticism due to their inadequate coverage of performance measurement (Gardiner, 2000);

Research in construction management emphasizes that organizational performance measurement should look beyond those traditional KPIs (Bassioni *et al.*, 2005).Robinson et al. (2002) have reported the increased use of customer aspects, impact on society, and internal stakeholders in performance measurement. Moreover, literature has cited frameworks to evaluate the organizational performance of contractors that include nonfinancial aspects. In view of these criticisms, a number of researchers have advocated for a wider focus of construction project performance to cover aspects of project safety, construction contract management, environmental impact and community satisfaction. (Shenhar, 2001).

Researchers now a day focuses on other way of measuring performance to reduce the limitation of focusing only on time, cost and quality thus Most studies have adopted the KPI framework, the BSC approach and the EFQM model, and included different perspectives in their PMS development. Some have adopted an integrated approach, using all three of these. For example, in terms of the application of KPI framework

According to Kingsley (2010), 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.

Improving the business practice through the employment of effective performance measurement and assessment tools will undoubtedly be of great benefit for all stakeholders in the construction market including contractors. In addition to enabling them to assess their projects' performance accurately, it helps them cut in costs, better utilize their valuable resources, keep track of work progress towards business objectives, and lessen the occurrence of work defects and hence save in unnecessary, avoidable cost overruns (Egan, 1998).

2.10 Factors affecting project and organizational performance

Different studies have identified different factors that affect the performance of construction projects but there is no common agreement on the factors. According to Chan & Tam (2000), generally perceived factors that influence quality performance can be grouped into categories of client, project environment, project team leaders, project procedures and project management procedures.

Tan & Lu (1995) grouped the elements affecting performance of the building construction project into eight criteria and every criterion is divided into several impacting factors listed below.

- ✓ Project Characteristics
- ✓ Manpower qualified to achieve project mission,
- ✓ Requirements, and objectives;
- ✓ Conformance to codes and standards,
- ✓ Conformance to owner's requirements,
- ✓ Conformance to design process and procedures,
- ✓ Conformance to schedule requirements,
- ✓ Conformance to cost requirements and ,
- ✓ Completeness of and conformance to output standards and constructability.

2.10.1Project Characteristics

Project characteristics are best described by project scope, project type, and project complexity. The sort of project, the number of stories, and the sophistication of the project are all referred to as project scope. The nature of the project determines whether it is a new works project or a renovation project. Some projects are more expensive to create than others are. Refurbishment works often have a greater unit cost than new ones.

Site access, design build ability, design coordination, site conditions, and quality management may all be used to assess project complexity. Sophisticated clients (those who have previously created projects) and specialized clients (those who have built comparable structures on a regular basis) have a greater likelihood of success with their projects than beginners do. Other factors of the customer have been found to impact project performance, such as the type of the client (i.e. whether they are from the public or private sector), clarity of project mission, competency in terms of capacity to brief, make decisions, define roles, and so on.

2.10.2 Manpower qualified to achieve project mission

Labor qualification significantly affects the quality of construction workmanship. Qualified personnel possess the necessary skills and expertise to perform tasks with precision and attention to detail. They understand industry standards and ensure compliance with quality requirements. High-quality workmanship results in durable structures, reduced maintenance costs, and enhanced client satisfaction.

Labor with the right qualifications possesses the necessary technical knowledge and skills required to handle various aspects of construction projects. This includes understanding construction techniques, materials, equipment operation, safety protocols, and adherence to building codes and regulations. With enhanced technical expertise, qualified labor can execute tasks more efficiently and effectively, leading to improved project performance.

According to ,Low & Goh, (1993) Poor workmanship by the contractors in completing the works results from low tender prices; the drawings and specifications that do not specify clearly the intentions of the designers which have resulted in poor co-ordination during construction; the contractors pay more attention to complete the works on schedule and control the costs to within budget than to achieving quality in construction; poor co-ordination exists between the contractors and the subcontractors as well as the nominated subcontractors; the designers do not consider the “build ability” problems in design.

Mallawaarachchi & Separate (2015) supported the above idea by stating quality of the housing projects is affected by lack of technical and professional expertise and resources to perform task, lack of employee commitment and understanding and lack of education and training to drive the improvement process.

2.10.3 Requirements and objectives

Clear and well-defined requirements help in setting the direction and scope of the construction project. They outline the specific goals, functionalities, and performance criteria that need to be met. By having clear requirements, the project team can focus their efforts on meeting the desired outcomes, minimizing the chances of scope creep and rework.

Project objectives provide a roadmap for the project team to follow. They define the desired outcomes, timelines, and deliverables of the project. By setting clear objectives, the team can align their efforts and work towards achieving them. Objectives also help in measuring the success of the project and ensuring that it is on track.

2.10.4 Conformance to codes and standards

Conformance to codes and standards has a significant impact on both construction projects and organizational performance.

Codes and standards often include safety regulations and quality requirements that must be met during construction. Adhering to these codes and standards ensures that the project is executed in a safe manner and meets the necessary quality benchmarks. This helps in preventing accidents, minimizing risks, and ensuring that the final product meets the desired standards.

Local, national, or international authorities usually mandate codes and standards. Compliance with these regulations is essential to avoid legal issues, penalties, and project delays. By conforming to the applicable codes and standards, construction projects can maintain legal compliance, which contributes to smoother project execution.

According to Abdel-Razeq (1998) factors that affect construction projects performance are: design and planning during the pre-construction phase; developing and improving quality assurance and control systems; using standards such as ISO 9000, contractors' technical and managerial efficiency standards ; maintenance standards and other codes relating to utilization of resources; specialization in construction work, co-operation between construction industry and scientific organizations, participating and co-operating with advanced international organizations, defining responsibilities between project parties, encouraging innovation for simpler and more accurate work methods.

2.10.5 Conformance to owner's requirements

Conforming to the owner's requirements ensures that the project aligns with their expectations, needs, and preferences. By meeting these requirements, construction projects can enhance client satisfaction and strengthen the client-contractor relationship. Satisfied clients are more likely to provide positive feedback, refer the contractor to others, and potentially engage them for future projects.

Owner's requirements define the scope of the project, including the desired features, functionalities, and deliverables. By conforming to these requirements, construction projects can effectively manage and control the scope. This helps in minimizing scope creep, preventing unnecessary changes, and ensuring that the project stays on track.

Conformance to owner's requirements is crucial for construction projects and organizational performance. It ensures client satisfaction, effective scope management, reputation building, and project success. By aligning with the owner's requirements, both the construction project and the organization can achieve their goals and thrive in the industry.

2.10.6 Conformance to design process and procedures

Conforming to design processes and procedures ensures that the construction project is executed according to the established design. This helps in maintaining the desired quality standards and accuracy in construction. By following the design processes, the project team can ensure that the project meets the intended specifications, minimizing errors, rework, and delays which intern insure desired performance of project or organization.

Design processes and procedures often involve collaboration between various stakeholders, such as architects, engineers, and contractors. Conforming to these processes facilitates effective coordination and collaboration among team members. This leads to better communication, streamlined workflows, and improved project performance.

2.10.7 Conformance to schedule requirements

Conforming to schedule requirements ensures that the construction project is completed within the specified timeframe. Adhering to the schedule helps in managing project timelines, meeting client expectations, and avoiding costly delays. It allows for effective planning, resource allocation, and coordination, resulting in timely project completion that can indicate the overall performance of a project.

Timely completion of construction projects is closely linked to cost control. Conforming to schedule requirements helps in minimizing project delays, which can lead to additional expenses such as labor costs, equipment rentals, and extended overheads. By adhering to the schedule, construction projects can optimize resource utilization and maintain profitability.

Meeting schedule requirements demonstrates reliability and professionalism, enhancing client satisfaction. Clients value contractors who can deliver projects on time, as it enables them to meet their own business objectives and deadlines. Satisfied clients are more likely to provide positive feedback, recommend the contractor to others, and engage them for future projects.

Consistently conforming to schedule requirements contributes to an organization's reputation for reliability and efficiency. This builds credibility in the industry and enhances its competitiveness. Organizations that consistently meet project deadlines are more likely to win new contracts and establish long-term relationships with clients.

2.10.8 Conformance to cost requirements

Conformance to cost requirements is vital for the success of construction projects and organizational performance.

Conforming to cost requirements ensures that the construction project is executed within the allocated budget. It involves effective cost estimation, tracking expenses, and managing financial resources throughout the project lifecycle. By adhering to cost requirements, construction projects can avoid cost overruns, maintain financial stability, and prevent negative impacts on project delivery.

Cost requirements often dictate the efficient utilization of resources, including labor, materials, and equipment. By conforming to these requirements, construction projects can optimize resource allocation and minimize wastage. This leads to better cost management, improved productivity, and increased profitability.

Conforming to cost requirements contributes to an organization's financial stability. It helps in controlling project costs, avoiding budget deficits, and maintaining a healthy cash flow.

Organizations that consistently meet the cost requirements are better positioned to invest in growth opportunities, manage risks, and sustain their operations over the long term.

2.10.9 Completeness of and conformance to output standards and constructability

Completeness of and conformance to output standards and constructability have a substantial impact on the success of construction projects and organizational performance.

A comprehensive set of output standards ensures that the construction project meets specific criteria and industry best practices for quality. By adhering to these standards, construction projects can achieve the desired level of quality in terms of performance, durability, aesthetics, and safety. Consistency in conforming to output standards enhances the reliability and reputation of the project.

The constructability of a design determines how efficiently and effectively the construction process can be executed. Considering constructability during the design phase helps identify potential conflicts, challenges, or limitations that may arise during construction. By addressing constructability issues, projects can be executed with fewer errors, reduced rework, and increased overall efficiency. This leads to improved project performance in terms of meeting timelines, budgets, and quality benchmarks.

The completeness of and conformance to output standards directly affect client satisfaction. Meeting or exceeding client expectations by adhering to comprehensive output standards enhances client trust, loyalty, and satisfaction. Satisfied clients are more likely to provide positive feedback and recommendations, contributing to an organization's reputation and leading to potential new business opportunities.

Organizations that consistently deliver projects conforming to output standards gain a competitive edge in the market. Their adherence to recognized industry standards and constructability considerations conveys professionalism, expertise, and reliability. This strengthens their market position, attracts clients seeking high-quality construction, and increases their chances of winning competitive bids.

