

**ST. MARY'S UNIVERSITY**  
**SCHOOL OF GRADUATE STUDIES**



**ASSESSMENT OF THE IMPLEMENTATION OF PROJECT  
MANAGEMENT PRACTICES REGARDING PROJECT QUADRUPLE  
CONSTRAINTS: IN THE CASE OF CBE HEAD QUARTER BUILDING  
CONSTRUCTION.**

**BY: Hiwot Nekatibeb**

**June, 2021**

**Addis Ababa, Ethiopia**

**ST. MARY'S UNIVERSITY**

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**ASSESSMENT OF THE IMPLEMENTATION OF PROJECT MANAGEMENT PRACTICES REGARDING PROJECT QUADRUPLE CONSTRAINTS: IN THE CASE OF CBE HEAD QUARTER BUILDING CONSTRUCTION.**

**A Thesis Submitted to the Department of Project Management as a Partial Fulfilment of the Requirements for the Award of Master of Arts (MA) Degree in Project Management**

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**June, 2021**

**Addis Ababa, Ethiopia**

## Declaration

I hereby declare that this thesis entitled “**Assessment of the implementation of Project Management Practices Regarding Project Quadruple Constraints: In The Case Of CBE Head Quarter Building Construction**” was composed by myself, with the guidance of my advisor, that the work contained herein is my own except where explicitly stated otherwise in the text, and that this work has not been submitted, in whole or in part, for any other degree or professional qualification.

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## Certificate

This is to certify that the thesis prepared by Ms. Hiwot Nekatibeb Gebreselassie entitled **“Assessment of the Role of Project Management Practices Regarding Project Quadruple Constraints: In The Case Of CBE Head Quarter Building Construction”** and submitted in fulfillment of the requirements for the Degree of Master of Science complies with the regulations of the University and meets the accepted standards with respect to originality and quality and Singed.

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## **ENDORSEMENT**

This thesis has been submitted to St. Mary's University School of Graduate Studies for examination with my approval as a university advisor

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Signature  
July, 2021

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## **List of Acronyms and Abbreviations**

**AAIHDP-** Addis Ababa Integrated Housing Development Project

**AAiT-** Addis Ababa Institute of technology

**AAU-** Addis Ababa University

**CBE-** Commercial Bank of Ethiopia

**CBEPMO-** Commercial bank of Ethiopia Project Management Office

**CMAA-** Construction Management Association of America

**CPM-** Construction Project Management

**CSCEC-** Chinese State Construction Engineering Corporation

**DB-** Design-Build

**DBB-** Design-Bid-Build

**DBIA-** Design-Build Institute of America

**EFY-** Ethiopian Fiscal Year

**GDP-** Growth Domestic Product

**HQ-** Head Quarter

**MoFED -** Ministry of Finance and Economic Development

**PM-** Project Management

**PMI-** Project Management Institute

**PMIBoK-** Project Management Institute Body of Knowledge

**UCBP-** University Capacity Building Program

## **Abstract**

*The role and implementation of project management practices on construction projects is underestimated for centuries and this has been the reason for the failure of most projects in Ethiopia and also in Africa. This research assessed the implementation of project management practices regarding project quadruple constraints on building construction projects in the case of CBE H.Q building construction. The researcher went through different literatures on the subject matter to understand about the factors of project quadruple constraints and decided to apply descriptive research design employing qualitative and quantitative research approaches. Purposive sampling method was used since all the respondents were selected purposely considering they have a direct involvement and pertinent information that can help the researcher. Descriptive analysis was applied in order to get the Percentage, frequency and mean of the respondents' data. The likert scale questionnaires were processed and analyzed using SPSS 25 and presented in a narrative form by using tables and charts. In this research 116 respondents were involved and 106 of them responded well, accordingly from the collected data the researcher has found out that 64.15% of the respondents responded strongly agreeing that the performance was good, 22.64 % agreed and 13.21% of the respondents disagreed, from this point of view the researcher generalized that the project performance is very good in spite of Covid. The major gaps in managing project constraints of this project were absence of defined stakeholder responsibility, quality standard knowledge gap, scope change, using different scheduling systems and lack of experts. Based on the analysis carried out, the researcher has forwarded some recommendations to the respective institutions; to have a centralized and consistent construction rule, regulation and standards as country, creating investment opportunities for individual investors to collaborate with investment biro to manufacture construction material and also to empower Ethiopian construction professional through trainings and experience sharing.*

**Key words: construction project management, quadruple constraints**



# CHAPTER ONE

## 1. INTRODUCTION

### 1.1 Background of the Study

A construction project is very complex by its nature and requires efficient project management practices to achieve its goal. Project management is a formalized and structured method of managing change in a rigorous manner. It requires the application of knowledge, skills, tools and techniques to project activities to achieve the required project outcome (IPMA, 2006). In light with this, Project management is the art of directing and coordinating human and material resources throughout the life of the project by using modern management techniques to achieve predetermined objectives of scope, cost, time, quality, and participation satisfaction. (Yilak, 2013; CIB, 2004 as cited by Negatu, 2017).

It is very essential to focus on the complete process of project management for constructed facilities rather than the historical roles of various specialists; each specialty might have important advances in developing new techniques and tools for efficient implementation of construction projects. However, it is through the understanding of the entire process of project management that these specialists can respond more effectively to the successful completion of the project on budget, within scope and schedule. Organizations using project management have shown better utilization of resources, shorter development times, reduced costs, interdepartmental cooperation that builds synergies across the organization, and a better focus on results and quality (Singh, 2019).

In the project life cycle, the most influential factors affecting the outcome of the project often reside at the early stages. At this point, decisions should be based on competent economic evaluation with due consideration for adequate financing, the prevalent social and regulatory environment, and technological considerations. Architects and engineers might specialize in planning, in construction field management, or in operation, but for project managers, they must have all the project management knowledge aspects in order to understand their role properly and be able to make competent decisions (PMI, 2007).

Construction managers, also known as construction project managers, oversee and allocate resources for various construction projects. A great construction project manager is skilled in both the technical skills required for the job and in leading and directing their team. Construction project managers oversee all aspects of the building process, working closely with engineers and architects to develop plans, establish timetables, and determine labor and material costs. They are responsible for ensuring the project is completed on budget and within scope (CIB, 2002).

Improvement of project management not only can aid the construction industry, but may also be the engine for the national and world economy. However, if we are to make meaningful improvements, we must first understand the construction industry, its operating environment and the institutional constraints affecting its activities as well as the nature of project management. (Ofori, 2006).

Generally, as Ofori (2006) and Jekale (2004) concluded, “The construction industry in developing countries failed to meet expectations of governments, clients and society as a whole”. Construction Projects can vary from residential, commercial, and industrial buildings to bridges and skyscrapers. Building construction is in its early stage in developing countries especially in our country high-rise (sky scraper) buildings are under construction, now a days most financial institution head quarter buildings are high-rise as if it seems as a competition between banks, CBE head quarter building is currently the tallest building under construction in our country in which it attracts more attentions and is a good place to start a research. The CBE new HQ Building consists of a high-rise office tower and two low-rise building volumes. The total floor area is estimated to be 165,476.4m<sup>2</sup>. The office tower has more than 48 floors (4B+G+48) including the main departments of the Bank. The low-rise buildings (4B+G+6 and 4B+G+8) are mainly conference centres, commercial centre and parking garage. After completion, the building will be one of the tallest buildings (with 205-meter height) in African continent. It will create an important landmark and icon for the Commercial Bank of Ethiopia, the City of Addis Ababa, and Ethiopia as a nation. The head quarter building will be an impressive contribution to the dynamic skyline of Addis Ababa (AAiT, 2017).

This research assesses the implementation of project management practices regarding project quadruple constraints on building construction projects in the case of CBE H.Q building construction. It identified the gaps and recommends possible solution to improve the implementation of project management practices and the determinants of project management practices. So far, as far as the researchers knowledge is concerned little research has been done in the country in this regard. This thesis is thus undertaken to fill the gap, primarily by doing the foundational work of determining where we are and where we need to go, leaving aside the how, for further research.

## **1.2 Statement of the problem**

The role of project management practice on construction projects is underestimated for centuries and this has been the reason for the failure of most projects in Ethiopia and also in Africa. Managing construction project is an arduous task, a project is considered successful when it is delivered on budget, on time, and in line with the required specifications and quality. A more complex but “holistic” view of a project success, however, would consider other measures that are usually pursued, such as social efficiency, effectiveness, equity, relevance, and political payoff, among others (Negatu, 2017).

Similar to the case with other developing countries, Ethiopian construction industry shares many of the problems and challenges the industry is facing in other developing countries, perhaps with greater severity. There has been an extended delay in projects and there were also some unattended goals. These problems are believed to be among other factors due to lack of efficient project management practices and certain barriers to do that (Yimam, 2011)

However, the sector has been noted for its multitude and frequent types of problems especially in developing countries. In fact, poor project management in developing countries has often led to the under-exploitation of the potential of these projects. Researches show that, Yimam (2011) in Ethiopia many construction projects are suffering with different problems such as delay, cost overrun and quality issues. Many factors have been reported to affect project performance in different developing countries. Some include inaccurate cost estimation techniques, high cost of construction materials, lack of equipment and un-skilled man-power contribute to the inefficient and poor management of building construction projects.



As far as the researcher knowledge is concerned there are little evidences on previous research studies which assess the role of project management practices on building construction projects regarding project quadruple constraints in our country. Rather several evidences from on-going projects and review of documents cast doubt on the effectiveness of project management practice on projects specifically on construction programs. Also on previous literatures regarding building construction project, most of them focus on single aspect of project management issues such as Stakeholder management, Risk management, Planning, and Monitoring and evaluation but not on the quadruple constraints of building constructions. A challenging factor in one area will have a significant ripple effect on all other related areas and not understanding the role of project management discipline will do the worst. Thus comprehensive view of all project management practices is necessary in order to effectively manage projects being implemented (Negatu, 2017); However in this particular study the project quadruple constraints are going to be studied.

It is important to understand that the project used a Design-Build project delivery system and determine what factors affect the project cost, scope, time and quality in implementing the project phases throughout the project lifecycle. Since this kind of project delivery system is new for our country it is very crucial to understand the system's advantage and disadvantage to learn from the experience and furthermore, to analyze which of these recommendations are more appropriate endeavors in overcoming the challenges for project managers, central governments should also look to deliver the widest possible range of positive transformational benefits that construction projects are able to bring in terms of economic, social, environmental, and territorial outcomes, both in the short run and in the long term. Therefore, the purpose of this study is to assess the project management practices in CBE head quarter building construction project and it's progress regarding the project quadruple constraints (Scope, Cost, Time & Quality Management) in order to give a definitive source for decision makers and professionals for future improvements.

## **1.3 Research Questions**

The study is guided by the following research questions:

1. What are the determinant factors to assess CBE building construction project regarding project quadruple constraints?
2. What are the major gaps on the project management practice on managing a Design-Build project regarding quadruple Constraints?
3. What is the progress of the project with respect to the baseline plan of the project lifecycle at the beginning? And
4. What is the impact of Design-Build project delivery system on the project stakeholders?

## **1.4 Research Objective**

### **1.4.1 General objective**

The overall aim of the study is to assess the implementation of project management practices on building construction projects regarding project quadruple constraints in the case CBE H.Q building construction.

### **1.4.2 Specific Objectives**

**Specifically the study tries to address the following key research objectives:**

1. To assess CBE building construction project regarding project scope, cost, time and quality management?
2. To assess the major gaps on practicing the project management practices in managing a Design-Build project regarding the quadruple Constraints Management

3. To identify the progress of the project with respect to the baseline plan of the project lifecycle at the beginning And
4. To identify the impact of Design-Build project delivery system on the project stakeholders

## **1.5 Significance of the Study**

This research paper will help to look in to the gaps in the Construction Project Management practices regarding quadruple constraints (scope, time, cost and quality) in CBE head quarter building construction. This study aims to point out these difficulties and thus improve the project management practice in order to benefit from the findings. This study will be significant for its contribution to:

- i.* **To further knowledge generation:** the study sheds light on the impact of project management practices on construction projects and what it roles is delivering a successful project.
- ii.* **To answer practical problems and managerial implication:** it is the researcher's opinion that the findings from this research benefits contractors, consultants, project managers and CBEPMO by indicating gaps, key problems, and shortcomings of PM practices and propose recommendations. And also Project managers and designers who are involved in the planning, designing, implementing and controlling of construction projects could make use of the obtained information from this study because it draws their attention to some of the points where corrective actions are necessary and enable them to make such corrections and decisions.
- iii.* **To pave the way for further research:** it could stimulate further studies on the topic, and also researchers and academicians can also refer it as secondary data source.
- iv.* **To serve as a policy or strategy input:** the findings and recommendations of the study are highly important to policy makers because it draws their attention to some of the points that need corrective measures on their side.

## **1.6 Scope of the Study**

The geographic scope of this study is restricted to one building construction site which is located in Addis Ababa. CBE head quarter building is located around Beherawi behind Ethiopia hotel. The study has covered AAiT consultation office, CBE project management office and CSCEC office practice under the construction of CBE head quarter building construction. Thus, the research result should be taken only as indicative of construction PM practices in CBE building construction.

The thematic scope of the study focuses on assessing the role of project management practices regarding the quadruple Constraints/Scope, Time, Cost and Quality of a project. These knowledge areas are drawn from internationally accepted dimensions because they are found to be the key areas of focus for a project management practice and also as key factors for a project to be called successful. And the results obtained from this research do not necessarily represent projects that are not under the control of these offices mentioned above and the time scope of this study is restricted to one academic year, this means the assessment implicates the progress and the practice of the project management until the end of May, 2021.

## **1.7 Limitations of the Study**

Assessing construction project management challenges is a very vast research topic and which needs a root cause analysis and approaches to the successful assessment of the practices throughout the project life cycle. Limitations are an imposed restriction beyond the control of the researcher (Theofanidis & Fountouki, 2018). It is a potential weakness related to the chosen research design, statistical model constraints, or other factors. Limitations affect the study design, results, and conclusion. In this regard, the acknowledged limitations of the study is the world new pandemic Covid-19 which is a huge limitation to this specific study in primary data collection, since the disease is highly contagious distributing questioners and interviewing eligible candidates was very difficult and also affects researchers and individuals economically and psychologically. The other limitations of this research are the unavailability of secondary documents written on this topic, especially in our country context.

The language barrier between contractors, project owner and consultant is also another issue since the contractors are from China and most of them speaks chines. The contractors and managers are very busy as the project is on the completion stages which is also another constraint encountered during data collection.

## **1.8 Organization of the Research Report**

**The report of the study was organized into five chapters:**

- The first chapter is introduction. Which discusses about; the general background of the study, the statement of the problem, the general and specific objectives of the study, the research question, the scope, significance and the limitations of the study.
- The second chapter is literature review. This has two parts. The first part discusses about theoretical review on international experiences and studies made on the study topic. The second part discusses about the empirical studies regarding related issues.
- The third chapter is research methodology. Which discusses about; the research methodology and design used to do the study, selection of sample frame, source and type of data and also data collection and analysis methods.
- The fourth chapter is data presentation and analysis. Which discusses about; the presentation and analysis of the collected data
- The fifth chapter is conclusion and recommendations. Which discusses; the conclusion of the whole study findings and also recommendations for the problems.

# CHAPTER TWO

## 2. REVIEW OF RELATED LITERATURE

### 2.1 Theoretical Review

#### 2.1.1 Project management

Project management as defined as PMI, (2013) is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements. It is also defined as the application and integration of modern management and project management knowledge, skills, tools and techniques to the overall planning, directing, coordinating ,monitoring and control of all dimensions of a project from its inception to completion ,and the motivation of all those involved to produce the product ,service or result of the project on time, within authorized cost, and to the required quality and requirement, and to the satisfaction of participants. (Chartered Institute of Building , 2002; Fewings, 2005; Carmichael, 2004)

Managing a project typically includes, but not limited to: Identifying requirements; addressing the various needs, concerns, and expectations of the stakeholders in planning and executing the project; setting up, maintaining, and carrying out communications among stakeholders that are active, effective, and collaborative in nature; managing stakeholders towards meeting project requirements and creating project deliverables; Balancing the competing project constraints, which include, but are not limited to: Scope, Quality, Schedule, Budget, Resources, and Risks. (IPMA, 2006).

