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M.Sc. IN INNOVATION MANAGEMENT AND ENTREPRENEURSHIP

Thesis

**Project Management Triangle and Building Construction
Performance: The Moderating Role of COVID 19**

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Project Management Triangle and Building Construction Performance: The Moderating Role of COVID 19.

A case study of Bole sub-city primary school building class extension program

Declaration

I understand the nature of plagiarism, and I am aware of the University's policy on this. The work provided in this thesis, unless otherwise referenced, is the researcher's work and has not been submitted by others elsewhere for any other degree or qualification.

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Abstract

The research aimed to investigate the degree of the project management triangle and its various measures (cost, time, quality) in the primary school extension program in Bole Sub City and to examine the degree of construction project performance and aimed to test the moderating role of COVID 19 the relationship between iron triangle and construction project performance. The target population of the study comprised 100 stakeholders involved in Bole sub-city public primary level school extension building construction projects. And out of these 80 samples were taken 71 samples are returned. The study used both descriptive and explanatory statistics to analyze the data collected from the questionnaire. The result revealed that COVID 19 is moderately affecting the relationship between the project management triangle and construction project performance. Based on the result the research recommended Keep applying and exerting efforts on the realization and application of effective Project management triangle practices is important for stakeholders in evaluating, controlling, and monitoring of cost, Time, and quality of construction projects during the crisis.

Keywords: project performance, project management triangle, cost, time, quality, COVID 19.

CHAPTER 1

INTRODUCTION

1.1 Background

The construction industry is a vital sector of the economy that contributes significantly to the country's social and economic development. Construction projects include erecting and repairing buildings of all types, constructing and repairing roads and bridges, erecting steel and reinforced concrete structures, and other civil engineering works such as laying sewers, gas or water mains, and electric cables, erecting overhead lines, extracting coal, and so on (Ofori, 1990). This construction project is complicated since it involves a significant number of stakeholders, suppliers, shareholders, and regulators, as well as owners (clients), contractors, and consultants (Foulkes, & Ruddock, 2007).

The success of a construction project is indicated by the project performance. Project success can be described as a complex and often unreal idea, but it is of crucial importance to effective project implementation (Alias et al. 2014). Project performance is measured for many reasons such as benchmarking, rewarding, and monitoring whether the organization's strategy is working well at all levels of the organization (Sezer, 2016).

The success criteria for a project management endeavor are usually limited to cost, time, and quality/performance. The goal of all stakeholders throughout the project life cycle and at all levels in the management hierarchy is to achieve cost, time, and quality performance when measuring project success (De Wit, 1988). In many studies, project management refers to the management of cost, time, and quality as a whole. The Triple Constraint (iron triangle) is an important concept in project management study and practice, demonstrating the link between essential performance requirements (Pollack, Helm, & Adler, 2018).

For the past two years, the construction project performance has exhibited a reduction in cost, time, and quality performance. Although several factors drag the success of construction projects the outbreak of COVID 19 create a new set of environments for the construction sector.

The study carried out by Abebe, (2020) revealed that covid 19 brought a significant impact on daily laborers, small and medium construction firms. As a result, daily income is failed, material escalation, hard currency shortage, productivity reduction, time extension and additional costs for project delay are creating challenges for the Ethiopian construction industry.

Alenezi, (2020) carried out a questionnaire survey with professionals including engineers, construction, and architecture practitioners operating in Kuwait. The result revealed that covid result in a delay in projects.

Tariq, & Manuel, (2021) Carried out secondary research or use secondary data sources to analyze the construction condition in Oman. The researcher suggests that covid results in critical material supply chain issues due to construction contracts being delayed and borders are closed. Unemployment is increased as the construction companies reduce their staff. Critical labor and field specialists are not available on their job due to the global travel ban. Generally, the pandemic changes the economic prospects of the construction industries in Oman. Shibani et al, (2020) Stated construction companies both dealing with residential and commercial development (building projects) are affected by the Covid-19 pandemic due to lockdown and social distancing in construction sites.

This study would help to understand the moderating influence of COVID 19 on the relationship between specified components of the project management triangle (cost, time, and quality) and construction project performance in the case of the Bole Sub City primary school class's extension program. Various sorts of studies on the effect of COVID 19 in the building industry have been conducted by various researchers. However, its effect on the performance of Ethiopia's building construction industry has not been determined. The majority of research does not expressly focus on the effect of COVID in Ethiopia's building construction projects. As a result, the goal of this research is to fill the knowledge gap about COVID 19's moderating effect on building project performance and project management triangle in Bole Sub City primary school classes' extension programs.

1.2 Statement of the problem

The construction industry is recently suffering after the outbreak of COVID 19 throughout the world. The pandemic gives rise to the inflation of construction material, unemployment, material scarcity, project suspension, cost overrun, time delay, decline of productivity, idleness of resources. All the above and other related factors are affecting the performance of the construction project. As the pandemic of COVID-19 had arisen into our glob that had affected the construction industries, including building the projects.

As a consequence of the Pandemic, the construction sector is exposed to a simultaneous reduction in supply and demand. The industry is severely hit by the current levels of uncertainty, a decline of business, consumer dissatisfaction, and loss of income as well as diversion of government funds towards COVID 19 management (Mahesh, & Virendra, 2021).

The study carried out by Alenezi, (2020) indicated that the main cause of delay in construction projects was due to employees being unable to work on-site as a result of the pandemic. The pandemic has a considerable effect on construction projects in slowing the process causing disruption and delay. Some have completely terminated to start at later date, Although legal the condition varies from nation to nation country to country (Ogunnusi et al.2020).

The pandemic generates delays, disruption, and uncertainty in an ongoing project. The condition enforces the construction industry to adopt more sophisticated technology. These bring a reduction of the workforce in a construction site (Adhikari, & Poudyal, 2021).

In general, the pandemic has a considerable effect on the cost, time, and quality of construction projects. This implies that the COVID 19 would have a significant effect on the project management triangle. This research will examine the moderating effect of covid 19 on the relationship between project management triangle and construction project performance in Bole Sub City primary school classes' extension program.

1.3 Objective

General objective

The research paper seeks to achieve its general objectives of the moderating effect of COVID 19 on the performance of building construction projects in Bole Sub City primary school classes' extension program.

Specific objective

- Analyzing the moderating effect of COVID 19 on the relationship between identified factors of the Iron triangle (cost, time, and quality) and construction project performance.
- Identify problems caused by COVID 19 in the building construction project of Bole Sub City primary school class extension building project.
- Investigate the perception of construction stakeholders on the moderating effect of COVID 19 between identified factors (cost, time, and quality) and construction project performance of building construction carried out under Bole Sub City primary school class extension.

1.4 Research question

- Does COVID 19 have a moderating effect on the relationship between the project management triangle and construction project performance?
- What are the problems caused by COVID 19 in the building construction projects?
- What is the perception of stakeholders on the moderating effect of COVID 19 between the project management triangle and construction project performance?

1.5 Significance

The originality of this work lies in studying unexplored relationships between project management Triangle and construction project performance with the moderating role of COVID 19 in the Bole Sub City primary school extension program.

Understanding COVID 19's moderating effect on the relationship between the Iron Triangle (Cost, Time, and Quality) and construction project performance may be useful for individuals such as contractors, consultants, and clients to see and use effective communication to improve construction performance and their respective organizational success during the pandemic. Stakeholders may be able to use these to assess, evaluate, and improve the current performance of construction projects and organizations.

This study may provide useful information to clients, contractors, and consultants about the variables that affect the iron triangle and its dimensions (Cost, Time, and Quality), allowing stakeholders to better understand and respond to these variables, resulting in improved construction projects performance.

This research indicates the effects of COVID 19 in achieving the construction firm objectives and this will lead to an increase in the management team's awareness about the effect of COVID 19 on construction performance and to focus on the alleviation of the problems that arise.

The role of COVID 19 as a moderator in the relationship between the Iron triangle and its identified factors (Cost, Time, and Quality) and construction project performance in Bole Sub City primary school class extension construction projects is investigated in this study. To better understand the relationship between Iron Triangle and construction project performance, the researcher may investigate other variables that may moderate the relationship.

1.6 Scope of the study

This research is focused on analyzing the moderating effect of COVID 19 on the relationship between identified factors of the Iron Triangle (Cost, Time and Quality) with construction project performance. Based on this

- COVID 19 is treated as a moderating variable.
- The Iron triangle is treated as the independent variable. And it is measured by its three dimensions are Cost, Time, and Quality.
- Construction project performance is evaluated as the dependent variable.

The data for this research is collected from Bole Sub City primary school building class extension projects in Addis Ababa. The construction is carried out in 8 public primary level schools located in the Bole sub-city.

The target population of the study will comprise the stakeholders involved in building construction. These include consultants, contractors, and clients. Both primary and secondary data will be collected from various sources. The data was analyzed using SPSS 25. The descriptive analysis, The Correlation between variables, the questionnaire item analysis, multiple regressions analysis all are analyzed using SPSS 25.

1.7 Organization of the paper

The following are the five main chapters of this study:

The background of the study, the statement of the problem, the research objective, the significance of the research, the scope of the study, and the research question will all be included in this chapter. The second chapter includes a detailed review of the concept, definition, and theory on the main factors affecting performance, key performance indicators, and the effect of covid on the construction industry's performance. The methodology used to achieve the research's goal will be discussed in Chapter 3. The result, description, and research result are all shown in Chapter 4. A conclusion and recommendations will be presented in Chapter 5.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter reviews the literature related to these research variables, project management triangle (cost, time, and quality) construction project performance, and COVID 19.

The first part is a theoretical review, and it has three parts this are project management triangle, construction project performance, and COVID 19. The second part illustrates the empirical studies on the effect of COVID 19 on the construction industry. The third one is a synthesis of the review.

2.2 Theoretical review

2.2.1 Project management triangle

While its origins are unknown, it has been in use since the 1950s. For over forty years the discipline of project management has been characterized by the icon of the Iron Triangle showing the triple constraint of time, cost, and scope. In 1969, Dr. Martin Barnes, an IPMA Fellow and a celebrity in the project management industry, was credited with coining the word (Naughton, 2013).

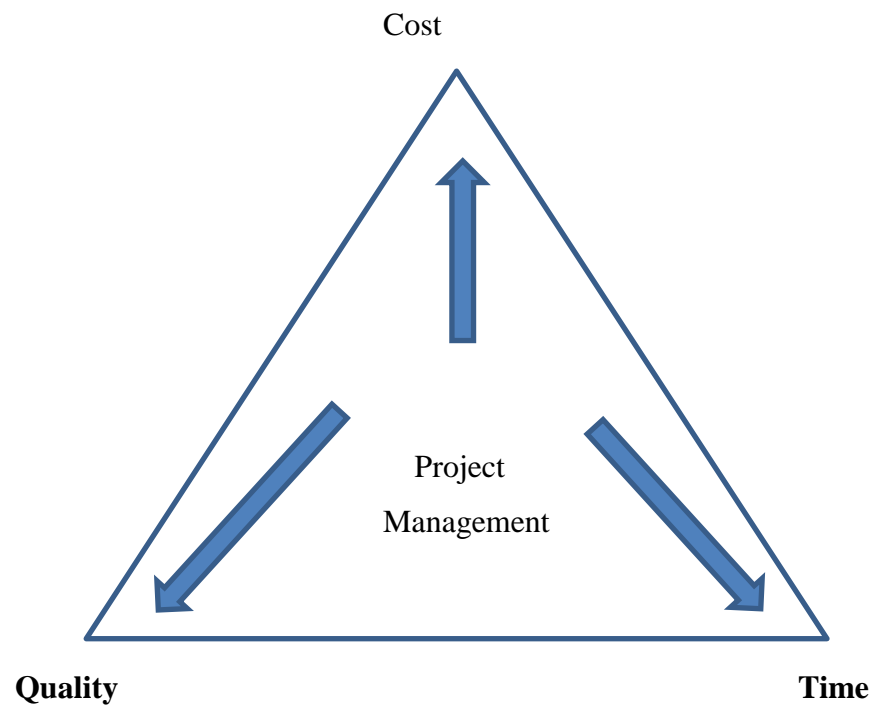
Different studies indicated that the project management triangle provides a useful framework to evaluate project performance and characteristics of the project. For the past 50 years cost, time and quality have been inseparable links in measuring the success of project management (Atkinson, 1999). In the early 90s', project success was inherently tied to success measures, which in turn were tied to project objectives. At the project level, success was measured based on time, monetary cost, and quality (Rani, 2014).

2.2.1.1 Project management triangle definition

The project management triangle, also known as the Iron Triangle, the Triple Constraint Triangle, or the Value Triangle, represents the relationship between major performance metrics in project management study and practice. However, there is debate over which criterion should be expressed on the triangle's vertices (Pollack, Helm, & Adler, 2018). (Jensen, 2013). (Nikolaos, 2014).

There is some debate on which factors represented the triangle's vertices. Time, cost, and quality have significant ties. This notion is one of the iron triangle's key vertices and has a greater link to alternatives like scope, performance, and requirement (Julien et al 2018).

