ADDIS COLLEGE

DEPARTMENT OF CONSTRUCTION TECHNOLOGY AND MANAGEMENT
POSTGRADUATE PROGRAM

Assessment of the Effectiveness of Contract Implementation on Design Build Federal Road Projects, the Case of Ajire-Keraker-Ketema Nigus Road Project, Ethiopia

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

BY: MITIKU TEFERA (ID. NO CMGSR/ 259/2015)

Advisor: **Mekonnen Abebe (Ph.D.)**

SEPTEMBER, 2024

ADDIS ABABA, ETHIOPIA

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ABSTRACT

Infrastructure projects, such as road construction, are one of the most important projects in Ethiopia Growth in this sector is critical for growth in national income as it is among the largest sectors that generate employment within the country as well as a key driver for economic development of Ethiopia. Ethiopia Roads Administration is administrating hundreds of road projects; however, the projects are completed with poor delivery, particularly in terms of cost, time, and quality. So the researcher expected that assessing the effectiveness of contract implementation in design-build federal road projects is crucial for ensuring the successful completion of infrastructure developments. Accordingly, the main causes of schedule growth for DB project delivery systems are (top three factors) changes in laws and regulations, Lack of experience and Lack of experience on the part of the consultant's site staff the main causes for cost overrun (cost growth) of design and build (DB) projects were additional works; time delay, inadequate pre-planning, takes the top three causes for cost growth. Then data were collected from the Ajire- keraker -Ketema Nigus Road Project in Ethiopia archive, desk study, and interviews & questionnaires from clients, consultants, and contractor's Representatives. Both primary and secondary data collection procedures were conducted. The research method used was the quantitative nonexperimental method. Quantitative analysis was done by SPSS software used for the analyses of data collected, and descriptive statistics and Relative Importance Index (RII) technique was applied for ranking of critical factors. The first factors used to select the Project delivery system, main causes for time and cost growth, and factors that affect the quality of the project were identified intensively from extensive literature. In addition, other local factors (context to our country) have been added as recommended by experts and according to the researcher's own experience in implementing construction projects the main causes for cost overrun (cost growth) of design and build (DB) projects were additional works; time delay, inadequate pre-planning, takes the top three causes for cost growth.

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Keywords – Design-build, Federal Road projects, Infrastructure development, Budget management, Quality control

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Construction Technology and Management Stream

Assessment of the Effectiveness of Contract Implementation on Design Build Federal Road Projects, the Case of Ajire-Keraker-Ketema Nigus Road Project, Ethiopia

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Internal examiner	Signature	Date
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Dean, school of graduate studies	Signature	Date

DECLARATION

I declare that this thesis entitled “Assessment of the Effectiveness of Contract Implementation on Design Build Federal Road Projects, The Case of Ajire-Keraker-Ketema Nigus Road Project, Ethiopia” is my original work. This thesis has not been presented for any other institution of higher education and is not concurrently submitted in the candidature of any other degree, and all sources of material used for the thesis have been properly acknowledged.

	Signature	Date
Mitiku Tefera	_____	_____

I declare that I have supervised the student in undertaking this study and confirm that the student has my permission to submit it.

Advisor	Signature	Date
Mekonnen Abebe (Ph.D.)	_____	_____

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ACRONYMS

CMR	Construction Management at Risk
CPD	Causes of Project Delay
DB	Design-Build
DBB	Design-Bid-build
FRPE	Federal road projects in Ethiopia
GMP	Guaranteed Maximum Price
PDS	Project Delivery System
PDM	Project Delivery Method
SPSS	Statistical Package for the Social Science
ERAMS	Ethiopian Roads Administration Management System

CHAPTER ONE
INTRODUCTION

1.1. Background of the study

The efficient implementation of contracts is paramount in ensuring the successful completion of infrastructure projects, particularly in the realm of federal road construction. In Ethiopia, like many other developing nations, road infrastructure plays a critical role in facilitating economic growth, enhancing connectivity, and improving the overall quality of life for citizens. However, the effectiveness of contract implementation on design-build federal road projects in Ethiopia remains a topic of significant concern and scrutiny (Birhanu 2017).

The Ajire- keraker -Ketema Nigus Road Project stands as a pertinent case study in examining the intricacies and challenges associated with contract implementation in Ethiopia's federal road construction endeavors. The Design and Build works of the project awarded to Powercon PLC in JV with Tesfaye Legesse Construction. The contract between Ethiopian Roads Authority now Ethiopian Roads Administration and the Contractor signed as on 18 June 2018. The commencement date of the project fixed as 21 September 2018 with period of completion to be 1095 calendar days from this date as per the original contract. Whereas, the project awarded extension of time of 838 calendar days till this reporting period, which brings the revised contract completion date to 25 November 2025.

The project road works is design and build road passing through the control points stated under the Employer's Requirements with DC4 standard and DBST with fog spray pavement finish. The road will have 6.5m carriageway width and 1.25m gravel shoulder in rural section in flat to rolling terrain; 6.5m carriageway width and 0.5m shoulder in rural section in mountainous to escarpment terrain.

To Date Overall Progress 63.79% achieved against plan of 88.61%. Hence, to date (as of this month) a slippage of -24.82% is recorded based on the Action plan program the contractor's aggregate financial plan to date has been ETB 1,026,735,308.46 (including 15% VAT). As compared to the plan, the contractor has achieved to accomplish an amount of ETB 739,063,397.47 (including 15% VAT) which is 63.79% of the plan.

The contract work comprises investigation, survey, design and construction of the road to a DC4 Geometric Design Standard and Double Bituminous Surface Treatment (DBST) with

fog spray surfacing with the accompanying structures and protection works supplemented by a compatible Environmental Mitigation Plan. This project, situated within the broader context of Ethiopia's infrastructure development initiatives, presents an opportunity to assess the effectiveness of contract management strategies, identify key factors influencing implementation outcomes, and propose recommendations for improvement. (Tadesse, Abate, and Zewdie 2020). Implementing contracts in federal road projects involves a multifaceted process encompassing planning, design, construction, and monitoring phases. Design-build contracts, in particular, offer a streamlined approach by integrating the design and construction aspects under a single contract, aiming for efficiency and cost-effectiveness. However, despite the potential advantages, the successful execution of design-build contracts is contingent upon various factors such as effective project management, stakeholder collaboration, regulatory compliance, and risk mitigation strategies (Gebremeskel 2020). In the Ethiopian context, the Ajire- keraker -Ketema Nigus Road Project represents a significant investment in enhancing transportation infrastructure, particularly in rural areas. This project aims to improve connectivity, reduce travel times, and stimulate economic development along the corridor. However, challenges related to contract implementation, including delays, cost overruns, quality issues, and disputes, have surfaced, highlighting the need for a comprehensive assessment of the underlying factors contributing to these issues Ethiopian Roads Authority (2018).

1.2. Statement of the problem

The construction industry is growing in Ethiopia at a high speed and it brings great development to the country and the city specifically, but it is also undeniable that there are various quality problems arising with it as well. The construction industry in Ethiopia is challenged by several problems that tend to confront the sector thus making efforts at developing the construction industry very difficult and complex.

Most construction projects face many problems, such as workmanship defects, project delays, and cost overruns in completing their projects. Over the past three decades, globalization and competition have been increasing as a result, public building projects need to improve and adopt advanced construction methods and tools (Neyestani and Juanzon 2016). Design-build federal road projects in Ethiopia, such as the Ajire- keraker -Ketema Nigus Road Project, represent significant investments in infrastructure aimed at enhancing transportation networks and fostering economic development. However, the effectiveness of contract implementation in ensuring the successful completion of these

projects remains a critical concern. Despite the allocation of resources and efforts towards these initiatives, there are persistent challenges that hinder optimal outcomes. Therefore, the problem statements for the study are

1. The key challenges and obstacles encountered in assessing the implementation of contracts for design-build federal road projects in Ethiopia, specifically in the context of the Ajire- keraker -Ketema Nigus Road Project.
2. On the implementation of contracts for design-build federal road project practices look like in ERA in the case of the Ajire- keraker -Ketema Nigus Road Project.
3. The strategies can be adopted to enhance the effectiveness of contract implementation and address the identified challenges to ensure the successful delivery of design-build federal road projects in Ethiopia.
4. In circumstances is the DB delivery system effective in the Ajire- keraker -Ketema Nigus Road Project.