The specific project characteristics and circumstances can influence the constraints on which the project management team needs to focus. The purpose of project management is to predict, plan, organize, and control activities and resources so that projects are completed successfully in spite of all the difficulties and risks. This process should start before any resource (IPMA, 2006).

### **2.1.1.1 Project management in developing countries**

The nature of projects and the environment in which they are implemented in developing countries is different from that of the developed countries where PM is originated and developed (Cusworth and Franks, 1993; Voropajev, 1998; Jekale, 2004). Most Projects in both developed and developing countries are complex and operate in a dynamic environment. However, projects in developing countries are highly uncertain, and operate in a highly unstable, unpredictable and poorly resourced environment. This poses a challenge on project manager in developing countries which is not seen by their counter parts in the developed nations.

Project Management in developing countries is facing many challenging problems and non-conducive environment (Jekale, 2004; Abbasi and Al-Mharmah, 2000). Many projects in such countries end up uncompleted, abandoned or unsustainable (Sonuga, Aliboh and Oloke, 2002; Andersen, 2008). For example, the cost of abandoned projects in Nigeria is estimated to be \$12.65 billion, requiring at least twice as much additional fund for their completion (Alutu and Udhawuve, 2009 citing Aliyu, 2000).

Further, the implementation of most projects in those countries is amalgamated with normal operational undertaking in functional organizations that have low capacity (Jekale, 2004). Further, corruption has become a challenge complicating project management in those countries (Sonuga, Aliboh and Oloke, 2002); Andersen, 2008), has summarized it as:

- Poor support infrastructures, low level of technology
- low capacity of implementing institutions
- scarcity of skilled professionals and financial resources
- unreliable communication, poor and protracted documentation
- high turnover of leadership and workmen
- considerable political instability
- low level or absence of accountability and transparency
- Long and tedious formal decision-making procedure is typical condition in Developing countries. The majority of the above factors affect the practice of Project management,

and the majority of them are either non-existent or not common in the developed countries where Project Management is developed and thrived.

### **2.1.1.2 Challenges of Project Management in Developing Countries**

A number of factors have been identified for the poor performance of projects in developing countries. Generally factors such as government policies, insufficient funds, withdrawal by donors, shortage of foreign exchange, inappropriate contract conditions, political priorities, poverty, socio-cultural conditions, corruption, low institutional and human capacity, and occurrence of unexpected events such as war, drought are considered to be the major factors behind the poor performance of projects in developing countries (Idoko, 2008; Jekale, 2004 and Andersen, 2008).

#### **Subsequent paragraphs provide detail discussion of the challenges:**

According to Jekale, et al, (2004) projects in developing countries are highly influenced by their external environment. Moreover, the project environment in many developing countries is unstable and characterized by rapid change of markets, shift of funding sources, frequent change of government policies and the business environment. In addition, projects in those countries are affected by prevalence of corruption, war, drought and governments political priorities (Alutu and Udhawuve, 2009; Jekale, 2004). For example in Nigeria, the cost of construction materials was reported to have shown a 400% increase over a period of two years because of change in government policies (devaluation of its currency and inflation) (Sonuga, et al,2002). Likewise, in Ethiopia inflation has increased in double digit and cost of construction has almost doubled in the last three years.

According to Cusworth & Franks (1993) “Most of the special problems of project management in developing countries is related to the environment, which can generally be attributed to the turbulence (the tendency of unpredictability) and rapid change in the project environment; and severe scarcity of resources in those countries”. These prevailing external factors are making the planning and generally management of project extremely challenging for the poorly trained



highly constrained project managers in those countries. The above generalizations are in contrast with those in the developed countries.

According to the Standish Group (2004) Report: the main reason for project failure (in developed countries) is not the absence of general resources or financial resources, but the lack of Project management capability (Malan, etal, 2007).

According to Voropajev (1998) lack of institutional capacity and trained personnel is also another main reason why projects fail in developing countries. Further, the lack of awareness about the benefit and application of Project Management in many developing countries“ organizations combined with the presence of few trained project managers and wrong perception that sees project managers as an unnecessary expense has contributed to the low level of development of project management in those countries.

According to Andersen and Idoko (2008) the presence of only three PMI chapters in Africa countries attest to the value and attention given to project management in developing countries. Further, according to Nguyen, (2007), many of the efforts to transfer Project management knowledge and technology to the developing countries were not successful mainly due to : lack of support of senior management and a perception that project management methodology is not applicable in developing countries. In addition to lack of institutional capacity and trained PM professionals, the nature of project management in itself is a challenge for many project managers in developing countries.

According to Pant and Hayes, (1996) , the principles of PM are contrary to what the managers in developing countries are accustomed to do and trained for. Muriithi and Crawford, (2003) Concluded the same based on similar study done on PM in Africa. Conventional project structure breeches classical principles of management-which is practiced in many developing countries; such as division of labour, organizational hierarchy and unity of command which are adhered to in developing countries. It demands certain qualities from its members including objectivity, flexibility, and preparedness to take risks, ability to make decisions independently, low preference for conformity, low power orientation and low rule orientation rare attributes in Developing Countries (see (Muriithi and Crawford, 2003)). Individuals employed in project organizations are expected to be able to work well in teams, to have the ability to lead and to

maintain close ties with other organizational members (almost none existent in developing countries). On the evidence of this, it may be difficult for project managers in Developing countries to fulfil requirements of project management. (Pant & Hayes, 1996).

According to Sonuga and Oloke, (2002) another important reason for failure of projects in developing countries is the way projects are set up and implemented in those countries This is mainly applicable to the so called “development projects.” In such projects, it is common to see lack of involvement and consultation of users and the tendency of some donors to finance only what they wanted or perceived to be important for the recipient rather than based on need of the users. Sometimes public projects in developing countries both government and donor financed fails due to lack of comprehensive planning and study .Such projects fail to consider the capacity and nature of the local support organization, economic, technological, and physical environments in the planning. Because of this, many of such projects left non-operational simply because there were no parallel work done to train staff or plan how to pay for the staff that runs them and provide the necessary support(such as spare parts, maintenance crew etc ) to run them .

According to (Muriithi and Crawford, 2003; Abbasi and Al-Mharmah, 2000; Jekale, 2004; Voropajev, 1998; Pant and Hayes, 1996) most of the reasons for failure of projects and their poor management in developing countries can be associated with the failure to consider the specific context of developing countries and critically adopt the PM methodologies to the context of developing countries. This is because the inherent assumption about people, culture, the environment and economic condition that PM methodologies which are developed in the developed nations consider, vary significantly in the developing countries Unfortunately, literature reviews has revealed that only few studies are done considering the above , except very few such as (Muriithi and Crawford, 2003; Cusworth and Franks, 1993) the majorities of them offer little insight on how to adopt the project management methodologies , tools and techniques to the cultural and economic condition of the developing countries context. These researchers tried to use Hofstede’s four dimensions framework in their study of PM in developing countries (in Africa) to explain application of project management in the context of developing countries. They showed how cultural variation in the developing world affects application of PM and the need to critically adopt PM to the context of the developing countries.

Hofstede's four dimensions framework for cultural study are:

- Power distance: the tendency to accept unequal distribution of power in a society.
- Uncertainty avoidance: the extent to which ambiguity is perceived as threatening and risk-taking behaviour is avoided.
- Masculinity/femininity: the extent to which masculine traits such as achievement, courage and competition are valued over feminine values and behaviour such as caring and sympathy.
- Individualism/collectivism: the extent to which people define themselves as individual entities or in terms of groups as the primary source of solution to their problems.

According to the authors the above tendencies are reflected in organizations in the way people behave in their work and structure their work. For example, tall organizational structure, and unwillingness of middle managers to make decision without reference to superiors, rare open criticism and willingness to disagree with supervisors are indicative of high power distance. Low risk taking, emotional resistance to change, a preference for clearly laid out rules and heavy involvement of managers in details is indicative of high uncertainty avoidance. Many African cultures score high on Power distance and Uncertainty avoidance and Medium on Masculinity and low on Individualism. The implications of these findings to project management were discussed in detail by (Muriithi & Crawford, 2003). The high power distance in developing countries (Africa), implicate the importance of high level of commitment, follow up and fast decision making by top management in such countries. This is because middle managers do not feel empowered to make decision and defer always to the top. Further, it emphasise the importance of having a clearly defined rules, structure, processes, methodologies, roles, responsibilities and authority. This provides clarity and minimizes uncertainty and the need to take risk by the middle managers, thus creating a better atmosphere that encourages the middle managers to make decision and take responsibility.

In summary, success and implementation of projects in developing countries is influenced much more by the external environment than the internal environment. Thus project management in those countries should focus more on the management of the externalities of the project environment (Muriithi and Crawford, 2003; Jekale, 2004). According to (Muriithi & Crawford,

2003), project Managers should be skilled in politics and interpersonal relationship skills, and use it to the advantage of the project. This has been found to be the crucial factor behind the success of Kenyan managers. In addition, continuous planning, risk management, resource planning and management should be given special consideration in the management of projects in developing countries. Further, the PM should work to continuously involve top management to get easily the necessary resources and facilitations, which otherwise would be very difficult (Muriithi and Crawford, 2003 and others).

In addition, procurement and contract administration should be given special attention as it has significant impact on the cost and time of projects and is an area that is highly susceptible to risk and corruption. Further, the integrating function of project management is difficult in developing countries because top management is slow to delegate and the external environment is overpowering (Muriithi & Crawford, 2003). Hence, PM's should work on relationship with the top management to get fast decision and the necessary power to get the support of others.

As discussed in the above paragraphs the environment in developing countries does not foster the application of project management. Thus, in the past, the efforts to promote development of PM in developing countries mainly dealt with how the environment in those countries should be changed to make it conducive and more favourable to PM (Cusworth & Franks, 1993). Now the tendency has shifted to the importance of critical works to adapt PM to the developing countries' environment rather than the other way around. The later one was advocated by many of the recent researchers in the area such as (Jekale, 2004; Voropajev, 1998; Muriithi & Crawford, 2003; etc). However, any sound approach for the development of PM in developing countries should combine both approaches; as some times it may be easier and more valuable to change the PM environment to adapt it to the need of PM rather than to adapt PM to the environment. Hence, there should be a planned effort to bring both, changes in the project environment to make it more favourable to the need of PM, as well as, critical adaptation of PM concepts and tools to the developing countries' project environment.

## 2.1.2 Construction PM

Construction project management (CPM) has some differences from managements of other projects. The differences mainly stems from the nature and characteristics of construction projects (Abadir Yimam, 2011). The consideration of these differences is important for successful management of construction projects. Construction projects are usually capital intensive, complex; and require significant management skills, involvement and coordination of a wide range of experts in various fields. (Chartered Institute of Building, 2002). Are usually undertaken outside; hence, they are susceptible to many variables such as weather and traffic (Gould & Joyce, 2003). Are also subject to a variety of laws and regulations that aim to ensure public safety and minimize environmental impacts. (Bennett, 2003). Compared to most other industries, construction projects involve relatively intensive labour use, and consume large amount of materials and physical tools. (Jekale, 2004).

Construction is an industry that has a great impact on the economy of all countries. Almost, it is very difficult to think of any development activity that does not involve construction. All infrastructure facilities needed for development such as road , telecom ,electricity , power projects , and socioeconomic facilities such as school , hospitals ,factories etc.; and the very neighbourhood we live in are all products of the construction industry (Abadir Yimam, 2011).

The role the construction industry plays in developing countries is quite significant. For example, in many developing countries, major construction activities account for about 80% of the total capital asset, 10 % of their GDP and; more than 50 % of the wealth invested in fixed assets. (Jekale, 2004) . Despite the industry's significant contribution, its development and efficiency is relatively low compared to other industries. "High project performance and project success are not commonplace in the construction industry, especially those in developing countries" (Long et al, 2004). Moreover, in many countries, the productivity of the construction industry is one of the lowest and; its degree of high technology utilization is not comparable with that of other industries. Further, the overall management in the industry is at a low level. "The Construction industry's large scale scope and its use of huge capital is in sharp contrast with the low benefit (profit) and inferior management" (Guangshe, *et al*, 2008).

The management of construction projects has much in common with the management of similar types of projects in other industries (Hendrickson). “Much of the content of *PMBOK\_ Guide* is also directly applicable to construction projects.” PMI, (2007). Even though, management of construction project is similar to management of other kind of project in many respects, it has also some peculiarities that differentiate it from managing other kind of projects such as software development. For example, unlike the management of many other projects, the project managers in construction project are often changed from one phase to another or some may specialize in only one phase of the construction project (PMI, 2007).

In acknowledgment of the difference, PMI has published a supplemental guide for managing construction project (The construction extension - Guide to Project Management body of Knowledge-3rd edition). In this guide, four additional knowledge the management of construction projects has much in common with the management of similar types of projects in other industries (Hendrickson). “Much of the content of *PMBOK\_ Guide* is also directly applicable to construction projects.” PMI, (2007). Even though, management of construction project is similar to management of other kind of project in many respects, it has also some peculiarities that differentiate it from managing other kind of projects such as software development. For example, unlike the management of many other projects, the project managers in construction project are often changed from one phase to another or some may specialize in only one phase of the construction project. According to PMI, (2007). in acknowledgment of the difference, PMI has published a supplemental guide for managing construction project (The construction extension - Guide to Project Management body of Knowledge-3rd edition). In this guide, four additional knowledge areas of Project Safety Management, Project Environmental Management, Project Financial Management, and Project Claim Management are included.

According to (Chartered Institute of Building , 2002), the major task of project management in construction is primarily to coordinate professionals in the project team to enable them to make their best possible contribution to the project efficiently. In addition to knowledge of project management and general Management, managing construction projects requires an understanding of the design and construction process (Hendrickson). The ability to communicate and the ability to manage team are also very important for successful management of construction projects (Chen, Partington, & Qiang, 2009).

Hendrickson has summarized the functions of project management in construction as:

1. Specifying project objectives and plans including defining the scope, preparing the budget and schedule, setting performance requirements, and selecting project participants.
2. Maximization of efficient resource utilization through procurement of labour, materials and equipment according to the prescribed schedule and plan.
3. Implementation of various operations through proper coordination and control of planning, design, estimating, contracting and construction in the entire process.
4. Development of effective communications and mechanisms for resolving conflicts among the various participants.

### **2.1.2.2 Construction Project Management Practice in Ethiopia**

According to Tadesse, et al, (2016), the research demonstrated that the level of Ethiopian construction project management practice in terms of improving the general project management procedures, project management functions, tools and techniques to be unsatisfactory. Project Management is designed to achieve a successful outcome of the projects and argues that if not properly practiced it may convey a differing result. Particularly the level of practice in terms of safety, risk and time management was found to be very low. The construction industry of Ethiopia, in general, suffers from poor project management and control with performance constraints including inadequate capacity of local contractors and consultants, inadequate public sector delivery capacity, corruption, erratic work opportunities, use of outdated technologies and practices, lack of effective supporting policies and poor state of the economy (Hailemeskel, 2013). Many factors attribute to failure of any construction project which is mainly related to the problems and failure in performance. Hence, the construction industry performance problems in developing economies can be classified into three categories: problems of shortages or inadequacies in industry infrastructure (mainly supply of resources), problems caused by clients and consultants and problems caused by contractor incompetency/inadequacies (Shaban, 2008).

“A detailed literature on the management practices of construction projects in Ethiopia is difficult to find. As a result research works in such an industry is difficult or mystified” Jekale, (2004). Despite this, this research has tried to summarize existing literature on the area. Like any developing country the construction industry plays major role and contributes highly to the development of the economy of the country. Next to agriculture, the industry provides one of the largest employment opportunities.