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(source : Nikolaos, (2014)/ page 5

Figure 2.1: 'Project management triangle'

The aforementioned three main elements of a project are interconnected via the 'project management triangle'.

Table 2.1: some concepts of project management triangle

<p>Cost, time, and quality are all intertwined, and any change in one has an impact on the others. Simply finishing the project on time and on budget isn't enough; the project must also be of acceptable quality.</p>	<p>(Lazarevic & Prlincevic, 2014).</p>
<p>During the preceding 50 years, project management performance has been intimately tied to cost, time, and quality (The Iron Triangle). Given how frequently those requirements occurred in project management descriptions within the same time span, this isn't surprising.</p> <p>Because time and cost are the easiest to calculate, quality is a phenomenon of emergent behavior of individuals with diverse attitudes and beliefs that vary over the course of a project's development life cycle.</p>	<p>(Atkinson, 1999).</p>
<p>The Iron Triangle, also known as the Project Management Triangle or the Triple Constraint, is a critical component of our project success thinking. The Iron Triangle is a diagram that depicts the most basic project success criteria: whether the project is completed on time, on budget, and to a predetermined degree of quality, performance, or scope. The Iron Triangle has become the gold standard for evaluating project performance on a consistent basis.</p>	<p>(Pollack, Helm, & Adler, 2018).</p>
<p>The Iron Triangle criteria are the most widely used criteria for determining project success. This triangle served as a framework for project managers to identify and balance the competing demands of cost, time, and quality.</p>	<p>(Al-Qahtani & Baymout, M 2021).</p>
<p>Having a clear project definition is crucial for successful construction projects. It affects design quality, project communication between stakeholders, and final</p>	<p>(Bo Xia et al,2015)</p>

project performance in terms of cost, schedule, and quality.



2.2.1.2 Project management triangle dimensions

a) Project Cost Dimension

Capital, Estimating, Performance, Schedule, and Activities were all included in the previous period. These concepts most commonly alluded to capital works projects, estimate techniques, performance assessment and monitoring, and the process of scheduling activities when interpreted in the context of the abstracts in which they were employed. This shows that these principles have lost their importance in the Cost Management concept. Previously, Cost Management was primarily concerned with engineering, software development, and the construction of huge projects, with power plants frequently serving as a research emphasis (Pollack, Helm, & Adler, 2018).

Cost management includes estimating costs (approximation of the monetary resources needed to complete project activities), determining budget (aggregating the estimated costs to establish cost baseline), and control (monitoring the status of the project and managing changes to the cost baseline) (Lazarevic & Prlincevic1, 2014).

b) Project Time Dimension

Time is an intangible resource that is unique in project management since it is entirely finite, and the availability of time required to perform a task is characterized as the time availability of a project. The term "project time overrun" refers to a project taking longer than intended to complete. In three areas relating to project time, project managers are accountable for increasing construction speed, maximizing delivery speed, and limiting schedule extension (Anuar & Ng, 2011).

Project time management refers to the procedures that must be followed to ensure that the project is completed on time. Planning is the most important aspect of project time management, followed by control and execution. Deadlines, client needs, hard and soft reasoning, and a little

foresight can all influence project schedule planning. Time management is essential for any project's success. Lack of schedule management is the most typical cause of bloated project budgets. (Lazarevic & Prlincevic, 2014).

C) Project Quality Dimension

Quality is defined by the Project Management Institute as the degree to which a set of intrinsic attributes fulfills requirements. A product, method, or system might have a set of inherent characteristics. Customers or stakeholders may have special needs that are commonly overlooked, jeopardizing the project's success.

The methods and actions of the performing organization that set quality policies, objectives, and responsibilities so that the project meets the needs for which it was formed are referred to as project quality management. It establishes a quality management system that includes policies and procedures, as well as continual process improvement initiatives as needed (Lazarevic and Prlincevic, 2014).

2.2.1.3 Project management triangle importance

Misunderstanding or misinterpreting the Iron Triangle can lead to project failure, even if all other aspects of the project are managed well. The Iron Triangle is critical to project success, but research into the Iron Triangle has also been found to be "one of the most overlooked fundamentals of project management" (Pollack, Helm, & Adler, 2018). The Iron Triangle is a great way for a project manager to figure out what the various stakeholders' priorities and motivations are, as well as how well the project is understood (Lazarevic & Prlincevic, 2014).

2.2.1.4 The inter relationship between cost, time and quality

Most large, complicated development projects, in reality, have significant cost and schedule overruns. Projects that take longer to complete usually cost more money. In a fast developing construction industry, estimating the cost of quality in projects becomes a critical responsibility, as the goal of producing a high-quality product is to not only exceed client needs, but also to do so at the lowest possible cost (Anuar & Ng, 2011).

The longer it takes to detect project flaws, the more significant the potential damage is, and the more complicated and expensive the project's corrective actions will be (Navon, 2005).

2.2.2 Construction project performance

2.2.2.1 Project

A project is a short-term activity with specific goals and starts and end dates to develop a one-of-a-kind product or service. The limited resources available to meet the project's objectives determine the project's success (Moe et al, 2006). Projects are a collection of tasks that must be completed in order to satisfy a set of objectives, and they need the use of a company's resources (Alias et al 2014).

A project is a set of unique, complicated, and interwoven operations that have a common objective or purpose and must be completed on time, within budget, and according to specifications. On the other hand, a routine collection of tasks or daily operations is designed to be a continuous process with no preset end (Ofori, 2013).

Money may be less important to the business when there is a tight deadline for the delivery of a product or the inauguration of a building. If a project is running smoothly, periodic evaluations may be conducted as a preventative measure. On the other hand, any volatility or the development of a previously unknown major risk necessitates a rapid and thorough examination of initiatives, particularly those receiving public financing or donations, necessitating an even higher level of transparency and accountability. In such cases, an audit or review may be required (Mills, 2016).

2.2.2.2 Concept of performance

As the economic environment in which businesses operate has become more competitive and complex, the dimensions of performance have shifted.

The term "performance" comes from a Latin word that means "to finish a predetermined activity." The word performance is currently derived from the verb perform, which refers to the regular completion of tasks that require specific abilities (Camelia & Luminita, 2013). The Oxford English Dictionary defines performance as "the act of performing a task, taking action, and doing so quickly." The sum of economic, social, and environmental performance, according to Reynaud (2003), is referred to as overall performance.

According to a number of sources, there is no unanimity on the concept of performance. According to Samsonowa (2011), all of the different definitions she had to review in the

performance measurement literature are related to two terms: effectiveness and efficiency; effectiveness as an indicator of the degree of goal attainment, and efficiency as an indicator of the resources used to achieve the level of achievement. As a result, the way it is managed is influenced by the environment in which it is discussed.

As the economic environment in which firms operate has gotten more competitive and complex, the parameters of performance have evolved. They all have one thing in common: they're all linked to two terms: effectiveness and efficiency; effectiveness as a measure of goal achievement, and efficiency as a measure of the resources needed to get there. As a result, its management is similarly influenced by the situation (Mirela & Monica, 2010).

2.2.2.3 Theory of performance

The Theory of Performance (TOP) is a framework that explores and connects six fundamental concepts to explain and improve performance. What it means to perform is to produce useful outcomes. A performer can be a single person or a group of people working on a project together. Performance improvement is a journey, and where you are on that journey is determined by your level of performance. Context, level of knowledge, skill levels, level of identity, personal characteristics, and fixed elements all have an impact on current performance. Three axioms are presented for effective performance enhancements. These include a performer's mindset, immersion in a stimulating environment, and reflective practice (Don, 2010).

2.2.2.4 Performance Management

Setting goals and regularly assessing progress toward those goals is the practice of performance management (PM). It entails tasks that ensure that organizational goals are consistently met in a timely and effective manner. It is a continual process of identifying, measuring, and improving organizational performance by tying an individual's performance and goals to the overarching mission and goals of the business (Kaviya & Hema, 2015). It's a term that refers to a set of activities that determine whether or not goals or objectives have been met. Defining work, setting goals, providing feedback, and encouraging development are some of these activities (Jay, 2015).

2.2.2.5 Performance measurement system

A performance measurement system is a tool that can be used to help an organization generate performance measurement activities. Separated and non-separated performance measurement systems are the two types of systems. A separate or 'individual' performance measurement

system refers to the fact that each unit or department in an organization uses a different system for tracking performance. A non-separated or "corporate" system is one in which every unit or department in an organization uses the same system to generate performance measurement (Latiffi et al). (2009).

A performance measurement system is an information system that assists managers in the performance management process by performing two primary functions: the first is to enable and structure communication between all organizational units involved in the target setting process (individuals, teams, processes, functions, and so on). The second is the collection, processing, and delivery of data on people's, activities', processes', products', and business units' performance (Forza & Salvador, 2000). Performance measurement is a process or activity that involves quantifying the outcomes of actions and comparing them to predetermined objectives. Some authors extend the definition to include the creation of instruments as well as the planning of subsequent actions and initiatives (Heini, 2007).

2.2.2.6 Organizational performance

According to Salminen (2005), an organization's performance is determined by the performance of individuals and groups. However, performance in all organizations refers to the organization's goal, reflects accomplishments in resource management, and accounts for the environment in which the organization operates (Pintea & Achim, 2010).

In today's dynamic environment, where success is dependent on meeting the changing needs of all stakeholders, an organization cannot develop a self-centered performance measurement system. Customers, suppliers, and other stakeholders must be consulted to assess performance from an external perspective (Michaela and Marketa, 2012). Evaluating an appropriate performance is a key role in an organization's success (Gameli et al, 2016) several important factors influence the success of a construction organization. Identification of these performance parameters is essential as they are the cornerstones of building an effective performance measurement system (Işık, 2009). The organization should use management accounting, controls, and performance measurement to ensure that employee activities are aligned with organizational goals and strategies (Sezer, 2016).

2.2.2.7 Performance management system at stakeholder level

A construction project, from a micro perspective, is a collection of actions involving several players, each of whom is seeking to achieve their own goals within the context of the project's overall goals. Owners, contractors, consultants, designers, managers, investors, users, suppliers, and subcontractors are all stakeholders (Leung & Olomolaiye, 2010). Managers are involved in important stages of project execution and hence have a high profile among these stakeholders (Soderholm, 2008).

A key characteristic of projects is the role played by a key actor appropriately named as project manager. While the project manager is central to the process of project management, s/he is only as good as the project team s/he leads. Thus, it might be an underestimation to propound that the success or otherwise of a project depends solely on the project manager (Ofori, 2013).

Atkinson et al, (1997) Clients will be disappointed if the final product fails to meet their expectations in terms of price, quality, timeliness, functionality, and delivery performance. As a result, the consultants will not develop the skills and expertise, nor will they attempt to build and manage processes, unless the client meets their desired employment circumstances. Contractors and suppliers, in particular, may be unable to continue to provide decent products and resources to clients or any company that does not pay them a reasonable return on their time and capital investment. As a result, if the final product fails to meet their expectations in terms of functionality and service quality, end-users will be dissatisfied. In essence, the performance of successful stakeholders must be measured and evaluated in order to ensure their continual participation and co-operation in a construction project.

2.2.2.8 Construction project performance measures and indicators

A construction firm's performance management system is the only component of the larger system that can lead to success, and it should be based on a balanced set of measures that represent critical areas for improvement. Despite extensive research, the construction industry continues to be plagued by inefficiency and ineffectiveness, and has been dubbed the worst of all industries, lagging behind others (Radujkovi et al 2010).

In a construction project, performance refers to the quality of a construction site's operation as well as the site's overall success. Project performance, on the other hand, can be assessed from a

variety of stakeholder perspectives, with a focus on discrete performance measures. The findings, taken together, highlight project strengths and weaknesses within the context of a practical performance measurement framework. Project performance is evaluated for a variety of reasons, including benchmarking, rewarding, and monitoring whether the organization's strategy is being implemented effectively at all levels (Sezer, 2016).

A construction project's performance is a good measure of its success. Project success is a complex and frequently illusory idea, but it is important to a project's success (Alias et al .2014). The supply of high-quality items to the client is aided by the successful completion of a construction project. Because project success implies different things to different individuals, clients do not currently employ a uniform approach to evaluate project performance. Others, in addition to the usual project performance indicators of cost, quality, and schedule, used non-traditional project performance criteria such as the environment, health and safety, degree of technology, and contractor planning (Idrus, Sodangi, & Husin, 2011).

Performance is measured at various levels, according to Sezer, (2016): industry, firm, project, and activity. While productivity is a common measure of performance at the industry level, sustainability is more commonly used at the firm and project levels in the construction industry. From a sustainability and productivity standpoint, monitoring resource use in refurbishment projects is desirable.

Project performance can be determined by two common sets of indicators, according to Pheng and Chuan, (2006). The first group includes the project owner, users, stakeholders, and the general public, who will assess project performance from a macro perspective. The second group consists of the developer, a non-operator, and the contractor, who will examine project performance from a micro perspective.