These questions form the basis for investigating the effectiveness of contract implementation on design-build federal road projects in Ethiopia, with a specific focus on the Ajire- keraker -Ketema Nigus Road Project. Addressing these issues is essential for overcoming barriers to project success, optimizing resource utilization, and achieving the intended socio-economic benefits associated with infrastructure development.

1.3. Objective of the study

1.3.1. General Objective

Assessment of the Effectiveness of Contract Implementation on Design Build Federal Road Projects, the Case of Ajire-Keraker-Ketema Nigus Road Project, Ethiopia

1.3.2. Specific Objective

- To assess the effectiveness of contract implementation on design-build federal road projects.
- To evaluate the cost, time, and quality performance of the traditional design and build Delivery methods.
- To assess the challenges faced by the employer, contractor, and consultant in the design-build contract administration practice.

1.4. Research Questions

1. What factors influence the effectiveness of contract implementation on design-build federal road projects in Ethiopia?
2. What is the impact of contract management strategies on project outcomes such as cost, schedule adherence, and quality standards?
3. What are the best practices and recommendations for improving contract implementation in the context of federal road projects in Ethiopia?

1.5. Significance of the Study

The findings of this research are expected to contribute to the body of knowledge on contract implementation in the context of federal road projects in Ethiopia. By identifying critical success factors and challenges, the study aims to inform policymakers, project managers, and other stakeholders on strategies for enhancing the effectiveness of contract implementation, ultimately improving the delivery of infrastructure projects and fostering sustainable development.

1.6. Scope of the study

The scope of the study was delimited geographically at the Ajire- Keraker – Ketema Nigus Road Project located in Ethiopia Amhara and Tigray Regional States.

Ajire- Keraker – Ketema Nigus Road Construction projects that are not yet finalized. Conceptually, this study focused on the effectiveness of contract implementation on design-build federal road projects in Ethiopia. Besides this, this study covered the last five fiscal years of road construction projects.

1.7. Limitation of the Thesis and future research direction

The limitation of this study, it was conducted Ethiopian Road Administration with the special consideration of Ajire- Keraker- Ketema Nigus design-build road projects by reviewing the last Five fiscal years' projects' lack of access to the organized data of this particular study.

Therefore, it is recommended that the study be conducted on projects of Ethiopian road administration five years of data practices with different research designs that help to draw conclusions based on the empirical findings.

1.8. Organization of the Document

The study is organized into four sections: Chapter One has a background of the study, a statement of the problems, the research questions intended to be addressed by the study, objectives, significance, scope, and limitations of the study, and contextual definition of key terms that will be used in the study are presented. On the other hand, Chapter Two deals with the review of the related literature, Chapter Three explains the research methodology, and Chapter Four presents the research result and discussion and Chapter Five summary of conclusion and recommendation.

1.9. Definition of terms.

- Design-Build (DB):-method integrates design and construction services under a single contract, aimed at improving project efficiency and reducing delays.
- Design-bid-build (D-B-B):- is a method of project delivery that involves the owner or agency contracting different entities for design and construction.
- The construction phase:- is when the actual project is underway and all of the appropriate subcontractors are busy working on their particular tasks
- Federal road projects in Ethiopia refer: - to infrastructure development initiatives undertaken by the government to enhance transportation networks at a national level.

CHAPTER TWO

Literature Review

2.1. Introduction

Road, as one of the basic infrastructures plays a vital role in the development of a country‘s development and civilization by connecting rural areas to deliver products to the nearest market and services and products from cities to the countryside. Building roads is very costly and needs highly educated manpower and roads are expected to serve longer periods the organization, Ethiopian Roads Administration has been given the mandate for the restoration, expansion, and maintenance of Ethiopia‘s Federal road network. Its goal is to improve transport operating efficiency and reduce road transport costs, provide access to rural areas, and develop the institutional capacity of the sector (ERA, 2012).

The construction industry is notably different from other industries. Particularly, the industry’s products must be custom-made to suit the problem for which a solution is sought. Secondly, because the industry’s products require the integration of ideas and products of many professionals, problems do arise in managing the interface of the different professionals as well as their products. The relationship between clients and contractors often presents a serious management problem. In many cases, contractors indulge in opportunistic behaviors by attempting to explore and exploit gaps in the contract framework to increase their profits. Clients on the other hand sometimes unreasonably expect the contractor to do extra work at the same price (Uyinmwen & Ogbu 2020).

According to ERA, (2019) Contract is defined as an agreement between two parties to undertake a certain work for the payment of a sum amount of money. A contract legally binds the two parties to undertake the works on one hand and to pay for the works on the other hand. In the meantime FIDIC,(1999) defines a contract as an agreement of conditions, requirements of the client, tender, specifications, and other further documents(if any) that are listed in the contract agreement.

The Ethiopian Civil Code Article 2610 describes a construction contract as a contract of work and labor whereby one party, the contractor, undertakes to produce a given result under his responsibility and in consideration of remuneration that the other party (the client) undertakes to pay him. With growing users' requirements, environmental consciousness, limited resources on one side, and high competition for the construction company marketplace on the other side, the contractor has to be capable of constantly

improving their performance (Saleh et al. 2008). The value of project management within the industry cannot be overemphasized. However, research suggests that some of these projects fail because of delay, cost overrun, low requirement requirements, and complete abandonment (Eichengreen, Rose, and Wyplosz 1994). It should be the issue of attention in the construction world due to problems associated with the construction project. So many projects fail to accomplish planned targets and objectives (Letarge, Quezon, and Macarubbo 2016).

2.2. Theoretical Review

2.2.1. Project Delivery Method

Contract or Project Delivery System is the way Project Owners together with Project Regulators and Financiers determine the assignment of responsibilities to Project Stakeholders along the Construction Process. It is often determined during the Basic Planning phase of a Construction Project. The project delivery systems are also categorized according to their performance Force Account Method (When the project owners engage themselves to undertake the project & believe that there is a comparative advantage in cost, time & quality); Contract Method (When the project owners outsource it).

A project delivery system has been defined as the set of "relationships, roles, and responsibilities of project team members and the sequence of activities required" for the deployment of a capital project (Konchar and Sanvido 1998).

The project delivery method defines the acquisition process, relationships, roles, and responsibilities of the project team and the sequence of events to deliver the facility. Depending on what project delivery method is chosen as the acquisition process, the roles and responsibilities of team members and the sequence of activities are different (Allen 2001).

A study conducted on Innovative Project Delivery Methods for Infrastructure-An International Perspective (Pakkala 2010) categorized contract method of project delivery system as (segmentation, integration & financing) listed below, these are:

2.2.1.1. Integrated Process Delivery Methods

- Design-Build-Operate; (D-B-O):- In a D-B-O contract, a single entity is responsible for designing, building, and operating the project. This method streamlines the process by consolidating these phases under one contractor, promoting efficiency and reducing the potential for disputes between design and construction teams

- Design-Build-Operate-Maintain; (D-B-O-M):- The D-B-O-M approach extends the responsibilities of the contractor to include maintenance of the project after construction. This method not only covers the design, construction, and operation but also ensures that the facility is maintained over a specified period, often ranging from 20 to 30 years. This comprehensive approach ensures the long-term quality and performance of the project
- Design-Build-Finance-Operate; (D-B-F-O):- In the D-B-F-O model, the contractor is responsible for designing, building, financing, and operating the project. This model involves private financing, which can be beneficial for public projects where immediate funding is a constraint. The contractor typically recovers the investment through operational revenues or other means agreed upon in the contract (Ding, Wang, and Hu 2018; Jazayeri and Pajouhi 2017).