Developing countries like Ethiopia , spend substantial amount of their budgets in infrastructure development that involve significant construction works in projects such as construction of roads, buildings, water works, telecom civil works, etc. This is also the case in Ethiopia. For example, the Ethiopian government has spent about 50% of its total budget in fiscal year 2007/2008 for capital projects out of which road construction accounts about 33 %. Ministry of Finance and Economic Development (MoFED), (2008). From project expenses in other sectors, the construction part accounts for the major part as most socio economic projects such as school and healthcare involve significant construction component. Even though significantly large amount of money is being poured in to infrastructure development, the infrastructure of the country is still considered to be very poor, even when seen by the standards of the Sub-Saharan countries. For example, the country's passengers and freight traffic, road density is one of the lowest compared to other Sub-Saharan Countries. From the huge hydropower potential the country has, only less than 10% of it has been put in use (Ministry of Finance and Economic Development (MoFED), 2006). These all mean, enormous volume of infrastructure (construction) works is coming to the industry. Nevertheless, the construction industry of the country looks unprepared for these huge volumes of works to come. The industry is still in the infancy stage, growing unfortunately, slowly both technically and financially.

Like the industry in other developing countries, the construction industry in Ethiopia is plagued by many problems .The description of the current state of the industry given in various studies is summarized here under:

Generally the current state of the industry is characterized by:

- Scarce construction resource, most notably cement
- Traditional way of project management
- Shortage of Skilled man power specially contractors and consultants



- Limited experience and participation of the private sector in large construction project.
- Insufficient and ineffective labour-based construction technology.
- Inadequate and inappropriate project organization structures, which lead to problems of authority, responsibility, communication and coordination, etc.

Generally speaking, according to Jekale, (2004), there is not enough construction and management capacity in the country. The practitioners (in Ethiopia) are less experienced in project management. The management of construction project is highly influenced by the utilization of scarce financial and physical resource with controlling activities limited to cost and time monitoring dimensions only. Contractors cannot properly administer contract, most of them are not properly trained to prepare cost and schedule reports, quality records, safety reports, change order records, claims records, progress reports, payment requisition, etc. Most local contractors even don't have claim management knowledge or are not interested to pursue legitimate claim for fear of damaging working relationships and their reputation in the industry as they will be dealing usually with few public institutions (Dessa, 2003).

Many studies in the area have indicated the need to improve the capacity of contractors in areas such as financial management, project estimating and costing, total quality management, change management ,claim management, business planning , personnel and general management skill, etc which almost all can be included under the 12 PMI's knowledge areas of construction project management. This shows that improving the project management capacity of contractors can significantly improve the current status of the construction industry in the country.

The need for the improvement and development initiative has already been acknowledged by the government of Ethiopian, and University Capacity Building Program (UCBP) has been initiated with the assistance of the German government to support the capacity of local contractors by providing managerial and entrepreneurial training and coaching that prepare contractors for ISO 9001 certification. Contractors under the program were given training in areas such as modern contract and project management, modern financial and construction equipment management systems, general management and leadership, marketing, project and quality management.

### **2.1.3 The quadruple constraints of construction Project management**

All projects are carried out under certain constraints. A constraint in project management is any restriction that defines project limitation. Haugney, (2012). In many literatures scholars associate only cost, time and scope identified as triple constraint. On the other hands, others strongly argue that performance and quality are closely associated with the triple constraints (Heagney, 2012; Oren, 2009 & Lewis, 2007). The triple constraints, performance, and quality are typically referred to as project constraints (Williams, 2011).

The project constraints affect each other in a fashion similar to the triple constraints (Heagney, 2012; Lewis, 2007; Oren, 2009). More recently, the triple constraint has given way to quadruple constraint, cost, time, scope and quality with customer expectations as a centre; that means project must delivered within cost, on time, must meet the agreed scope and required quality. Haugney, (2012). Project managers may succeed at addressing the triple constraints, but fail to address performance and quality. As a result, performance and quality may suffer unless efforts are made to address performance and quality as well as the triple constraints. Each element of cost, quality, performance, time, and scope is a function of the other and a change to one will affect the other and the entire project Heagney, (2012).

Each of the project constraints can be difficult to manage separately Lewis, (2007). Managing the project constraints and their relationship simultaneously is even more complex and difficult (Lewis, 2007 & Williams, 2011). Increased focus on one or more project constraints can lead to reduced focus on one or more of the other project constraints (Lewis, 2007). Larger projects usually have a subject matter expert dedicated to providing focused oversight to each project constraint (Williams, 2011). In general each constraint need appropriate focus without reducing focus on the other constraint. If the project is larger and complex assigning experts for each constraint is recommendable; (Heagney, 2012; Oren, 2009 & Lewis, 2007). The triple constraints, performance, and quality are typically referred to as project constraints Williams (2011). The project constraints affect each other in a fashion similar to the triple constraints (Heagney, 2012; Lewis, 2007 & Oren, 2009). More recently, the triple constraint has given way to quadruple constraint, cost, time, scope and quality with customer expectations as a centre; that means project must delivered within cost, on time, must meet the agreed scope and required

quality. (Haughey, 2011). Project managers may succeed at addressing the triple constraints, but fail to address performance and quality. As a result, performance and quality may suffer unless efforts are made to address performance and quality as well as the triple constraints. Each element of cost, quality, performance, time, and scope is a function of the other and a change to one will affect the other and the entire project (Heagney, 2012).



Figure 2.1 Quadruple Constraints of Construction Project Management

### **2.1.3.1 Time management**

Time is an extremely important issue in construction. Together with cost and quality, it is a primary objective of project management, and a major criterion by which the success of a project is judged (Charmer,1990).Time covers the structuring, sequencing, duration, estimating and scheduling of activities and/or work packages, including the assignment of resources to activities, establishing project deadlines and monitoring and controlling their timely execution. These aspects should be displayed on a critical path diagram (IPMA, 2010)

According to PMI (2013) Project Time Management includes the processes required to manage the timely completion of the project. Project Time Management processes comprises;

- **Plan Schedule Management:** The process of establishing the policies, procedures, and documentation for planning, developing, managing, executing, and controlling the project schedule. The key benefit of this process is that it provides guidance and direction on how the project schedule will be managed throughout the project. The inputs, tools and techniques, and outputs of this process are depicted.
- **Define Activities:-**The process of identifying and documenting the specific actions to be performed to produce the project deliverables.
- **Sequence Activities:-**The process of identifying and documenting relationships among the project activities:-
- **Estimate Activity Resources:-**The process of estimating the type and quantities of material, human resources, equipment, or supplies required performing each activity
- **Estimate Activity Durations:-**The process of estimating the number of work period needed to complete individual activities with estimated resources.
- **Develop Schedule:-**The process of analyzing activity sequences, durations, resource requirements, and schedule constraints to create the project schedule model.
- **Control Schedule:-**The process of monitoring the status of project activities to update project progress and manage changes to the schedule baseline to achieve the plan.

### 2.1.3.2 Cost management

Cost management is the act of managing all or part of the cost of planning, design and construction projects process so as to remain within the owner's budget (CMAA, 2001); from this definition one can simply understand that; Project cost management should consider the owners requirements for managing costs. Different stakeholders will measure project costs in different ways and at different times. Project cost management is primarily concerned with the cost of the resources needed to complete project activities. Project Cost Management should also consider the effect of project decisions on the subsequent recurring cost of using, maintaining, and supporting the product, service, or result of the project.

The cost management planning effort occurs early in project planning and sets the framework for each of the cost management processes so that performance of the processes will be efficient and

coordinated. PMI (2013) Project cost management estimates the cost of each work package, the sub-systems and the whole project and establishes the budget for the overall project. It also involves comparing planned versus actual costs incurred at various points in the project and estimating the remaining cost, as well as updating the final cost estimate. The cost of the deliverables should be measurable and calculable.

The cost of any change should be calculated, agreed and documented. Project costs should include an appropriate allocation for overhead items such as office services and support. The project budget should include a sum of money that is held in reserve to fund uncertainties such as contingencies, claims, or cost over-runs. Funds may also be made available to cover favourable outcomes such as successfully managing risks or realizing opportunities (IPMA, 2006)

### **2.1.3.3 Scop managemnet**

According to IPMA (2010); the project scope defines the boundaries of a project. If the boundaries of the project are not properly defined and if additions to and deletions from the project, programme or portfolio are not properly documented, then the situation tends to get out of control. From the point of view of the interested parties the scope embraces the totality of all the deliverables, which are included in a project. The solutions within the scope gradually evolve from the initial concept of the project to the final deliverables, through the documents that define those deliverables in more and more detail as they are developed. From the view of the interested parties the scope and deliverables represents the total content (functional, technical and user interface characteristics) included in the project. The project should deliver all that is described within its scope. In some types of project the scope also includes the geographical and users environment

where new systems or changes to existing systems delivered by the project will be operated. In defining the scope of a project it is also important to specify what is out of its scope. According to IPMA (2010); the project scope defines the boundaries of a project. If the boundaries of the project are not properly defined and if additions to and deletions from the project, programme or portfolio are not properly documented, then the situation tends to get out of control.

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Project Scope Management includes the following key components to be addressed during the entire process of the project from the inception to completion.

- **Plan Scope Management:** - The process of creating a scope management plan that documents shows how the project scope will be defined, validated, and controlled.
- **Collect Requirement:-**The process of determining, documenting, and managing stakeholder needs and requirements to meet project objectives.
- **Define Scope:-**The process of developing a detailed description of the project and product.
- **Create WBS:-**The process of subdividing project deliverables and project work into smaller, more manageable components.
- **Validate Scope:** - The process of formalizing acceptance of the completed project deliverables.
- **Control Scope:-**The process of monitoring the status of the project product and managing changes to the scope baseline (PMI, 2013)

### 2.1.3.3 Quality management

According to PMI,(2013); project quality management includes the processes and activities of the performing organization that determine quality policies, objectives, and responsibilities so that the project will satisfy the needs for which it was undertaken. Project quality management uses policies and procedures to implement, within the project's context, the organization's quality management system and, as appropriate, it supports continuous process improvement activities as undertaken on behalf of quality improvement. It is also the performing organization. Project quality management works to ensure that the project requirements, including product requirements, are met and validated.

Quality management is the act of overseeing and tasks needed to maintain a desired level of excellence. This includes the determination of quality policy, creating and implementing quality planning and assurance, and quality control and quality improvement.

Project quality management processes, include:

**Plan Quality Management:-**The process of identifying quality requirements and/or standards for the project and its deliverables and documenting how the project will demonstrate compliance with quality requirements.

**Perform Quality Assurance:-**The process of auditing the quality requirements and the results from quality control measurements to ensure that appropriate quality standards and operational definitions are used.

**Control Quality:-**The process of monitoring and recording results of executing the quality activities to assess performance and recommend necessary changes (PMI, 2007).

Project Quality Management addresses the management of the project and the deliverables of the project. It applies to all projects, regardless of the nature of their deliverables. Quality measures and techniques are specific to the type of deliverables being produced by the project. In either case, failure to meet the quality requirements can have serious, negative consequences for any or all of the project's stakeholders (PMI, 2013).

### **2.1.4 Impact of Design -Build Delivery System on a project performance**

According to Seyoum (2020) this type of project delivery system has an advantage for innovation and constructability and early engagement for both design consultant and trade contractors simultaneously. Following request for qualification or request for proposal, there is a chance for trade contractors to be engaged at early stage and there is a possibility to carry out the design task as well as the construction activities concurrently. Apart from DBB delivery system, based on the survey study of state of DOT's, (DBIA, 2016), revealed that 91% of highway projects, 65% of bridges and 9% of Rail roads in the state are procured using Design Build Delivery system. The Design-Build Institute of America (DBIA, 2016), compiled many articles related to design build practice and project specific cases studies conducted by researchers. Taking the findings of the publications it showed that DB project delivery system is cheaper than DBB delivery system by an average of 6.7% and has less cost growth up to an average of 20%. DBIA(2016), also taking transportation specific studies conducted by ((FDOT,2014), (Shrestha, 2012), and (FHWA, 2006)) revealed that DB project delivery system is faster than DBB by an average of 53% and cost effective by an average of 3.75%.

Studies conducted under DBIA (2016) taking 60 commercial projects procured through DBB and DB systems found that the cost growth (the increase of total project cost based on the initial contract sum) for DBB projects is significantly higher than DB projects. The study has indicated also that the mean values of the schedule growth for DBB is higher than DB projects with DBB project 38% and DB projects 13% growth consecutively.

"The greatest motivation and realized benefit to a contracting agency of using design build ... is the ability to reduce the overall duration of the project development process by eliminating a second procurement process for the construction contract, reducing the potential for design errors and omissions, and allowing for more concurrent processing of design and construction activities... (FHWA 2006)



According to Design Build Institute of America (DBIA, 1994) Design Build delivery method has several advantages over the traditional method DBB. Its advantages are listed as below:

- a) Single Responsibility:** Both the design and construction are the responsibility of a single entity. Litigation issues are removed between designer and contractor allowing the owner to focus on the scope need definitions, and decision making rather than coordination between designer and contractor.
- b) Quality:** The owners' expectations and needs are documented with performance specifications and the design builder responsibilities to produce an end product in accordance to these specifications. The Design - Builder warrants that the design is free from error rather than the owner in the case of traditional system. This allows the designer builder to focus on quality and project performance.
- c) Cost Savings:** Design and construction team working and communicating as a team can better evaluate methods and material options more efficiently. Value-Engineering and constructability are utilized continuously and more effectively when design and construction team work together
- d) Time Savings:** Design and construction can be overlapped. Material/Equipment procurement and construction can begin before designs fully completed. The resulting time saving can lead to reduced project cost and early facility utilization.
- e) Early knowledge of firm cost:** Guaranteed construction cost can be known far earlier using Design-Build than other delivery systems because of the entity responsible for design is continuously able to better estimate cost based on the current project details.
- f) Impacted Risk Management:** Performance aspects of cost, schedule, quality and responsibility of risk are more appropriately balanced.

Grifith and Sidwell (1995 as cited by Seyoum Admasu, 2020) elaborated that the functional-ability of constructability issue can be well addressed by using Design -Build project delivery system details are summarized in table 2.1

Table 2.1: Summary of constructability

Source: adopted from a thesis study by Seyoum Admasu

Constructability: Functional Aims	Design and Build Functional Ability
✓ Simplified contractual arrangements	✓ The contract is b/n the client and the contractor, with total responsibility given to the contractor
✓ Integrated design and construction	<ul style="list-style-type: none"> <li>✓ Promotes an integrated design&amp; construction team in the firm of the main contractor.</li> <li>✓ Encourage professionals to work towards the real interest of the client</li> </ul>
✓ Improve communication	✓ Client-contractor single link & integration of design and construction improve communication b/n building or engineering team members
✓ Increased operational efficiency	✓ Client knows at any time who to contact, i.e. the contractor. The contractor can respond quickly to client's needs.
✓ Reduced project duration	✓ Significant savings in project time are possible through overlapping design and construction aspects. Pre-construction procurement time greatly reduced and earlier start on site is possible.
✓ Reduced cost	✓ Client knows within a reasonable degree of accuracy, the total financial commitment before commencing work on site. More rapid procurement also makes cost savings.
✓ Increased performance	✓ Detailed brief (employer's requirements and contractor's proposals set out the detailed specification for design workmanship, materials and performance.
✓ Minimum project changes	✓ Detailed brief reduces likelihood of project changes. If variations occur contractor can respond quickly and directly to client

## **2.2 Empirical Review**

### **2.2.1 A case study on the Quadruple Constraints of Construction Project Management: in the case of Nifas Silk Lafto Koye Fetche Condominium site**

Gathering “facts,” whatever they may be, drives the search for empirical evidence (Holosko, 2006). Authors of empirical literature are expected to report the facts as observed, whether or not these facts support the investigators’ original hypotheses. Empirical review drives conclusion based on experience which can be directly visualized or indirectly observed with the help of experiments. Unlike the theoretical review the idea of empirical review is to present the findings of a research paper that are quantifiable or described in order to understand the output.

As researcher Nigatu Abera (2017) mentioned in his study the project was commenced on January 2013 and the construction agreements were signed between 140 contractors and Nifas Silk Lafto Sub city Branch Project Office. In this research it was mentioned that 93 respondents were involved in the questionnaires for data collection and 75 questionnaires were distributed for those who were involved in condominium housing projects, among them 60 questionnaires were received from professionals. Formal and informal discussions were conducted with selected Professionals, Coordinator and Resident Engineers from consultant firm. The questionnaires and site observations were on construction site and project offices that were carried out on condominium housing project.