According to Sanvido et al. (1992) in USA author factor affect project and organization performances, Team performance Contracts characteristics Experience in the management, planning, design, construction, and operations of similar facilities Timely, valuable optimization information from the owner, user, designer, contractor, and operator in the planning and design phases of the facility.

2.10.10 Project Environment

The project environment includes all external impacts on the building process. The project environment is broadly classified as physical, economic, sociopolitical, and industrial interactions, which operate at the national or local level and in various ways in the public and private sectors. Changes in the environment can cause pricing and investment uncertainty in an organization's activity, affecting its performance.

Construction project management encompasses many different parties, including the client, designers, suppliers, subcontractors, and the construction management team and client consultants, who are part of the project environment in charge of advising on progress in terms of schedule, cost, and quality that can affect project performance.

2.11 Gaps in knowledge of performance measurement in construction

Construction executives are being compelled to consistently enhance the performance of their projects by the construction industry's intense competition and significant technical developments. It is widely acknowledged that a project's performance in terms of cost, time, and quality serves as a gauge of its success.

Construction companies have implemented a number of performance measurement frameworks, such as KPI, the Balanced Scorecard, and the EFQM Excellence Model**.** The existing performance measurement models, designed to measure construction project performance, mainly focus on the project iron triangle of cost, time, and quality.

Due to the lack of a single performance measurement, it is impossible to compare construction project performance among various projects. Researchers and practitioners face challenges in comparing the performance of different projects due to a lack of universal and feasible measurement methods, models, and indices that could be transferred to use in any construction project and resolve contradictions among the various performance indices.

A research need exists to develop more comprehensive performance measurement frameworks that incorporate the relevant aspects of different performance frameworks, models, and improvement methods. This remains a main gap in knowledge that should be further addressed by research and supported by practice.

- ✓ The applications of the Balanced Scorecard, EFQM, and KPI are in their early years. Much can be learned from the problems faced in their implementation, and research is still limited in this area.
- ✓ Specific measurement issues for performance in construction, particularly relating to soft issues, need more research: for example, leadership, people, and innovation, learning, partnership, and technology management.
- ✓ Strategic management in the construction industry opens many areas of research, particularly the measurement of strategy deployment. This issue should be accounted for when developing or applying any performance measurement framework.

Additional gaps in knowledge have been identified that apply across industries, including construction.

2.12 Traditional Performance Measures

Traditionally, performance measures have been primarily based on management accounting systems. This has resulted in most measures focusing on financial data i.e. the return on investment (ROI) , the pyramid of financial ratio, the discounted cash flow(DCF), residual income (RI), economic value added (EVA) and cash flow return on investment return on sales, price variances, sales per employee, productivity and profit per unit production. (FROI) (Bassioni *et al*., 2004).Van Schalkwyk (1998)

Traditional approaches to performance measurement in organizations may not aid in improving the organization's performance. They fail to provide clear indicators of what needs to be changed in the way an organization is managed and operated. Instead, they focus on aspects that are more associated with financial feasibility and profitability of the business instead of the best practice and performance assessment. However, integrating different approaches of performance measurement into a unified single more comprehensive approach can render the performance assessment process more efficient and its output more beneficial for the users (Robson, 2004).

Furthermore, Myers (1997) explained that traditional financial performance measurement results in overestimation when only the net income or earning is used as aggregate performance measure and another problem of underestimation occurs when a ratio- such as return-on-investment or return-on equity is used. Financial performance measures have also been described as 'lagging' the dissatisfaction with these measures led to the introduction of contemporary performance measurement frameworks.

The shortcomings of traditional indicators are(Domanović, 2010) that they can lead to wrong conclusions and bad business decisions because they are based on past events, on what has already happened in the previous period, and not on what has happened, is currently happening or will happen in the coming period.

Even though there a lot of short coming with traditional measurement systems there are few advantages of traditional indicators based on data from financial statements, it is stated that they meet number of performance measurement criteria such as accuracy, objectivity, comprehensibility, controllability, data availability, ability to measure in short periods of time, the ability to rely on international accounting and financial reporting standards and auditability. (Merchant, & amp;Van der Stede, 2007).

2.13 Modern Performance Measures

As critical success factors, the modern approach to performance measurement places emphasis on measuring a smaller number of variables, on the connection of performance measures with success factors and defined company strategy, on providing insight into information through all three time dimensions, i.e. information on past, present and future events, to observe all organizational parts of the company and all levels of business activity, not just the company as a whole, to observe all relevant resources of the company (Domanović, 2010).

Modern performance measurement systems include the following measures (Fitzgerlad, 2007)**:**

- ✓ Criteria of results that indicate the success of the company after the completion of a certain process (market share, revenue, profit, etc.);
- ✓ Input and process criteria that indicate the success of the company before the end of the process, thus creating the possibility to make the necessary corrections (time, work invested, process duration, capacity utilization, etc.

According to Kwame, Baiden and Badu (2012), construction contractors in developing economies often lack the capacity to compete with foreign contractors. Their use of obsolete technologies, equipment, and outdated training programs for staff and employees are among the factors that negatively affect local contractor's performance in many economies.

According to Salaheldin (2009) Because of their failure to complete contracts, most local contractors in Ethiopia are currently controlled by international contractors in the market. 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).

As a result, it is unquestionably critical to design a set of KPIs that are relevant to the goals and aims of local construction contractors. Such a collection should include both financial and non-financial data, as relying just on financial indicators can be extremely misleading to decision-makers in today's building industry. Furthermore, the number of KPIs in such a collection should be kept to a minimal level that allows for a proper assessment of a construction contractor's performance in a certain project, whether satisfactory or not.

2.14 Major Key performance measurement indictor

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)

Implementing Key Performance Indicators (KPIs) to assess performance in construction projects is one of the most effective, yet a straightforward, construction management practices in developed economies (Construction Excellence, 2011).

Performance indicators (PI`s) are tools used within the performance measurement systems to assess the performance of various processes. Performance Indicators (PI`s) are the measurable evidence necessary to prove that a planned effort has achieved desired results (Kaufman, 1988).

"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).

Performance Indicators (PI`s) were defined as the quantifiable measures of Critical success factors (CSF`s) by (Mbugua et al., 1999).Key Performance Indicator (KPI) is defined by Swan, W. and Kyng, E. (2004) as a measure which indicates the performance of a project or a company against critical criteria.

The construction sector is labor-intensive, including indirect jobs, provides employment to millions of people. Considering the variety of construction projects across various sectors of economy like energy, housing, transport etc., it is necessary to identify a set of common indicators and develop a measurement scale to standardize the measures of construction project performance.

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).

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 For measuring the performance of companies and for applying benchmarking approach, one must first establish suitable key performance indicators (KPIs) that are most critical in determining the overall success of the company. KPIs are compilations of data measures used to assess the performance of a construction operation (Cox et al., 2003). KPIs play a key role in providing information on the performance of construction tasks, projects, and companies.

A set of KPIs that can be used to measure and compare the performance of an organization or be considered as a basis for benchmarking is lacking. The purpose of KPIs is enabling the measurement of project and organizational performance in the construction industry KPI Working Group (2000).

The major performance indicators of a building construction project can vary depending on the specific project and its goals. However, some commonly used performance indicators include: Schedule performance, Cost performance, Quality performance, Safety performance, Environmental performance, Productivity performance and Stakeholder satisfaction thus by tracking these performance indicators, project managers can identify areas of strength and weakness, make informed decisions, and take proactive steps to improve project outcomes.

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).Most indicators, such as construction cost, construction time, defects, client satisfaction with the product and service, profitability, and productivity, promote result-oriented thinking, whereas others, such as predictability of design cost and time, predictability of construction cost and time, and safety, promote process-oriented thinking.

Kagioglou et al. (2001) raised some questionable issues including the KPI being non comprehensive and focusing more on project rather than organizational performance. Additionally, the KPI are designed as benchmark for the whole industry, where companies can benchmark themselves against national performance and identify areas for improvement.

According to Kuragu, Baiden, and Badu (2014), an effective approach to choosing appropriate performance measures to implement is to review existing sets of measures to either adopt them or develop new ones per the business characteristics of interested organizations accordingly existing KPIs are listed below

Table 2.1 Summary of the KPIs from different literature review

KPI Group	KPIs	Reference
New Housing Buildings	Time, Cost, Profitability, Client Satisfaction, Quality & Defects, Time Predictability, Cost Predictability, Productivity, Safety.	(Construction Excellence, 2011)
Infrastructure	Time, Cost, Profitability, Client Satisfaction, Quality & Defects, Time Predictability, Cost Predictability, Productivity, Safety.	(AEP, 2006)
Rethinking Construction	Construction time, Capital cost, Predictability, Defects, Productivity, Accidents, Turnover & Profit.	(Egan, 1998)
Construction Institute of the USA	Performance, Productivity, Engineering Productivity, Engineering practices.	(Maya, 2016)
KPI Working Group	Cost, Time, Business Performance, Quality, Change Orders, Client Satisfaction, Health & Safety, Environment.	(KPI working group, 2000)

Further explanation of the major KPIs is required to explain their importance in the construction industry: to list few

- ✓ Cost of Construction.
- ✓ Time of Construction.
- ✓ Health and Safety

- ✓ Quality and Defects.
- ✓ Clients Satisfaction.
- ✓ Productivity.
- ✓ Profitability.

2.14.1 Cost of Construction

Vasista (2017) defined the cost of construction as a performance indicator as “the degree to which the general conditions promote the completion of a project within the estimated budget”.

The Cost of Construction is an important KPI in the construction industry. Effective cost management ensures financial stability, budget adherence, profitability, optimal resource allocation, and competitive pricing. By tracking and actively managing this KPI, construction organizations can maximize their success and achieve better financial outcomes.

2.14.2 Time of Construction

Time of construction is essentially the time needed to complete the contracted construction project. A construction project’s delivery date is of a crucial importance to both the client and contractor likewise, as it marks the date at when clients can make use of the premises. It is the definite time that is measured as per the number of working (or calendar) days since the commencement of work on site until the substantial or full completion of the project (Chan and Chan, 2001).