2.2.1.2. Segmented Delivery Methods

- Design-Bid-Build; (D-B-B):- This traditional method involves separate contracts for design and construction. The project is first designed by architects and engineers, and then bids are solicited from contractors to perform the construction
- Design-Build; (D-B):- This method combines design and construction services under a single contract. The design-build entity is responsible for both designing and constructing the project, leading to a more integrated approach and often faster delivery
- Construction Management ;(CM):- construction Management (CM) involves the overall planning, coordination, and control of a project from inception to completion. CM aims to meet the client's requirements to produce a functionally and financially viable project. There are different roles a Construction Manager can take:
    - Construction Manager-as-Agent (CMaA): The CM acts as an advisor to the owner and does not contract directly with subcontractors. They provide professional management services to oversee the construction process
    - Construction Manager-at-Risk (CMAR): The CM commits to delivering the project within a guaranteed maximum price and contracts directly with the sub-contractors. This method provides a balance of risk management between the owner and the CM

- Pure Operations & Maintenance (O&M):- Operations and Maintenance (O&M) refer to the broad set of activities involved in managing and maintaining facilities. The goal of O&M is to ensure that a facility operates efficiently and safely and that it is maintained properly throughout its lifecycle. Key aspects include
- Operational Activities: These involve the day-to-day functioning of the facility, ensuring that systems are running smoothly and efficiently.
- Maintenance Activities: This includes preventive and corrective maintenance to keep the facility in good working condition and to prevent breakdowns.
- O&M Manual: An essential document provided to the owner, detailing the operational procedures and maintenance schedules required to manage the facility effectively

2.2.1.3. External Financing Methods

- Design-Build-Finance-Operate ;(D-B-F-O):- is a project delivery method where a single entity is responsible for the design, construction, financing, and operation of a project. This method is often used in public-private partnerships (PPP) for infrastructure projects. The private sector partner assumes the responsibility of securing financing, and after the construction is complete, it operates the facility for a specified period. This approach helps distribute risks and can lead to more efficient project delivery and management
- Build-Own-Operate ;(B-O-O):- is a model where a private entity builds a project, owns it, and operates it indefinitely. The ownership remains with the private entity, which is responsible for the operation and maintenance of the project. This method is typically used in scenarios where the project generates continuous revenue, such as utilities or toll roads. It allows the private entity to benefit from the long-term income generated by the project
- Build-Own-Operate-Transfer; (B-O-O-T):- is similar to the B-O-O model but with a transfer clause. In a B-O-O-T contract, a private entity builds a project, owns and operates it for a specific period, and then transfers ownership to the government or another public authority at the end of the concession period. This model is used to attract private investment for public infrastructure projects while ensuring that the public sector ultimately gains ownership of the asset

Design-build (DB) is the principal project delivery system used in many countries.

In our countries also Federal road construction in Ethiopia is the two public enterprises that use the two types of delivery methods. Since the establishment of Federal road construction in Ethiopia, there have been different project delivery systems (PDS) DB and DBB. Most of the PDS used in ERA are DB. Each project is unique and the owner's objectives change from project to project. Thus, owners should evaluate their objectives carefully and then study the effectiveness of each method in achieving their specific objectives before deciding on the most appropriate delivery method (Sagah et al. 2015).

2.2.2. General Definitions and Concepts

2.2.2.1. Design-Build (DB) Approach

Design-Build (D-B) is simply a project delivery method in which the Owner/Client selects an organization that will complete both the design and construction under one agreement. Upon completion, the Owner is then responsible for the operations and maintenance of the project. The Owner is also responsible for all the financing aspects (Pakkala 2010).

The DB approach in construction projects integrates the design and construction phases under a single contract, typically awarded to a single entity, the design-builder. This method contrasts with the traditional design-bid-build approach, where the owner hires separate entities for design and construction. (Abou Chakra and Ashi 2019; Enshassi 2009)

DB aims to streamline project delivery, enhance collaboration, and potentially reduce project duration and costs (Enshassi et al. 2019).

In this arrangement both the design & construction liability rests with the Contractor. The purpose of the design-bid process is to reduce risks to the owner of the property by assigning all responsibilities to one single entity. It may also help meet shorter deadlines because you can overlap the design and construction process. According to the Design-Build Institute of America, the lead position on the project may be assigned to a general contractor, designer, developer, or as a joint effort. Whoever is in charge selects and follows up with the appropriate subcontractors for all elements of the job, from start to finish. A 2011 study found the design-build project delivery method was used by approximately 40% of non-residential construction projects in the US, which represented a 10% increase from 2010. Popularity continues to increase, but some projects with more complicated components still prefer the design-bid-build process (Conte de Leon et al. 2017).

The following defining characteristics identify Design-Build (DB)

- Integrated process: overlapped design and construction – typically fast-tracked.
- Two prime players: owner and design-build entity.
- One contract – owner to design-builder with a single point of responsibility

The design-builder is responsible to design and construct the project to meet the performance standards set forth by the owner in the contract (employer's requirement).

With respect to any prescriptive designs or specifications, the design-builder is responsible for discovering any inconsistency between the prescriptive requirements and the performance standards and the owner remains responsible for the cost to reconcile the inconsistent standards.

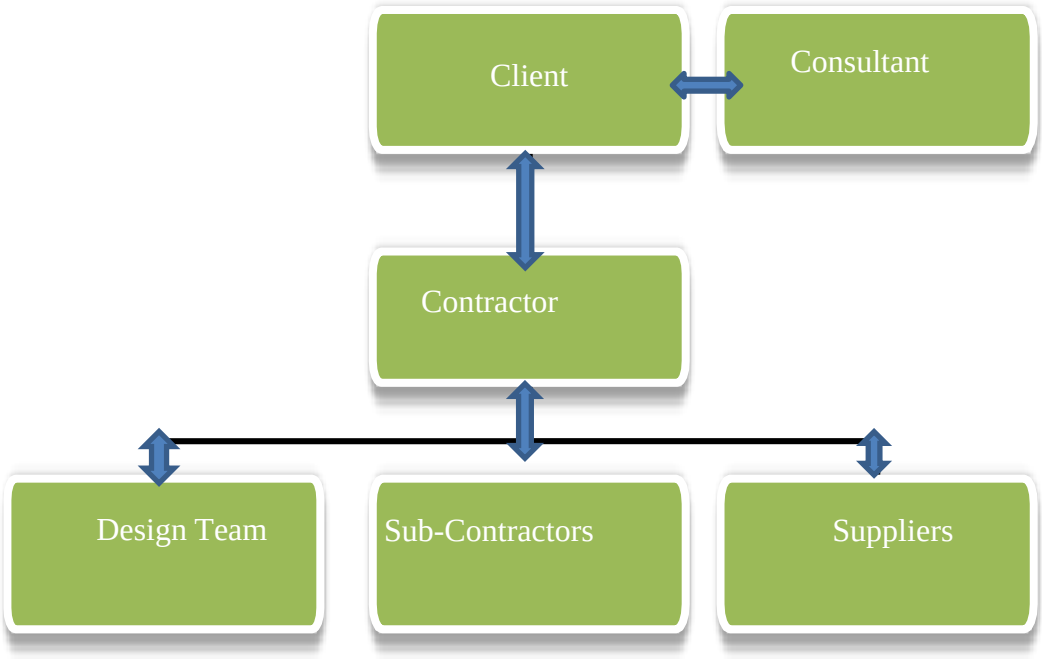


Figure 2-1:-Contractual relationships (project organization structure) of DB projects

Some of the advantages and disadvantages of design-bid-build and design-build are listed below but it may not include all the known but highlights the main points for a clearer understanding of this delivery method's strengths and weaknesses.