2.2.2.9 Construction project performance measurement models

A) Key performance indicators KPI

Chan, (2004) devised a set of key performance indicators (KPIs) to assess the success of construction projects. Key performance indicators (KPIs) are measurement instruments developed by the Construction Industry Best Practice Program in the United Kingdom. They are implemented in three steps: determining what should be measured, gathering data, and calculating and analyzing KPI results (Alsulamy et al 2012)

The KPI is a useful tool for measuring and communicating performance among various stakeholders, including investors, subcontractors, clients, employees, and others (Vukomanovic et al 2007). The purpose of Key Performance Indicators (KPIs) in the construction industry is to allow for the measurement of project and organizational performance (Chan, 2004).

They are one of the factors that go into determining the success of a construction project, which is why most performance measurements on construction projects are done by establishing KPIs that provide objective criteria for measuring project success. Program for Best Practices Time, Cost, Quality, Client Satisfaction, Client Changes, Health and Safety, and Business Performance are all KPIs that represent the industry's performance in seven key areas. Quality, Cost, Number of investor interferences, and Changes in project support, Time increase, Client satisfaction, Employee satisfaction, Innovation and learning, Time, and Identification of client's interest are the top ten KPI indicators that are valued by all three perspectives (Radujkovi et al 2010).

b) The Balanced scorecard

Professor Robert Kaplan and David Norton created the balanced scorecard (BSC) in the early 1990s (Michaela and Marketa, 2012). BSC is a performance measurement framework that incorporates strategic non-financial performance measures alongside traditional financial metrics to provide managers and executives with a more complete picture of the organization's performance (Gameli et al. 2016).

It aids managers in identifying goals, metrics, and the relationships between them (Andjelkovic & Dahlgaard, 2013). There were four perspectives in traditional BSC. It combines financial measures of customer satisfaction, internal business processes, and the organization's innovation and improvement activities with operational measures of customer satisfaction, internal business processes, and the organization's innovation and improvement activities (Wadugodapitiya et al 2010).

c) Benchmarking

According to the Construction Best Practice Program, benchmarking is a systematic process of comparing and assessing the performance of organizations (business activities) against others and leveraging lessons learnt from the best to create targeted changes (CBPP). Businesses perform benchmarking for two primary reasons. They're either attempting to determine how they stack up against important competitors, or they're aiming to learn from and implement successful concepts from best-in-class companies (Takim & Akintoye, 2002).

2.2.2.10. The Construction Industry under Unforeseen Conditions

Ground condition is one of the factors that determine the project successfulness. The unforeseen ground condition defined as an un-anticipated physical condition other than weather, climate, or another act of discovered on site during the works commencement. The worse ground condition makes the greater the risk. This risk surely has a cost, which sometimes can be catastrophic. In most ground conditions, the certainty of ground condition is quite a challenge, even for a geotechnical expert (Assad, 2015).

2.2.2.11 Factor affecting cost of construction project

Although some factors are common to all projects in developing nations, some are not, such as inadequate management, fluctuating material prices, erroneous material estimations, and the contractor's financial position (Ahady et al 2017). The overall findings revealed that frequent design revisions, construction faults, and timetable delays were the most significant cost overrun culprits in Bahrain's construction industry (Hedaya, 2017).

Fetene (2008) highlighted the most prevalent repercussions of cost overrun as delay, extra agreements, hostile relationships among stakeholders, and project owners' budget shortfall. It is believed that these insights would help to guide future attempts to improve the construction industry's performance. Frequent design changes, contractor funding, payment delays for finished work, contractor inexperience, poor cost estimation, tendering documents, and material management are all factors to consider.

2.2.2.12 Factors affecting time of construction

Poor planning and scheduling, slow or poor decision making process internal administrative procedures and bureaucracy with in project organizations resource shortage (human resource, machinery equipment, poor communication and coordination between parties slow quality inspection process of the completed work, design change during construction/ change orders, delay payment of contractor poor planning and scheduling poor site management and supervision are main cause of delay in construction (Zidan & Andersen, 2018).

The 10 most causes of delay indicated by Pourrostan & Ismail, (2012) are, Client delays in making progress payments, change orders during construction, poor site management, client delays in making decisions, contractor financial difficulties, client delays in reviewing and

approving design documents, client problems with subcontractors, contractor ineffective planning and scheduling of project, mistakes and discrepancies in design documents, and bad weather.

According to Islam et al , (2015) The main causes of construction project delays are a lack of experienced construction managers, lowest bidder selection, owner funding shortages, lack of proper management, improper planning and scheduling, lack of skilled workers, site constraints, contractors' cash flow problems during construction, escalation of resource prices, and contractors' excessive workload. The most major causes of construction project delays were found as contractors' uncertain financial backgrounds, clients' poor financial and business management, challenges in obtaining financing from financiers, and inflation (Rahman et al, 2011).

Time overrun, expense overrun, conflicts, outright abandonment arbitration, and litigation were the six significant repercussions of the delay. The report forecasts certain future trends and offers some areas where construction project research could be addressed in the future (Pourrostam & Ismail, 2012).

2.2.2.13 Factors affecting quality of construction

One of the traditional and universal indicators of project performance is project quality. Clients, contractors, and consultants all want to ensure that construction projects are completed according to approved and agreed-upon standards (Atkinson et al , 1997).

The use of unskilled and incompetent trade contractors was one of the key factors affecting the performance quality of building projects in the study area. More importantly, there is a lack of commitment from the supervising team in charge of ensuring that stated standards are followed, as well as poor on-site supervision. Poor planning and scheduling, as well as a lack of knowledge, training, and skills among construction workers, are all difficulties (Oke, Aigbavboa, & Dlamini, 2017).

2.2.2.14 Factors affecting construction performance:

Economic, social, environmental, and technological performance components are separated into four categories. Understanding a multi-dimension performance evaluation framework that encompasses all crucial variables affecting a company's construction performance is critical for management to establish and implement an effective performance development plan that is in line with the company's goals and vision. (Soewin & Chinda, 2018).

A variety of elements influence the success of a construction project, including project parameters such as size, cost, and environmental impact, contract and specifications, stakeholder relationships and cooperation, engineer qualifications, and teamwork (Cheung et al, 2004).

2.2.3 COVID 19

On March 13, 2020, Ethiopia declared the first confirmed case, and further cases are quickly growing. The government has taken a number of steps after three days, including closing schools, limiting public meetings, and advocating physical separation. Public transportation has also been restricted by regional governments. The federal government declared a state of emergency on April 8, 2020. (Hespi et al, 2020).

To avert job losses in the manufacturing, construction, and service sectors, Ethiopia's government has implemented a package of measures totaling 11 billion ETB to aid the recovery of economic activities (Victor et al, 2020).

The pandemic expects to drag African economies into a fall of about 1.4% in GDP. Reduction is mainly the result of loss of tax revenue which reduces the capacity of the government to extend public service. According to (Gondwe, 2020) Africa is losing around 5% of its public revenue, with overall merchandise exports declining by about 17%.

2.3 Empirical reviews

2.3.1 Factors affecting Ethiopian building construction performance

Biyadgign (2017) claims that the study was conducted using a case study and a questionnaire. Twelve owner's representatives, 19 contractors, and 16 consultants were handed 47 questionnaires for building construction projects. The survey questionnaires were returned in a total of 35 cases. The owner received 83% of the vote, followed by contractors (74%), and consultants (69%). According to the research, cost, time, and quality are the three most common performance challenges. An increase in material prices, a shortage of resources, and a

disagreement among stakeholders are the most important factors that affect the performance of building projects.

Emer et al, (2020) disseminate 120 surveys to eight owners, 25 consultants, 86 contractors, and one head office. The organization's solvency, enhanced commodity availability for personnel with high experience and competence, and the quality of the project's equipment and raw materials were all important considerations. The relative relevance index (RII) is used to rank the components in the study. The findings revealed that the top five key criteria affecting the performance of government public buildings in the study area are cost, time, quality, productivity, and customer satisfaction..

Cost, time, quality, productivity, customer satisfaction, health and safety, innovation and learning, and environmental variables that were of different relevance in Ethiopian building construction projects were the primary performance issues that were most frequently encountered before the pandemic.

2.2.2 Effect of COVID 19 on construction performance

The study carried out by Abebe (2020) suggests that covid 19 will have a significant impact on daily laborers, small and medium construction firms. As a result, daily income will fall, material escalation, hard currency shortage, productivity reduction, time extension, additional costs may incur for project delay are major challenges for the Ethiopian construction industry in prolonging the pandemic

Ogunnusi et al (2020) surveyed the built asset of procurement professionals. They collect 71 questionnaires from Architects, Building Engineers, civil engineers, structural engineers, Electrical engineers, Mechanical Engineers, Construction / Project Managers, and Quantity Surveyors. The result indicates as there are challenges in the area of workflow and supply chain disruption, new policy issues, workers' anxiety, and a review of COVID-19 vs. Force Majeure in standard forms of the construction contract in Nigeria.

The survey conduct by Alsharaf et al , (2021) reveal that the pandemic results in a significant delay in projects, material scarcity, reduction in productivity rate material price escalation, and others. The study was carried out through 34 telephone interviews with project managers, engineers, designers, and superintendents that represent different states in the sector in the USA. The interviewees offered information on their experience with the pandemic, including the

general and adverse effects experienced, new opportunities created, and risk management efforts being undertaken.

The lockdown and social alienation on building sites in the United Kingdom have an impact on construction enterprises. Shibani et al. (2020) surveyed 30 individuals, including site engineers, project managers, construction teams, subcontractors, and contractors. According to the findings, construction enterprises involved in both residential and commercial development were affected by the pandemic as a result of the lockdown and social isolation.

The study conducted by Umar (2021) identifies four impacts of COVID-19 in the Gulf Cooperation Council (GCC) member countries' construction industry. To achieve the aim of the research, the study carried out a qualitative research method involving face-to-face online interviews held with professionals in the industry. The analysis of the interview revealed that COVID-19 results in delay in construction projects, problems in workforce management, health and safety challenges, and problems with legal issues increased.

COVID-19 affecting the building construction industry by causing operational and financial issues. Zamani et al. (2021) interviewed 20 contractors of building construction projects. The study suggests that COVID-19 is causing operational and financial crises in the industry. The operational issues related to project timeline, reduced labor, and logistics, while the financial crises relate to late payment, increased project cost, and reduced number of projects.

The novel coronavirus results in time extension in construction projects. Alenezi (2020) carried out a questionnaire survey with professionals including engineers, construction, and architecture practitioners operating in Kuwait. The result revealed that COVID-19 results in a delay in projects. Tariq & Manuel (2021) carried out secondary research or used secondary data sources. Newspaper government statistics and up-to-date literature are used to analyze the construction condition in Oman. The researcher suggests that COVID-19 results in critical material supply chain issues due to construction contracts being delayed and borders being closed. Unemployment is increased as construction companies reduce their staff. Critical labor and field specialists are not available on their job due to the global travel ban. Generally, the pandemic changes the economic prospects of the construction industries in Oman.

2.4 synthesis of the review

In the citation of previous studies, little attention is being paid to the moderating effect of covid 19 on the relationship between project management triangle and construction performance. Based on the literature review factors that affect the performance of construction projects due to the pandemic can be grouped as cost, time, and quality which are commonly known as project management triangle. These factors form the basis on which the research model is developed to measure their effect on the building construction performance in the presence of covid 19

2.4.1 Research variable

The independent variable is the project management triangle with its three-dimension (cost, time, and quality) dimension. The dependent variable is construction project performance. And the Moderator variable is COVID 19.

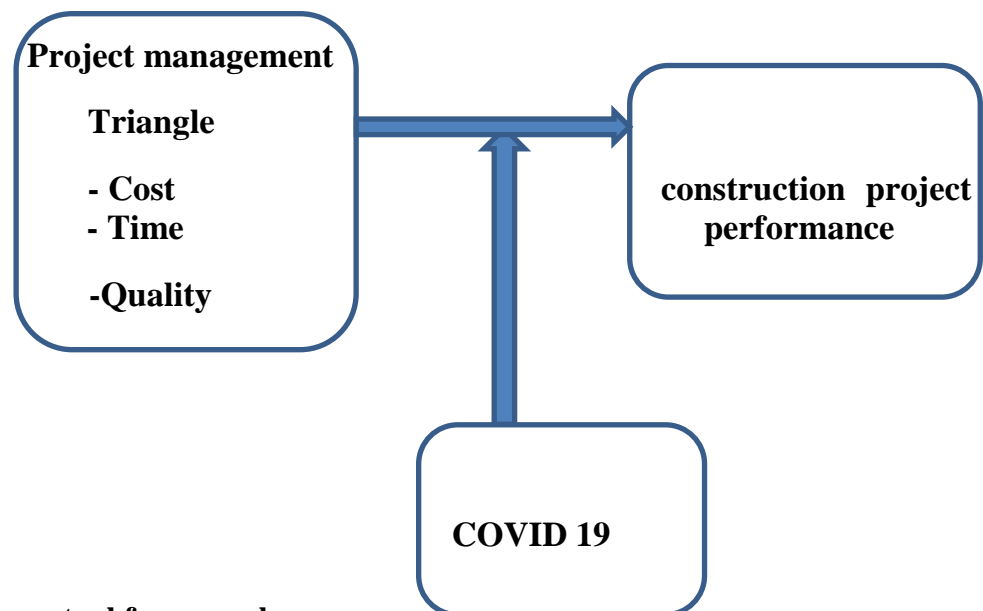


Fig 2.2: research conceptual framework

(Source; own survey, 2021)

CHAPTER 3

METHODOLOGIES

3.1 Introduction

Research methodology provides a solution for particular problems. This chapter intends to examine the objectives that have been adopted and it covers the following process: research design, data collection, and research method,

3.2 Research Methodology

Explanatory, exploratory, and descriptive research as well as a combination of these is the three types of design. Explanatory research's major goal is to find any causal relationships between the elements or variables that are relevant to the study problem. The primary goal of exploratory research is to define the boundaries of the environment in which the problem, opportunity, or scenario of interest is likely to exist, as well as to identify the key factors or variables that may be present and relevant to the study. The primary goal of descriptive research is to offer an accurate and valid depiction of (encapsulate) the relevant factors or variables to the research topic (van Wyk, 2012).