Time of Construction is a vital KPI in the construction industry. Adhering to project schedules ensures timely project delivery, efficient resource management, disruption mitigation, and a competitive advantage. By effectively managing project timelines, construction organizations can drive success, enhance client satisfaction, and position themselves as reliable industry leaders.

2.14.3 Health and Safety

Construction workers around the world are subject to fatal incidents on job sites three times more than workers of any other economic activity (Sousa and Teixeira, 2004).

Health and Safety as a KPI in the construction industry is of utmost importance. It safeguards workers, ensures legal compliance, reduces costs, enhances project performance, and builds a positive reputation. By effectively managing Health and Safety, construction organizations can create a culture of safety, protect their workers, and achieve success in their projects.

2.14.4 Quality and Defects

Construction defects were defined by Prahl (2002) as the parts of the performed work, which are perceived as less than the promised or expected standards by clients or procurers of products or services. The causatives of construction defects vary between lack of experience, lack of knowledge, lack of skills, building difficulties, improper design, missing information, unforeseen conditions, force majeure and soon (Atkinson, 1999).

Quality and Defects are critical KPIs in the construction industry. Prioritizing quality leads to higher customer satisfaction, a positive reputation, compliance with standards, cost reduction, effective risk management, and continuous improvement. By emphasizing these KPIs, construction organizations can achieve excellence, differentiate themselves in the market, and ensure the long-term success of their projects.

2.14.5 Clients Satisfaction

Ling and Chong (2005) and al-Momani (2000) have identified the quality of construction projects/services as a key component for addressing and evaluating the clients' satisfaction.

Client Satisfaction is closely linked to the quality and success of construction projects. Meeting or exceeding client expectations for the project's performance, aesthetics, and functionality significantly contributes to client satisfaction. By prioritizing client satisfaction, construction companies ensure a focus on delivering high-quality work, thereby increasing the chances of project success.

2.14.6 Productivity

Productivity in the construction industry stands for labor efficiency, which is the units work produced per person-hour. Halligan, Demsetz, Brown, and Pace (1994) indicated that the converse of labor efficiency, person-hours per unit (unit rate), is also frequently used. Hence, as a KPI for construction projects' success, productivity stands for the contractor's value added per worker on job site (Souza, 2010).

High productivity directly contributes to timely project completion. Construction projects are often time-sensitive, with contractual deadlines and client expectations. Monitoring productivity helps identify areas of improvement, streamline processes, and allocate resources efficiently. Timely project completion enhances client satisfaction, minimizes project-related costs, and strengthens the organization's reputation.

2.14.7 Profitability

Profitability reflects the financial success of a construction project along with the fact the project is substantially accomplished and submitted as per the contracted specifications (Parfitt and Sanvido, 1993). However, in order to be implemented as a KPI and a performance measure, Souza (2010) suggested that profitability of a construction project is the gross profit realized as a percentage of sales, or expenditures.

Profitability is tightly connected to effective cost management. By tracking profitability, construction companies can identify areas where costs can be reduced or optimized without compromising quality or safety. It drives a focus on cost control measures, efficient resource utilization, and avoiding unnecessary expenses, thus maximizing the margin between revenue and costs.

CHAPTER THREE: RESEARCH METHODOLOGY

3.0 Introduction

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 assessment of performance measurement and management in building construction project and specifically on governmental housing (20/ 80 condominium) construction projects in Addis Ababa have been assessed.

The research methodology is discussed in different sections which includes Research Design and Approach Study area, source of data, Sampling Design, sampling technique, Target population, sample size, data collection method, Methods of Data Analysis, validity and reliability,

3.1. Research Design and Approach

This research taken quantitative, qualitative, and descriptive approach in performance measurement and management in building construction specifically on governmental housing (20/ 80 condominium) construction projects in Addis Ababa.

3.2 Study area

The study was conducted in Addis Ababa focusing on the 20/80 condominium housing project see figure 3.1

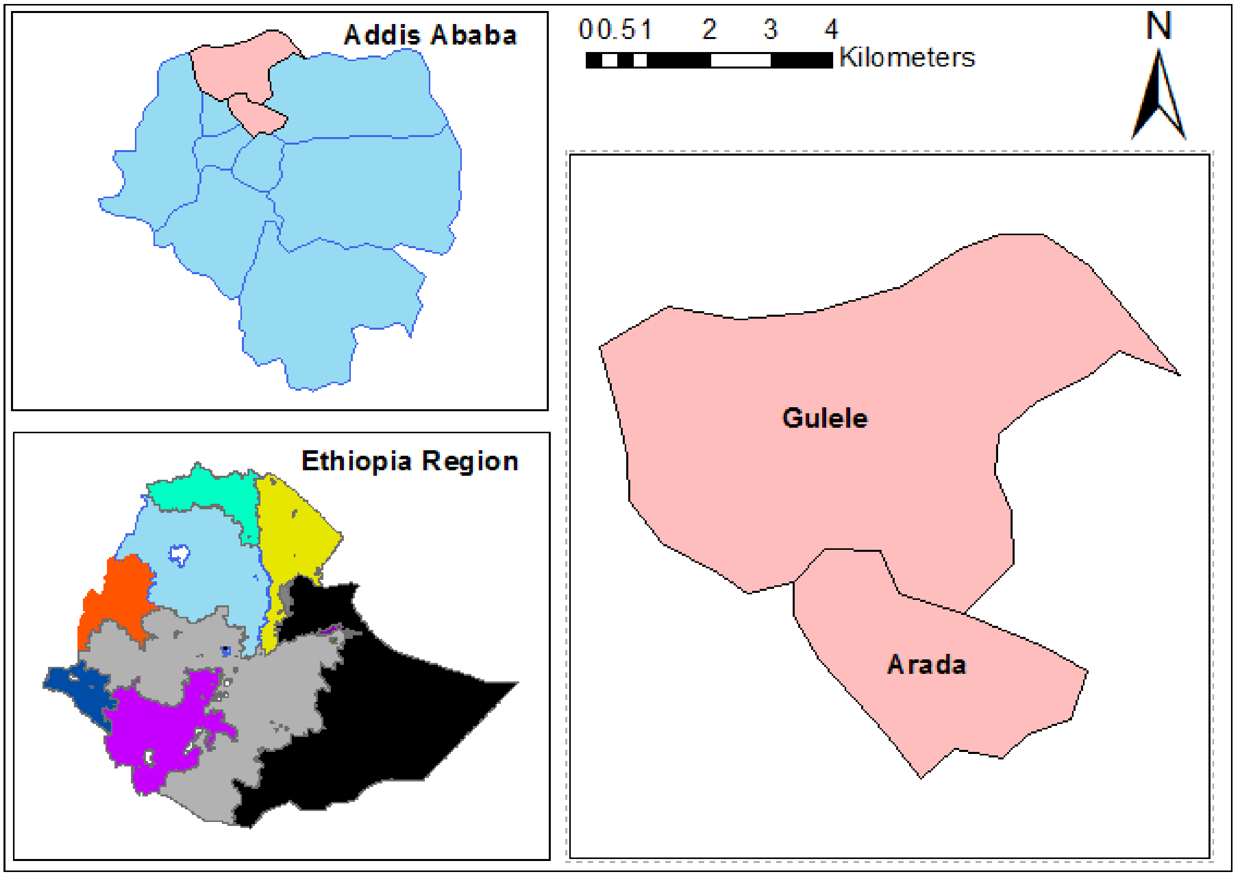

Figure 3.1 Map of the study area (Source own)

3.3 source of data

Both primary and secondary data sources were used in this study to gather the necessary data the majority of the secondary data was collected from published and unpublished papers, various researches, publications, and the internet.

3.4 Research Design

A mixed research design was adopted in this thesis. Both quantitative and qualitative techniques were used. Primary data is collected through questionnaires for the thesis, while secondary data was gathered through published and unpublished materials. This helped in assessing building performance measurement by using key performance indicators to measure (20/80 condominium) housing developments.

The questions were divided into three categories. Section one focused on the respondents' personal information, such as educational level, job description and experience, and so on.

In the second, respondents were asked to score the selected KPIs and their importance for Ethiopian building projects using a Likert scale grading method. The relative score of each KPI, according to the respondents, shows whether it should be included in the suggested list of KPIs. Each KPI can be assigned a score between one and five on the survey form's scale. The third component of the questionnaire was designed to collect information from the population's sample respondents using open-ended surveys in order to enhance the closed ended questions.

3.4.1 Sampling technique

To select responders from the specified group, the researcher used a simple random sampling technic Respondents in the targeted block were contractors, clients, project managers, site engineers, and site Forman. In the client's case, building inspectors were purposefully chosen since they have a superior understanding of the performance assessment system and are actively involved in the performance indicators. As a result, to pick respondents from the designated firms, this study employed purposeful and simple random sampling procedures.

3.4.2 Target Population

This research was carried out on governmental housing (20/80 condominium) development projects in Addis Ababa. Addis Ababa housing project office has exhausted 10 project branch offices1-10 branch offices and purposefully selected project sixe branch office. Arada and Gulele project location. The project sixe branch office was chosen since there were numerous projects running under this branch office at the time.

As a result, these project offices have a higher number of going on blocks than other project offices. There are 88 blocks on the Arada project site and 122 blocks on the gulele; project site. The total number of blocks in the two project sites is 210.

3.4.3 Sampling size

Sample size for the study was determined by Yemane (1967) formula based on a 95% desired confidence level and a 5% desired level of precision.

$$n = N / [1+N (e) 2$$

Where: -

n = Sample size

N = population size, N=210

e = level of precision, e=0.05

$$n = N / [1+N (e) 2$$

$$n=210/ [1+210(0.05) 2$$

$$n=137$$

Table 3.1 Sample size

Target Population	Contractor			Client			Total size of respondents
	Project Manager	Site Engineer	Site Forman	Director	Team Leader	Site Inspector	
Arada project site	14	18	28	1	2	15	78
Gulele project site	15	20	27	1	2	18	83
Total Respondents							161

3.5 Data collection Method

3.5.1 Questionnaire

The questionnaires were closed-ended and open-ended questions; multiple choice, and 5 Point Likert-Scale approaches (i.e., from "List important-most important for the 5-point Likert scale). The respondents were asked to indicate their level of agreement with the ratings (i.e., one=least important, two=slightly important, three=important, four=very important, and five=most important). The questionnaires were written in English so that respondents could read and understand the questions. As a result, there was no need to translate into Amharic or any other language.