2.2.3. Criteria for Selection of Project delivery systems

Selecting the appropriate project delivery method is a key decision that has to be made in the early phases of the project. Many delivery methods can be used on any project. The decision is usually based on certain factors of importance to the owner. The effectiveness of the delivery methods varies according to the factors. Owners must rank their objectives and choose the method that maximizes the effectiveness in achieving the project objectives(El-Sayegh 2009) & ignoring the significance of these factors can lead to substantial problems, disputes, and litigation among the project stakeholders; especially when owners face difficulties in identifying these factors (El-Sayegh 2009) .

The proper selection of a project delivery system (PDS) is considered one of the primary determinants of project success as it influences the subsequent relationships among project stakeholders (Khalafallah and Fahim 2018).

The criteria used for selecting (or evaluating) the appropriate method(s) among the alternative delivery methods were: project time certainty, controlling project cost, ensuring project quality, and reduction of the owner's administrative burden (Lema 2006).

Research conducted by(Asaminew et al. 2013) on Federal road projects in Ethiopia, identified the major factors used to select project delivery systems are: project size, Project complexity, Employers Requirement, and risk considerations, Budget (source and availability), Design, Schedule, Risk Assessment, owners' level of expertise.

The delivery method selected should help the owner to achieve their project goals and objectives efficiently and cost-effectively. A comprehensive study should include all the available PDMs and all the qualitative and quantitative characteristics of the project that may be influenced by the delivery method option (Ghavamifar and Touran 2009).

Research conducted by (Riaz, Abbas, and Solat 2013) on Investigating selection methods for construction project delivery systems based on professionals' perspectives in Qatar, after reviewing Existing Literature and identifying categories into four major pertinent factors for the selection of project delivery system 1. Project Characteristics (cost overrun, schedule delay, project size, risk allocation, responsibility, project design or innovation, Coordination/communication, owner goal, owner control, owner staff capability, Owner PDS experience, Third party Agreements, Owner staff involvement) 2. Regulatory issues (Competitive bidding, Local laws) 3.Life cycle issues (Maintenance, Life cycle cost, sustainability) 4. Other issues (Construction claims/disputes, Adversarial relationships.

According to (Ratnasabapathy and Rameezdeen 2006) the factors for the selection of appropriate project delivery systems are classified into internal and external factors as shown in Fig 2.2 Below.

The figure shows how the factors relate and interrelate with each other. It explains how the task involved in selecting the right Procurement Method can be extremely complex and difficult to unravel.

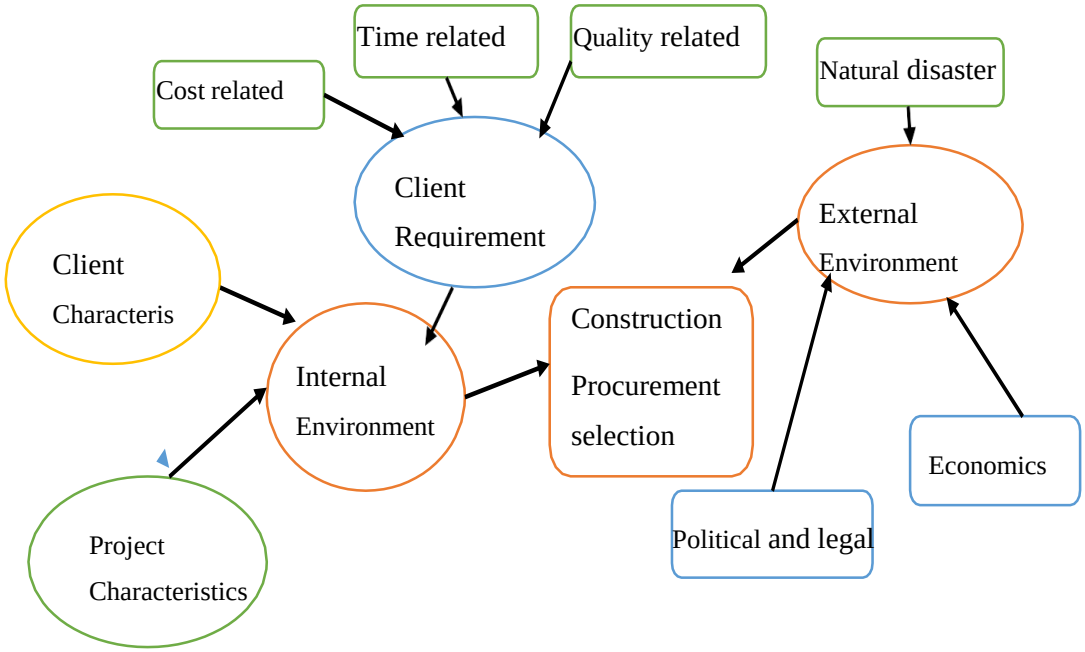


Figure 2-2:-Factor Affecting Selection of Procurement Method

Source: (Ratnasabapathy and Rameezdeen 2006)

2.2.4. Selection of project delivery system & project performance

The success of construction projects depends mainly on the success of performance. The selection of project procurement method has a great impact on project performance (time. cost and quality). (Cheung, Suen, and Cheung 2004) identified project performance categories such as people, cost, time, quality, safety and health, environment, client satisfaction, and communication.

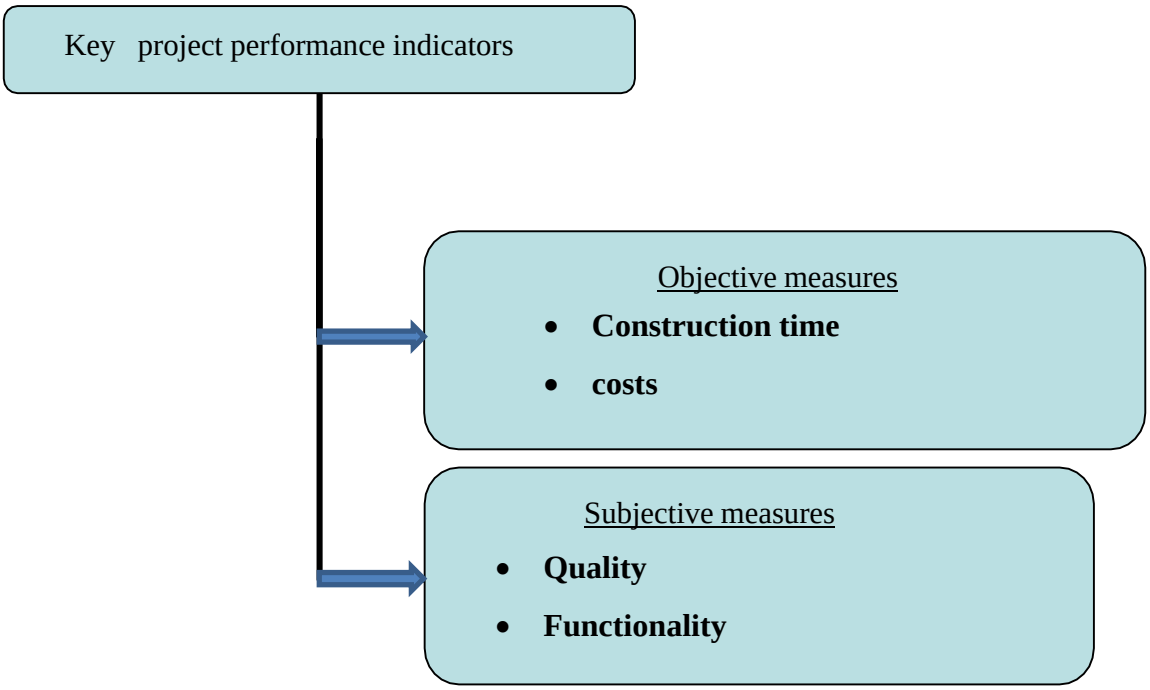


Figure 2-3:-Key Performance Indicators for Project Success

Source:(Chan et al. 2016).