Because it attempts to investigate the moderating influence of COVID 19 on the link between the project management triangle and construction project performance, this study is classified as descriptive and explanatory research. It also looks into the connections between the project management triangle and the success of construction projects. A questionnaire was utilized to collect data and measure factors for the research and sent to all stakeholders in the Bole Sub City school class extension program. The SPSS 25 software was used to analyze the results.

3.3 The Research Process

- The first step of this research addresses stating the concept note including introduction, the problem of the statement, and the research gap and adopting research proposal.
- The second step includes the related literature review concerning the project management triangle, construction project performance, and COVID 19 and the relationships between them.
- The third step contains adopting a questionnaire to collect data and measure variables of the research to analyze the research objective and research question

- The fourth step includes checking the validity of the questionnaire by an academic advisor from the university and applying a pilot study to check the clarity.
- The fifth step is mainly focused on distributing the research questionnaire among the stakeholders.
- The final step the last step was concerned with analyzing of collected data using SPSS 25.

3.4 Data Source

3.4.1 Primary source

To acquire the required information a questionnaire was used as the main instrument which was adopted from previous literature, scales, global natures, and from importance for the study. The study was used the online service and telephone to apply questionnaire survey and to minimize some risk of the novel coronavirus. After validating the questionnaire, it was distributed on the study samples to collect needed data.

3.4.2 Secondary source

The study took different types of secondary data sources to develop the literature review of the research. These include books, journals, related researches, and worked thesis. To enrich the literature review of the research, different types of secondary resources have been used such as books, journals, related researches, and thesis as secondary data sources.

3.5 Population and Sample

The stakeholders involved in the Bole Sub-City public primary school extension building construction projects were the study's target population. There are 40 consultants, 35 contractors, and 25 clients among them. There are 100 people in total. Natnael G/ Hana consultants and engineers is the project's consultant, the Bole sub-city construction office is the project's client, and the contractor is EDAB engineering and manufacturing firm.

3.5.1 Sampling method

The population is partitioned into a stratum. Each stratum is mutually exclusive. Simple random sampling was applied for selecting the respondent from each group of strata. The population consists of 40 consultants, 25 from clients, and 35 are from the contractor side. According to this, the total population is 100.

Sample size

The sample size is determined by the following formula

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

Where: n = sample size

N = the population size

e = the error margin

N=100 and e = 0.05

$$n=100/[(1+100*0.05^2)]$$

Therefore, n = 80, (Yamane, 1967)

3.6 Steps followed in this research to develop a questionnaire

- Related studies and literature are reviewed and items related to the objective and variable of the research are selected.
- The questionnaire is adopted under the guidance of the research Advisor.
- To check the acceptance and clarity of the questionnaire pilot sample was taken. And 5samples distributed to the respondents.
- The final questionnaire with some modifications is prepared and distributed to research samples.

3.7 Research measurement

The questionnaire was established based on a five scale known as the Liker scale. The responses were measured using a Liker scale system, which comprised a scale of 1 to 5 whereby

1. Extremely disagree
2. Very disagree
3. Moderately agree
4. Very agree and
5. Extremely agree

According to Amal, (2016), a mean score of 0.01 to 1.00 indicates extreme disagreement, 1.01 to 2.00 indicates very disagreement, 2.01 to 3.00 indicate moderate agreement, 3.01 to 4.00 indicate very agreement, and 4.01 to 5.00 indicate extreme agreement.

The questionnaire is divided into two sections: The first section contains the respondent's personal information as well as a company profile. The research variables are the project management triangle dimensions (Cost, Time, and Quality), the construction project performance variable, and the COVID 19 variable in the second portion. (Tagesse & Dinku,2017),(Geletu,2020)(Andjelkovic,&Dahlgaard,2013), (Bhatti, Awan, & Razaq, 2014) , (Abebe, 2020), (Alenezi, 2020) (Mahesh, & Virendra, 2021)..

3.8 Validity

Validity is the extent to which a concept is accurately measured in a quantitative study. Validity is often defined as the extent to which an instrument measures what it purports to measure. There are three types of validity measurements these are content validity, construct validity, and criterion validity (mocking, et.al. 2010).

Validity tests were constructed for this study based on earlier studies, assessments of related literature, and standard questions in the related research area to ensure the instrument's validity. In addition, to assess the content validity in this study, experts with appropriate knowledge and competence in the field, as well as the research advisor's assessment, were developed.

3.9 Reliability

The second measure of quality in a quantitative study is reliability or the accuracy of an instrument and it measures the extent to which a research instrument consistently has the same results on repeated occasions. Reliability coefficients range from 0.00 to 1.00, with higher coefficients indicating higher levels of reliability (Heale, R., & Twycross, A., 2015).

Homogeneity (or internal consistency):- The extent to which all the items on a scale measure one construct. The function that is used to estimate the internal reliability is called Cronbach alpha and it shows the average inter correlation of item and number of items in scale (Kimberlin & Winterstein, 2008).

Table3. 1: Cronbach's Alpha for each field of the questionnaire

No.	Field	Cronbach's Alpha
1	Cost	.825
2	Time	.690
3	Quality	.649
4	COVID 19	.845
5	Performance	.759
	All questionnaire item	.866

Cronbach's Alpha test confirmed the reliability of the questionnaire distributed and utilized to meet the purpose of this research.

3.10 Data processing and analysis

The statistical package for social science (SPSS) 25 was utilized to conduct this study's statistical analysis. Before deciding on a statistical test to use on your data, you need to determine whether or not your data is parametric. Measurements taken from a regularly distributed population are usually viewed as parametric (Andrew, 2008). Based on this, a normality test is performed for this study, which shows that the population is normally distributed, allowing parametric tests like Pearson correlation coefficient, linear regression, one-sample t-test, and one-way ANOVA to be used.

This study employs Pearson correlation to examine the relationship between two variables. The existence (provided by a p-value) and strength (given by the coefficient r between -1 and +1) of a linear relationship between two variables are measured by Pearson correlation. It should only be utilized if the assumptions that it is based on are met. If the result is significant, we can conclude that there is a correlation (Samuels, 2014).

In the social and organizational sciences, Cronbach's alpha reliability is one of the most extensively used metrics of reliability. The reliability of a sum (or average) of q measurements, where the q measurements may represent q raters, occasions, alternate forms, or questionnaire/test items, is described by Cronbach's alpha reliability. Cronbach's alpha is a measure of "internal consistency" reliability when the measurements represent several questionnaire/test items, which is the most common application (Douglas & Thomas, 2014).

The profiles of respondents are analyzed using frequency analysis in this study. The number of occurrences of each response chosen by the respondents is shown in frequency analysis, which is a descriptive statistical method. SPSS Statistics can determine the mean, median, and mode when performing frequency analysis to assist users in analyzing and drawing conclusions.

One sample t- test and one way ANOVA test is applied to compare the mean. The one-sample t- test is used to determine whether a sample comes from a population with a specific mean. This population mean is not always known, but is sometimes hypothesized. The one-way analysis of variance (ANOVA) is used to determine whether there are any statistically significant differences between the means of two or more independent (unrelated) groups (although you tend to only see it used when there are a minimum of three, rather than two groups) (Park, 2009).

To examine the moderating effect of COVID 19 on the relationship between project management triangle and construction performance Multi Moderation regression analysis was applied. Linear regression analysis is used to examine the effect of project management triangle on the construction project performance.

3.11 Moderated Regression Equation

Create a new variable that is the product of the X and Z values to test for moderation. This is referred to as a product or interaction term. In a regression model, along with X and Z as predictors, include this interaction term as a predictor. The regression coefficient for X can vary as a linear function of Z by inserting the product of X and Z in the equation. There is evidence of moderation if the interaction term is significantly different from zero, indicating that the influence of X on Y is dependent on the values of Z (Mateus & André 2018).

$$Y = B_0 + B_1 X + B_2 Z + B_3 XZ + e$$

Y dependent variable

X independent variable

Z moderator variable

e residual

CHAPTER 4

DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.1 Introduction

This chapter introduces a descriptive analysis of the research sample, analysis the correlation of questionnaire's items results, and finally answers the research's questions and objectives.

4.2 Sample descriptive Analysis

4.2.1 Response Rate

A questioner survey was utilized as the primary data collection strategy to meet the research's goal, and it was given to consultants, clients, and contractors who participated in the Bole Sub City primary school classes' extension program. A total of 100 professionals made up the target audience. There are 40 consultants, 25 clients, and 35 contractors in this group. This study has an 80-person sample size. On this basis, 32 samples are given to the consultant, 20 samples to the client, and 28 samples to the contractor. Nine samples are dismissed, leaving 71 samples that are valid. These findings revealed an 88 percent response rate, which is sufficient for the analysis.

Table 4.1 Shows the questionnaire response rate.

No	group	Questionnaire distributed	Questionnaire returned	Percentage of returned
1	Consultant	32	28	87.5%
2	Client	20	18	90%
3	contractor	28	25	89%
	total	80	71	88.7 %

Source: own survey, 2021

Table (4.1) shows that 25.4 percent (18) of the respondents are from the client side, 35.2 percent (28) are from the consultant side, and 37.4 percent (25) are from the contractor side of the study. 90% of clients correctly complete and return the questionnaire. 89 percent of contractors

completed and returned the survey. 87.5 percent of consultants are also completing and returning the survey. This suggests that the majority of experts were willing to comment on COVID 19's moderating influence in the link between project management triangle and construction project performance of Bole Sub City primary school classes' extension program.

4.2.2 Respondent demographic characteristics

Table 4.2: The frequency of respondent profile

description	client		contractor		consultant	
	frequency	percentage	frequency	percentage	frequency	percentage
Respondent designation in the organization						
Project manager	1	0.05	2	0.08	1	0.035
Site engineer	11	0.61	15	0.6	19	0.67
Office engineer	6	0.33	8	0.32	8	0.28
total	18	100%	25	100%	28	100%
Years of experience of the respondents						
0 to 5 years	11	0.611	14	0.56	9	0.32
6 to 10 years	5	0.277	9	0.36	13	0.46
11 to 15 years	2	0.111	2	0.08	6	0.214
total	18	100%	25	100%	28	100%
Number of executed projects						

1 to 10	4	0.222	12	0.48	23	0.82
11 to 20	7	0.388	13	0.52	5	0.178
More than 21	7	0.388	0	0	0	0
total	18	100%	25	100%	28	100%
Value of executed projects in the last five years						
2,000,000 to 5,000,000	1	0.055	0	0	25	0.89
5,000,000 to 10,000,000	1	0.055	0	0	0	0
More than 10,000,000	16	0.888	25	1	3	0.107
total	18	100%	25	100%	28	100%

Source: own survey, 2021

Depending on the respondent's position within the company Project managers account for 5.6 percent (4) of the respondents, site engineers account for 63.4 percent (45), and consultants account for 31% (22) of the respondents.

Site engineers and office engineers account for 61 percent and 33 percent of professionals for the client, respectively. This shows that the organization prioritizes on-site activity. This would allow the client to handle and supervise any issues that arose on the job site, such as delays, poor quality, and waste. However, having only one project manager for the entire eight-building site may make it impossible to assess control and closely monitor site activity.

Site engineers and office engineers account for 60% and 32% of professionals for contractors, respectively. The same as client contractor organization prioritizes onsite activities as well. This would allow the contractor to address and supervise any difficulties that arose on the job site,

such as delays, poor quality, and wastage. In comparison, the contractor has two project managers, which makes it easier to oversee and control both site and office operations.

Site engineer and office engineer account for 67 percent and 28 percent of consultants, respectively. This suggests that the consultant is using the majority of its staff to monitor site activity. This would allow the consultant to address and supervise any difficulties that arose on the job site, such as delays, poor quality, and waste. Having only one project manager may have an effect on the consultant's ability to oversee and control the work.

From the 71 responses, 52.1 percent (37) have less than 5 years of experience, which has two implications. First, the figure indicates that the majority of respondents may have recently graduated, allowing the activity to be completed with full vitality. The second issue is that it may cause certain qualification issues. The low experience could slow down the construction process in terms of cost, time, and quality. 33.8 percent (24) have 6 to 10 years of building experience, while 10 respondents (14.1%) have more than 10 years of experience.