3.6 Methods of Data Analysis

3.6.1 Qualitative Data Analysis

In order to insure qualitative data analysis in this research the researcher followed specific steps to ensure accuracy, reliability, and consistency of data and results. The approaches followed includes Data Preparation through organizing collected data , Familiarization of data collected by understanding of the content, identify patterns, and develop a comprehensive understanding of the context and Data Interpretation through Analyze, interpret, and draw conclusions from the collected data.

3.6.2 Quantitative Data Analysis

The questionnaire data was analyzed using quantitative data analysis techniques. The Relative Importance Index (RII) approach was used to analyze the data gathered from respondents.

Dominowski (1980) and Fugar and Agyakwah-Bahh (2010) suggest, that in such an approach, to evaluate the importance of each KPI relative to other KPIs using an index, which would eventually allow for ranking them according to their relative importance as per the survey's results. The RII score of each KPI can be calculated through the following formula:

$$RII\ (\%) = \frac{5(n5) + 4(n4) + 3(n3) + 2(n2) + n1}{5(n1+n2+n3+n4+n5)} \times 100$$

n1= the number of respondents that assigned a score of 1 to the KPI

n2 = the number of respondents that assigned a score of 2 to the KPI

n3 = the number of respondents that assigned a score of 3 to the KPI

n4 = the number of respondents that assigned a score of 4 to the KPI

n5 = the number of respondents that assigned a score of 5 to the KPI

The main purpose of this step is to identify the appropriate KPIs that can, be used to measure the performance of the construction companies.

3.7 data presentation technique

According to Hassanain and Juaim (2011) and Dominowski (1980), the use of an appropriate calibration allows for the quantification of the importance index (I) for each of the evaluated KPIs. Hence, the importance index can, be classified based on the ranking system illustrated in Table 3.1 (Hassanain and Juaim, 2011).

Table 3-1 Importance Index Ranking System (Hassanain and Juaim, 2011)

Table 3-2 Importance Index Ranking System

Importance Index (Value)	Ranking
0 - < 12.5%	Not Significant
12.5% - <37.5%	Low Significant
37.5 - < 62.5%	Significant
62.5% - < 87.5%	High Significant
87.5% - 100%	Very High Significant

The relative importance index should provide a linear transformation for the results over the range [0, 1]. However, examining the RII equation shows that it converts the results over [0.2, 1] which casts doubts over the proposed range in Table 3.1 Hence, an adjusted relative importance index RII adj as per Holt (2014) is used. Formula 6 is used to calculate RII adj:

Formula six - Adjusted Relative Importance Index (Holt, 2014)

RII $adjust$ (%) = $(125 \times RII) - 25$

Accordingly, the classification system in Table 3.1 must be changed. Table 3.2 shows the new classification system that is used throughout our analysis. If the 43 RII adjust score of a certain KPI falls below 25%, the KPI should be excluded from the proposed KPIs list. This preliminary assessment should allow excluding the irrelevant KPIs off the proposed model.

Table 3-3 - Adjusted Importance Index Ranking System

Adjusted Importance Index (Value)	Ranking
0 - < 25 %	Not Significant
25% - < 50%	Low Significant
50 % - < 75%	Significant
75 % - < 87.5%	High Significant
87.5% - 100%	Very High Significant

Furthermore, IBM SPSS 20.0 software is used as a statistical analysis tool to further analyses the obtained data.

3.8 Validity and Reliability

3.8.1 Validity test

Validity refers to the extent to which a study measures what it claims to measure or accurately represents the phenomenon under investigation. It ensures that the research findings reflect the true nature of what is being studied. Validity assures the area of investigation is explained by the collected data.

Prior to the Data analysis, data were screened using the entire sample to check data entry correctness, missing values, and also sample size and representativeness were checked. Peer review and outside input are used to find errors, biases, or gaps in the design and analysis of research when it is shared with peers.

3.8.2 Reliability

Reliability refers to the consistency, stability, and reliability of research findings. It reflects the degree to which the measurements or data collection methods produce consistent results over time or across different conditions. Reliability checks whether the questioner provides a stable and consistent result. Therefore, the reliability of the questioner was checked before any analysis by running reliability analysis in SPSS software and the output shown in table 4.1.

CHAPTER FOUR: RESULT AND DISCUSSIONS

4.1. Introduction

This section has provided the findings, results and outcome of this research. The respondent overview has discussed in the beginning of the section. As an outcome, the three research specific objectives discussed in relation of the result were to analyses the process and procedures of the current performance management of 20/80 condominium building projects in Addis Ababa.to identify the significant KPI's, and to categorize the KPI's into distinct groups using factor analysis. All obtained findings and results are introduced accordingly to the objectives of the research in this section.

To achieve the study objectives, One hundred Sixty-one questionnaires were distributed and collected to the respondents and out of these questionnaires; One hundred fifty two were collected that accounts 94.4% 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 20.

4.2. Results

4.2.1 Process and procedures of the current performance management of 20/80 condominium building projects in Addis Ababa

This analysis part specifically answers the research questions "How is the process and procedure of the current performance management system of the Addis Ababa 20/80 condominium projects? " "To answer these questions the researcher of this thesis formulated a questioner that are related to this objective the questions.

The research aims to analyze the performance management and measurement of 20/80 condominium buildings in Addis Ababa. The current performance management system identifies and addresses performance gaps through various methods, such as regular appraisals, self-assessments, peer feedback, customer feedback, and managerial observation. These gaps are addressed through constructive feedback, training and development opportunities, setting goals, assigning mentors, and closely monitoring progress through regular evaluations.

The system may also provide resources and tools to support employees' development, such as job aids, online courses, or access to subject matter experts. Regular performance evaluations are conducted to assess the progress made by employees in addressing their performance gaps. Key performance indicators (KPIs) such as cost time quality and safety of the project progress, periodic surveys, and root case analysis are used to track and monitor progress.

The most commonly tracked metrics or indicators for these projects include time quality, cost and safety, day-to-day evaluation, risk management, progress record, cost time quality and safety, customer satisfaction, Kpi, time, cost time and quality, quality, cost and time, and cost variance.

The majority of respondents evaluate the performance of condominium housing projects against their objectives, considering the number of houses built and provided to owners as good but not on schedule or satisfactory. Performance evaluation involves checking project performance throughout its life cycle, collecting performance data, and comparing it against established objectives and targets.

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 0.775.

4.2.2. Reliability of the Questionnaire

Table 4-1 Reliability Statistics

Reliability Statistics

Cronbach's Alpha	N of Items
.775	20

Moreover, the Cronbach alpha value for the measurement variables was indicated to be 0.775, thus portraying good reliability of the research instrument and the internal consistency of the measurement variables. 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.

4.3 Selection of the KPIs

Prior to analyzing the usable sample, it was important to check for mistake initially. Data were screened using the complete sample (N = 137) prior to the main analysis to examine accuracy of data entry, missing values, and fit between distributions and the assumptions of necessary analysis tools. The Frequencies and Descriptive statistic command in SPSS Version 20 were used to detect any out of range values. None was found and the descriptive results are described in Table 4.2 below

Table 4-2 Descriptive analysis result of the data collected

NO	Major key performance measurement indictor	Mean	Std. Deviation
1	Cost for construction	4.85	0.360
2	Cost predictability-design and construction	3.97	0.614
3	Consultant fee	3.38	0.486
4	Cost per m2	3.82	0.710
5	Time for construction	4.76	0.427
6	Time to rectify defects	3.86	0.620
7	Time predictability design and construction	3.84	0.656
8	Time allowed for pre-construction preparation work	3.70	0.788
9	Health and Safety	4.02	0.521
10	Reportable accident	3.66	0.652
11	Lost time accident	3.76	0.737
12	Quality and Defects.	4.18	0.662
13	Defects (Number / Severity)	3.74	0.561
14	Quality issues at end of defect rectification period	3.70	0.540
15	Quality management system	4.45	0.525
16	Clients Satisfaction.	4.08	0.546
17	Customer Satisfaction.	4.12	0.487
18	Productivity	3.85	0.606
19	Profitability	3.97	0.665
20	Environment	3.57	0.627

The preliminary assessment using adj. RII, demonstrated that all KPI are relevant for the local construction need and considered for further modeling as indicated in the Table 4.2 above. Hence, the proposed model was including the twenty initially proposed

Table 4-3: Significance description of the KPIs

Key Performance Indicators	RII	Adj. RII	Rank
Cost for construction	96.97	96.22	1
Time for construction	95.26	94.08	2
Quality management system	88.94	86.18	3
Quality and Defects.	83.55	79.44	4
Customer Satisfaction	82.36	77.96	5
Clients Satisfaction	81.57	76.97	6
Health and Safety	80.39	75.49	7
Profitability	79.34	74.18	8
Cost predictability-design and construction	79.3	74.18	9
Time to rectify defects	77.23	71.55	10
Productivity	76.97	71.22	11
Time predictability design and construction	76.71	70.89	12
Cost per m2	76.44	70.56	13
Lost time accident	75.13	68.91	14
Defects (Number / Severity)	74.73	68.42	15
Time allowed for pre-construction preparation work	74.01	67.60	16
Quality issues at end of defect rectification period	73.94	67.43	17
Reportable accident	73.15	66.45	18
Environment	71.31	64.14	19
Consultant fee	67.5	59.38	20

A comprehensive assessment of condominium construction projects performance relies heavily on their performance in certain aspects, which their implication could be proven through the Adj. RII scores. Accordingly, a discussion of the various KPIs along with their respective adjusted relative importance index scores is outlined.

Cost for construction (96.22%) and Time for construction (94.08%)

The most significant KPIs found to be Time for construction and Cost for construction for performance assessment.

Chan and Chan (2001), Heravi and Ilbeigi (2012), Olaoluwa (2013), Jainendrakumar (2015), and Vasista's (2017) all found that contractors' ability to accomplish projects' objectives within a reasonable budget and time is affected by Time and Cost related issues.

Quality management system (86.18%), Quality, **and Defects (79.44%)**

Comply with contracted standards either unit wise or as a whole is also asserted as a major KPI in the construction market. This is indicated by "Quality management system", Quality, and Defects (79.44%) KPI with an Adj. RII score of 86.18%.