Traditionally, a project is considered to have achieved a high level of performance if it is delivered at the right time, right price, and good quality level(Ghadamsi 2016). These criteria have been described as the iron triangle of project performance. Fig. 2.4 below shows the iron triangle as adopted by (Atkinson 1999).

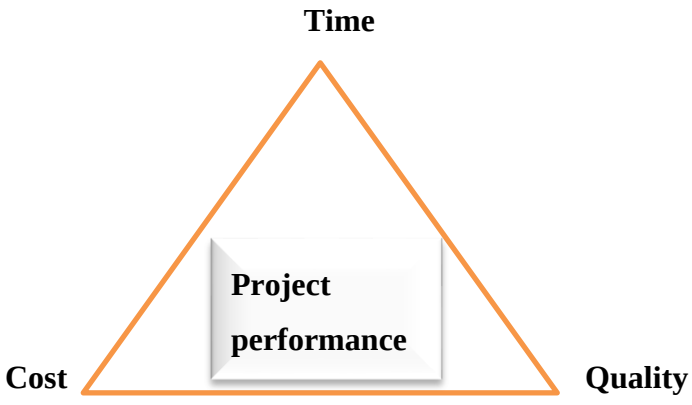


Figure 2-4:-Project Performance Criteria Trade-Off

Source: (Atkinson 1999)

A study and Analysis of Factors Affecting the Performance of Construction Projects conducted (Alias and Mohamad 2015) listed the most important performance indicator of any construction industry as below 1-9.

(1). Cost

(2). Time

(3). Quality

(4). Productivity

(5). Client Satisfaction

(6). Community Satisfaction

(7). Health and Safety

(8). Innovation and Learning

(9). Environment

(Collins 1996) also point out in the area of project management that, the schedule, cost, and quality achievement is also referred to as the iron triangle. Out of these three aspects, it is the achievement of schedule and cost compliances that the project management is attending to most of the time.

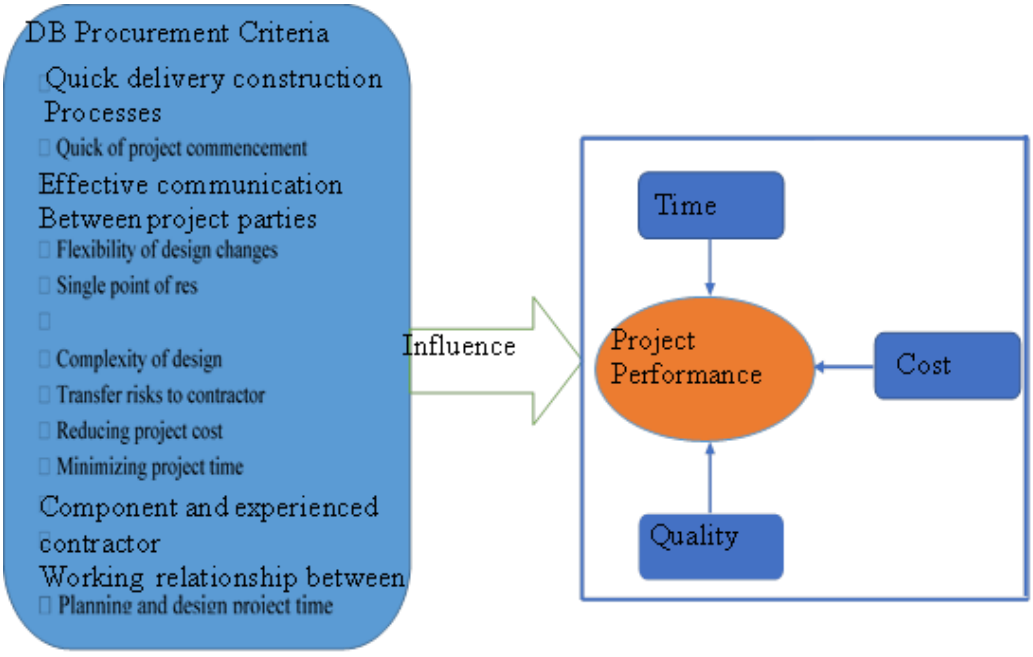


Figure 2-5:-Conceptual Framework of Construction Procurement Influence on Project Performance

Source: (Ghadamsi 2016)

2.2.5. Factors which affect project time performance

(Ogunlana, Promkuntong, and Jearkjirm 1996) investigated 12 high-rise buildings and categorized their findings into client/consultant-related, contractor-related, and external causes for time delays.

Factors influencing construction time and cost overruns on high-rise projects in Indonesia, (Kaming et al. 1997) found that ‘design changes’, ‘materials shortage’, and ‘inadequate planning’ were the most significant contributors to time delays on construction projects.

Similarly (Sambasivan and Soon 2007) categorized their findings into client, contractor, and consultant categories. The ten most important causes were:

1) Contractor’s improper planning,
2) Contractor’s poor site management,
3) Inadequate contractor experience,
4) Inadequate client finance and payments for completed work,
5) Problems with subcontractors,
6) Shortage in material,
7) Labor supply,
8) Equipment availability and failure,
9) Lack of communication between parties, and
10) Mistakes during the construction stage.

An increase in material cost, inaccurate materials estimation, and underestimating of project costs among others are the most significant cost factors while the most significant time factors include unexpected site conditions, increase in project scope, lack of timely progress payment, and inadequate planning. (Odediran, Gbadegesin, and Babalola 2015) Study conducted by(Hosseini et al. 2018)

Accordingly, the findings reveal that researchers from developing countries have contributed the most to identifying the causes of CPD. A total of 149 causes of CPD were identified in a thorough review of 97 selected studies. Weather/climate conditions, poor communication, lack of coordination and conflicts between stakeholders, ineffective or improper planning, material shortages, financial problems, payment delays, equipment/plant shortage, lack of experience/qualification/competence among project stakeholders, labor shortages, and poor site management were identified as the ten most common CPDs.

2.2.6. Factors which affect project Cost performance

Studied the performance of transportation infrastructure projects in Nigeria and concluded that ‘material price fluctuations’, ‘inaccurate estimates’, ‘project delays’, and ‘additional work’ contributed most to cost overruns. In a fourth study on construction projects in Nigeria by (Elinwa and Buba 1993), it was found that ‘cost of materials’, ‘fraudulent practices’, and ‘fluctuations in materials prices’ had the most significant impact on project costs.

The above causes of cost growth or cost overrun can be summarized as:

Additional works;

- Time delay (client and contractor);
- Material, machinery, and labor cost increment;
- Inaccuracy of material take-off and estimation;
- Inadequate pre-planning and fraudulent practices.

2.2.7. Factors which affect project Quality performance

Quality can be described as meeting specifications and approved standards agreed upon by stakeholders. (Collins 1996) describes quality as the world’s oldest documented profession. Quality professionals use several definitions to define project quality. Quality in its simplest form can be defined as: ‘meeting the customer’s expectations,’ or ‘compliance with customer’s specification.’ No matter what definition we follow for quality, it becomes very complex when we try to put it into actual practice. For a user, quality is nothing but satisfaction with the appearance, performance, and reliability of the project for a given price range research conducted on Factors affecting the performance of Construction projects in the Gaza Strip identified factors that affect the quality of the project and rank from highest to lowest respectively as (Conformance to specification, Unavailability of competent staff, Quality of equipment and raw materials, Quality assessment system in organization and Quality training/meeting). Construction Quality from Different Perspectives is discussed below;

2.2.7.1. Client’s Perspective on Quality

The majority of research work in this area indicates the clients’ main concern boils down to ‘value for money’ and ‘fit for the purpose’. However, these objectives are rather broad in

definition and encompass a vast variety of factors. Because of the subjectivity associated with these definitions, their objective assessment is very difficult. Below an outline definition is provided.