According to the respondent's response, the client (Bole construction office) has completed more building projects than the contractor and Consultant Company in the last five years. This signifies that the client has more building construction experience. The client's project value over the last five years has likewise increased. The consultant's and contractor's financial strength is insufficient. The respondents are very much related to construction to respond to the questionnaire, and the majority of the respondents are experienced to provide meaningful data on factors effecting construction performance, as shown in the table above.

4.3 Descriptive Statistical analysis and one sample t-test value

4.3.1 Project Management triangle (Iron triangle) analysis

- The researcher takes hypothesized t value 3 for all items of the questionnaire to analyze the one-sample t-test.

4.3.1.1 Cost dimension analysis

Table 4.3 Means and Test values for Cost dimensions

No	Item	Mean	S.D	Test value	P-value (sig)	Rank
1	Material price escalation.	4.31	.767	14.389	.000	1
2	Increase in Cost of project Design, Operation and maintenance.	3.23	.974	1.950	.055	8
3	A drop of Liquidity of organization.	3.30	1.074	2.32	.023	6
4	Material wastage on site.	2.76	.992	-2.033	.046	9
5	Additional cost due to variation work	3.63	1.059	5.044	.000*	4
6	Poor Cost control system	3.25	.937	2.280	.026	7
7	Fluctuation in the money exchange rate.	3.72	1.098	5.513	.000*	3
8	Poor productivity of labor and equipment	3.34	.940	3.029	.003	5
9	Escalation of construction Equipment and tools cost.	4.01	.837	10.214	.000*	2
Cost dimension		3.505	.62567	6.807	.000*	
		5				

Source: own survey, 2021

According to Amal (2016), with a five-point Likert scale instrument, the mean score from 2.0 to 3.0 was regarded moderate, the mean score from 3.0 to 4.0 was considered very agreeable, and the mean score above 4 was considered extreme.

The item No. 1 "material price escalation" had the highest mean score of 4.31. The test value and p value for material price escalation ($t = 14.389$, $p = 0.000$) had a statistically significant mean difference. The p value and the mean indicate the scale given by respondents for material price

escalation is different from 3 or different from moderate level of agreement. The mean shows that respondents are extremely agreed to the material price escalation item.

This suggests that respondents agree that material price escalation has a much larger effect on cost dimension than any other item on the list. As a result, material price inflation is a serious obstacle in the construction of class extensions in public primary schools in Bole Sub City.

The finding of Prashant, Rucker, & Hayes, (2007) that cost escalation is one of the primary concerns facing the Ethiopian construction industry supports the findings of this study. Building development projects in Ethiopia's capital city, Addis Ababa, are suffering from a lack of funding. Material inflation is the most significant element affecting cost performance, according to Dagim (2017), who put it top in the study. Inflation is the increase in the cost of construction materials above their original value.

Material price increases have an effect on project liquidity and cost performance. Because of a shortage of raw materials, a lack of suppliers, and the expense of transportation from foreign nations, the cost of construction materials rises from time to time (Biyadgign, 2017). The fundamental issue is a depreciation of the birr and a scarcity of hard currency, which has a direct and indirect influence on construction projects, particularly material and labor costs.

Material price increases in Bole Sub City primary school classes' extension program are also linked to the country's political instability, which forces suppliers out of business. The project has to update material pricing and labor rates on a regular basis.

With a mean score of 4.01, item No. 9 "Escalation of construction equipment and tool costs" is ranked second in terms of its effect on the cost of a construction project. This indicates that respondents extremely agree that this item has a significant effect on the cost dimension.

While item No. 4 "on-site material wastage" received the lowest mean score of 2.76. These findings suggest that on-site material waste has only a moderate effect on the cost variable.

Except for "Increase in Cost of Project Design, Operation, and Maintenance," all questionnaire items had a p-value of less than 0.05. The null hypothesis is rejected, as the mean of all cost dimension components differs considerably from 3. The null hypothesis cannot be rejected for item No. 2 ("Increase in Project Design, Operation, and Maintenance"), and the mean of item

No. 2 is not significantly different from 3. This implies, respondents are moderately agreed on item No. 2 on building costs.

In general Variable "Cost" had a mean value of 3.5005 overall, whereas ($t = 13.541$, $p = 0.000$) had a statistically significant mean difference. Respondents are quite very agreed on the cost dimension, as indicated by the mean. This indicates that the items on the list are more dispersed. And respondents show that material price escalation, Escalation of construction Equipment and tools cost, Fluctuation in the money exchange rate and Additional cost due to variation work had the greatest effect on building project costs, according to respondents. The findings are consistent with Fetene's (2008) study, which found that inflation or increases in the cost of construction materials, poor planning and coordination, change orders due to enhancements requested by clients, currency exchange rate, and excess quantity during construction are the most common causes of cost overrun in Ethiopia. According to Biyadgign (2017), escalation of material prices, cost of variation orders, material and equipment costs, and currency price differentials all affect the owner's liquidity and cost performance of the organization.

4.3.1.2 Time dimension analysis

Table 4.4 Means and Test values for Time dimensions

No	Item	Mean	S.D	Test value	P-value (sig)	Rank
1	Unforeseen ground conditions.	4.75	.470	31.338	.000	1
2	Resource and financial constraints.	4.27	.736	14.513	.000	2
3	Delay in designing and planning construction documents.	3.79	.893	7.442	.000	5
4	The average delay in payment from the owner to contractor.	3.89	.979	7.637	.000	4
5	The average delay in claim approval.	3.41	.803	4.285	.000	8
6	The time needed to rectify defects.	3.55	.824	5.614	.000	7
7	Site preparation time.	3.10	1.002	.829	.410	9

8	Orders delivered late.	4.04	.818	10.732	.000	3
9	The time needed to implement variation orders.	3.73	.827	7.459	.000	6
Time Dimension		3.83	.4451 8	15.817	.000	

Source: own survey, 2021

Item No. 1 “Unforeseen ground condition.” scored the highest mean value which is equal to 4.75. Respondents agreed that the time is taken for "unforeseen ground condition" is the most extreme item that causes a delay in construction. Unexpected ground conditions, also known as unanticipated ground conditions, are one of the most common causes of construction delays in Bole Sub City public primary school class extension projects. The findings are largely consistent with research conducted by Lessing, Thurnell, and Durdyev, (2017), which found that unforeseen ground conditions are significant factors that cause construction delays, and that this is because geological tests do not always predict the condition of the entire site.

The second-highest mean value was 4.27 for item No. 2 (Resource and financial constraint). Human, machinery, equipment, financial, and material resource constraints, according to Zidan, & Andersen, (2018) research, are major delay causes for a construction project.

While item #7, "site preparation time," had the lowest mean score of 3.10. This means that of all the items listed, this one has the least effect on the Time dimension. but the mean indicates that respondents are moderately agree on the effect of this item on the time dimension of Bole sub city school class extension projects.

The p-value of all questionnaire items except “site preparation time” is less than 0.05. The research rejects the null hypothesis, and the mean of all Time dimension factors is significantly different from 3. For item No. 7 ("site preparation time") the null hypothesis cannot be rejected, and the mean of item No. 7 is not significantly different from 3. Hence, respondents are moderately agreed on the effect of item No. 7 on construction delay.

Time dimension scored a mean value equal to 3.83 while ($t = 15.817$, $p = 0.000$), which is that the time dimension shows a statistically significant mean difference. The mean indicates that Respondents are very agreed with the effect of the item listed on the Time dimension in general.

And respondent's response shows Unforeseen ground conditions, Resource and financial constraints and Orders delivered late have the most significant effect on the time dimension of Bole sub city school class extension projects. The findings are congruent with Biyadgign, (2017), who claims that too many change orders from owners, unanticipated ground conditions, and a lack of resources all affect building speed.

4.3.1.3 Quality dimension analysis

Table 4.5 Means and Test values for Quality dimensions

No	Item	Mean	S.D	Test value	P-value (sig)	Rank
1	Poor compliance with specifications and standards.	3.62	.916	5.701	.000	2
2	Low quality of equipment and raw material in projects.	3.30	.991	2.514	.014	4
3	Poor quality assessment and monitoring	3.35	.880	3.372	.001	3
4	Weak quality assurance training	3.28	.865	2.744	.008	5
5	Unavailability of a person with high experience and qualification	3.63	.930	5.746	.000	1
Quality dimension		3.436	.59167	6.218	.000	

Source: own survey, 2021

The highest mean value was 3.63 for item No. 5 "Unavailability of a person with high experience and qualification." One of the constructions quality associated challenges in Bole Sub City public primary schools building class extension projects is the unavailability of a person with high expertise and qualification. One of the primary issues affecting the performance quality of building projects in the research field is the use of inexperienced and incompetent trade contractors. Due to the availability of highly experienced and skilled personnel to support contractors in the effective and suitable implementation of their projects, this aspect is the most important consideration for contractors, clients, and consultants. The lack of a person with

extensive expertise and qualifications will reduce the client's pleasure with the job. Providing assistance to contractors and consultants in order to improve their experience and qualifications should take precedence. Lessing, Thurnell, & Durdyev, (2017) study revealed that major factors affecting the performance quality of construction projects in the study area are related to the use of unskilled and incompetent trade contractors.

While item No. 4 “Weak quality assurance training scored the lowest mean value which equals 3.28. But the mean indicates that respondents very agree on the effect of Weak quality assurance training on the Quality dimension.

The p-value of all questionnaire items is less than 0.05. Therefore, the research rejects the null hypothesis, and the mean of all Quality items is significantly different from 3.

The dimension of “Quality” scored a mean value equal to 3.436 while ($t = 6.218, p = 0.000$), hence the Quality dimension has a statistically significant mean difference. The mean of all items is greater than three this indicates that respondents are rate each item with a minimum scales of moderately agreed.

Unavailability of a person with high expertise and qualification, poor compliance with specifications and standards, and poor quality evaluation and monitoring are all factors that have a moderate effect on the Bole sub city school class extension construction project, according to the respondents. The outcome is consistent with Emer, Eyob, & woyesa , (2020) the study reveal Quality training, quality of equipment and raw materials, quality evaluation and monitoring, and specification compliance are the most essential elements that have an effect on every construction project.

4.3.2 Construction performance analysis

Table 4.6 Means and Test values for Performance dimensions

No	Item	Mean	S.D	Test value	P-value (sig)	Rank
1	Financial capacity	3.54	.790	5.410	.000	1
2	Competitor’s performance	2.31	.821	-7.083	.000	9

3	Creation of an environment for innovation and learning new technology.	3.49	.860	4.831	.000	2
4	Productivity of labor and equipment	3.35	.812	3.652	.000	4
5	Client satisfaction	3.21	.809	2.200	.031	6
6	Regular and community satisfaction	3.41	.855	4.026	.000	3
7	Employee satisfaction	3.23	.831	2.254	.025	5
8	Health and safety practices	3.14	.798	1.487	.142	7
9	Socio- environment	2.42	.690	-7.052	000	8
Construction Performance		3.122	.47296	2.175	.033	

Source: own survey, 2021

The highest mean value was 3.54 for item number one, "financial capacity." This suggests that more people agree that financial performance has a greater effect on performance variables than any other factor. As a result, financial capacity is a major stumbling block in the development of class extension projects in Bole Sub City public primary schools.

Because financial competence is one of the key construction performance-related concerns at the chosen construction site, the conclusions of this study are supported by the findings of Rahman, et al, (2011), who found that financial concerns affect the construction business.

Although the financial performance factor and the cost factor are closely related, the major difference is that the focuses on the revenue side, which is the most important for a company's survival, whereas the Cost focuses on cost reduction. As a result, it can be argued that FP is more tied to the company level, whereas cost is more related to the project level (Soewin & Chinda, 2018).

With a mean score of 3.49, item No. 3 "Creation of an atmosphere for creativity and learning new technologies" is ranked second in terms of its effect on the performance of building projects.

This indicates that the influence of this item on the performance dimension is moderately agreed upon by respondents.

The second item, "Competitor's performance," had the lowest mean value of 2.31. As a result, the performance of the competitor has only a minimal effect on the performance variable.

The p-value of all questionnaire items except “Health and safety practices” is less than 0.05. The research rejects the null hypothesis, and the mean of all performance dimension factors is significantly different from 3. For item No. 8 ("Health and safety practices") the null hypothesis cannot be rejected, and the mean of item No. 8 is not significantly different from 3. Hence, respondents are moderately agreed on the effect of item No. 8 on the performance of construction.

As a whole, the Variable “construction performance” scored a mean value equal to 3.122 while ($t = 2.175, p = 0.033$), which has a statistically significant mean difference. The mean indicates that Respondents are moderately agreed on the construction performance dimension.

And respondents are very agreed on the effect of financial capacity, the Creation of an environment for innovation and learning new, Regular and community satisfaction, and Productivity of labor and equipment on the construction performance of Bole Sub City public primary schools. Soewin, & Chinda,(2018) indicates Financial Performance, Information Technology & Innovation., productivity are has an effect on construction project.