Customer satisfaction (77.96%) and Client (76.97%)

Moreover, Client and Customer satisfaction are significant factors for projects' success. The Adj. RII score of 75.98 % and 73.02 %. The importance of post-delivery and post occupancy satisfaction with the executed facilities has also been emphasized by AlMomani (2000), Bititici (1994), Deolitte and Touche (2018), Tang et al. (2003), and Torbica and Stroh (2001). It is the ultimate objective of all construction projects to be of a best fit for their owners and occupants' goals, needs, and functions.

Health and Safety (75.49%)

Health and Safety emphasizes the importance of keeping track and maintaining proactive measures to insure the welfare of labor on site**.**

Profitability 74.18%)

Chan and Chan (2004), and Ofori-Kuragu, Baiden, and Badu (2016). Stated that, as the goal for any business entity active in the market is to flourish and develop, the significance of project's Profitability for the contractor cannot be underestimated, likewise any contractor working on a condominium construction project focus on the profitability margin of project.

Cost predictability-design and construction 74.18%) and Time predictability (70.89%)

Results showed that both Cost predictability-design and construction and Time predictability design and construction are significant KPIs of condominium construction projects performance.

Productivity 71.22%)

According to Horner and Talhouni (1996), and Souza's (2010) performance is the prominence of the value added per worker to the overall performance of any construction including condominium construction projects.

Environment (64.14%)

The Environment KPI scored lower compared to the rest KPI's but still to be considered in the proposed model with an Adj. RII of (46.21%.)

Heravi and Ilbeigi (2012) suggested that the topic of the environmental impact of construction works remains of certain degree of ambiguity to most construction contractors.

As a finding of this research, the lists of 20 identified KPIs for the condominium construction projects comprised of 20 indicators discussed above. The assessment indicated that all the KPI that are selected from literature are acknowledged as a relevant for the Ethiopian construction industry.

4.4. Factor Analysis of the KPIs

4.4.1. Data Validation for the Factor Analysis

Factor analysis is a statistical method used to identify underlying relationships between observed variables. Its primary purpose is to reduce a large number of variables into a smaller, more manageable set of hidden factors. These factors are hypothesized to account for the common variance in the observed variables.

Major frame works of factor analysis entails:

Variable Reduction: Factor analysis is often used to condense the information contained in a large number of original variables into a smaller set of latent factors. This reduction simplifies the analysis and helps in identifying the key dimensions underlying the data.

Unobserved Factors: Factor analysis assumes that a smaller number of UN observed (latent) factors influences observed variables. These factors are not measured directly but are inferred from the patterns of correlations among observed variables.

Correlation Structure: Factor analysis is based on the assumption that observed variables are correlated due to being influenced by common underlying factors. It aims to uncover these latent factors accounting for the observed correlations in the data.

Factor Loadings: Factor loadings represent the correlations of the observed variables with the latent factors. High factor loadings indicate that a particular variable is strongly associated with a specific factor, while low loadings indicate weak associations. The loadings help in interpreting the structure of the factors and their relationship to the observed variables.

Eigenvalues and Variance Explained: Eigenvalues and percentage of variance explained are used to assess the significance of factors. Eigenvalues measure the strength of each factor, and the percentage of variance explained indicates the proportion of the total variance in the observed variables explained by each factor.

Interpretation and Rotation: Factor analysis often involves interpreting and rotating the factors to enhance their interpretability. Rotation methods help clarify the relationship between variables and factors, making the results more straightforward and easier to understand.

Application Areas: Factor analysis is commonly utilized in social sciences, psychology, market research, and various fields of science to uncover the underlying structure of a dataset, identify important dimensions, reduce data complexity, and develop theories about the underlying causes of observed data patterns.

Assumptions: Factor analysis relies on several key assumptions, such as linearity, normality, and the absence of multicollinearity. Violation of these assumptions can affect the validity of the factor analysis results.

Overall, factor analysis is a powerful tool for uncovering hidden patterns within complex datasets and for simplifying data by extracting meaningful insights from a large set of observed variables.

As previously stated, factor analysis was used in this study to decrease the data set of KPI variables. For this reason, factor solutions with Eigen values larger than one were chosen for analysis following the Varimax Rotation approach. Factor loading values demonstrate how closely the variables are connected to each of the detected factors.

Following the preliminary evaluation with the adjusted RII two assumptions were validated before undertaking factor analysis to ensure data validity.

- ✓ The initial assumption was that the sample size would be determined. Hair et al. (2010) recommend that the minimum sample size be five times the number of variables. The sample size for this survey is 137, which equates to 6.85 instances per variable. As a result, the first assumption was met.
- ✓ The second assumptions used are Kaiser–Meyer–Olkin (KMO) test for sampling adequacy coupled with Bartlett’s test of sphericity. SPSS 20 used to analyses the data and Table 4.4 below shown the study used the Kaiser-Meyer-Olkin (KMO) test for sampling adequacy and Bartlett's test of sphericity to analyze data. The KMO reading was 0.808, indicating a meritorious level. The Bartlett's test of sphericity showed a large correlation matrix and significant difference between the inputs and identity matrix. The KMO value indicated adequate sample size and significant correlation between variables.

Table 4.4 Kaiser-Meyer-Olkin (KMO) test

KMO measure	Interpretation
KMO ≥ 0.90	Marvelous
0.80 ≤ KMO < 0.90	Meritorious
0.70 ≤ KMO < 0.80	Average
0.60 ≤ KMO < 0.70	Mediocre
0.50 ≤ KMO < 0.60	Terrible
KMO < 0.50	Unacceptable

Table 4-5: KMO and Bartlett's test result

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.808
Bartlett's Test of Sphericity	Approx. Chi-Square	683.441
	df	190
	Sig.	0.000

4.4.2. Factor Analysis Result

An factor analysis was performed using a principal component analysis and verimax rotation the communality of the scale which indicates the amount of variance in each dimension was also assessed to insure acceptable level of explanation the results shows that all communalities where over 0.50

An important step involved weighing the iverall significance of the correlation matrx through Bartlett's Test of Sphericit which rovides a mesure of strutuaral probability that the correlation matrix has significant correkation among some of its componets .The Kaiser-Meyer-Olkin Measure of Sampling Adequacy which indicates the approperatness of the data for factor anlysis was 0.808 in this regurd data with Measure of Sampling Adequacy value aove 0.80 are considered approperate for factor analyssis finaly the factor solution drived from this analysis yeldes 6 factor for the scale which accounted for 58.674 percent of variation in the data

An initial analysis is performed to acquire eigenvalues for each component in the dataset in order to identify how many components to be exteracted . When the Eigen value is larger than 1, the Kaiser Rule recommends extracting the varibles that complay with the criterion in our case six factors complay with this criterion and has Eigen value is larger than 1. The figure 4.1 scree plot.

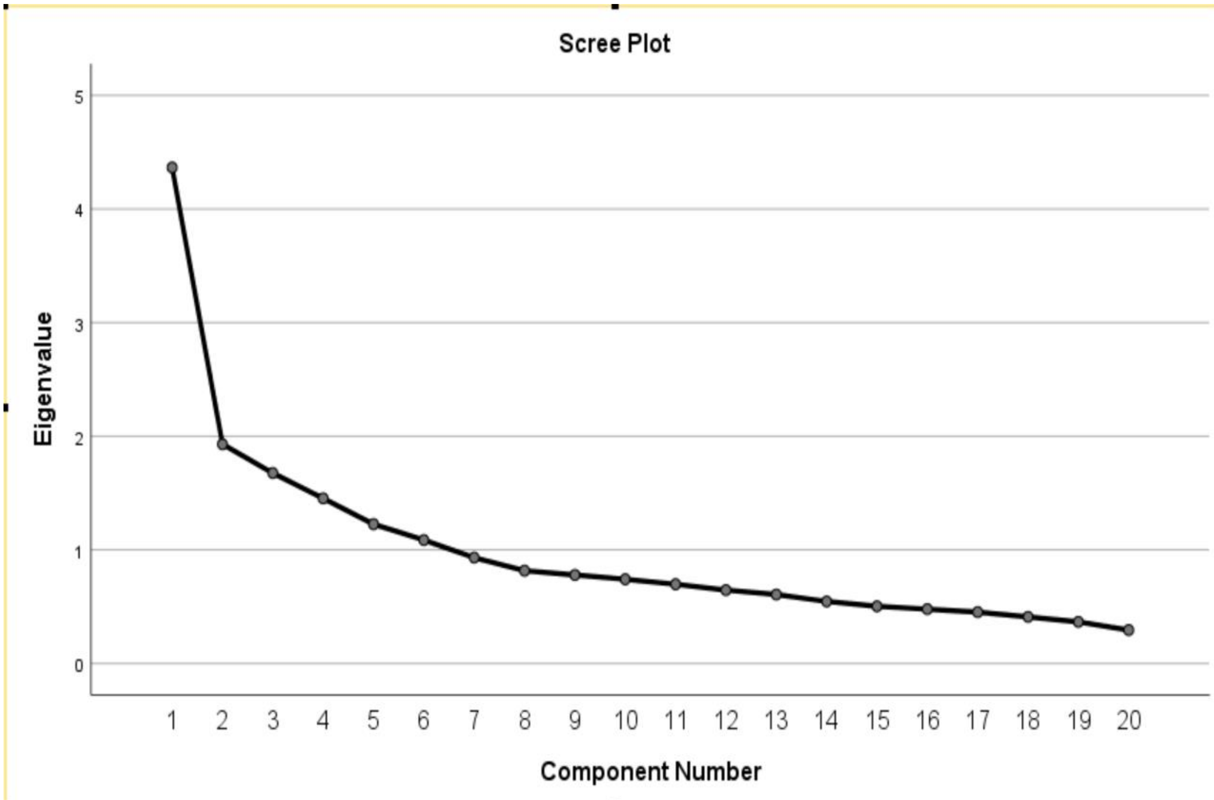

Figure 4-1. Eigen Value Greater than 1 Screen Plot

The commonalities are an important aspect of factor analysis as they help assess how well the extracted factors represent the observed variables. "commonalities" represent the proportion of variance in each observed variable that is accounted for by the extracted factors. Commonalities range from 0 to 1, where a value close to 1 indicates that a high proportion of the variable's variance is explained by the factors, and a value close to 0 indicates that the variance is not well accounted for by the factors.This resulted in extracting five factors,

When setting a threshold for commonalities in SPSS factor analysis, it's common to consider commonalities above 0.5 as relatively high and reflective of a good fit with the factor model. Variables with commonalities above this threshold are generally considered well-represented by the extracted factors and are likely to contribute meaningfully to the identified factors.