### **2.2.2 Project Management Practice of the empirical study**

According to Nigatu Abera (2017) case study the construction project management practices were assessed by analyzing the data collected through direct site observation, interviews and questionnaires to involved professionals in the project. The findings are summarized below in table 2.2 by reviewing the study paper by Nigatu Abera about CPM on the quadruple constraints in the case of Koye Fetche condominium construction project site.

Table 2.2 Summary of the empirical study

Project management practice	Reasons for poor management	Percentages
Performance	<ul style="list-style-type: none"> <li>• Lack of project management practice of the construction / consulting companies</li> <li>• Poor Resources Management /Capital, Material, Equipment etc</li> <li>• Lack of competent and experienced professionals in the field</li> <li>• Poor organizational setup of construction companies</li> <li>• Absence of clear regulations and Guidelines</li> </ul>	<ul style="list-style-type: none"> <li>• 45</li> <li>• 22</li> <li>• 13</li> <li>• 12</li> <li>• 8</li> </ul>
Time management practice	<ul style="list-style-type: none"> <li>• Lack of clear procedures</li> <li>• Lack of planning skill &amp; software application</li> <li>• poor project managers</li> <li>• Limited mg't experience of technical skill Org.</li> </ul>	<ul style="list-style-type: none"> <li>• 45</li> <li>• 35</li> <li>• 15</li> <li>• 5</li> </ul>
Scope management practice	<ul style="list-style-type: none"> <li>• Not Clearly defined scope                             <ul style="list-style-type: none"> <li>✓ Strongly agreed</li> <li>✓ Agreed</li> <li>✓ Not agreed</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• 15</li> <li>• 10</li> <li>• 75</li> </ul>
Cost management practice	<ul style="list-style-type: none"> <li>• Reasons for cost over run                             <ul style="list-style-type: none"> <li>✓ Poor cost planning management</li> <li>✓ Poor budge and cost projection</li> <li>✓ Unplanned extended time</li> <li>✓ Poor cost controlling system</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• 38.89</li> </ul>

Quality management practice	<ul style="list-style-type: none"> <li>• Reasons for unsatisfactory project quality <ul style="list-style-type: none"> <li>✓ Materials production quality management process are unsecured to insure quality requirements</li> <li>✓ Negligence of supervision, on the quality requirements on the constructions and on the material production sites</li> <li>✓ poor competency of the professionals assigned from the consultants, contractors side</li> <li>✓ Poor Controlling mechanism to control the implementation of quality policy was unsatisfactory.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• 49</li> <li>• 37</li> <li>• 9</li> <li>• 5</li> </ul>
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As table 2.2 shows the researcher assessed the practice of Construction Project Management in AAIHDP (Addis Ababa Integrated Housing Development Project) of condominium houses in Koye Feche site regarding the quadruple constraints; Time, cost, Scope and Quality and identify factors affecting CPM practices. The study paper conducted in line with research questions such as; how does the project be managed? What are the gaps and the effect? In the study critically assessed the CPM regarding quadruple constraints by collecting data's based on the research objectives and question using data collection instruments. The collected data thoroughly analyzed and a general conclusion and recommendations are provided by the researcher as followed:

**Conclusion:** The findings of the researcher shows the construction project management practice of AAIHDP lacks some efficiency that requires improvements with regard to quadruple constraint such as Project time management, Project scope management, Project cost management and Project quality management. As a result the project suffered by 8 folds time exertion and 38.8% cost overrun to this the project cost rose to about 1.2 Billion birr and built with poor quality materials.

**Recommendation:** since the project is a mega project professionals and technologies should be applied; Prior to the commencement the project office must have a well-planned project charter

with defined scope, cost estimation, defined schedule and quality material suggestion followed by implementation with routine monitoring and evaluation by the construction project management.

A critical path scheduling method was recommended at Pre-Bid stage involving the whole project team including subcontractors and materials suppliers. Proper cost management plan shall be prepared, the cost shall be estimated in detail, determine the budget and seriously control the cost not only the direct cost but also the indirect cost or recurrent cost by professional in collaboration with Consultant. The study paper also recommended the revision for the quality management related policies, procedures and guide lines .High level quality control mechanism shall be implemented. Particularly the quality test shall not only depend on the sample test.

### **2.3 Conceptual framework**

There are constraints in every working environment. However, there can be situations that we are unaware of the existence of the constraints, or, we tend to put more emphasis on the project goals. Although constraints have been discussed in much of the management literature, there is little detailed study on constraints in construction working environment. The construction working environment involves multi-party participation. Needs and constraints in a multi-party working situation bring complications in project management. These can further develop into conflicts and disputes, which bring cost consequences, direct and indirect, to clients and contractors (Yates, 2002). The project team members have to meet client's needs on one hand and to overcome constraints on the other hand. With the limited literature for the constraints in the construction working environment, it is important to identify the potential constraints in the construction project, which will help to decrease the unnecessary wastage and loss of both money and time because of inadequate planning. Controlling the constraints is thus a pre-condition for high performance of the project.

The identification of the constraints helps project managers not only understand the characteristics of the constraints, but also predict the time and stage that the constraints may be encountered. Constraint is defined as a constraining condition, agency, or force that limits the systems' performance in a given context/environment (Mayer, Painter and Lingineni 1995, Whelton, Penneanen and Ballard 2004). Every production system will have at least one constraint

(Chua, Shen and Bok, 2003). Constraint describes the relationships between objects and processes (Whelton, Penneanen and Ballard 2004; Tam, 2006). It is whatever impedes progress toward an objective or a goal (Mcmullen, 1998).

The management of construction projects requires knowledge of modern management as well as an understanding of the design and construction process. Construction projects have a specific set of objectives and constraints such as a required time frame for completion. While the relevant technology, institutional arrangements or processes will differ, the management of such projects has much in common with the management of similar types of projects in other specialty or technology domains such as aerospace, pharmaceutical and energy developments, (Donald, 1984).

The role of construction project management on the quadruples of project constraints framework represented schematically in Figure 2.2 Hence, the representation in Figure 2.2 reflects only the sources from which the project management framework evolves. Specifically, project management in construction encompasses a set of objectives which may be accomplished by implementing a series of operations subject to resource constraints other than the nine project knowledge areas. There are potential conflicts between the stated objectives with regard to scope, cost, time and quality, and the constraints imposed on human material and financial resources. These conflicts should be resolved at the onset of a project by making the necessary trade-offs or creating new alternatives. Subsequently, the functions of project management for construction generally include the following:

1. Specification of project objectives and plans including delineation of scope, budgeting, scheduling, setting performance requirements, and selecting project participants.
2. Maximization of efficient resource utilization through procurement of labor, materials and equipment according to the prescribed schedule and plan.
3. Implementation of various operations through proper coordination and control of planning, design, estimating, contracting and construction in the entire process.
4. Development of effective communications and mechanisms for resolving conflicts among the various participant

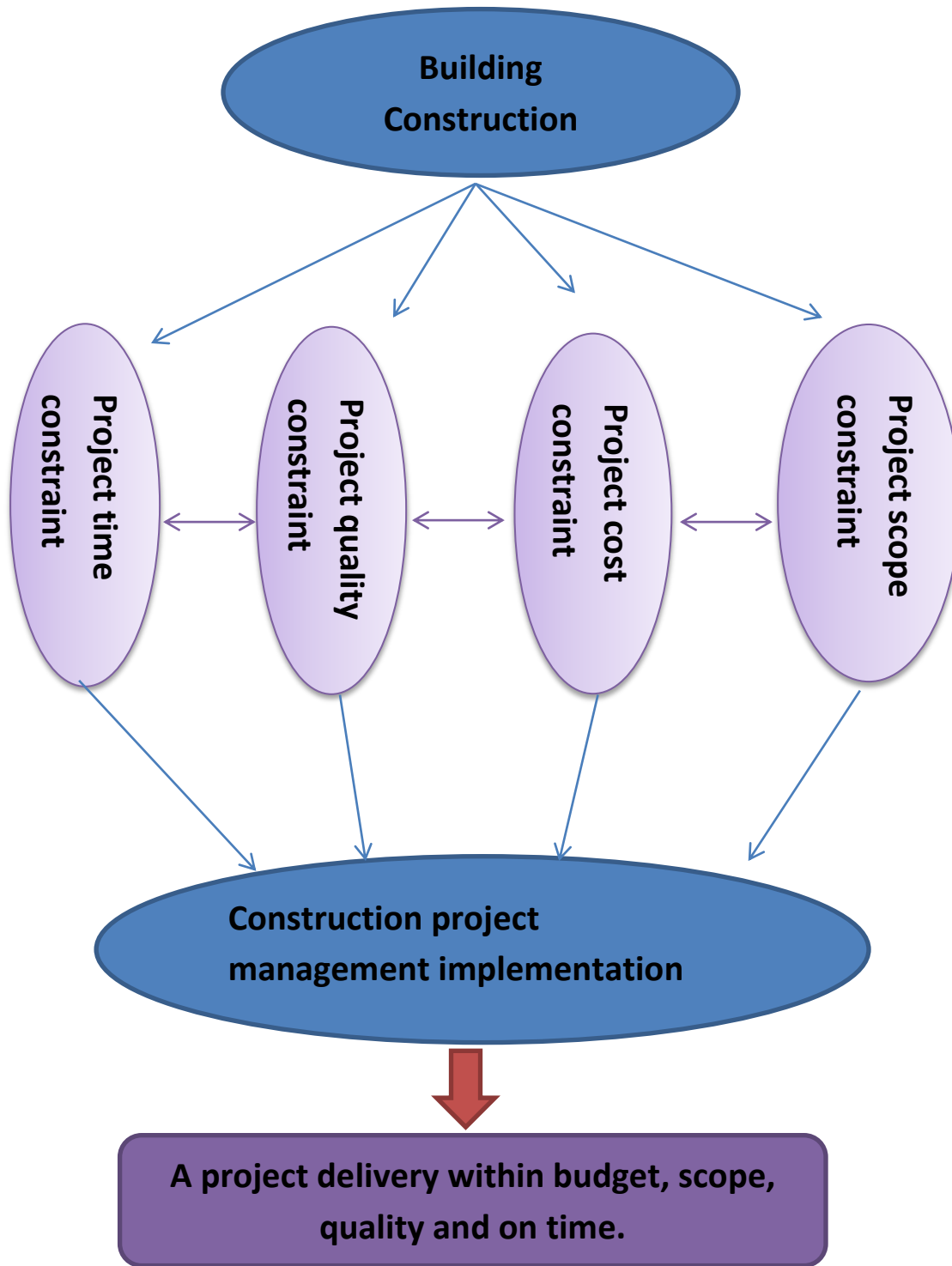


Fig 2.1: Conceptual framework

Source: own, 2021



## CHAPTER THREE

### 3. RESEARCH METHODOLOGY

#### 3.1 Research Design and Approach

Kumar (2005) described a research design as a procedural plan that is adopted by the researcher to answer questions validly, objectively, accurately and economically. According to Kumar (2005), the following two objectives need to be fulfilled in a research design:

1. To conceptualize an operational plan and to undertake various procedures and tasks required to complete the study.
2. To ensure that these procedures are adequate to obtain answers to the research questions.

Research approaches can be broadly categorized as either quantitative or qualitative. Quantitative research is objective in nature (Johnson and Harris, 2002). It usually requires respondents to record their attitudes, opinions, or beliefs on different-point scale measured with numbers (Krosnick and presser, 2010). Three main approaches were suggested to collect the data: asking questions of respondents by means of questionnaires and interviews, undertaking experiments and performing extensive reviews of the relevant literature (Johnson and Harris, 2002). On the other hand, qualitative research is subjective in nature (Naoum, 2007). It relies on observing people in their own environment, communicating with them in their own language, and on their terms. In addition, a research study using both qualitative and quantitative approaches can be called a “mixed-methods” approach (Creswell, 2009).

The purpose of this research is to assess the project management practices and project constraints of the organization under study. Descriptive research design is applied to describe what the current project management practice looks like in the study organization. The researcher has chosen this design because the major purpose of descriptive research is description of the state of affairs as it exists at present and it reports what has happened or what is happening (Kothari

1990). So as justified above for such type of studies, the recommended research design is descriptive.

Therefore for this descriptive research design both qualitative and quantitative research approaches were employed; quantitative aspects of this research are concerned with the assessment of project management practices with respect to project quadruple constraints using different points of scale measures with numbers and the qualitative aspect concerned with investigation on project management problems of construction projects. These are featured with qualitative elements.

## **3.2 Data Type and Source**

### **3.2.1 Data type**

**Primary Data:** Data that has been collected from first-hand-experience is known as primary data. Primary data has not been published yet and is more reliable, authentic and objective. Primary data has not been changed or altered by human beings; therefore its validity is greater than secondary data.

**Importance of Primary Data:** In statistical surveys it is necessary to get information from primary sources and work on primary data. For example, the statistical records of female population in a country cannot be based on newspaper, magazine and other printed sources. A research can be conducted without secondary data but a research based on only secondary data is least reliable and may have biases because secondary data has already been manipulated by human beings. One of such sources is old and secondly they contain limited information as well as they can be misleading and biased.

For this specific study primary data is developed to elicit information to address the research objectives and assess the performance of contractors and construction project managers about the current status of the building construction in terms of cost, time, scope and quality. The weekly and quarterly project performance reports were very useful for the assessment of the project in comparing the baseline project plan with the current status in addition to the interview conducted.

**Secondary Data:** data collected from a source that has already been published in any form is called as secondary data. The review of literature in any research is based on secondary data. For examples, Census data being used to analyse the impact of education on career choice and earning. Common sources of secondary data for social science include censuses, organizational records and data collected through qualitative methodologies or qualitative research. Secondary data is essential, since it is impossible to conduct a new survey that can adequately capture past change and/or developments. Furthermore, secondary data can also be helpful in the research design of subsequent primary research and can provide a baseline with which the collected primary data results can be compared to. Therefore, it is always wise to begin any research activity with a review of the secondary data.

For this specific study the secondary data were literature reviews and studies related to construction management implementation regarding project quadruple constraints were very helpful in understanding the concept and also to study further on.

### **3.2.2 Data source**

This research used both primary and secondary data sources:

**Sources of Primary Data:** Sources for primary data are limited and at times it becomes difficult to obtain data from primary source because of either scarcity of population or lack of cooperation. Following are some of the sources of primary data: experiments, survey, site observation, questionnaire and interview.

For this specific research the primary data source were questionnaire, an in-depth interview and discussions with the key informants namely the construction contractors CSCEC( china state construction engineering corporation), Addis Ababa institute of Technology (AAiT) consultant office and the owner(CBE project management office) and staffs of organization that work on the issues. The questionnaires were distributed through virtual for some respondents who preferred that way because of the world pandemic Covid and also in person for respondents who chose that way.

**Sources of Secondary Data:** the following are sources of secondary data Books, Records, Biographies, Newspapers, Data archives, Internet articles, Research articles by other researchers (journals) and Databases, etc.

For this specific research the secondary data sources were company official websites, organization reports, payment certificates, contract documents, published or unpublished documents from different research papers and Journals on related issues were also used.

### **3.3 Target Population and Sample size determination**

#### **3.3.1 Target population**

Target population for this study are General Managers, Project Managers/Operations Managers and the Chief Executive Officers (CEOs) of the construction firms namely construction contractors CSCEC( china state construction engineering corporation), Addis Ababa institute of Technology (AAiT) consultant office, the owner(CBE project management office) and staffs of the organizations that work on the issue. These respondents are selected assuming that the selections of key respondents shall be generally based on those who have knowledge about the problem and subject area of the research. According to Kumar, et al., (1993), indications are that their responses will minimize response error.

#### **3.3.2 Sample size determination**

In this research, after identifying a target population for the study the sample size was determined by purposive sampling method since all the respondents are selected purposely. The justification for using purposive sampling is that; first the researcher believes that pertinent information can be obtained from professionals who are in managerial level and who are involved in the case closely, secondly as stated on the study so far project management practices and managing constraints cannot involve, be understood, monitored and evaluated by every professionals involved in the project as a result random sampling or any other sampling methods are not suitable for this case study.