4.3.3 COVID 19 analysis

Table 4.7 Means and Test values for COVID 19 dimensions

No	Item	Mean	S.D	Test value	P-value (sig)	Rank
1	Time extension after the outbreaks increase.	4.13	.925	10.267	.000	2
2	Covid results in too many change orders from the Owner	3.92	.841	9.174	.000	7
3	Covid result worker anxiety,	3.75	.806	7.807	.000	9

4	Project cost increase after covid,	3.66	.894	6.243	.000	11
5	Client faces cash flow problem	3.72	.865	6.998	.000	10
6	The poor motivation of project staff after covid.	3.35	.943	3.148	.002	15
7	Travel ban on critical labor and field specialists.	3.32	1.011	2.700	.009	16
8	Tendering method delay in construction projects.	3.20	.935	1.776	.080	17
9	Suspension and termination of contracts.	3.80	.804	8.415	.000	8
10	Quarantine makes job workers unable to come to	3.42	.889	4.005	.000	14
11	Problem with legal issues has increased.	3.56	.874	5.432	.000	13
12	Difficulties in mobilizing importing materials.	3.59	.965	5.166	.000	12
13	Quarantine affects lenders, sureties, the government, and developers.	4.30	.818	13.355	.000	1
14	Reduction in productivity due to the social distancing of labor and restriction by the	4.00	.956	8.812	.000	6
15	Additional cost for new technologies, tools health, and safety challenges.	4.01	.802	10.659	.000	5
16	Additional costs due to the idealness of human resources, equipment machinery, and tools increase.	4.07	.834	10.819	.000	3
17	Foreign currency shortage due to covid.	4.03	.894	9.691	.000	4
COVID 19		3.75	.47591	13.363	.000	

Source: own survey, 2021

The highest mean value was 4.30 for item No. 13 ("Quarantine impacts lenders, sureties, government, and developers"). This shows that the statement "Quarantine impacts lenders, sureties, government, and developers" has a high level of agreement among responders. This means that item No. 13 is the most affected item after the outbreak of COVID 19 than any other item on the list.

Construction industry members, including owners, developers, contractors, subcontractors, and supply chain Vendors, have experienced varied degrees of impacts as a result of the COVID-19

pandemic, according to James, Gina, and Gregory, (2020). The nature of the consequences and the scope of the problems are largely determined by the locations of the individual enterprises and projects.

Item No. 1 (Time extension after the outbreaks increase) scored the second-highest mean value which equals 4.13. Respondents are very agreed on the time effect of COVID 19 in Bole Sub City public primary schools building class extension projects. The study carried out by Alenezi, (2020) revealed the construction projects are delayed after the outbreak of COVID 19.

While item No. 8 “Tendering method delay in construction projects” scored the lowest mean value which equals 3.20. This implies that respondents are moderately agreed on the effect of COVID 19 on tendering method delay in construction projects. Since item No. 8 scored the lowest mean of 3.2, all questionnaire item incorporated in the COVID 19 dimension has scored a mean value which corresponds with the scale of above moderately agreed.

The p-value of all questionnaire items except “Tendering method delay in construction projects” is less than 0.05. The research rejects the null hypothesis, and the mean of all performance dimension factors is significantly different from 3. For item No. 8 ("Tendering method delay in construction projects") the null hypothesis cannot be rejected, and the mean of item No. 8 is not significantly different from 3. Hence, respondents are moderately agreed on the effect of item No. 8 on the performance of construction.

In general, “COVID 19” scored a mean value equals to 3.75 while ($t = 13.363$, $p = 0.000$), which has statistically significant mean difference. The mean indicates that Respondent's intention is almost close to the very agreed scale on items listed under COVID 19. In Bole Sub City public primary schools, quarantine and social distancing result in time extensions, additional costs for idealness, foreign currency shortages, and productivity reductions. The findings are in line with those of Alenezi (2020), who conducted a questionnaire study of professionals in Kuwait, including engineers, construction, and architectural practitioners.

The result revealed that covid result in a delay in projects. The study carried out by Abebe (2020) suggests that covid 19 will have a significant effect on daily laborers, small and medium construction firms. As a result, daily income will fall, material escalation, hard currency

shortage, productivity reduction, time extension, additional costs may incur for project delay are major challenges for the Ethiopian construction industry in prolonging the pandemic.

4.4 Normality Test

Kolmogorov-Smirnov test

This research applies one sample Kolmogorov- Smirnov test to check the normal distribution of the research.

Table4.8: Normality test for each field of the questionnaire

No	field	Test value	p-value
1	Cost	.970	.090
2	Time	.974	.142
3	Quality	.971	.100
4	Performance	.987	.669
5	covid	.975	.163

Source: own survey, 2021

The p-value for each variable in the questionnaire is not significant at $\alpha \leq 0.05$, which indicates that the collected data from the sample research are normally distributed. This implies that the validity of using **parametric tests** Such as the Pearson correlation, linear regression, and t-tests.

4.4 Inferential Statistics

4.4.1 Tests of Assumptions of Regression Analysis

4.4.1.1 Multicollinearity Test

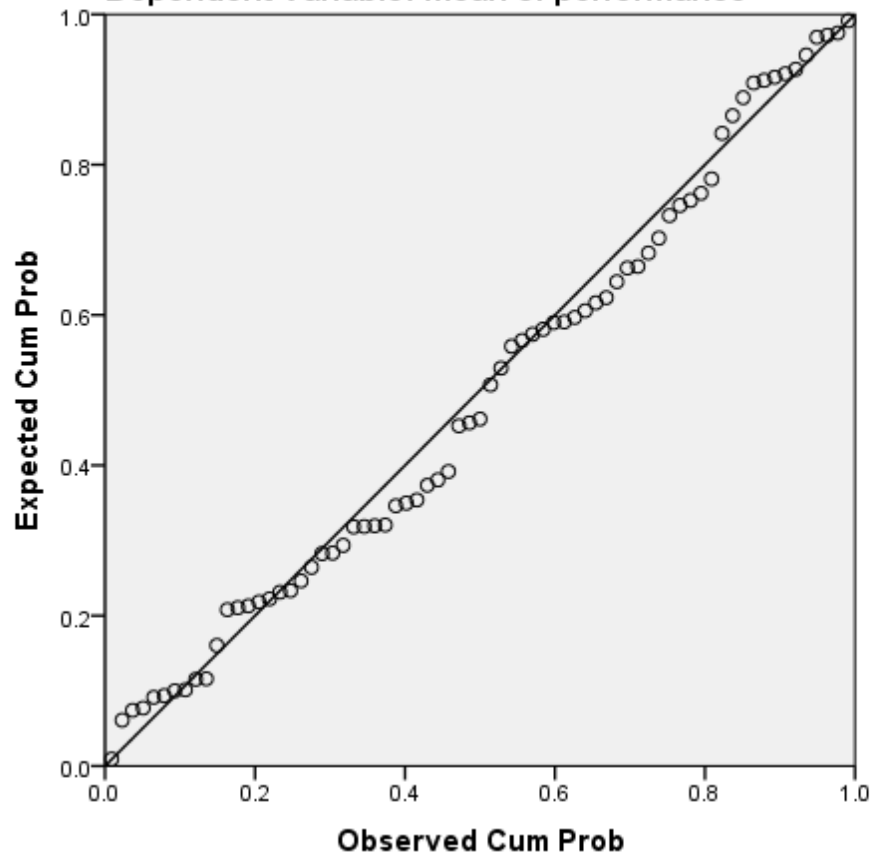
According to McClelland et al, (2016) Multicollinearity is irrelevant to the search for moderator variables.

4.4.1.2 Linearity Test

The linearity assumption of multiple regressions was tested using the scatter plot test, and it was revealed that the independent and dependent variables have a linear relationship. The residual distribution near the mean zero was depicted by the linearity result.

Normal P-P Plot of Regression Standardized Residual

Dependent Variable: mean of performance



Source: own survey, 2021

Figure 4.1 Test of Linearity

4.4.1.3 Auto correlation Test

The Durbin Watson test was used to determine the autocorrelation between observations. The Durbin-Watson statistic has a range of values between 0 and 4. Non-autocorrelation is indicated by a number near 2, positive autocorrelation by a value near 0, and negative autocorrelation by a value near 4. The premise of independent error has almost likely been met, as evidenced by the Durbin Watson value of 1.768, which is near to 2.

Table 4.9 Test of Error Autocorrelation

Model Summary										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.350 ^a	.122	.083	.45291	.122	3.112	3	67	.032	1.768

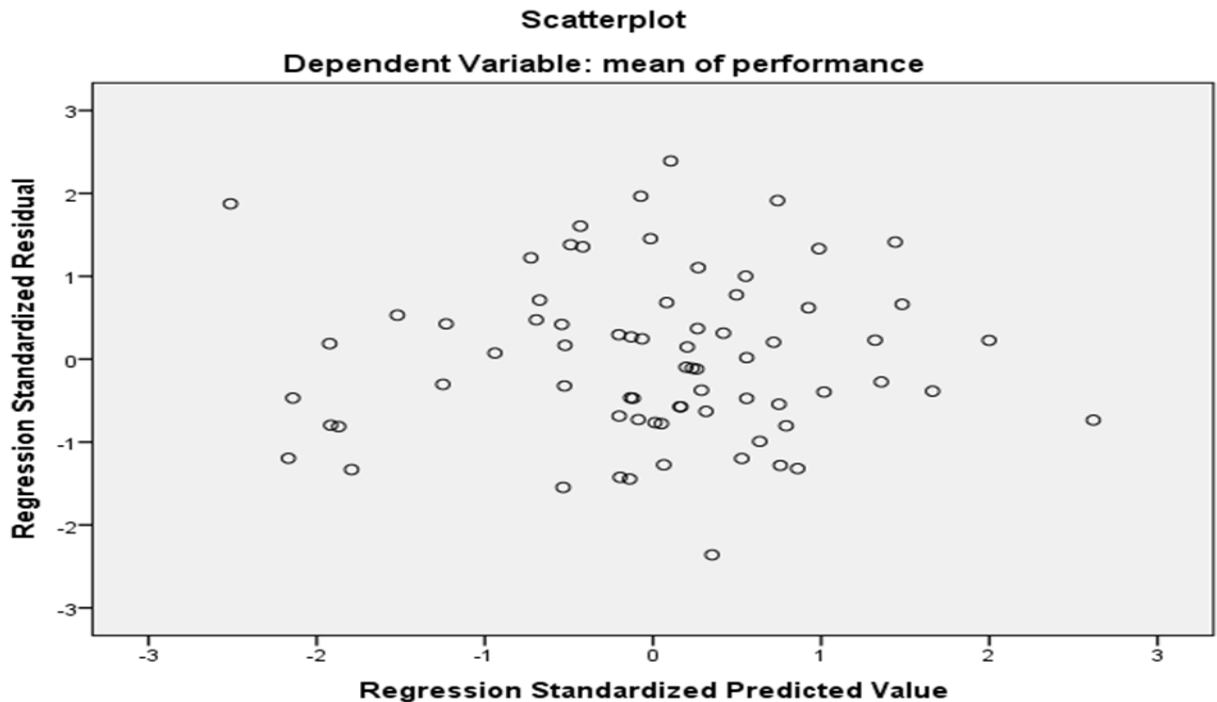
a. Predictors: (Constant), interaction of iron triangle and covid, iron triangle, covid

b. Dependent Variable: performance

Source: own survey, 2021

4.4.1.4 Homoscedasticity

This assumption states that every disturbance has the same variance whose value is unknown, implying that the dispersion of the error term (disturbance) is the same regardless of its size. We get the case of heteroscedasticity whenever this assumption is broken. In cross-sectional data, heteroscedasticity is common.