On the other hand, variables with commonalities below 0.5 may be considered less well-represented by the factor model, indicating that their variance is not adequately captured by the factors. These variables may be candidates for further evaluation, reconsideration, or exclusion from the factor analysis, especially if their commonalities are considerably lower.

Even while commonalities below 0.5 may be seen as less well-represented by the factor model, the threshold for commonalities may vary depending on the particular context of the study, the features of the dataset, and the aims of the factor analysis. the majority Take Out The values of most communities are greater than 0.5 or very near to it; the only variable that is not dropped is the consultant fee, which is extremely distant from the threshold and cannot be dropped since other factors must be taken into account.

Table 4-6: all KPIs communalitie

Communalities	Initial	Extraction
Cost for construction	1.000	0.616
Cost predictability-design and construction	1.000	0.532
Consultant fee	1.000	0.368
Cost per m2	1.000	0.601
Time for construction	1.000	0.696
Time to rectify defects	1.000	0.712
Time predictability design and construction	1.000	0.559
Time allowed for pre-construction preparation work	1.000	0.744
Health and Safety	1.000	0.736
Reportable accident	1.000	0.437
Lost time accident	1.000	0.493
Quality and Defects.	1.000	0.614
Defects (Number / Severity)	1.000	0.607
Quality issues at end of defect rectification period	1.000	0.556
Quality management system	1.000	0.608
Clients Satisfaction.	1.000	0.641
Customer Satisfaction.	1.000	0.464
Productivity	1.000	0.661
Profitability	1.000	0.553
Environment	1.000	0.536

A correlation matrix is often examined in the context of factor analysis to understand the relationships between the observed variables (or items) after the factor analysis has been conducted. The correlation matrix presents a grid of correlation coefficients, which indicate the strength and direction of relationships between pairs of variables. the correlation matrix after factor analysis is essential for validating the relationships between variables and ensuring that the factor model effectively summarizes the information in the data. It provides insights into the coherence of the factor solution and aids in detecting any potential issues such as multicollinearity, cross-loadings, or misalignment of variables with their respective factors.

Cross-Loadings: Identify any unexpected or substantial correlations between variables that belong to different factors. Cross-loadings may indicate that certain variables are not distinctly aligned with the factors as intended, suggesting potential misalignment or interpretational challenges.

Inter-Variable Relationships: The correlation matrix allows you to examine how variables are related to each other after the factor analysis. High absolute correlation coefficients (close to 1 or -1) suggest strong relationships, whereas low absolute correlation coefficients suggest weaker relationships or independence between variables.

Pattern of Correlations: Look for discernible patterns in the correlation matrix. In the context of factor analysis, it is expected that variables within the same factor should exhibit higher correlations with each other compared to variables belonging to different factors. This pattern supports the validity and coherence of the factor solution.

For Reproduced Correlations out put please see Apendex A at the back of this report.

Residuals are computed between observed and reproduced correlations, and from the above table there are 84 (44.0%) non-redundant residuals with absolute values greater than 0.05 as shown in Table 4.5. And hence, the current number of factors extracted is adequate.

"Extraction Sums of Squared Loadings" (SS Loadings) is an essential component of factor analysis and aims to quantify the amount of variance in the original variables that is accounted for by the extracted factors. It quantifies the proportion of variance captured by the identified factors, providing insights into how much of the variance in the original variables is accounted for by the factors.

Individual Factors: The SS Loadings are typically computed for each factor separately, reflecting the proportion of variance in the observed variables that is explained by each individual factor. Higher SS Loadings for a particular factor indicate that the factor is effectively summarizing a larger proportion of the variance in the original variables.

Total Variability: The sum of squared loadings across all factors represents the total amount of variance in the observed variables that is collectively explained by the entire set of extracted factors. It provides a comprehensive measure of how well the factors capture the overall structure and variability in the data

Table 4-8: Total Variance Explained

Com.	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumu. %	Total	% of Variance	Cumu. %	Total	% of Variance	Cumulative %
1	4.365	21.825	21.825	4.365	21.825	21.825	2.866	14.332	14.332
2	1.930	9.648	31.473	1.930	9.648	31.473	2.310	11.549	25.882
3	1.676	8.379	39.852	1.676	8.379	39.852	2.043	10.214	36.096
4	1.453	7.263	47.115	1.453	7.263	47.115	1.995	9.977	46.073
5	1.226	6.130	53.245	1.226	6.130	53.245	1.362	6.808	52.881
6	1.086	5.429	58.674	1.086	5.429	58.674	1.159	5.793	58.674
7	0.931	4.656	63.330						
8	0.817	4.084	67.413						
9	0.779	3.896	71.309						
10	0.741	3.705	75.013						
11	0.697	3.485	78.498						
12	0.646	3.229	81.727						
13	0.606	3.032	84.759						
14	0.546	2.728	87.488						
15	0.503	2.516	90.004						
16	0.478	2.389	92.393						
17	0.452	2.258	94.651						
18	0.410	2.050	96.702						
19	0.366	1.830	98.531						
20	0.294	1.469	100.000						

In summary, the Extraction Sums of Squared Loadings in factor analysis provide a comprehensive assessment of how effectively the extracted factors capture the variance and underlying structure in the observed variables. They aid in evaluating the fit of the factor model and help understand the shared variance and contributions of individual factors to the overall dataset.

Rotation Method:The rotation method refers to a statistical technique used in factor analysis to simplify and interpret the underlying structure of a set of variables for this study, the rotation method used is called Varimax with Kaiser Normalization.

Varimax is a popular rotation method that aims to maximize the variance of the squared loadings of each variable on a factor, making the factors more interpretable.

Kaiser Normalization is a scaling technique used in factor analysis to adjust the loadings of the variables on the factors.

The combination of Varimax rotation and Kaiser Normalization helps to simplify and clarify the factor structure, making it easier to interpret the results.

The term "convergence" refers to the point at which the rotation process reaches stability and no further changes occur.

Table 4-9 Rotated Component Matrixa

Rotated Component Matrix						
	Component					
	1	**2**	**3**	**4**	**5**	**6**
Cost for construction					**0.769**	
Cost predictability-design and construction	**0.608**					
Consultant fee						
Cost per m2	**0.677**					
Time for construction					**0.590**	
Time to rectify defects	**0.691**					
Time predictability design and construction	**0.556**					
Time allowed for pre-construction preparation work	**0.716**					
Health and Safety						**0.830**
Reportable accident						
Lost time accident				**0.644**		
Quality and Defects.		**0.741**				
Defects (Number / Severity)		**0.672**				
Quality issues at end of defect rectification period		**0.670**				
Quality management system		**0.517**				
Clients Satisfaction.				**0.786**		
Customer Satisfaction.						**0.584**
Productivity			**0.622**			
Profitability			**0.731**			
Environment			**0.632**			

The Rotated Component result can be summarised using the EFA expansion table. Six factors make up Matrixa, and the first component (Factor1) includes five variables with results that are strongly related to each other. These variables include Cost per m2, Time to fix flaws, Time predictability design and construction, Time allotted for pre-construction preparation work, and Cost predictability-design and construction Defects (Number / Severity), Quality problems at the conclusion of the defect rectification phase, and the Quality Management System are all included in Factor 2. Productivity, Profitability, and Environment make up Factor 3. Factor 4: Customer satisfaction and lost time accidents Factor 5: Time and Cost of Construction and Finalization Factor 6: Health and safety as well as customer satisfaction.

CHAPTER FIVE :CONCLUSION AND RECOMMENDATION

5.1 Conclusion and Recommendation

Performance measurement is one of the important aspects of construction management in the construction industry and it has been a topic of discussion for a long time, but there is no consensus on what determines a project's success. This is due to the unique conditions, expertise, and requirements of different construction project characteristics. A specific performance assessment tool designed based on input from a specific environment may not fit some projects, while being acceptable in others projects.

The study shows that, despite being crucial, performance assessment is a difficult undertaking for building projects because of the multitude of indicators involved and the constant collection of data required for appropriate and acceptable accuracy levels.

This study was conducted with an objective to assess the performance measurement management of building construction of Addis Ababa by using different pre identified Key performance indicators. This general objective was broken down in three specific objectives; the first one bining analyses the process and procedures of the current performance management of 20/80 condominium building projects in Addis Ababa ,seconed, identifying the significant key performance measurement indictor in the study area and the last objective focusing on categorizeing the KPI's into distinct groups using factor analysis. The study was conducted by using two condominium projects that are under construction; and buildings from the two locations are taken as target population which are at different stage of construction progress. To achieve the study objectives, 161 questionnaires were distributed and 152 were returned.

Among Cost related project performance indictores the major indictor on the performance of condominium construction projects is Cost for construction and it is listed as a main factor that is affecting the project performance especially budgetery costs of constrution works and it is indicated by mean value of 4.85.

Among Time related project performance indictores the major indictor on the performance of condominium construction projects is Time for construction and it is listed as a main factor that is affecting the project performance especially budgetery costs of constrution works and it is indicated by mean value of 4.76.

Among Quality related project performance indictores the major indictor on the performance of condominium construction projects is Quality management system and it is listed as a main factor that is affecting the project performance especially on quality related activities and it is indicated by mean value of 4.45.

Among safety related project performance indictores the major indictor on the performance of condominium construction projects is Health and Safety and it is listed as a main factor that is affecting the project performance especially on the safety aspects of constrution works and it is indicated by mean value of 4.02..

Clients Satisfaction is also observed to be major indictor on the performance of condominium construction projects and it is listed as a main factor that is affecting the project performance and it is indicated by mean value of 4.08.

Customer Satisfaction is also observed to be major indictor on the performance of condominium construction projects and it is listed as a main factor that is affecting the project performance especially budgetery costs of constrution works and it is indicated by mean value of 4.12 and the overall avergae mean value of all KPI is 3.91.

To identify main factors in affecting project performance in the selected projects factor analysis was implemented with the use of principal component analysis based on Varmax rotation method. As a result, six key components were identified and used to summeriz the pre identified 20 KPI in to 6 groups ased on there correlation to each other.