The sample size for each section is as shown in table 3.1:

Table 3.1 sample size

Sections Name	No. of sample Population
General contractors	69
CBE(owners) managements	15
AAiT consultation	32
	116

### 3.3.3 Sampling selection procedure

CBE H.Q building from categories of building construction projects in Addis Ababa is chosen using purposive sampling method; the researcher believed that CBE building construction is appropriate and representative project site as case study. The project is selected for three reasons. First, the site is the number one high-rise building in the city which it can represent high rises building construction. Secondly it is above 90% of completion stage that gives complete depictions of execution practices and thirdly AAiT was undertaking the project as a consultant firm under AAU which makes it very reliable and organized to show the construction project management role regarding the quadruple project constraints in order to deliver a successful project.

## 3.4 Data Collection Methods and Tools

### 3.4.1 Data Collection Methods

In this research, the researcher used Qualitative method is applied for collecting data and quantitative method is used to compute and analyze data collected from responsible bodies concerning the issue.

### 3.4.2 Data Collection Tools

This study applied different tools in data collection method namely: interviews, questionnaires direct observations and documents revisions.

**Interview:** is one of the primary data collection methods which are flexible and adaptive way of investigating underlying motives of a subject in a way that visual observation cannot (Odur, 2005). This type of interview has a predetermined set of questions (generalized form of questionnaire) with a flexible order depending on what the interviewer perceives the subject matter by looking at the respondent capability and exposure or experience.

The researcher conducted in-depth Interviews with the respective managers who have pertinent information that can help the researcher to proceed to the analysis, conclusion and recommendation part of the study.

**Direct Observation:** direct observations are when the investigator has the opportunity to observe a “case” in its natural setting within a case study. The advantage of using observational evidence is that it often provides additional information about the topic being studied. The observations can be so valuable that one may even consider taking photographs at the site.

The researcher observed the site multiple times in order to see the progress of the project and also to check the quality.

**Questionnaire Distribution:** A questionnaire is a research instrument that consists of a set of questions or other types of prompts that aims to collect information from a respondent. A research questionnaire is typically a mix of close-ended questions and open-ended questions. Open-ended questions offer the respondent the ability to elaborate on their thoughts. Research questionnaires were developed in 1838 by the Statistical Society of London. The data collected from a data collection questionnaire can be both qualitative as well as quantitative in nature.

Questionnaires were distributed to 116 participants and delivered in person and also virtually to contractors, consultants and employer of the project on site level and who have a direct involvement and believed to have a sufficient know how about this specific project.

### 3.5 The research process summary

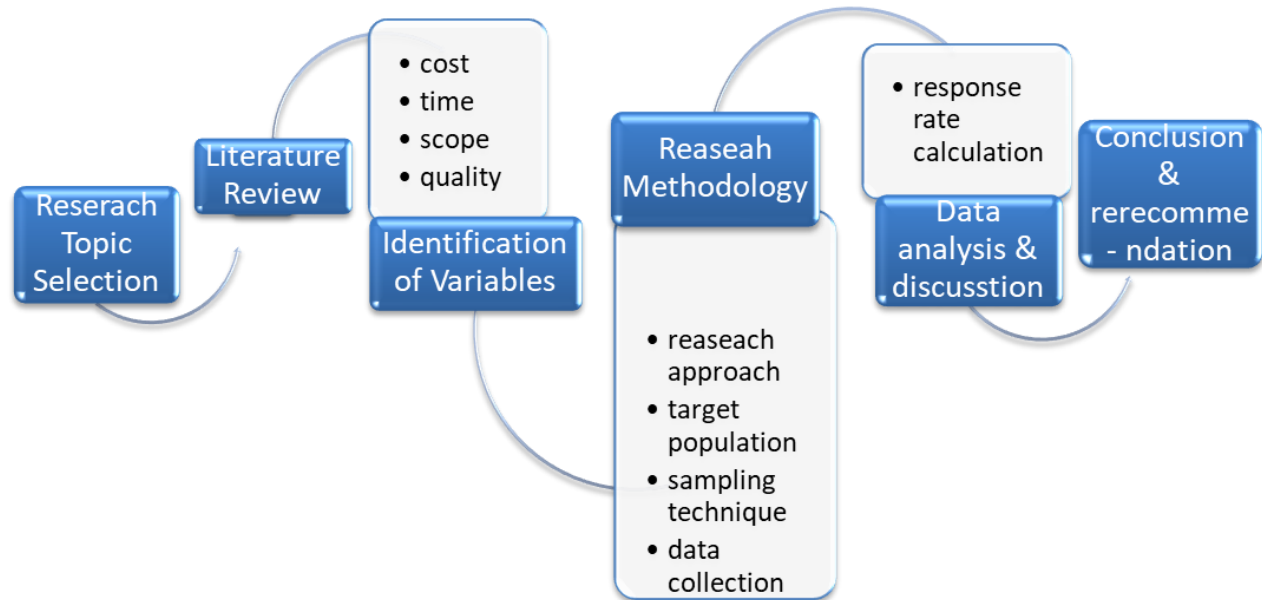


Fig 3.1 research process

### 3.6 Data Analysis and Presentation

According to Goodwin, (2004), descriptive statistics provides a summary of the main features of a set of data collected from a sample of participants. As data means raw material, it has to pass through a process of analysis and interpreted accordingly before their meaning and implications are understood. Hence, both qualitative and quantitative data analysis techniques were employed to analyze the data. After data gathering by using the five scale likert scale questionnaires; it is edited, classified and tabulated by using different techniques. Descriptive analysis is used to analyze the data that is obtained from the questionnaires and the secondary sources yielding the demographic factors such as Age, Gender and professional status. The data was processed, analyzed and interpreted using Statistical Package for the Social Sciences (SPSS) 25. The data from document analysis and likert scale questionnaire will be presented in a narrative form by

using tables, charts and graphs to represent the outcomes. Descriptive analysis will be applied. Percentage, frequency and mean were used to determinants the factors affecting the practice of project management and project scope, time, cost and quality management.

### 3.7 Validity and Reliability Test

Validity refers to the ability of the instrument to measure what it is designed to measure. Kumar, (2005) defines validity as the degree to which the researcher has measured what he set out to measure. It is the accuracy and meaningfulness of inferences which are based on research results. Validity therefore is whether an instrument is on target in measuring what is expected to measure. To check the validity of the instrument the researcher worked with the adviser as the expert and agreed whether the instrument was valid or not. The tool was also subjected to peer review to ensure its validity. The instrument was subjected to face validity, content validity test and construct validity test through testing it using the research done in the past.

In any research results, the issue of validity and reliability are important confidence measures. Cronbach's alpha is one of the most commonly accepted measurements of reliability. It measures the internal consistency of the items in a scale. It indicates that the extent to which the items in a questionnaire are related to each other Fubara and Mguni, (2005). The normal range of Cronbach's coefficient alpha value ranges between 0-1 and the higher values reflects a higher degree of internal consistency. Different authors accept different values of this test in order to achieve internal reliability, but, satisfactory value is required to be more than 0.6 for the scale to be reliable (Sekaran, 2003 as cited by Sirbel, 2012).

Table 3.2 Cronbach's Alpha reliability test

Cronbach's Alpha	N of Items
0.857	21

In the study the Cronbach's alpha coefficient was calculated. Table 3.2 shows the values of Cronbach's Alpha for the questionnaire taken as variables and are analyzed excluding some



questions. For this study, the value of Cronbach's Alpha is 0.857. This is considered high. Hence, the result ensures the reliability of the questionnaires. Therefore, it can be said that the questionnaire is adequately reliable.

### **3.8 Ethical Considerations**

Obeying ethical rules is very vital in conducting a research. The researcher received a letter of permission from St. Mary's university which enabled the researcher to carry out the research and approach the informants. Participants of the study were informed about the objectives of the study emphasizing that the data were used only for the intended academic purpose only. Careful attention was given, regarding respecting the rights, needs and values of the study subjects, and maintaining confidentiality of the data and acknowledging sources of information.

## CHAPTER FOUR

### 4. Data Presentation, Analysis and Interpretation

#### 4.1 Data presentation of respondents profile

In this research 116 respondents were involved in data collection process and questionnaires were distributed to the selected sample size populations, among them 106 questionnaires were received. Formal and informal discussions and interviews were conducted with selected managerial level respondents like project managers, general contractors and management directors. The names of the interviewee are not mentioned in order to keep the privacy of companies. In line with this; interviews, document assessment using check list, formal and informal discussion and observations on construction sites carried out for further data collection. Details of gender, age and organization information is displayed in tables in appendix C. Table 4.1 and figure 4.1 shows respondent's number, percentile and also graph of the sector as per their organization.

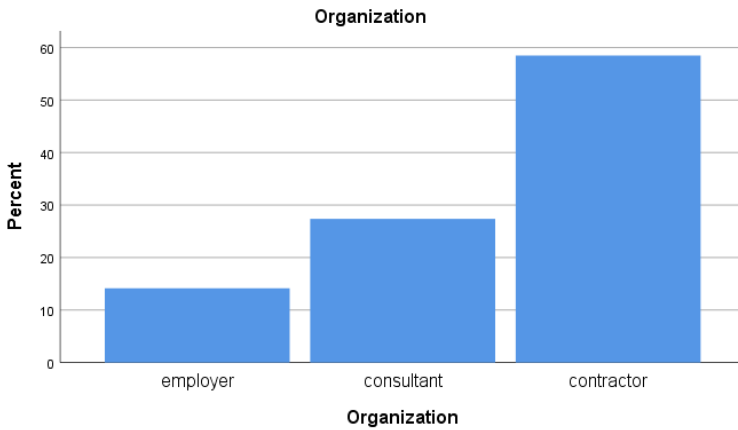
Table 4.1 Respondents information as per their organization

Type of Respondent	Number of questionnaires Distributed	Number of questionnaires Received	Percentage of participant
Employer	15	12	13.2
Contractor	69	56	57.5
Consultant	32	28	26.2
	116	106	97.2

Source: own survey, 2021

As shown in fig 4.1 the contractors are the majorities in number then the consultant firm and last but not least is the employer CBE.

Figure 4.1: The organizations information

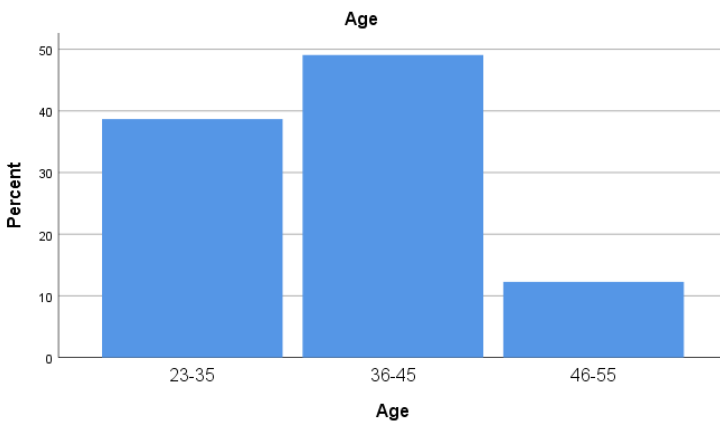


Source: own survey, 2021

#### 4.1.1 Respondents Age Information

According to the collected data 38.7% of the employees are in the age range of 23-35, 49.1% of the employees are in the age range of 36-46 and 12.4% are within the range of 46-55. As shown in fig 4.2 the composition of staffs which are directly involved in the project is dominated by employees with the age range of 36-46.

Figure 4.2: Respondents age information

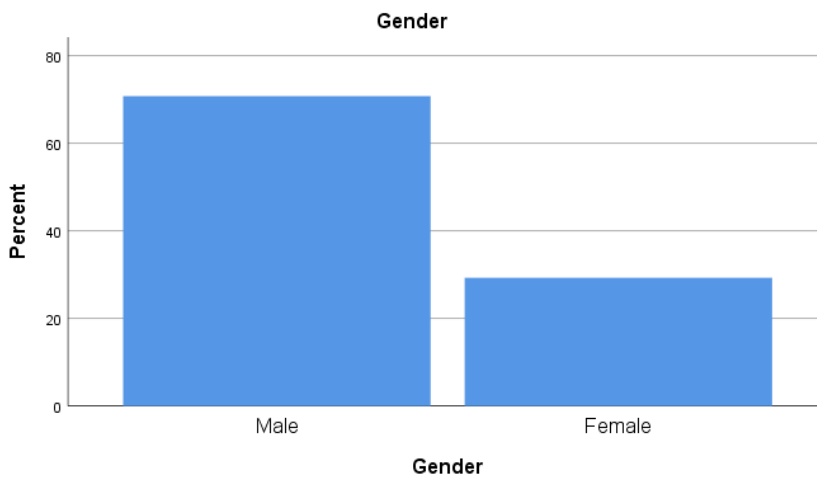


Source: own survey, 2021

### 4.1.2 Respondents Gender Information

According to the collected data and as shown in fig 4.3 the composition of staffs which are directly involved in the project are dominated by male employees with the percentage of 70.8% of the sample size and the rest 29.2% are female employees.

Figure 4.3: respondents gender information



Source: own survey, 2021

## 4.2 Analysis and Interpretation

### 4.2.1 Project management practice of the organization

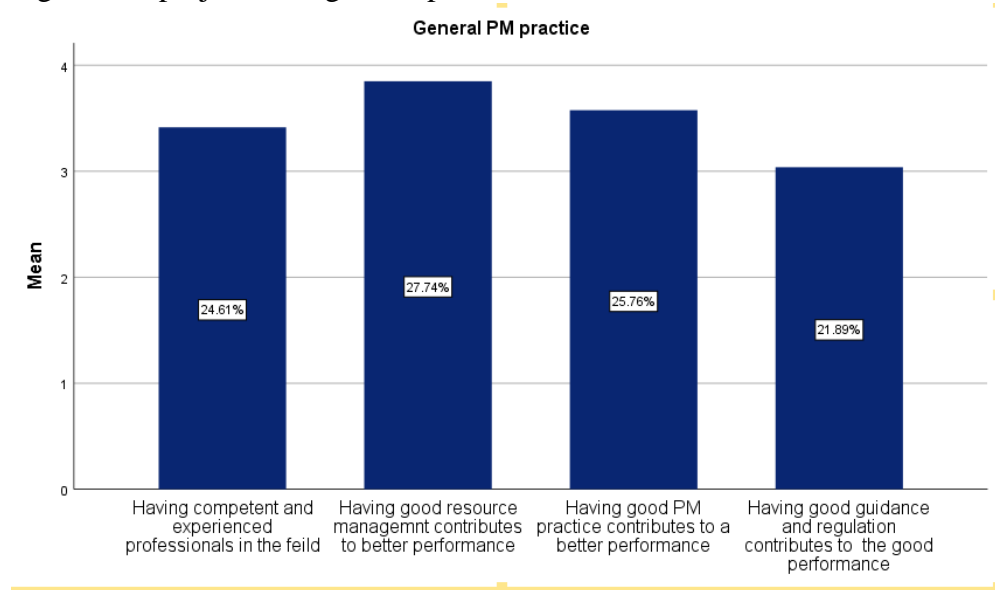
According to the data collected from the questionnaires and in person interviews with the key informants of the three sectors the researcher understood that CBE has a project office which manages constructions of the company by hiring consultants and Contractors; for this specific project the Bid was international in which the Chinese company CSCEC won the Bid with a Design-Build project delivery system and the consultant firm is from Addis Ababa University of Technology (AAiT). According to PMI a best project management practice is defines as “A best practice is an optimal way currently recognized by industry to achieve a stated goal or objective.” (PMI, 2003^ p. 171). The study assessed the practice of the project management with respect to the project performance and the quadruple constraints, point are discussed accordingly below with the help of graphs and percents of respondents.

The major determinant factors of project management practice are grouped under the following categories accordingly the responses are listed with the percent found from the questionnaire analysis;

- The respondents who said there are competent and experienced professionals in the field are 24.61%
- The respondents who said there is a proper resources Management /Capital, Material, Equipment etc. . . are 27.74%
- The respondents who said project management in the construction is well practiced are 25.76%
- The respondents who said there is a clear regulations and Guidelines on procedures are 21.89%

When words are placed in numbers it makes it easier to understand which factor is more practiced and which is not, as shown in fig 4.4 it doesn't show a vast percentage differences which in return indicates consistent service of the organization, resource management leading and having clear regulation and procedures has less value which shows there is a need to improve this factor.