- Value for Money: Basically, value for money means the best available for the client, for a given money. This is a measure of how well the product is and the level of satisfaction it creates. Different roads have different characteristics; however, it may be possible to use statistical techniques to develop a quantified method for measuring the value of money.
- Fit for Purpose: This parameter, from the client's point of view, is a reflection of the degree to which the product satisfies his requirements as defined, as early as, the briefing phase.

2.2.7.2. Contractor's Perspective on Quality

The prime concern of the constructors is 'client satisfaction'.

- Client's Satisfaction: How pleased the client is with the final product is a matter of concern to the Contractor. This can be divided into subjective and measurable parameters. Therefore, the perception of the client about the subjective parameters, such as design features and finishing, is a matter of concern to the Contractor.

2.2.7.3. Third Party Perspective

Normally, the third parties in the construction industry consist of quality assurance companies or local authorities. The standards adopted by the third parties often measure 'fit for the purpose' and 'material quality level'(Oliver 1993).

2.2.8. Federal Road Projects in Ethiopia

Federal road projects in Ethiopia refer to infrastructure development initiatives undertaken by the government to enhance transportation networks at a national level. These projects are crucial for economic growth, social connectivity, and regional integration. The Ethiopian government invests significant resources in road construction and rehabilitation to improve access to markets, services, and employment opportunities across the country (Tadesse, Abate, and Zewdie 2020).

2.2.9. Contract Implementation

Contract implementation encompasses the process of executing the terms and conditions outlined in the contract agreement between the project owner (the Ethiopian government, in this case) and the contractor (design-builder). Effective contract implementation ensures

that the project progresses according to schedule, budget, and quality standards while mitigating risks and disputes. It involves various activities such as project planning, resource allocation, communication, monitoring, and compliance with contractual obligations (Abbas et al. 2018).

Contract implementation is a critical aspect of infrastructure development projects, particularly in the context of design-build federal road projects in Ethiopia. Effective contract implementation ensures that projects are completed on time, within budget, and meet quality standards. In the case of the Ajire- keraker -Ketema Nigus road project, understanding the factors influencing contract implementation effectiveness is crucial for successful project delivery. This literature review examines previous research and scholarly act implementation in infrastructure projects, with a focus on design-build federal road projects in Ethiopia.

2.2.10. Ajire- keraker -Ketema Nigus Road Project

The Ajire- keraker -Ketema Nigus road project is a specific federal road project in Ethiopia, likely encompassing the construction or rehabilitation of a road network connecting the Ajire- keraker -Ketema Nigus or Amhara and Tigray regions. Understanding the context and challenges of this project is essential for evaluating the effectiveness of contract implementation and identifying factors influencing project outcomes (Ministry of Transport of Ethiopia, 2019).

By synthesizing existing literature on these concepts and applying them to the context of the Ajire- carmaker -Ketema Nigus Road Project, this research aims to provide insights into the effectiveness of contract implementation in DB federal road projects in Ethiopia.

The foundation for a comprehensive understanding of the key terms and concepts relevant to the research topic sets the stage for further investigation into the specific case study of the Ajire- carmaker -Ketema Nigus Road Project.

2.2.11. Contract Management in Infrastructure Projects

Contract management plays a vital role in the success of infrastructure projects. According to (Mekonnen 2018) effective contract management involves proper planning, execution, and control of the contract terms to achieve project objectives. The authors emphasize the importance of clear communication, risk management, and stakeholder engagement throughout the contract implementation process.

2.2.12. Challenges in Contract Implementation

Several challenges can hinder effective contract implementation in infrastructure projects. According to (Abebe, Gugsa, and Ahmed 2020).common challenges include inadequate project planning, poor contract administration, lack of skilled personnel, and delays in payments. The study underscores the need for improved coordination among project stakeholders and enhanced capacity building to address these challenges.

2.2.12.1. Factors Affecting Contract Implementation

Various factors influence the effectiveness of contract implementation in infrastructure projects. (Gashaye et al. 2023) identify factors such as contractual disputes, inadequate project monitoring, and changes in scope, and political interference as significant challenges. The authors suggest the adoption of appropriate contract management strategies, including regular monitoring and evaluation, to mitigate these challenges.

2.2.12.2. Best Practices in Contract Implementation

Despite the challenges, certain best practices can enhance contract implementation effectiveness. According to (Birhanu 2017), establishing clear project objectives, defining roles and responsibilities, and promoting collaborative relationships among stakeholders are essential for successful project delivery. The study emphasizes the importance of effective communication and conflict resolution mechanisms in ensuring project success.

2.2.13. Conceptual frame work

Based on the reviewed literatures, the researcher has developed a conceptual frame work for this study.

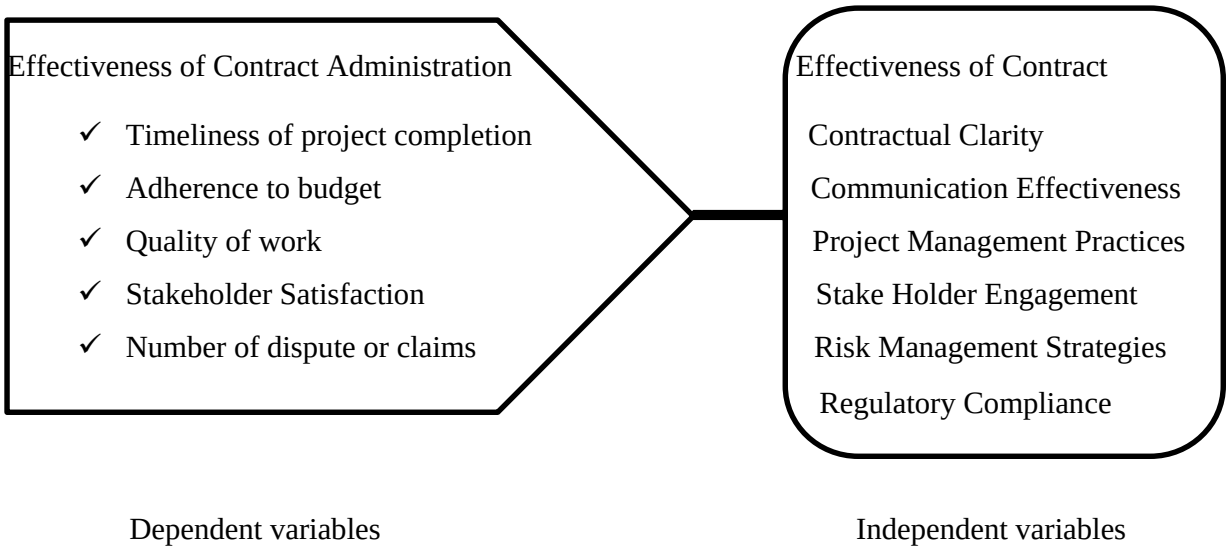


Figure 2-6:-conceptual frame work of an effective contract administration

Source: (Madas and Kitsios 2021)

2.2.14. Research gap

A gap in effect DB project delivery could benefit from further research. In conclusion, while Design-Build contracting has proven to be a successful project delivery method, there are still research gaps that need to be addressed for optimized outcomes. Addressing these gaps could lead to improved practices and Create awareness among all stakeholders from clients, contractors, and consultants about optimized design and build delivery methods.