Exploratory factor analysis (EFA) was conducted on the identified performance measurement factors that are influential KMO value of 0.808, which is >0.5 set as the threshold set by the study. In addition, the Bartlett test of sphericity gave a value of 683.441 and a p-value of 0.000, thus being significant. These results affirm the factorability and suitability of the data to undergo EFA. Furthermore, the correlation matrix of the output was inspected to ascertain the suitability of the data for analysis. Moreover, the Cronbach alpha value of 0.755 which upholds the suitability of the dataset.

Commonalities of the measurement variables extracted. The results provided show that all the variables had a value above 0.5, which was the threshold taken from other studies, thus indicating that all the variables do explain much of the variance.Furthermore, with the use of the varimax rotation, it is revealed that six components with an eigenvalue greater than 1 were extracted among the measurement variables. The total cumulative variance was given as 58.674 %, which is above the threshold of 50%.

Result of the rotated component matrix of the measurement variables for performance measurement. The result outlines that the factor loading for the variables is above 0.5, which is the threshold commonly used. In conjunction with the values of the extracted communalities, these results showcase that all the variables within a given component attain a good relationship with each other. The result of the rotated component matrix indicates that there are six components extracted. The first component has factor loadings ranging from 0.716 to 0.556 and . The second component has factor loadings ranging from 0.741 to 0.517 .The third component ranges from 0.731 to 0.622. The forth component ranges from 0.786 to 0.644 The fifth component ranges from 0.769 to 0.590 and the sixth component ranges from - 0.830 to 0.584.

5.2. Conclusion

This research aims to provide insights into the performance management practices of building construction projects in Addis Ababa, focusing specifically on 20/80 condominium projects. The analysis aims to identify the key performance indicators relevant to the construction context and further categorize them using factor analysis to gain a better understanding of their interrelationships and potential impact.

The study's empirical results and the analysis that followed imply that a construction company's performance is not only determined by the conventional iron triangle of quality, cost, and time. It also depends on a wide range of other variables, Client satisfaction, Customer satisfaction, environment, safety and health, profitability and productivity.

The examination of the process and procedures of the current performance management of 20/80 condominium building projects in Addis Ababa might reveal strengths and weaknesses in the existing approach to performance management. This analysis could shed light on areas for improvement as well as best practices that contribute to successful project outcomes.

Through the identification of significant key performance measurement indicators in the study area, the research can highlight which factors play crucial roles in determining the success and effectiveness of building construction processes in Addis Ababa. Through the review of extant literature, 20 variables are identified since it is more effective to develop a locally adapted KPIs that benefits from existing reliable and established ones, and this study used such approach.

The categorization of KPIs into distinct groups using factor analysis could reveal patterns and relationships among various performance indicators, potentially leading to a better understanding of how these factors interrelate and impact project outcomes accordingly all twenty different KPIs in the model that the participants were presented with deemed significant and classified into 6 groups based on the results of factor analysis using IBM SPSS Version 20.0.

Using the study, a framework for multidimensional performance evaluation may be created to efficiently measure construction performance. There are certain limitations to the study. In this study, the unofficial relationships among the factors affecting construction performance were not investigated. Therefore, to check the validity of the measurement scale, confirmatory component analysis (CFA) has to be carried out.

5.3. finding

Based on the conclusions reached, following recommendations are provided to improve the project performance.

- Based on the strengths and weaknesses identified through the process and procedures analysis, the research could recommend specific best practices or improvements to enhance the overall performance management of construction projects in Addis Ababa.

- The construction of 20/80 condominium buildings in Addis Ababa lacks established benchmarks or standards, so there is a need of standardization efforts which includes a regulatory frameworks, industry collaboration, research and best practices, training and capacity building, and continuous improvement are required to create a clear, effective, and agreed-upon benchmarks or standards for project performance in the construction of 20/80 condominium buildings in Addis Ababa.
- The 20/80 condominium projects in Addis Ababa require a comprehensive metric analysis to assess project performance. To get the required metrics it is required to
    - ✓ Integrate performance indicators to measure success in areas like affordability and accessibility.
    - ✓ Stakeholder satisfaction should also be integrated into performance tracking.
    - ✓ Risk and progress management should be prioritized, ensuring timely interventions and corrective actions.
    - ✓ Standardization and benchmarking should be advocated, promoting benchmarks that reflect the specific goals and challenges of the projects.
    - ✓ Continuous improvement processes should be promoted, focusing on enhancing metrics and indicators based on industry learnings and changing project dynamics.

These recommendations aim to improve project tracking and measurement practices, ensuring they align with the unique characteristics and challenges of the 20/80 condominium construction projects in Addis Ababa.

- The performance of condominium housing projects is evaluated against their objectives, but there are identified delays and challenges concerning this objectives based on the respondent reprocess. To address these, improving data collection, addressing timeliness and quality issues, strengthening quality assurance measures, promoting stakeholder involvement, and advocating for transparency and accountability is highly required and the following points should be considered .
    - ✓ Objective realignment should be encouraged to reflect ground realities and address delays and bottlenecks in housing delivery.
    - ✓ Efficient data collection systems should be implemented to ensure evidence-based evaluation processes.
    - ✓ Proactive measures should be taken to address delays and bottlenecks in housing delivery.
    - ✓ Stakeholder involvement should be promoted to integrate perspectives and feedback from key stakeholders into performance assessments.
    - ✓ Transparency and accountability should be advocated to ensure timely corrective actions are taken.
- The 20/80 condominium buildings in Addis Ababa should focus on quality management, risk management, cost and schedule adherence, continuous performance monitoring,

stakeholder satisfaction, and regular performance reporting. These recommendations aim to ensure the successful execution of these projects by focusing on quality, risk management, cost and time adherence, stakeholder satisfaction, and comprehensive performance reporting.

- The identification of significant KPIs could lead to recommendations for a more focused measurement and monitoring approach, highlighting the specific crucial areas that require close attention for improved project outcomes accordingly 20 KPIs are identified that are highly important to track performance of condominium construction projects.
- The identified KPIs where categorized and this can be used for the strategic allocation of resources, both in terms of financial investment and human capital, to address the various categories of KPIs identified through the factor analysis.
- Through a better understanding of the interrelationships among KPIs, the research could recommend improved decision-making processes, particularly in areas such as project planning, risk management, and resource allocation.

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Appendix A Reproduced Correlations

Reproduced Correlations

		Cost for construction	Cost predictability-design and construction	Consultant fee	Cost per m2	Time for construction	Time to rectify defects	Time predictability design and construction	Time allowed for pre-construction preparation work	Health and Safety	Reportable accident	Lost time accident	Quality and Defects.	Defects (Number / Severity)	Quality issues at end of defect rectification period	Quality management system	Clients Satisfaction.	Customer Satisfaction.	Productivity	Profitability	Environment
Reproduced Correlation	Cost for construction	.616[a]	-0.087	-0.198	0.006	0.393	0.126	-0.035	0.030	-0.050	-0.206	-0.021	0.007	-0.207	0.042	0.115	-0.079	-0.240	-0.118	0.044	0.192
	Cost predictability-design and construction	-0.087	.532[a]	0.326	0.265	0.398	0.316	0.517	0.475	0.035	0.249	0.190	0.224	0.138	0.276	0.267	0.226	0.198	0.237	-0.057	0.068
	Consultant fee	-0.198	0.326	.368[a]	0.267	0.126	0.256	0.340	0.464	0.022	0.256	0.229	0.087	0.083	0.157	-0.070	0.259	0.138	0.397	0.189	0.195
	Cost per m2	0.006	0.265	0.267	.601[a]	0.225	0.591	0.218	0.425	-0.035	-0.077	-0.140	-0.215	-0.002	0.037	-0.200	-0.147	0.075	0.231	0.088	0.089
	Time for construction	0.393	0.398	0.126	0.225	.696[a]	0.300	0.388	0.413	0.109	0.021	0.153	0.113	-0.161	0.153	0.289	0.179	-0.050	0.030	-0.101	0.126
	Time to rectify defects	0.126	0.316	0.256	0.591	0.300	.712[a]	0.330	0.493	-0.123	0.005	-0.116	0.003	0.187	0.277	-0.056	-0.195	0.055	0.331	0.185	0.230
	Time predictability design and construction	-0.035	0.517	0.340	0.218	0.388	0.330	.559[a]	0.532	-0.055	0.323	0.280	0.342	0.206	0.394	0.294	0.283	0.197	0.357	0.081	0.217
	Time allowed for pre-construction preparation work	0.030	0.475	0.464	0.425	0.413	0.493	0.532	.744[a]	-0.032	0.291	0.337	0.168	0.054	0.306	-0.015	0.342	0.108	0.563	0.320	0.416
	Health and Safety	-0.050	0.035	0.022	-0.035	0.109	-0.123	-0.055	-0.032	.736[a]	0.109	-0.024	0.000	-0.023	-0.133	-0.142	-0.014	-0.423	-0.119	-0.130	-0.169
	Reportable accident	-0.206	0.249	0.256	-0.077	0.021	0.005	0.323	0.291	0.109	.437[a]	0.331	0.411	0.298	0.335	0.119	0.307	0.035	0.375	0.213	0.223
	Lost time accident	-0.021	0.190	0.229	-0.140	0.153	-0.116	0.280	0.337	-0.024	0.331	.493[a]	0.273	-0.044	0.171	0.096	0.538	0.075	0.343	0.242	0.318
	Quality and Defects.	0.007	0.224	0.087	-0.215	0.113	0.003	0.342	0.168	0.000	0.411	0.273	.614[a]	0.434	0.517	0.389	0.182	0.002	0.259	0.150	0.237
	Defects (Number / Severity)	-0.207	0.138	0.083	-0.002	-0.161	0.187	0.206	0.054	-0.023	0.298	-0.044	0.434	.607[a]	0.461	0.180	-0.176	0.037	0.236	0.129	0.084
	Quality issues at end of defect rectification period	0.042	0.276	0.157	0.037	0.153	0.277	0.394	0.306	-0.133	0.335	0.171	0.517	0.461	.556[a]	0.304	0.057	0.064	0.358	0.224	0.303
	Quality management system	0.115	0.267	-0.070	-0.200	0.289	-0.056	0.294	-0.015	-0.142	0.119	0.096	0.389	0.180	0.304	.608[a]	0.092	0.179	-0.141	-0.258	-0.078
	Clients Satisfaction.	-0.079	0.226	0.259	-0.147	0.179	-0.195	0.283	0.342	-0.014	0.307	0.538	0.182	-0.176	0.057	0.092	.641[a]	0.144	0.289	0.158	0.244
	Customer Satisfaction.	-0.240	0.198	0.138	0.075	-0.050	0.055	0.197	0.108	-0.423	0.035	0.075	0.002	0.037	0.064	0.179	0.144	.464[a]	0.082	-0.078	-0.048
	Productivity	-0.118	0.237	0.397	0.231	0.030	0.331	0.357	0.563	-0.119	0.375	0.343	0.259	0.236	0.358	-0.141	0.289	0.082	.661[a]	0.515	0.497
	Profitability	0.044	-0.057	0.189	0.088	-0.101	0.185	0.081	0.320	-0.130	0.213	0.242	0.150	0.129	0.224	-0.258	0.158	-0.078	0.515	.553[a]	0.497
	Environment	0.192	0.068	0.195	0.089	0.126	0.230	0.217	0.416	-0.169	0.223	0.318	0.237	0.084	0.303	-0.078	0.244	-0.048	0.497	0.497	.536[a]