Figure 4.4: project management practice

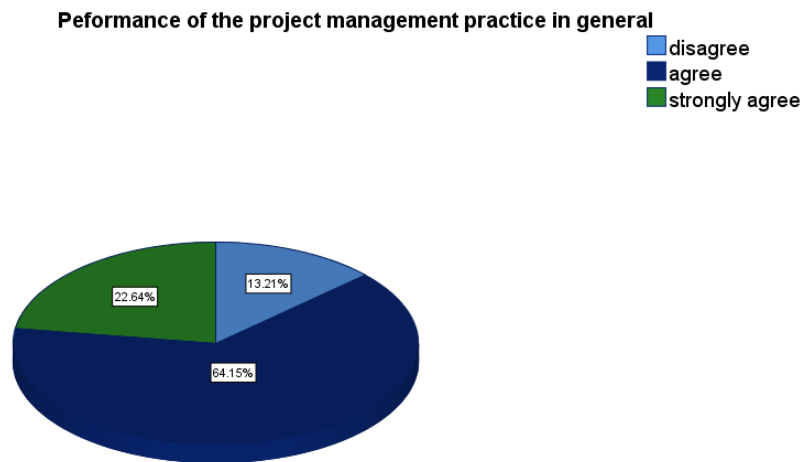


Source: own survey, 2021

#### 4.2.1.1 Project Management Performance

In the questionnaire designed for this research, respondents were first asked how they can describe the performance of construction project management in CBE building Construction Project and they were given a chance to respond based on a five point Likert scale. According to the collected data the researcher found out that 64.15% of the respondents responded strongly agreeing that the performance is good, 22.64 % agreed and 13.21% of the respondents disagreed.

Figure 4.5: Performance of project management



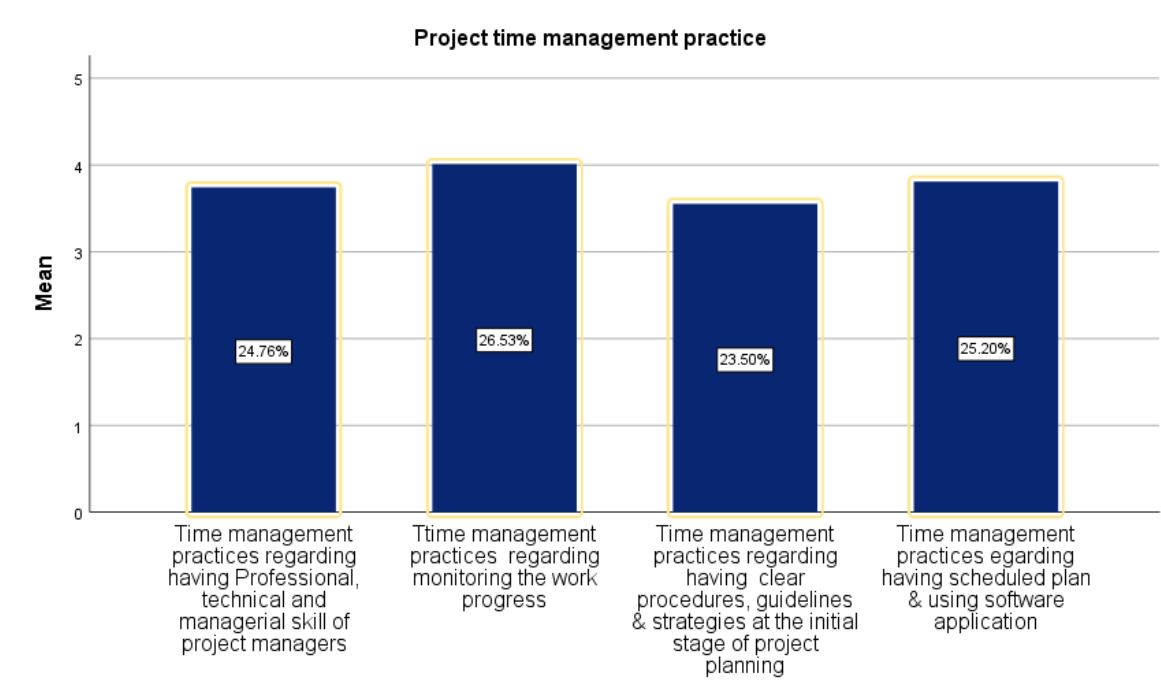
Source: own survey, 2021

#### 4.2.2 Project Time Management Practice

Time management process (schedule developing and controlling) is vital to achieve the project objective (timely completion, with the expected budget and quality). This task requires skilled project team, a competent project manager and proficient organization to manage project in effective and efficient manner which are the challenges in the construction industries. To evaluate this perspective the participants were asked ‘‘how you rate time management practices in CBE H.Q building construction projects?’’ regarding the four factors discussed below.

According to the Likert Scale questionnaire ,all respondent’s answer is categorized under the major factors affecting project time management; 23.50% of the respondents have replied that it is because of a clear procedures, guidelines& strategies at the initial stage of project planning that contributed for the good time management, 25.20 % of them believed that it is because of planning skill & software application, 24.76% of them said that it is as result of professional, technical and managerial skill of project managers and the remaining 26.53% which are the majority of the respondents said that it because of monitoring the tasks progress according to the WBS or the mile stones.

Figure 4.6: Time management practice



**Source: own survey, 2021**

In the case of the selected site regarding time management the principal investigator has put the gathered information through his observation and informal interview as follow;

In a DB project delivery system the contractor company is responsible for designing the project, constructing the building and delivering the project with a key, the major delay causes are caused by the world pandemic Covid-19 which mainly affected the contractor side and also the project as a whole.

#### **I. Delay caused by Covid:-**

- Delay on material manufacturing and importing by the contractors; since the contractor is china based company every material input for the construction is imported as per the project contract however Covid was a huge delay factor because china was in lock down and factories were also shut down.
- Delay caused by Covid lock down period by government both in Ethiopia and china
- Delay caused by Covid lock down in terms employee sickness



even after the project started

- Delay caused by Covid lock down regarding foreign trade

## II. Delay caused by employer scope change

- Even if this delay is not added on the delay days because it is an approved time extension it was one of the major factors for the project delay as whole
- The scope change affected material manufacturing time

## III. Delay caused by other factors

- Experts on specific subject matters and new technologies came from china because of lack of experts in our country that also added transportation time every now and then.
- Employer's not having a clear regulation and guidelines on decision making.

## IV. Delay caused by language

- Every meeting takes twice time compared to normal meeting hours because of translation this has an impact on the working hours as whole at the end of the project.

Construction Consultant for the selected site has given their justification of time extension as follow on table 4.2:

Table 4.2: Justification for time extension

No	Description	Time Given	Delays(days)
1	Original start and finish period	<b>July 27, 2015 - July 23, 2019</b> + 365 days defects liability period	635 days
2	(Approved Time Extension not a delay) Revised Completion date (Revision No. I)	6 months (180 days), Additional Time for Supplementary Contract caused by the scope change (For the new building)  <b>January 21, 2020</b>	

3	Revised Completion date (Revision No. II)	November 30, 2020 (Extension for a delay amicably settled)	
4	Revised Completion date (Revision No. III)	May 31, 2021 (Extension for a delay amicably settled)	

Source: AAiT, 2021

### 4.2.3 Project scope management practice

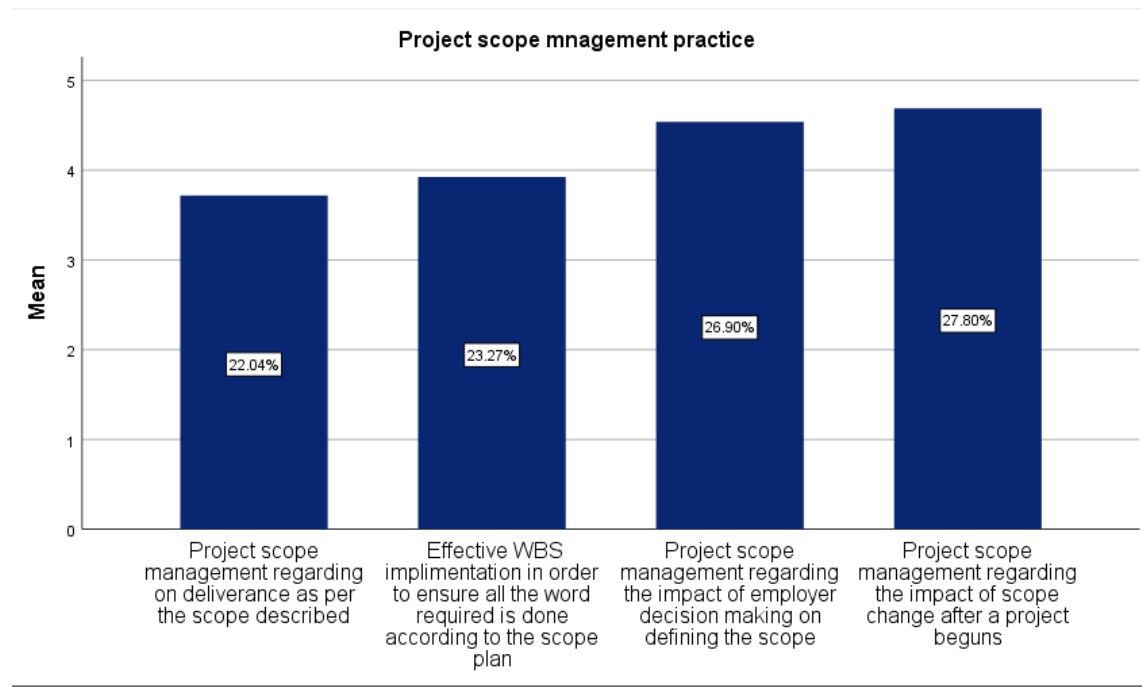
The project scope defines the boundaries of a project and properly documented. Project Scope Management includes the processes required to ensure that the project includes all the work required, and only the work required, to complete the project successfully and one the process is to create work breakdown structures (WBS). The participants were asked if they agree or disagree based on a likert scale questionnaire that if the listed factors contributed for the existing scope management practice.

The importance of a well formulated scope of work has been shown several times in many projects. Proper planning and preparation is mandatory for the successful accomplishment of the project prior to the commencement of the project. A clear project scope facilitates the project and also makes organization to realize the actual magnitude of the work and creates an understanding for the achievements that are required in the project.

Accordingly from the collected data the researcher found out that:-

- The respondents who believed the Project is going as per the scope defined are **22.04%**
- The respondents who believed the Project is effectively using WBS or mile stones in order to ensure all the work required is done according to the scope plane are **23.27%**
- The respondents who believed the Project scope has been affected by the employer decision making on defining the scope before project inception are **26.90%**
- The respondents who believed the Project has been affected by the scope change after a project begins are **27.80%**

Figure 4.7: Scope management practice



Source: own survey, 2021

As shown in fig 4.7 the major factors which affected the project scope management are the employer decision making to give a clear and final scope before the project begins and the second factor is scope change after the project inception, this shows if it hadn't been for the design and build project delivery system the project could have been totally out of scope in this case employers have to decide on the project charter before the project starts and work according to the plan.

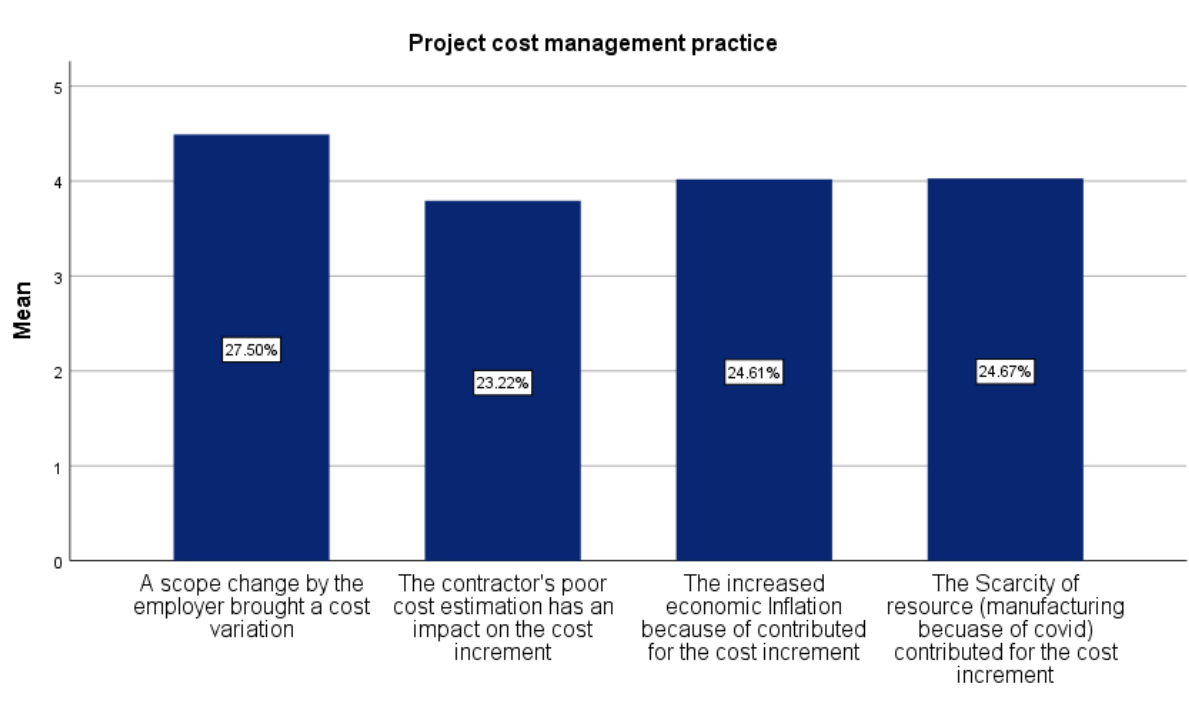
#### 4.2.4 Cost Management Practice

The idea of a DB project delivery system is in a favor of the client in order to minimize a project delay and cost over because of the delay from contractors side. In a DB project cost is fixed however it needs to be managed from the contractor side in order to deliver the project as per the scope. Contractors estimate the project cost considering all the design cost and the construction cost before the project inception but a pandemic like Covid 19 was not considered so it has a huge impact on the cost overrun on the contractors especially on shipment cost, manufacturing cost and cost incurred because of economic inflation.

The investigator asked respondents on this subject matter and categorized the factors as shown in figure 4.8 below with their percentages:

- The respondents who believed the cost variation comes from the project scope change are 27.50%
- The respondents who believed the contractors poor cost estimation has incurred the cost increment are 23.22%
- The respondents who believed the economic inflation caused by Covid has contributed for the cost increment are 24.61%
- The respondents who believed scarcity of resource caused by Covid has contributed for the cost increment are 24.67%

Figure 4.8: Cost management practice



Source: own survey, 2021

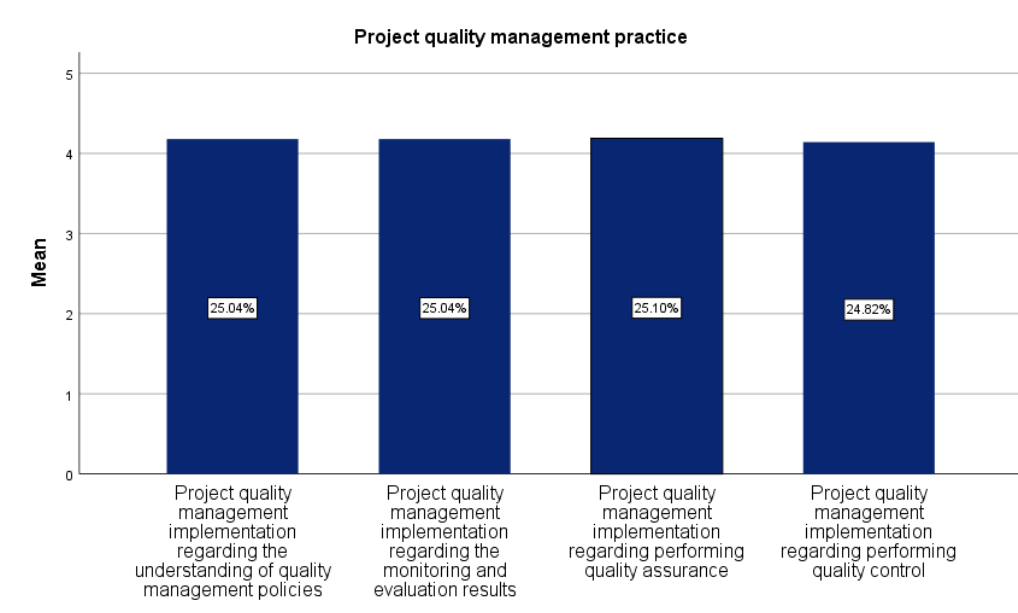
## 4.2.5 Project Quality Management Practice

Project quality management involves all processes and activities in the project organization to determine quality policies and control that the performed work is of a satisfying quality. The major processes in quality management are quality planning, quality assurance and quality control. Quality Assurance is the process of auditing the quality requirements and the results from quality control measurements to ensure that appropriate quality standards and operational definitions are used.