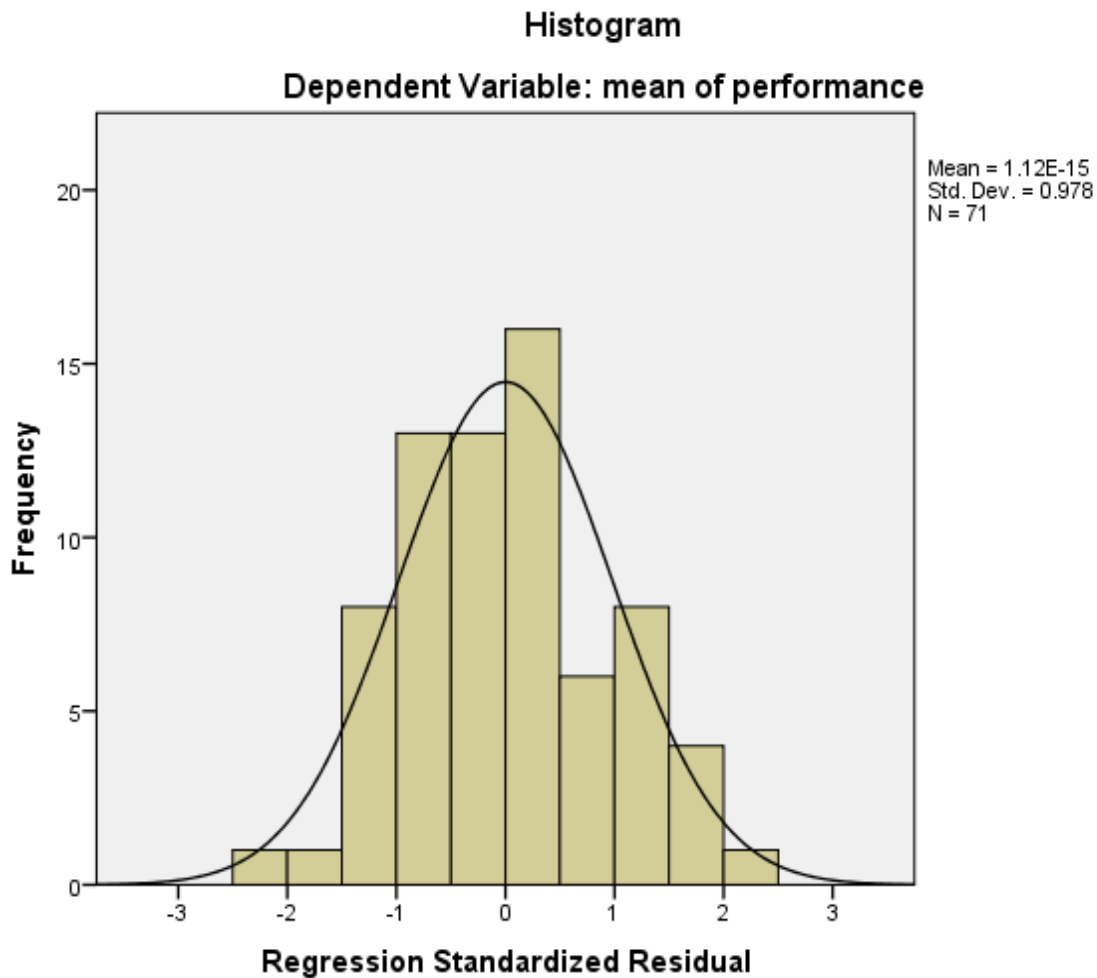


Source: own survey, 2021

Figure 4.2 Test of heteroscedasticity

4.4.1.5 Normality Test

The dependent variable's score distribution should be normal, describing a symmetrical, bell-shaped curve with the highest frequency of scores around the mean and lower frequencies at the extremities. The form of the histogram, as well as the kurtosis and skewness values, were all examined using SPSS version 25 to ensure that the data was normal. The degree to which cases are grouped towards one end of an asymmetric distribution is measured by skewness, while the peak of the distribution is measured by kurtosis. The histogram and the ratio of skewness to kurtosis were tested for this investigation, and the results show that the data was regularly distributed.



Source: own survey, 2021

Figure 4.3 Test of Normality

4.4.2 Correlation Analysis

Table 4.10 Pearson Correlation

		Construction Performance
Cost	Pearson Correlation	.271*
	Sig. (2-tailed)	.022
	N	71
Time	Pearson Correlation	.149
	Sig. (2-tailed)	.216
	N	71
Quality	Pearson Correlation	.332
	Sig. (2-tailed)	.006
	N	71
COVID 19	Pearson Correlation	.257*
	Sig. (2-tailed)	.031
	N	71

Source: own survey, 2021

Because the Pearson correlation ($r=.271$) and ($p < 0.05$) imply that the association is statistically significant, Table 4.8 shows that there is a positive weak linear correlation coefficient between cost and construction project performance.

The researchers refer to the correlation between cost and construction project performance in Bole Sub-city school extension construction project such as Material price escalation, Poor productivity of labor and equipment, Escalation of construction Equipment's and tools cost, Additional cost due to variation work, Fluctuation in money exchange rate all of which have a weak positive linear relationship with construction project performance.

Table 4.8 illustrates that ($p < 0.05$) which indicates there is a statistical relationship between COVID 19 and construction project performance. And there is a weak positive linear relationship

between COVID 19 and construction project performance variable. As well as there is weak positive linear relationship between Quality and project performance.

The table illustrates that ($p > 0.05$) which indicates there is no statistically significant relationship between the “time” dimension and construction project performance variable. There is no evidence to know the relation between time and construction performance variables at the 5% significance level. Although in real world there is a relationship between time and construction project performance, the above table has deviated from reality. This indicates type 2 errors this might be alleviated by increasing the level of confidence and the sample size. But the relationship doesn’t define the causal relationships exist between the variables. The study of Knudson, & Lindsey, (2014) indicates Reducing sample size increased type II errors using correlation analysis. Partial correlation analysis of smaller samples increased type II errors Correlation studies of small sample sizes are likely vulnerable to type I or type II statistical errors

4.4.3 Regression analysis

4.4.3.1 Moderated multiple regression analysis

The moderating effect of covid 19 on the relationship between project management triangle and construction project performance: -

To analyze the research question, the researcher used SPSS 25 moderation test to drive the model and examine the moderating role of COVID 19 between the independent variable (Iron Triangle) and the dependent variable (Construction project performance)

Table 4.11 Moderation model of COVID 19 between project management triangle and construction performance

Model summary	R ²	Adj-R ²	F-value	P-value (sig.)
	0.122	0.083	3.112	0.032

Source: own survey, 2021

Table 4.9 shows that COVID 19 has a moderating role in the relationship between project management triangle and construction project performance with P-Value = 0.032 which is less

than 0.05 which is significant to the moderating role of COVID 19. Therefore, the model is statistically significant. Similarly, $R^2 = 0.122$ which means that COVID 19 explains 12.2% of the variation in the relationship between the project management triangle and construction project performance. And the rest 87.8 % of variation in the relationship between dependent variable (construction project performance) and independent variable (project management triangle) is explained by other moderating variable. Even though The R-squared is low or high-variability data occur a significant model can be achieved. Even when data points deviate from the regression line, the model indicates that the predictor variable still provides information about the response. According to Cohan, (1992) Effect-size indices and conventional values for these are given for operationally defined small, medium, and large impacts. In other words, the value of r squared is affected by the sample size and level of significance.

This was to answer the research question of COVID 19 having a moderating effect on the relationship between the project management triangle and construction project performance. In other words, COVID 19 moderates the relationship between independent variables which are Cost, Time, and Quality with the construction performance.

Various studies have revealed the effect of the pandemic on project costs, timeline, and quality. As a result of Covid 19, material prices have risen, there is a foreign currency shortage, and this will soon affect the cost of the building project, lowering the project's performance. According to Hesna, Sunaryati, and Hidayati (2021), COVID 19 can lead to poor project cost performance, resulting in increased project costs. Covid 19 has a negative effect on the construction business by producing financial problems. According Zamani et al. (2021) analysis, COVID 19 is producing financial problems in the sector. Late payments, increasing project costs, and a reduction in the number of projects are all financial concerns.

Unforeseen ground conditions are the major component that determines the project's timeline, according to the prior mean research. COVID 19 is classified as having unforeseeable consequences. And these circumstances are mostly driving stakeholders to stop or postpone their work. As a result, construction projects will take longer to complete. The outbreak causes terminations to be halted, orders to be delivered late, and payments to be late. All of this causes a timing delay at the chosen construction site. The result is consistent with the Alenezi (2020) carried out a questionnaire survey with professionals including engineers, construction, and

architecture practitioners operating in Kuwait. The result revealed covid result in a delay in projects.

Finding and keeping dependable, skilled workers is one of the most difficult aspects of construction projects. Any construction project necessitates the hiring of additional trained people. The outbreak has a negative effect on such personnel' availability. According to the previous analysis, the most crucial element affecting the quality of the building projects in the chosen field of study was the lack of a person with extensive expertise and qualifications. As a result, the challenges that COVID creates in locating skilled workers have a direct effect on the quality of construction projects, which could have an effect on project performance. According to Abebe's study (2020), COVID 19 causes labor shortages owing to mobilization issues, resulting in 61 percent employment loss and various degrees of skilled jobs being affected in the waves.

Table 4.12 estimated coefficients for moderating effect of COVID 19 between project management triangle and construction performance

model	coefficient
constant	1.935
Project management triangle	.166
COVID 19	-.004
The interaction term	.045

Source: own survey, 2021

4.5.3.2 Moderating multiple regression model

$$Y = \alpha + \beta_0 \text{PIT} + \beta_1 \text{COV} + \beta_2 \text{INTER} + \gamma$$

Y stands for the dependent variable and that is construction project performance.

α , Stands for the constant term.

β_0 The coefficient for project management triangle variable.

β_1 The coefficient for COVID 19 variable.

β_2 The coefficient for interaction term (multiplication of PIT and COV)

PIT, project management triangle

COV, COVID 19

$$\text{INTER.} = \text{PIT} * \text{COV.}$$

γ residual term.

$$Y = 1.935 + 0.166\text{PIT} - 0.004\text{COV} + 0.045\text{INTER}$$

The construction project performance at Bole Sub City Primary School Extension equals 1.935 when all other independent variables are held constant.

Keeping all other variables fixed, if the project management triangle rises by 1%, the performance of the Bole Sub City Primary School Extension Project increases by 16.6% at 5% significance level.

Except for the COVID variable, all other variables are held constant. The construction project performance of the Bole Sub City Primary School Extension Project decreases by 0.04 percent when COVID is increased by 1% at 5% significance level.

According to the researchers COVID 19 has a significant moderating effect on the construction project by lowering the performance. The performance of the construction project, which was carried out in Bole sub-city primary school building projects, is being influenced by social separation, quarantine, and soon measures. Furthermore, it is obvious to the researcher that several elements influence the relationship between the iron triangle and construction project performance, one of the most recent being the COVID 19 epidemic.

4.5.3.3 Linear regression analysis

Significant effect of project management triangle on construction performance at a 0.05 level

Table 4.13: relationship between project management triangle and construction performance

Model summary	R ²	Adj-R ²	F-value	P-value (sig.)
	.102	0.089	7.862	0.007

Source: own survey, 2021

Table (4.11) shows that the measure of goodness of fit statistic between the total degree of project management triangle and construction performance is statically significant, and R² = 0.102 which means that variation in project management triangle explains (10.2%) from

variation occurs in construction performance, and P-Value =0.007 less than 0.05 which indicates that the linear relationship is statically significant and that there is an effect for project management triangle on construction performance.

Table 4.14: regression model project management triangle and construction performance

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.661	.524		3.170	.002
	Project management triangle	.407	.145	.320	2.804	.007

Dependent Variable: mean of performance

Source: own survey, 2021

Table (4.12) illustrates ($p \leq 0.05$), so the project management triangle has a significant effect on construction performance.

The estimated regression equation is:

$$\text{Construction project performance} = 1.661 + 0.407(\text{project management triangle})$$

The researcher views that Cost, Time, And Quality affect construction performance. The result is consistent with the finding of Tagesse & Dinku (2017) finding study revealed that the major performance problems that most frequently occur have been Cost, Time, and Quality. Building project execution involves a variety of difficult challenges, the most important of which are time, cost, and quality (Emer , (2020).

The significant effect at a 0.05 level of **COVID 19** on **construction performance**

Table 4.15: relationship between COVID 19 and construction performance

Model summary	R ²	Adj-R ²	F-value	P-value (sig.)
	.066	0.052	4.874	0.031

Source: own survey, 2021

Table (4.13) shows that the measure of goodness of fit statistic between the total degree of COVID 19 and construction performance is statically significant, and $R^2 = 0.066$ which means that variation in COVID 19 explains (6.6%) from variation occurs in construction performance, and P-Value =0.031 less than 0.05 which indicates that the linear relationship is statically significant and that there is an effect for COVID 19 on construction performance.

Table 4.16: regression model COVID 19 and construction performance

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.908	.510		3.744	.000
	mean of iron triangle	.514	.141	.402	3.644	.001

a. Dependent Variable: mean of covid

Source: own survey, 2021

Table (4.14) shows that the measure of goodness of fit between the total degree of COVID 19 and the total of construction performance is statically significant, and $R^2 = 0.066$ which means that variation in COVID 19 explains (6%) from variation occurs in construction performance, and P-Value = 0.031 less than 0.05 which indicates that the linear relationship is statically significant and that there is an effect for COVID 19 on construction performance.

Tables (4.19) illustrate that ($p \leq 0.05$), so COVID 19 has a significant effect on construction performance. The estimated regression equation is:

$$\text{Construction Performance} = 1.908 + (0.514 * \text{COVID 19})$$

COVID 19 has a direct effect on construction performance and many recent studies are revealing this effect. Zamani et.al. (2021) findings show that COVID-19 is causing operational and financial issues in construction projects. COVID 19 results in workers' anxiety, the challenge in workflow and supply chain disruption, new policy issues are brought to the construction industry (Ogunnusi et.al. 2020).

4.5 One Way ANOVA Test

There are significant differences among respondents towards the moderation effect of COVID 19 on the relationship between iron triangle and construction project Performance due to stakeholder

Table4.17: One Way ANOVA test of the dimensions and their p-values for stakeholders.