CHAPTER THREE

Research Methodology

3.1. Study Area

The study covered all completed and progress design bids of federal road projects in Ethiopia, using the case study of the Ajire- keraker -Ketema Nigus road project to assess the effectiveness of contract implementation of DB. (Refer figure 3.1)

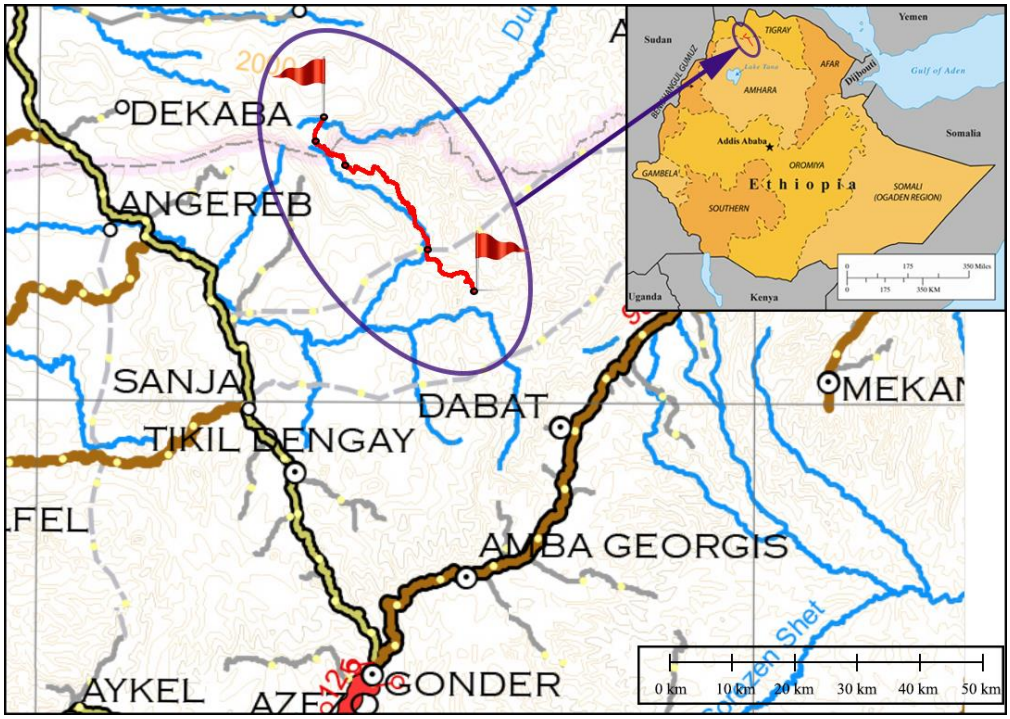


Figure 3.1 Ajire- keraker -Ketema Nigus road project in Ethiopia (Google Earth, 2024)

3.2. Research Design

The research design followed a descriptive survey and, a desk study, a desk study was chosen as one of the instruments to assess the practices from relevant studies, reports, and documents. Besides, the research instruments use questionnaires, Interviews, and document reviews. Hence the research design used for this research are a descriptive survey to compare the effectiveness of the project delivery system.

3.3. Sources of Data

The population for this study are Ethiopian Roads Administration head office staff .who have a direct relation with the contract administration of projects. The questionnaires were

prepared and distributed to the ERA at Addis Ababa, Mexico area North 50, Contractors 50, and Consultant 50. The effectiveness of contract implementation on design-build federal road projects from the perspective of the employers. The total population for this research is 150 respondents.

3.4. Sampling Design

The targeting population are in line with the objectives of the assessment on the effectiveness of the Design-build and Design bid build and The Sampling frame are designed from the list of participants in Ethiopian road projects development projects. It illustrates as below are Contractors, Consultants, and Clients. Determining the sample size are the key to the overall statistical process. To determine the sample size, use an equal proportion of positive and negative responses.

The sample size was calculated using the following Sliven's formula, with a margin of error of 5% and 95% confidence levels.

n= N/ [(1 + $N * e2$)] ---------- (1)

n = 150 / [1+150(0.05)2] = 109

Where:

n = sample size

N = the population size

e = the error margin

The sample size has at least 109 respondents.

3.4.1 Sampling Population

The target population of this research are clients, consultants, contractors and management professionals who have direct and indirect relation with the contract administration practice in target construction project site.

3.4.2 Sampling Size

The Sample Size were prepared and distributed to the ERA at Addis Ababa, Mexico area North 50, Contractors 50, and Consultant 50. The effectiveness of contract implementation

on design-build federal road projects from the perspective of the employers, consultant and contractor. The total population for this research is 150 respondents.

3.4.3 Sampling Technique

Sampling is the selection of subset of the population of interest in research study. In the vast majority of research endeavors, the participation of entire population of interest is not possible, so a smaller group is relied up on for data collection. Sampling from the population is often more practical and allows data to be collected faster and at a lower cost than attempting to reach every member of the population (Turner, 2020).

In order to generalize from a random sample and avoid sampling errors or biases, a random sample needs to be of adequate size. What is adequate depends on several issues like the absolute size of the sample selected relative to the complexity of the population, the aims of the researcher and the kinds of statistical manipulation that have been used in data analysis (Taherdoost, 2016).

3.5. Method of Data Collection

The researcher used both primary and secondary data collection instruments for this study. Ethiopian Roads Administration head office staff are the major source for the primary data where the questionnaire was distributed and semi-structured interviews were conducted with the specific construction administration staff. The secondary data are obtained from different articles, reports, academic journals, manuals and guidelines of ERA and publications on contract administration practice, performance reports of the roads from ERAMS (Ethiopian Roads Administration Management System)

3.6. Method of data Analysis

Questionnaires were distributed to respondents with a brief orientation on how respondents use their perceptions and thoughts to answer questions. The survey pack included a copy of the cover letter with a brief introduction to the questions.

- **Questionnaires**

The structured questionnaires used are close-ended and open-ended. The open-ended questionnaires are developed to assess the contract administration practices of the organization. The close-ended questionnaires are constructed based on the five-point Likert scale model to assess the effectiveness of Contract Administration practice. Questionnaires

are developed after reviewing different books, articles, reports, academic journals, manuals, and Guidelines of ERA and publications on contract administration practices.

- **Interview**

The interview are a conversation, whose purpose were to gather descriptions of the life- -the world of the interviewee concerning the interpretation of the meanings of the described phenomena. It adds that an extendable conversation between partners aims at having in-depth information 'about a certain topic or subject, and through which a phenomenon could be interpreted in terms of the meanings interviewees bring to it (Kvale 1996). The researcher has used semi structures interviews for this study, and according to (Holstein and Gubrium 2002) unlike structured interviews, semi-structured interviews are open to situations through which greater flexibility and freedom are offered to interviewers and interviewees in terms of planning, implementing, and organizing the interview content and questions.

3.7. Method of Data Presentation

To best meet the objective of the study Summary of statistics was organized both in the form of qualitative and quantitative measures by using frequencies and percentages. The questionnaire is designed in a structured way still containing open-ended questions and a Likert scale indicating measurement used based on survey 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, and 5=strongly agree and other open-ended questions as well. Responses to the questionnaire are summarized and presented making use of SPSS software version 26 and Excel. Though the sample size is 109, 117 questionnaires were distributed assuming a response rate of 95%.

Qualitative data analysis includes a ranking of factors that affect time, cost, and quality through the Relative Importance Index. The RII was computed as (Alias and Mohamad 2015; Cheung, Suen, and Cheung 2004; Enshassi 2009).($RII = \Sigma W / (A \times N)$, $(0 \leq index \leq 1)$, Where W is the weight given to each factor by the respondents and ranges from 1 to 5; A – is the highest Weight (that is 5 in this case) N – is the total number of respondents (where "1" is "very poor" and "5" is "very high").

3.8. Reliability and validity

When something are reliable, it consistently produces the same results in various instances that are comparable. If a study is considered reliable, it produced comparable or identical

results when it was duplicated. As the most popular test to establish an instrument's internal consistency, Cronbach's alpha was employed to evaluate reliability in the present study. For integrating items in Likert-type scales that employ each item to measure a distinct observable fact with an original quantitative measurement range, use Cronbach's alpha (Gliem and Gliem 2003). According to (Gliem and Gliem 2003), Cronbach's alpha result, which is a value between 0 and 1, a reliability score of 0.7 or above is considered acceptable. Questionnaires were distributed to some professional respondents, according to the results, the questionnaire was well organized, clearly prepared, and easy to complete, and then it was returned to the study.