The researcher found out from interviews and project reports that the project is performing well when it comes to quality management likewise the participants were asked about their opinion on the project quality management practice and their answer is as below:

- The respondents who believed the Project stakeholders has an understanding of quality management and quality policies are **21.58%**
- The respondents who believed the Project quality has been monitored and evaluated on a routine base are **24.37%**
- The respondents who believed Project quality assurance has been performed well are **25.26%**
- The respondents who believed Project quality control has been performed are **28.77%**

Figure 4.9: Quality management practice



Source: own survey, 2021

AAiT consultant firm has been monitoring and evaluating the quality of materials being used by the contractors on a routine basis, that is why the highest percentage refers to the project quality control performance even though in a design and build project delivery system this part is left for the contractors.

**Summary of data interpretation:** By looking at the mean value of every determinant factors score (details can be referred from Appendix D), it is above the average value with a standard deviation of less than 1 and also the values showed consistency which is another sign that the result didn't have variation. Categorizing the determinants in four factors for every project constraint and project management practice eased the analysis of the research and also for the readers to identify which affected the project the most and to recommend CBE project office for future CBE construction projects across the country,

Based on the interviews conducted the researcher found out that there were internal and external challenges while managing this project but most challenges were external specially Covid pandemic. Details will be discussed in next section.

### **4.3 Major findings and gaps on construction project management practice regarding the quadruple project constraints**

The main objective of this study is to assess the implementation of project management practice in CBE H.Q building construction project regarding the quadruple project constraints, in doing so the researcher tried to investigate the project by analysing the research questionnaire responses, conducting interviews and desk studying to come up with the below findings:

So far in this particular project the CPM practice as discussed in the analysis section it was understood that the key informants and also the professionals engaged in the project believe that the project is successful. Most of them agreed that it is because the project is a Design-Build project in which by nature it has less pressure on employer and consultants and also the fact that the building is the first to be the tallest of all has caught peoples' attention and that has given the managements extra responsibility of being over watched.

The major gaps in managing project constraints of this project were that the absence of defined responsibility between stakeholders and this happened because DB project system is new to our country construction industry especially for buildings. The employer responsibility is to overlook and assess the project progress by monitoring and evaluating on a routine base with help of their representative or consultant firm. For DB project the contractors have major responsibility on managing cost, scope, quality and time but because of the ambiguity client was interfering every now and then throughout the project and this has made the contractors uncomfortable. Cost is fixed in DB projects and also is contractor's responsibility, it needs to be estimated considering risk contingency costs and managed properly to avoid disputes. Covid has affected the contractors on incurring cost overrun since it is a very different uncertainty and stayed for long.

Professionals from Addis Ababa university (AAiT), Ethiopian institute of architectural, building construction and city development (EiABC) and also from other institutes participated in consulting this project however as a country we lack experts and also competent professionals for instance in this particular project curtain wall experts were brought from China, this is just an example but most of the experts on a specific subjects are from abroad.

There was a huge gap in quality assurance between the contractors and consultants, Ethiopians for so long are using European standard of quality assurance and china has its own quality assurance standards; this gap was avoided after lots of discussions and practical quality testing and approval. From the study factors affecting the quality of the project as mentioned in fig 4.9 have similar percentiles and most of the respondents agreed that the quality has good standard.

The major gap on scope management has occurred because of a scope revision by the client after the design has been finished, the change is to add two floors on each building of the tower and conference buildings and three to the Commercial center hoping to increase the capacity of the functional area, full cinema equipment, bath room and shower room equipment for fitness center, staff canteen, fixed kitchen equipment, fixed sauna and spa. For this change six month of approved extension time and estimated cost of 32,011,920.00 USD was allowed however the cost and time approval might double itself because of inflation, foreign trade, shipment lockdown, manufacturing material scarcity and human resource scarcity occurred because of the Covid pandemic.

The major gap on time management is that the contractor's schedule development system and controlling is based on putting project mile stones and consultants were using WBS to control their time there was a gap in going in line, even some times the consultants provide specific WBS for the contractors just to arrange the timing.

The actual progress of the project as of May is 83% in which the detail of the progress duration is on Appendix E, in analysing the progress in line with the baseline plan the progress was supposed to be 99.27% which of course is before Covid. Considering the unexpected pandemic majority of the respondents agreed that the project is successful in spite of Covid.



## **4.4 The impact of Design-Build project delivery system on the project stakeholders**

### **1. On employer side**

- The idea of DB project delivery system by nature benefits the employer side because that was the intention of the system to be developed in the first place, the need of the employer is documented with performance specifications before the inception of the project especially scope, quality and time.
- Cost is fixed which is a big discharge is for employers, this minimizes disputes between contractors and employer about cost and minimizes construction delay as briefly discussed on the literature part of this study.

### **2. On the contractor side**

- The major project responsibilities are on contractors especially cost, it gives freedom of work and minimizes interference of other stakeholders.
- Since cost is fixed it shapes the whole project's scope, time and quality, this shows how the project constraints affect one another but when it comes to quality it needs constant monitoring and evaluation from the consultant side.

### **3. On the consultant side**

- It has given the consultant firm extra time for monitoring and evaluating the work done than consulting a tradition DBB project because DB contractors are more responsible.
- Their main job is to monitor and evaluate project quality since it can be deceived by contractors with wrong intentions.

# CHPATER FIVE

## 5. Conclusion and Recommendation

### 5.1 Conclusion

The main objective of this study is to assess the implementation of project management practices on building construction projects regarding project quadruple constraints in the case CBE H.Q building construction. Questionnaires were categorized in to four factors (as shown in all graphs representing PM, cost, scope, quality and time management practice in the analysis section) in accordance with the research objects before feeding it to SPSS data analyser in order to draw the response percentiles and make it easy for analysis. 106 respondents have answered the questionnaires and based on the analysis carried out, the following conclusions have been drawn and recommendations were forwarded.

Accordingly to the data collected the investigator found out that 64.15% of the respondents strongly agreed that the performance is good, 22.64 % agreed that the performance is good and 13.21% of the respondents disagreed from this data it is possible to generalize that the project is successful in spite of Covid, it is the first of its kind in our country and the project office, the contractors and consultants has collaborated to take Ethiopia's construction industry to the next level by involving professionals in the industry as much as possible and applied the new DB project delivery system which has a huge impact on the project success.

By looking at the mean value of every factors score it is above the mean value with a standard deviation of less than 1, we can decide the project has a good practice on the project quadruple constraints and percentage of most respondents have similar level on the provided factors for determining their contribution on project management general practice and project quadruple constraints, this shows that the project has a consistent way of managing the project focus areas.

CBE H.Q building is under the completion stage, it has a huge impact on the country's' economy, job creation now and after completion, and changed the country's image serving as a landmark. It will also be an example for future building constructions in terms of design, DB project for building constructions, quality and performance.

The findings of the research shows the CPM practice of CBE H.Q building construction has some gaps on project management practice that requires improvements with regard to quadruple constraint such as Project time management, Project scope management, Project cost management and Project quality management. Lack of skilled man power especially experts is one of the gaps identified by the researcher. The conceptual framework of this research explained the importance of identifying potential constraints in the construction project helps project managers not only understand the characteristics of the constraints, but also predict the time and stage that the constraints may be encountered and the implementation of proper project management is the way to success for construction projects. Lesson shall be taken from the gaps identified and the impacts assessed on the stakeholders in the analysis section so as to enhance the project management performance.

## **5.2 Recommendation**

Based on the findings of the research, there are gabs on the building construction project management, quality, cost, scope and time management practice which needs attention and the researcher draw some recommendations in order to minimize the gap for the next similar projects in the construction industry:

1. As a country there is luck of experts on construction industry so the government should perhaps take into account specialization curriculum for the construction sector. This will benefit both clients and our country to keep foreign currency, once experts came from abroad, partnering with them to pass on their knowledge through trainings and experience sharing for professionals in the field will be quite valuable.
2. Communication between stakeholders is a very curial matter, from the findings point of view the researcher suggests to have a defined work responsibility, clear rule and regulation of their roles in organizations in order to avoid difficulties and disputes.
3. Ethiopia's construction sector became decentralized few years back, which leads to different procedures and regulations in each region of the country, which in return affected the standard procedure and consistency in the construction industry in this regard the researcher suggests the government to implement a uniform set of rules

and regulations across the country, as well as to build a single accountable institute with standards to accountable for.

4. For this project, 522 Chinese and 388 Ethiopian employers were involved; this number may vary at times, but the average number of employees is 1050. As can be seen from the figure the majority of employees were from Chines, the researcher's suggestion for the clients is give more job opportunities for Ethiopians and for the respective government institute to provide law to forbid foreign employers dominancy in construction sector. This can be achieved by empowering Ethiopian employees through trainings and experience sharing as mentioned before.
5. Each and every construction material was imported from china for this specific project, the researcher's suggestion on this regard is for the investment sector to shift the manufacturing business from China to Ethiopia by involving individual investors even in a cost of employing chines professionals and also train Ethiopians as the same time, this in turn will be an input for future constructions and also saves foreign currency as a country.
6. The building is the tallest building in our country history and with the size and the design complication it was purposely open to be exhibited by everyone and most of the consultants, students, engineers, construction managers, project managers, quality assurance agencies and similar subject teachers has benefited a lot from the experience, the researcher also recommends other regions universities administrators and construction company owners to create an opportunity to learn this experience.
7. The researcher's suggestion for project management institutes is to consider including leadership skills to the nine project management knowledge areas in the learning process. This was one of the issues the researcher identified while interviewing managers at the CBE project office. The project managers in the office are not more than two because they still believe that project managers needs leadership skill to manage this huge project.

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## APPENDICES

### ST. MARY'S UNIVERSITY SCHOOL OF GRADUATE STUDIES

#### ANNEX A – Questionnaire

This questionnaire is prepared to collect information's to conduct a research entitled;  
**“Assessing the role of Project management practices regarding project Quadruple Constraints: The Case of CBE Head Quarter Building Construction** under the supervision of Dr. Dereje Teklemariam (Associate Professor)

Please consider each question in terms of your organization's experience and/or your personal knowledge and indicate your response by marking (X or ✓) in the boxes provided or by filling the blank spaces as appropriate. You can use the back side of the paper if the blank space (s) is/are not sufficient.

**Please note that:**

- 1) The result of these questionnaires is used only for academic research purpose.
- 2) Responses provided will be kept confidential if needed.
- 3) Raw data's obtained from these questionnaires will not be transferred to a third party during the research work.

For any clarification and further information please contact the researcher with this Email address: [hiwotnekatibeb@gmail.com](mailto:hiwotnekatibeb@gmail.com)



## 1. Organization, Project & Personal Profile

### 1.1 Personal information:

Name (Optional): \_\_\_\_\_

Sex: \_\_\_

Age: \_\_\_

### 1.2 Title and contact address

Job Title: \_\_\_\_\_

Year of experience: \_\_\_\_\_

Contact addresses (Optional): \_\_\_\_\_

E-mail: \_\_\_\_\_

Tel: \_\_\_\_\_

### 1.3 Name of Organization

Employer/Project Office       Consultant       Contractor

Other (Please specify) \_\_\_\_\_

\_\_\_\_\_

## 2. General Questions

2.1 Which one of the following factors affects the performance of the construction project management in CBE building Construction Project?

Please state your level of opinion; each scale represents the following rating:

1 = strongly disagree    2 = Disagree    3 = Neutral    4 = Agree    5 = strongly agree

No	Factors affecting project performance	Level of agreement
1	Competent and experienced professionals in the field	
2	Resources Management (Capital, Material, Equipment etc.)	
3	Project management practice of the construction project	
4	Organizational setup of construction companies of clear regulations and Guidelines	

2.2 In general **Project Management** is an essential responsibility of the project which starts from the inception goes to the completion through the suitable application and integration of project management processes, which embrace Initiating Processes where **project charter** approved, Planning Processes where **project management plan developed**, Executing Processes where **execution documents** develop, Monitoring and Controlling Processes and Closing Processes. How do you rate the implementation of project management practice in CBE building construction projects?

Please state your level of opinion; each scale represents the following rating:

*1 = strongly disagree 2 = Disagree 3 = Neutral 4 = Agree 5 = strongly agree*

2.3. Understanding the use of Planning in project management by stakeholders is necessary to perform their project evaluation. How do you rate the level of awareness of parties to use work program appropriately?

Please state your level of opinion; each scale represents the following rating:

1 = strongly disagree 2 = Disagree 3 = Neutral 4 = Agree 5 = strongly agree

No	Organizations	Level of agreement
1	Employer	
2	Consultant	
3	Contractor	

2.4. Considering that Design-Build project delivery system is new for our country in the case of building construction projects how do you rate the value added by using a Design-Build system?

Please state your level of opinion; each scale represents the following rating:

1 = strongly disagree   2 = Disagree   3 = Neutral   4 = Agree   5 = strongly agree

No	Organizations	Level of agreement
1	Employer	
2	Consultant	
3	Contractor	

2.5. Considering that Design-Build project delivery system is new for our country in the case of building construction projects how do you rate the value added on the performance and efficiency of the project?

Please state your level of opinion; each scale represents the following rating:

1 = strongly disagree   2 = Disagree   3 = Neutral   4 = Agree   5 = strongly agree

No	Organizations	Level of agreement
1	Employer	
2	Consultant	
3	Contractor	

2.6 Considering that Design-Build project delivery system is new for our country in the case of building construction projects; do you the project is successful?

Please state your level of opinion; each scale represents the following rating:

1 = strongly disagree   2 = Disagree   3 = Neutral   4 = Agree   5 = strongly agree

No	Organizations	Level of agreement
1	Employer	
2	Consultant	
3	Contractor	

### 3. Specifically on Time Management

3.1 Time management process (schedule developing and controlling) is vital to achieve the project objective (timely completion, with the expected budget and quality). This task requires skilled project team, a competent project manager and proficient organization to manage project in effective and efficient manner which are the challenges in the construction industries.

How do you rate time management practices in CBE H.Q building construction projects?

Please state your level of opinion; each scale represents the following rating:

1 = strongly disagree    2 = Disagree    3 = Neutral    4 = Agree    5 = strongly agree

No	Time management practice	Level of agreement
1	Professional, technical and managerial skill of project managers	
2	Experienced project managers	
3	Clear procedures, guidelines & strategies at the initial stage of project planning	
4	planning skill & software application	

3.2 In CBE H.Q building construction project most of the project completion period is predetermined by the Client/ Engineer. What is your opinion?

1 = strongly disagree    2 = Disagree    3 = Neutral    4 = Agree    5 = strongly agree

3.3 In CBE H.Q building construction projects most of the projects failed to meet the predetermined time frame due to limited capacity of consultants and contractors to manage their projects. What is your opinion?

1 = strongly disagree    2 = Disagree    3 = Neutral    4 = Agree    5 = strongly agree

3.4 Schedule performance (Scheduling, Monitoring & Controlling schedule) is essential for smooth project management. Do you think that your practices in this regard meet the desired performance?