Reproduced Correlations

		Cost for construction	Cost predictability-design and construction	Consultant fee	Cost per m2	Time for construction	Time to rectify defects	Time predictability design and construction	Time allowed for pre-construction preparation work	Health and Safety	Reportable accident	Lost time accident	Quality and Defects.	Defects (Number / Severity)	Quality issues at end of defect rectification period	Quality management system	Clients Satisfaction.	Customer Satisfaction.	Productivity	Profitability	Environment
Residual	Cost for construction		0.034	0.108	-0.034	-0.154	-0.013	-0.015	0.021	0.066	0.125	0.006	-0.005	0.107	-0.075	-0.105	0.005	0.191	0.073	-0.093	-0.133
	Cost predictability-design and construction	0.034		-0.085	-0.112	-0.074	-0.032	-0.102	-0.043	-0.075	-0.029	0.027	-0.046	0.010	-0.067	-0.056	-0.080	-0.096	0.035	0.054	0.049
	Consultant fee	0.108	-0.085		-0.072	0.017	-0.061	-0.124	-0.068	-0.051	-0.078	-0.047	0.054	-0.010	0.051	0.057	-0.071	-0.047	-0.045	-0.048	-0.005
	Cost per m2	-0.034	-0.112	-0.072		-0.015	-0.121	-0.039	-0.070	-0.009	0.030	0.120	0.043	0.017	0.064	0.095	0.081	-0.052	-0.079	0.026	-0.011
	Time for construction	-0.154	-0.074	0.017	-0.015		-0.074	-0.055	-0.051	-0.058	0.020	-0.021	-0.010	0.065	0.022	-0.079	-0.042	0.027	-0.016	0.074	0.007
	Time to rectify defects	-0.013	-0.032	-0.061	-0.121	-0.074		-0.028	-0.022	0.050	0.024	0.057	0.025	-0.045	-0.067	0.043	0.071	0.022	0.000	-0.020	-0.028
	Time predictability design and construction	-0.015	-0.102	-0.124	-0.039	-0.055	-0.028		-0.024	-0.013	-0.037	-0.075	-0.015	-0.018	-0.050	-0.097	0.012	-0.053	-0.020	0.013	0.011
	Time allowed for pre-construction preparation work	0.021	-0.043	-0.068	-0.070	-0.051	-0.022	-0.024		-0.003	0.013	-0.074	0.035	0.009	-0.035	0.001	-0.010	0.018	-0.019	-0.022	-0.047
	Health and Safety	0.066	-0.075	-0.051	-0.009	-0.058	0.050	-0.013	-0.003		-0.089	-0.015	0.009	-0.027	0.037	0.061	0.008	0.309	0.023	0.055	0.074
	Reportable accident	0.125	-0.029	-0.078	0.030	0.020	0.024	-0.037	0.013	-0.089		-0.051	-0.101	-0.093	-0.048	-0.036	-0.100	0.052	-0.055	-0.025	-0.055
	Lost time accident	0.006	0.027	-0.047	0.120	-0.021	0.057	-0.075	-0.074	-0.015	-0.051		-0.088	0.112	-0.008	0.034	-0.160	-0.049	-0.011	-0.043	-0.076
	Quality and Defects.	-0.005	-0.046	0.054	0.043	-0.010	0.025	-0.015	0.035	0.009	-0.101	-0.088		-0.111	-0.107	-0.105	0.017	0.076	-0.027	-0.002	-0.034
	Defects (Number / Severity)	0.107	0.010	-0.010	0.017	0.065	-0.045	-0.018	0.009	-0.027	-0.093	0.112	-0.111		-0.157	-0.070	0.115	0.005	-0.004	-0.081	0.022
	Quality issues at end of defect rectification period	-0.075	-0.067	0.051	0.064	0.022	-0.067	-0.050	-0.035	0.037	-0.048	-0.008	-0.107	-0.157		-0.033	0.047	-0.002	-0.054	0.006	-0.048
	Quality management system	-0.105	-0.056	0.057	0.095	-0.079	0.043	-0.097	0.001	0.061	-0.036	0.034	-0.105	-0.070	-0.033		-0.008	-0.103	0.043	0.130	0.028
	Clients Satisfaction.	0.005	-0.080	-0.071	0.081	-0.042	0.071	0.012	-0.010	0.008	-0.100	-0.160	0.017	0.115	0.047	-0.008		-0.055	-0.033	-0.023	-0.028
	Customer Satisfaction.	0.191	-0.096	-0.047	-0.052	0.027	0.022	-0.053	0.018	0.309	0.052	-0.049	0.076	0.005	-0.002	-0.103	-0.055		0.002	0.049	0.044
	Productivity	0.073	0.035	-0.045	-0.079	-0.016	0.000	-0.020	-0.019	0.023	-0.055	-0.011	-0.027	-0.004	-0.054	0.043	-0.033	0.002		-0.117	-0.078
	Profitability	-0.093	0.054	-0.048	0.026	0.074	-0.020	0.013	-0.022	0.055	-0.025	-0.043	-0.002	-0.081	0.006	0.130	-0.023	0.049	-0.117		-0.166
	Environment	-0.133	0.049	-0.005	-0.011	0.007	-0.028	0.011	-0.047	0.074	-0.055	-0.076	-0.034	0.022	-0.048	0.028	-0.028	0.044	-0.078	-0.166	

Table 4-7: Reproduced Correlation of KPIs

Reproduced communalities

Residuals are computed between observed and reproduced correlations. There are 84 (44.0%) no redundant residuals with absolute values greater than 0.05.

Appendix B Questionnaire

Addis College

Postgraduate Program

Construction Technology and Management program

Questionnaire

Thank you for taking time to fill this questionnaire. This survey questions are a research instrument for the fulfillment of my MSC program on construction technology and Management at Addis college and of the study of assessment of building performance measurement of low cost housing construction,the case of Addis Ababa 20/80 Condominium project your response will be completely anonymous and confidential, and will not be identified by individual. All response will be compiled together and analyzed as a group.

Part 1 - Personal data of the respondents (personal information)

1. Where is your job location now?

Project Site	Mark √
Arada project site	
Gulele project site	
Addis Ababa housing project office	

2. What is your organization type?

Organization Type	Mark √
Owner	
Contractor	
Other	

If your answer is other, please specify

____

3. Your job description and position

………………………………………………………………………………………………
………………………………………………………………………………………………

4. Your level of education:

Education level	Mark √
Diploma and certificate	
First degree	
Above First degree	

Part 2 - Questionnaire for analyses the process and procedures of the current performance management of 20/80 condominium building projects in Addis Ababa. Mark √

1. What are the performance management processes and procedures currently structured for the 20/80 condominium building projects in Addis Ababa?

Goal Setting	Mark √
Performance Planning	
Ongoing Monitoring and Feedback	
Performance Evaluation	

If your answer is other, please specify

____

2. What specific metrics or Key Performance Indicators (KPIs) are used to measure the performance of these projects?

Time	Mark √
Cost	
Quality	

Safety	
Another	

If your answer is other, please specify

____

3. At which stage of project lifecycle performance metrics are determined and evaluated throughout the project lifecycle?

From the binging of the project	Mark √
from the middle of the project	
From the ending of project	
At all stage	
Any other	

If your answer is other, please specify

____

4. What methodologies or tools are in place to gather and analyze performance data for these projects?

Key Performance Indicators (KPIs)	Mark √
Performance Dashboards	
Project Management Software	
Surveys and Feedback Mechanisms	
Others	

If your answer is other, please specify

____

5. How are performance gaps or areas of improvement identified and addressed within the current performance management system?

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……

6. Are there any established benchmarks or standards for project performance in the construction of 20/80 condominium buildings in Addis Ababa? If your answer is yes, please specify?

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……

7. What metrics or indicators are currently being tracked or monitored for these projects?

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8. How do you evaluate the status of condominium housing project performance against the Objectives?

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9. What should be most relevant key performance e indictor in Ethiopia? Specially of 20/80 condominium buildings in Addis Ababa?

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……
……

Part 3. Major Key performance measurement indictor in the construction of 20/80 condominium housing:

The following questions aims to identify the most important KPI in condominium housing projects in Addis Ababa: please put (X) mark in the box corresponding to your preferred response using the scale below:

LI: List important SI: slightly important I: important VI: very important MI: most important

NO	Major Key performance measurement indictor	LI	SI	I	VI	MI
1	Cost for construction					
2	Cost Predictability-design and construction					
3	Consultant fee					
4	Cost per m2					
5	Time for construction					
6	Time to rectify defects					
7	Time predictability – design and construction					
8	Time allowed for pre-construction preparation work					
9	Health and Safety					
10	Reportable accident					
11	Lost time accident					
12	Quality and Defects.					
13	Defects (Number / Severity)					
14	Quality issues at end of defect rectification period					
15	Quality management system					
16	Clients Satisfaction.					
17	Customer Satisfaction.					
18	Productivity.					
19	Profitability					
20	Environment					