Field	Mean			F-value	p-value
	Client	Contractor	Consultant		
Cost	3.6049	3.4089	3.5275	0.536	0.588
Time	3.8859	3.7644	3.8651	0.502.	0.607
Quality	3.5778	3.1520	3.6000	4.981	0.010*
Iron triangle	3.6905	3.4418	3.6643	3.422	0.038
Performance	3.0432	3.2089	3.0952	0.711	0.498
COVID 19	3.6797	3.7553	3.8025	0.358	0.700
All questionnaire	3.5589	3.4579	3.5781	1.019	0.366

Source: own survey, 2021

Table 4.15 shows that $p < 0.05$ for the quality dimension, hence there is a significant difference in the sample related to this dimension referring to stakeholders. Therefore stakeholder affects the quality dimension. Lam et al, (2010) used the Mann–Whitney U-test and subtle differences between stakeholders in specifying construction work quality have been detected even with the

high consistency of the responses among the groups. Different stakeholder groups have different emphases on the quality of construction project.

For the other dimensions, the ($p \geq 0.05$), then there is an insignificant difference within the sample related to these dimensions due to stakeholders. Hence, the stakeholder does not affect the other dimensions.

The result indicates consultants had the highest mean value compared to other groups, which indicated that employees who belong to that group are more agree with questionnaire items than others. This can be referred to as the fact that the majority of respondents belong to this group.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter will deal with some results that have been reached by this researcher. The research was conducted in Bole Sub City primary school class extension projects. The prime intent of the research is to identify the role of COVID 19 on the relationship between project management Triangle and construction project performance. Based on objectives and the results of the study the following conclusions are drawn. Finally, some future studies will be suggested.

5.2 Research findings

The research aims to examine the project management triangle (iron triangle) and its various dimensions (cost, time, and quality) and the degree of construction project performance in Bole Sub-city primary school extension projects.

As well as this research aimed to test the moderating role of COVID 19 on the relationship between the iron triangle and construction project performance. The research results are discussed according to the research variables and dimensions studied as follows.

1 project management triangle

- Project management Triangle Variable Respondents from the selected projects are very agreeable on the level of the project management triangle. This indicates that the items included in the project management triangle variable have a good explanation.
- The multiple moderation regression analysis indicates COVID 19 is affecting the project management triangle dimensions. Therefore the relationship between the project management triangle and construction performance is moderated by COVID 19.

The dimensions of the project management Triangle are ordered as follows.

Cost Dimension

- Respondents from the selected projects are very agreeable on the dimensions of cost, based on the mean. This indicates that the items included in the Cost variable have a good explanation of the Cost dimension.
- From the correlation, there is a positive linear weak significant relationship between cost and construction performance in the Bole Sub City School class extension program.
- The multiple regression analysis indicates that Cost has a significant effect on construction performance in the Bole Sub City school class extension program.

Time Dimension

- Respondents from the selected projects are very agreeable on the dimensions of Time, based on the mean. This indicates that the items included in the Time variable have a good explanation of the Time dimension.
- There is no statistically significant relationship between the "Time" dimension and construction performance variable in Bole Sub-city primary school extension projects increasing sample size may depict the actual correlation. However, the relationship doesn't indicate the cause and effect relationship.
- The multiple regression analysis indicates that Time has a significant effect on construction performance in the Bole Sub City school class extension program.

Quality Dimension

- Respondents from the selected projects are very agreeable on the dimensions of Quality, based on the mean. This indicates that the items included in the Quality variable have a good explanation of the Quality dimension.
- From the correlation, there is a positive linear weak significant relationship between Quality and construction performance in the Bole Sub City School class extension program.
- The multiple regression analysis indicates that Quality has a significant effect on construction performance in the Bole Sub City school class extension program.

2 Construction project performances

- The level of agreement for construction performance is moderate from the perspective of the stakeholder of the Bole Sub City School class extension program, which indicates that the item is moderately affected by construction performance.
- From the multiple moderation analysis covid, 19 is moderate the relationship between project management triangle and construction project performance.

3 COVID 19

- The mean level of agreement for COVID 19 is very agreed from the perspective of the stakeholder of the Bole Sub City School class extension program, which indicates that the items are the result of the effect of COVID 19.
- The correlation indicates there is a statistically significant relationship between COVID 19 and Construction Performance in the Bole Sub City school class extension program. The two variables have a weak positive linear relationship.
- The multi-moderated regression analysis indicates COVID 19 moderates the relationship between the project management triangle and Construction performance in the Bole Sub City school class extension program.

5.3 Conclusion

Cost, Time, and Quality (the iron triangle) are the most well-known construction project performance measurements. Those three variables are interrelated and interconnected with each other. Under any circumstance, if one of these is affected the performance of the construction project is declined. The outbreak of the Coronavirus has highly affected the cost, time, and quality of construction projects. The social separation and quarantine travel restrictions alter the construction project's features.

COVID has resulted in an increase in material prices, a decrease in the organization's liquidity, and an increase in the cost of equipment and tools. Human resources, equipment, machinery, and tools, as well as the suspension and termination of projects, all incur additional expenditures. The outbreak causes foreign currency shortages, which affect lenders, sureties, the government, and developers, resulting in a financial crisis.

As a result of the outbreak, construction projects take longer to complete. After the pandemic, change orders from the owner, contract suspension and termination, difficulty in mobilizing importing material, resource, and financial limits, and other issues quickly arise in the construction project. All of these issues cause delays in the construction process and slow it down.

The unavailability of a person with high experience and qualifications has a significant effect on a building project's quality. Low project staff motivation, worker anxiety, and a covid-imposed travel limit for crucial labor and field specialists could all play a role. This is how covid degrades a building project's quality and produces a performance issue. Furthermore, quarantine prevents

job workers from reporting to work, even though the construction sector, by its very nature, requires the availability of on-site activities, which has an effect on work quality. Productivity is dropping as a result of government constraints, and workers' social distance has resulted in quality difficulties. During the construction of the Bole Sub City public primary school class building extension effort, all of the difficulties stated occurred.

5.4 Recommendation

Several recommendations can be presented to stakeholders of the Bole Sub City school class extension program, depending on the implications of this research.

- During the crisis, stakeholders must continue to apply and exert efforts toward the realization and application of effective project management triangle practices in evaluating, controlling, and monitoring construction cost, time, and quality of the final construction project.
- It is critical to examine and evaluate historical project management triangle strategy practices to match them with the present organization's strategic goals. This would allow the organization to better withstand the COVID 19 pandemic's effects.
- Applying the project management triangle during the pandemic may result in desirable outcomes for the construction firms.
- The building construction stakeholders must define, prepare and apply the project management triangle practice to for what the sector will look like after the crisis.
- Stakeholders must reconsider their digitization adoption. This will improve remote communication during the whole construction process, including the planning, engineering, and execution phases. Creating a market with other stakeholders, suppliers, government entities, and manufacturers through an e-commerce model would reduce the risk of financial disruption.

5.5 Theoretical contribution and policy implications

The findings of this study add to the literature on COVID 19's moderating role in the relationship between the project management triangle and project performance in construction. COVID 19 has a moderating effect on the relationship between the project management triangle and construction project performance, according to the study. This study makes several specific theoretical contributions based on the findings. First, the findings show that implementing a good project management triangle improves the construction project's performance. Second, the study

confirms COVID 19's moderating effect on the iron triangle and construction performance. Finally, this research contributes a body of knowledge by examining its application in a construction project.

The findings of this study suggest that stakeholders in the construction industry could make a significant contribution to the performance of construction projects during the crisis by improving the existing project management triangle method. Furthermore, to maintain the performance of construction projects, organizations must implement an effective digitalized project management triangle at a higher level.

These findings will help policymakers improve existing strategic plans and create new policies to cope with the circumstances caused by COVID-19 among building construction organizations.

5.6 limitation and future research

- The research was applied in Bole sub-city public primary school class building extension projects, which affect the generalization of finding.
- The study was carried out on a public-school construction project, but it can be applied to other construction projects as well.
- The research uses the project management triangle factor as an independent variable; further other factors that affect construction performance shall be assessed with the moderating effect of covid.
- It is recommended to use other methodology such as qualitative research.

It is suggested to research the following relationships:

- The moderating role of political stability between project management triangle and construction project performance in Ethiopia.
- The moderating role of corruption between project management triangle and construction project performance.

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Appendices
Addis Ababa University
College of Business and Economics
Department of Management
M.Sc. in Innovation Management and Entrepreneurship

Dear Respondents: In order to complete my MSc. Management studies at Addis Ababa University, I am currently working on a research study on the moderating effect of COVID 19 on building construction performance on the selected project.

The goal of this study is to see if COVID 19 has any moderating influence on the performance of building construction projects in the Bole sub-city primary schools class extension projects. Identifying the unique coronavirus-affected variables in the chosen building project and rating them in order of severity is critical for conducting analysis and subsequent recommendations of feasible solutions aimed at minimizing the problem. To complete this research properly, it is necessary to investigate the issues from many viewpoints by enlisting the help of individuals with relevant experience.

I would like to confirm that your response will be kept strictly confidential and will be used exclusively for this research. Besides, your quick response is vitally important to finalize the research timely and I would appreciate it if you return the completed questionnaire within a week of your receipt of the same.

Thank you very much for your time and cooperation and looking forward to receiving your response.

Thank You for your kindly cooperation!

Best Regards,

Part One: General Information: Please add (√) as appropriate

1) Which stakeholder do you represent?

Client [Owner] <input type="checkbox"/>	Contractor <input type="checkbox"/>	consultant <input type="checkbox"/>
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2) Your Designation in the organization

Owner <input type="checkbox"/>	Project manager <input type="checkbox"/>	Site engineer <input type="checkbox"/>	Office engineer <input type="checkbox"/>
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3) Years of Work Experience

0 to 5 years <input type="checkbox"/>	6 to 10 years <input type="checkbox"/>	11 to 15 years <input type="checkbox"/>	16 to 20 years <input type="checkbox"/>	Above 20 <input type="checkbox"/>
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4) Number of projects executed in the last five years by the company

1 to 10 <input type="checkbox"/>	11 to 20 <input type="checkbox"/>	More than 21 <input type="checkbox"/>
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5) Value of executed projects in the last five years by the company : (in million ETB)

1 - less than 2 M <input type="checkbox"/>	2 - less than 5 M <input type="checkbox"/>
5 - less than 10 M <input type="checkbox"/>	More than or equal 10 M <input type="checkbox"/>

Part Two: research variables

The following variables are the number of factors that affect the performance of building construction projects. From your experience, please express your opinion on the importance of the following factors as key performance indicators of construction projects within the selected school building projects. (Please tick (√) the appropriate box).

Indicate your level of agreement with the following statements based on the scale given:

Scale

Extremely agree	Very agree	moderately agree	slightly agree	disagree
5	4	3	2	1

First variables: - project management triangle (Cost, Time and Quality)

Cost dimension

No.	Factors	5	4	3	2	1
	Cost related factors					
1.	Material price escalation.					
2.	Increase in Cost of project Design, Operation, and maintenance.					
3.	A drop of Liquidity of organization.					
4.	Material wastage on site.					
5.	Additional cost due to variation work					
6.	Poor Cost control system					
7.	Fluctuation in the money exchange rate.					
8.	Poor productivity of labor and equipment					
9.	Escalation of construction Equipment and tools cost.					

Time dimension

No.	Factors	5	4	3	2	1
	Time-related factors					
1.	Unforeseen ground condition					
2.	Resources and financial constraints					
3.	Delay in designing and planning of construction documents					
4.	The average delay in payment from the owner to contractors					
5.	The average delay in claim approval					
6.	The time needed to rectify defects					
7.	Site preparation time					
8.	orders delivered late					
9.	The time needed to implement variation orders					

Quality dimension

No.	Factors	5	4	3	2	1
	Quality related factors					
1.	Poor compliance with specifications and standards.					
2.	Low quality of equipment and raw material in projects.					

3.	Poor quality assessment and monitoring					
4.	Weak quality assurance training					
5.	Unavailability of a person with high experience and qualification					

The second variable: - constructions project performance or the dependent variable

No.	Factors	5	4	3	2	1
Construction performance-related factors						
1.	Financial capacity.					
2.	Competitor's performance					
3.	Creation of an environment for innovation and learning new technology.					
4.	Productivity of labor and equipment.					
5.	Client satisfaction					
6.	Regular and community satisfaction					
7.	Employee satisfaction					
8.	Health and safety practices					
9.	Socio- environment					

Third variable: - COVID 19 or the moderating variable

No.	Factors	5	4	3	2	1
4/ COVID 19 related factors						
1.	Time extension after the outbreaks increase.					
2.	Covid results in too many change orders from the owner.					
3.	Covid result Workers anxiety.					
4.	Project cost increase after covid.					
5.	Clients face cash flow problems.					
6.	Poor Motivation of project staff after Covid.					
7.	Travel ban on Critical labor and field specialists.					
8.	Tendering method delay in construction projects.					
9.	Suspension and termination of contracts.					
10.	Quarantines make job workers unable to come to work.					
11.	Problems with legal issues increased.					
12.	Difficulties in mobilizing importing materials.					
13.	Quarantines affect lenders, sureties, governments, and developers, all of which will pinch jobs.					
14.	Reduction in productivity because of the social distancing of laborers and restrictions by the government.					
15.	Additional cost for new technology, tools Health and safety challenges.					
16.	Additional Costs due to the Idleness of human					

	resources, equipment, machinery, and tools increase.					
17.	Foreign currency shortages due to Covid					