Please state your level of opinion; each scale represents the following rating:

1 = strongly disagree    2 = Disagree    3 = Neutral    4 = Agree    5 = strongly agree

No	Schedule performance	Level of agreement
1	Contract administration of Employer	
2	Contractor's given time to execute projects with schedule	
3	Employer focuses on time than cost, scope and quality related issues	

3.5 What do you recommend to improve the practices of using work schedule?

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#### **4 Specifically on Scope Management**

4.1 The project should deliver all that is described within its scope. Do you think the project is delivering as per the scope described?

1 = strongly disagree    2 = Disagree    3 = Neutral    4 = Agree    5 = strongly agree

4.2 Project Scope Management includes the processes required to ensure that the project includes

all the work required, and only the work required, to complete the project successfully and one the process is to create WBS (work breakdown structures).

Did the contractors prepare WBS or milestones in detail for the project? What do you think?

1 = strongly disagree    2 = Disagree    3 = Neutral    4 = Agree    5 = strongly agree

## 5. Specifically Cost Management

5.1 Cost management is the act of managing all or part of the cost of planning, design and construction projects process so as to remain within the owner’s budget. Since the project is a Design-Build project where do you think the cost variation comes?

Please state your level of opinion; each scale represents the following rating:

1 = strongly disagree    2 = Disagree    3 = Neutral    4 = Agree    5 = strongly agree

No	Design-Build cost variation	Level of agreement
1	a scope change by the employer	
2	the contractors poor cost management	
3	the country’s economic Inflation	
4	the new pandemic Covid-19(lockdown)	
5	Scarcity of resource (manufacturing)	

## 6. Specifically Quality Management

6.1 Project Quality Management includes the processes and activities of the performing organization that determine quality policies, objectives, and responsibilities so that the project will satisfy the needs for which it was undertaken Project Quality Management works to ensure that the project requirements, including product requirements and validity.

How do you rate the following issues regarding project quality management implementation in this particular project?

Please state your level of opinion; each scale represents the following rating:

1 = strongly disagree    2 = Disagree    3 = Neutral    4 = Agree    5 = strongly agree

No	Quality management	Level of agreement
1	Understanding of quality management policies	
2	Monitoring and evaluation results	
3	Performing quality assurance	
4	Performing quality control	

## 7. Impact

7.1 This project will have an impact on the following issues Do you agree with this?

Please state your level of opinion; each scale represents the following rating:

1 = strongly disagree    2 = Disagree    3 = Neutral    4 = Agree    5 = strongly agree

No	Quality management	Level of agreement
1	On the country's GDP	
2	On creating job opportunity	
3	On the country image as a land mark	
4	On future Design-Based construction projects	

*Thank you very much for spending your valuable time!*

## **ANNEX B – KEY INFORMANTS INTERVIEW QUESTIONS**

### **ST. MARY’S UNIVERSITY SCHOOL OF GRADUATE STUDIES**

These questions are prepared to collect information from the key informants to conduct a research entitled;

**“Assessing the role of Project management practices regarding project Quadruple Constraints: The Case of CBE Head Quarter Building Construction** under the supervision of Dr. Dereje Teklemariam (Associate Professor)

Please consider each question in terms of your organization’s experience and to your personal knowledge regarding this specific project in order to minimize bias.

#### **Interview Questions**

1. What is your involvement and for long is your involvement in the project?
2. How many of your company stuffs are project management graduates and with what year of minimum experience?
3. How many project managers were involved in this particular project?
4. Are there any PM software’s practiced by the project managers?
5. What is the level of understanding about the role of project management in your company?
6. The Construction Project management has it features and require significant management skills, involvement and coordination of a wide range of experts in various fields. How do you evaluate the Project Managers/ Construction Manger knowledge in this regards?
7. As a project manager do you think the project is successful regarding the quadruple project constraints? You can justify your answer by answering the



following questions

- a) Is there a project cost variation? If yes what were the reasons?
  - b) Is there a project delay? If yes what were the reasons?
  - c) Is the project within the defined scope? If No what were the reasons?
  - d) Is the project under completion with the desired quality? If No what were the reasons
- 
8. How do you evaluate the Project Scope Management (Plan Scope Management, Collect Requirement, Define Scope, Create WBS, Validate Scope, and Control Scope)?
  9. Time is an extremely important issue in construction and a major criterion by which the success of a project is judged. How do evaluate the time management of the project?
  10. Project Cost Management includes resource planning, estimating, and cost budgeting, and controlling costs so that the project can be completed within the approved budget. How do you evaluate the cost management?
  11. What is the impact of Design-Build project delivery system on the performance of this specific project as contractors (CSCEC)?
  12. What is the impact of Design-Build project delivery system on the performance of this specific project as an employer (CBE)?
  13. What is the impact of Design-Build project delivery system on the performance of this specific project as a consultant (AAiT)?
  14. Do you agree that the quality management is satisfactory to meets its objectives?
  15. What are the management gabs? If any what do you recommend?
  16. What do you recommend on the overall project management practice?

***Thank you very much for spending your valuable time!***

## ANNEX C – RESPONDENTS DEMOGRAPHIC INFORMATION

### Age

		Frequency	Per cent	Valid Per cent	Cumulative Per cent
Valid	23-35	41	38.7	38.7	38.7
	36-45	52	49.1	49.1	87.7
	46-55	13	12.3	12.3	100.0
	Total	106	100.0	100.0	

### Gender

		Frequency	Per cent	Valid Per cent	Cumulative Per cent
Valid	Male	75	70.8	70.8	70.8
	Female	31	29.2	29.2	100.0
	Total	106	100.0	100.0	

### Organization

		Frequency	Per cent	Valid Per cent	Cumulative Per cent
Valid	employer	15	14.2	14.2	14.2
	consultant	29	27.4	27.4	41.5
	contractor	62	58.5	58.5	100.0
	Total	106	100.0	100.0	

## ANNEX D- Descriptive Statistics of General Project Management Practice, Scope, Cost, Time and Quality Management

	N	Mean	Std. Deviation
<b>Project management practice</b>			
How do you rate the performance of the project management practice in general?	106	3.96	.872
Having competent and experienced professionals in the field contributes to the good performance of this construction project management in CBE building Construction Project?	106	3.42	.904
Having good resource management contributes to better performance of the construction project management in CBE building Construction Project?	106	3.85	.714
Having good PM practice contributes to the better performance of the construction project management in CBE building Construction Project?	106	3.58	.975
Having good guidance and regulation contributes to the good performance of the construction project management in CBE building Construction Project?	106	3.04	.985
<b>Project time management</b>			
How do you rate time management practices in CBE H.Q building construction projects regarding having Professional, technical and managerial skill of project managers ?	106	3.75	.840
How do you rate time management practices in CBE H.Q building construction projects regarding monitoring the work progress?	106	4.01	.750
How do you rate time management practices in CBE H.Q building construction projects regarding having clear procedures, guidelines & strategies at the initial stage of project planning?	106	3.56	.937
How do you rate time management practices in CBE H.Q building construction projects regarding having scheduled plan & using software application?	105	3.81	.889
<b>Project scope management</b>			
How do you rate project scope management regarding on deliverance as per the scope described? ; what is your opinion on this matter?	106	3.72	.790

How do you rate project scope management regarding using effective WBS in order to ensure all the work required is done according to the scope plan; what is your opinion on this matter? ?	106	3.92	.825
How do you rate project scope management regarding the impact of employer decision making on defining the scope; what is your opinion on this matter? ?	106	4.54	.588
How do you rate project scope management regarding the impact of scope change after a project begins; what is your opinion on this matter?	106	4.69	.505
<b>Project cost management</b>			
A scope change by the employer brought a cost variation?	106	4.49	.605
The contractor's poor cost estimation has an impact on the cost increment?	106	3.79	.613
The increased economic Inflation contributed for the cost increment?	106	4.02	.534
The Scarcity of resource (manufacturing) contributed for the cost increment?	106	4.03	.577
<b>Quality management</b>			
How do you rate project quality management implementation in this particular project regarding the understanding of quality management policies?	106	4.18	.659
How do you rate project quality management implementation in this particular project regarding the monitoring and evaluation results?	106	4.18	.741
How do you rate project quality management implementation in this particular project regarding performing quality assurance?	106	4.19	.664
How do you rate project quality management implementation in this particular project regarding performing quality control?	106	4.14	.798

## ANNEX E –PARTICULARS OF THE DESIGN-BUILD CONTRACT

Contract type	Design and Build Project, EPC Turnkey	Contractor	China State Construction Engineering Corporation
<b>Contract Amount</b>	<b>Original – Main Agreement {A}: USD 266,500,000.00</b>	<b>Issued Payments</b>	Advance Payment <b>USD 79,950,000.00</b>
	<b>Currency Proportion:</b> USD; 65%; ETB: 35%		Advance Payment- Supplementary <b>USD 9,603,576.00</b>
	Supplementary Agreement (B): <b>USD 32,011,920.00</b>		Interim Payment No. 1 <b>USD 27,915,998.95</b>
	Additional Work {C}		Interim Payment No. 2 <b>USD 18,957,675.02</b>
	Variation Work {D} <b>USD 4,964,638.17</b>		Interim Payment No 3 <b>USD 8,532,403.16</b>
	Omission work {E}		Interim Payment No 4 <b>USD 12,836,158.07</b>
			Interim Payment No 5 <b>USD 8,101,640.01</b>
	Revised (Total) (A+B+C+D+E): <b>USD 298,511,920.00</b>		Interim Payment No 6 <b>USD 2,614,677.27</b>
	Interim Payment No 7 <b>USD 3,146,678.48</b>		
	Interim Payment No 8 <b>USD 8,725,882.64</b>		

		Interim Payment No 9 <b>USD 4,041,908.98</b>
Commencement	<b>July 27, 2015</b>	Interim Payment No 10 <b>USD 2,518,368.11</b>
Original Project duration	<b>1460 days + 365 days defects liability period + 10 Years Guarantee Period</b>	Interim Payment No 11 <b>USD 4,909,484.95</b>
		Interim Payment No 12 <b>USD 2,988,699.53</b>
		Interim Payment No 13 <b>USD 4,773,317.36</b>
		Interim Payment No 14 <b>USD 1,286,964.09</b>
		Interim Payment No 15 <b>USD 5,048,185.03</b>
Original Completion date	<b>July 23, 2019</b>	Interim Payment No 16 <b>USD 3,914,536.70</b>
		Interim Payment No. 17 <b>USD 1,609,333.59</b>
		Interim Payment No. 18 <b>USD 1,305,922.68</b>
		Interim Payment No. 19 <b>USD 1,530,135.16</b>
		Interim Payment No. 20 <b>USD 830,557.24</b>
		Interim Payment No. 21

			<b>USD 3,160,772.86</b>
			Interim Payment No. 22
			<b>USD 476,462.28</b>
Approved Time Extension	<b>6 months (180 days), Additional Time for Supplementary Contract</b>		Total Payment Up-to-date
			<b>USD 218,779,338.17</b>
Revised Completion date (Revision No. I)	<b>January 21, 2020</b>	Advance Repaid/ Deducted from Interim payments (before VAT)	<b>USD 51,347,984.96</b>
Revised Completion date (Revision No. II)	<b>November 30, 2020 (Extension for a delay amicably settled)</b>	Advance outstanding (before VAT)	<b>USD 26,524,689.62</b>
Revised Completion date (Revision No. III)	<b>May 31, 2021 (Extension for a delay amicably settled)</b>	5% Retention Up-to-date (before VAT)	<b>USD 8,557,997.49</b>
Time Elapsed in days	<b>2095, by end of the reporting month</b>	Performance Guarantee	To Expire on May 21, 2022
Time Elapsed Vs. Project Period in %	<b>96.68%</b>	Advance Payment Guarantee	To Expire on July 31, 2021

## **ANNEX F –PROGRESS DURATION**

Progress Duration	Subject	2008 EFY -2015/2016											
		1st Quarter			2nd Quarter			3rd Quarter			4th Quarter		
		July	August	September	October	November	December	January	February	March	April	May	June
Total to Date	Plan	0.05%	0.11%	1.14%	1.64%	2.59%	3.47%	4.00%	4.66%	5.37%	6.51%	7.38%	9.40%
	Actual	0.07%	0.14%	1.25%	1.78%	2.80%	3.79%	4.36%	5.06%	5.81%	7.02%	7.94%	10.06%
	Actual VS. Plan in %	133.33%	123.08%	109.81%	108.41%	108.26%	109.16%	109.12%	108.56%	108.17%	107.77%	107.55%	107.02%
Progress Duration	Subject	2009 EFY - 2016/2017											
		1st Quarter			2nd Quarter			3rd Quarter			4th Quarter		
		July	August	September	October	November	December	January	February	March	April	May	June
Total to Date	Plan	11.52%	12.84%	14.94%	17.14%	17.68%	18.44%	18.78%	19.38%	20.08%	22.30%	23.18%	24.19%
	Actual	12.25%	13.60%	15.75%	17.93%	18.45%	19.15%	19.46%	20.01%	20.64%	22.63%	23.42%	24.34%
	Actual VS. Plan in %	106.37%	105.95%	105.39%	104.58%	104.33%	103.87%	103.64%	103.27%	102.81%	101.46%	101.04%	100.61%
Progress Duration	Subject	2010 EFY - 2017/2018											
		1st Quarter			2nd Quarter			3rd Quarter			4th Quarter		



		July	August	September	October	November	December	January	February	March	April	May	June
<b>Total to Date</b>	Plan	25.25%	26.24%	28.18%	30.19%	31.63%	33.02%	34.66%	35.96%	37.25%	38.53%	39.79%	41.04%
	Actual	25.28%	26.14%	27.82%	29.53%	30.76%	31.94%	33.34%	34.45%	35.56%	36.66%	37.76%	38.85%
	Actual VS. Plan in %	100.10%	99.64%	98.71%	97.83%	97.24%	96.73%	96.18%	95.79%	95.45%	95.15%	94.89%	94.67%

<b>Progress Duration</b>	<b>Subject</b>	<b>2011 EFY – 201782019</b>											
		<b>1st Quarter</b>			<b>2nd Quarter</b>				<b>3rd Quarter</b>			<b>4th Quarter</b>	
		July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	March	Apr.	May	June
<b>Total to Date</b>	Plan	42.45%	44.04%	45.56%	47.40%	49.89%	52.30%	53.52%	54.76%	55.99%	56.84%	57.37%	57.37%
	Actual	40.09%	41.50%	42.83%	44.46%	46.66%	48.77%	49.85%	50.95%	52.05%	52.81%	53.28%	53.74%
	Actual VS. Plan in %	94.44%	94.22%	94.01%	93.79%	93.52%	93.25%	93.13%	93.04%	92.96%	92.91%	92.88%	93.68%

<b>Progress Duration</b>	<b>Subject</b>	<b>2012 EFY – 2019/2020</b>											
		<b>1st Quarter</b>			<b>2nd Quarter</b>				<b>3rd Quarter</b>			<b>4th Quarter</b>	

		July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	March	Apr.	May	June
<b>Total to Date</b>	Plan	57.37%	57.37%	57.37%	57.87%	58.87%	60.37%	62.87%	65.37%	68.97%	70.97%	72.97%	74.97%
	Actual	53.97%	54.33%	54.56%	54.96%	55.40%	56.36%	57.62%	58.79%	59.88%	60.47%	61.15%	65.03%
	Actual VS. Plan in %	94.08%	94.71%	95.11%	94.98%	94.11%	93.36%	91.66%	89.94%	86.83%	85.21%	83.81%	86.75%
<b>Progress Duration</b>	<b>Subject</b>	<b>2013 EFY – 2020/2021</b>											
		<b>1st Quarter</b>			<b>2nd Quarter</b>				<b>3rd Quarter</b>			<b>4th Quarter</b>	
		July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	March	Apr.	May	June
<b>Total to Date</b>	Plan	76.97%	78.97%	80.97%	82.97%	84.97%	86.97%	89.77%	92.88%	97.25%	99.27%		
	Actual	65.47%	66.55%	67.52%	68.32%	69.54%	71.20%	73.13%	75.73%	77.94%	78.94%		
	Actual VS. Plan in %	<b>85.06%</b>	<b>84.28%</b>	<b>48.50%</b>	<b>82.35%</b>	<b>81.84%</b>	<b>81.87%</b>	<b>81.47%</b>	<b>81.54%</b>	<b>80.15%</b>	<b>79.52%</b>		