The reliability of the questionnaire was checked by the Cronbach‘s-Alpha test coefficient using SPSS version 26.0 software and the result obtained was 0.781

The general rule of thumb is that a Cronbach’s alpha of 0.70 and above is good, 0.80 and above is better and 0.90 and above is best.(shown on appendix B)

Table 3-1:-Cronbach‘s alpha test coefficient values

Reliability Statistics	
Cronbach' s Alpha[a]	N of Items
0.781	62

Source: Own computation based on data collected (SPSS 26 result)

3.9. Validity Test

As (M. Joppe 2003),, stated that, Instrument validity pertains to the ability to accurately measure what to measure based on the objective of the study. It is used to make sure that all the relevant variables are included and irrelevant ones are excluded. It also assures all the variables considered are accurately measured

In this regard, a universally accepted sampling method was used to draw the selected sample of the population. Due emphasis was given to making the questions objective type and understandable so that the client, contractor, and consultant can answer the questions properly based on what they know. Vague and confusing wordings were avoided so as not to mislead the employees at the time of filling out the questionnaires. The questionnaire was organized and finalized with a close consultation of expertise in the subject. To address Ambiguous claims, the same spirited questions were forwarded to Key informant

participants for triangulation purposes. Furthermore, secondary documentations were reviewed to verify factual claims made by respondents.

3.10. Ethical Considerations

The data was collected by obeying ethical considerations. A supportive letter was written to the concerned organization for the researcher to collect data from the construction Engineering and management chair and the data is used only for academic purposes.

(saunder, 2019) states that respondents and participants during research data collection should participate based on informed consent. Since the study was conducted only for academic purposes there were no conflicts between the researcher and the respective project stakeholders.

CHAPTER FOUR

Results and Discussions

4.1. Description of demographic profile & response rate of respondents

This chapter of the study deals with the analysis and interpretation of data collected from the questionnaire and interview taken from employees of the authority out of the 117 questionnaires distributed a total of 109 questionnaires were returned and the analysis is conducted on those. Accordingly, tables and charts are used for ease of understanding.

(Yesegat 2008), as cited in (Lulseged 2021), argued that the response rate of 71.8% will be good in poor developing countries, like Ethiopia where data collection activity is very challenging. The response rate for this study is 92.7%, based on the above criteria it is considered as good. Based on the returned 109 questioners

4.1.1 Response Rate

This study deals with the analysis and interpretation of data collected from the questionnaire and interview taken from employees of the authority out of the 117 questionnaires distributed a total of 109 questionnaires were returned and the analysis is conducted on those.

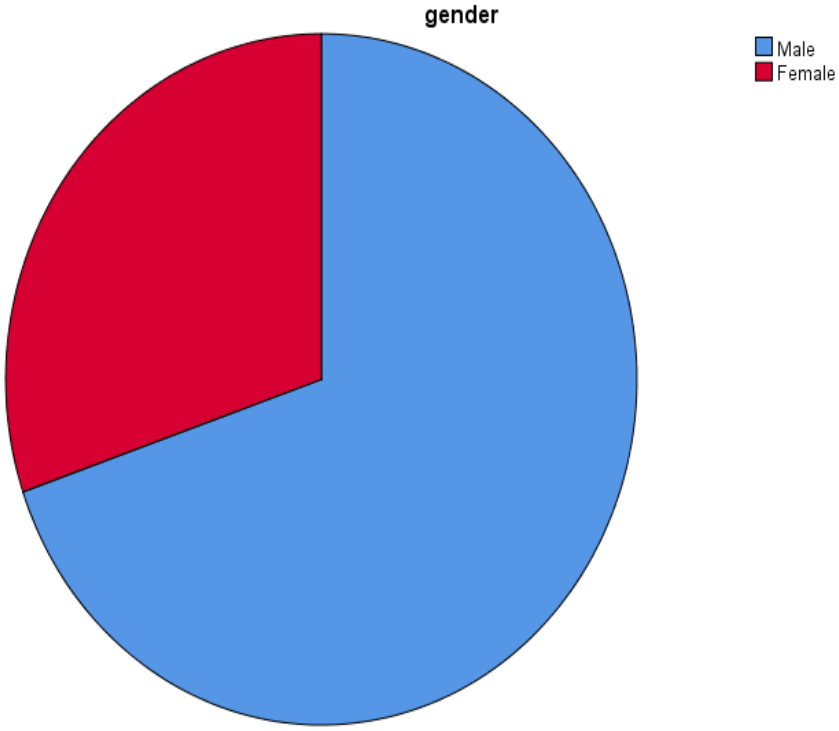
4.1.2. Demographic characteristics of Respondents

Table 4-1:-Classification of the Respondent based on Gender

	Description	**Frequency**	**Percent**
Gender	Male	76	69.7
	Female	33	30.3
	Total	109	100

Source: Own Survey (2024)

This section classifies respondent based on their gender category. Based on Table 4.1.2 out of the total respondents, (69.7%) of the respondents are males and the rest (30.3%) of them are females. Hence in this sector, the majority of workers are Male.



Source: Own Survey (2024)

Figure 4-1:-gender

4.1.3. Classification of the Respondent based on Age

Table 4-1:-Classification of the Respondent based on Age

	Description		Frequency	Percent
Age		under 25	13	11.9
		25-34	45	41.3
		35-44	39	35.8
		45-54	6	5.5
		>55	6	5.5
		Total	109	100.0

Source: Own Survey (2024)

This section classifies respondent based on their Age category. Based on Table 4.2, about 11.9 % of the respondents are under the age category of less than 25 years inclusive, 41.3% of the respondents are under the age category of 25-34years inclusive, 35.8% are under the age of35-44, 5.5 % of the respondents are under the age category of 45-54years inclusive

and the rest of the others are above 55 years. These showed employees between the ages of 25-34 years make up the major portion.

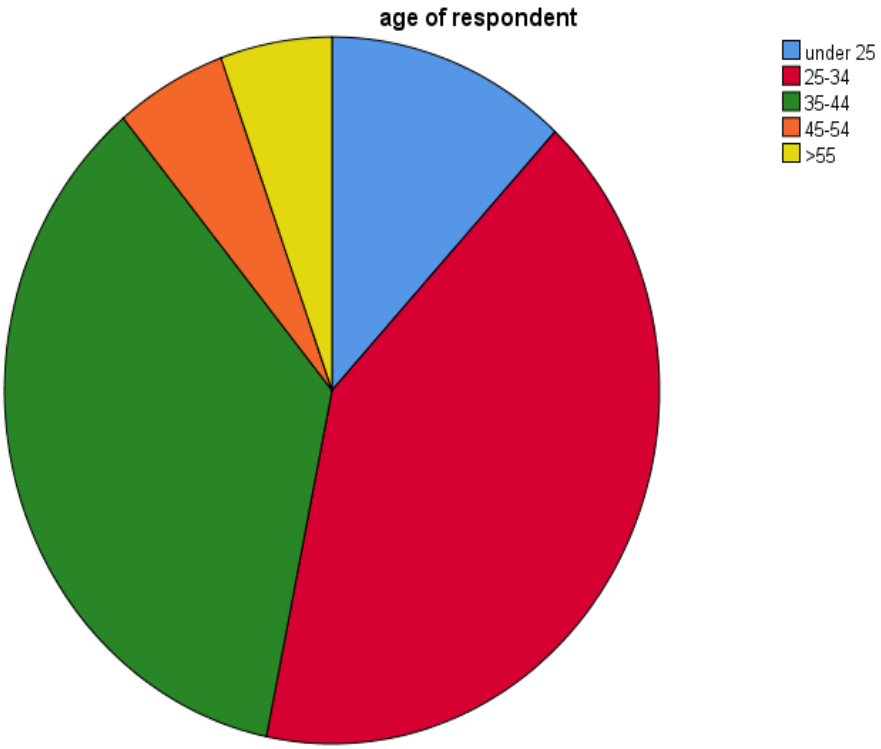


Figure 4-2:-Respondents Age

Source: Own survey (2024)

4.1.4. Higher Academic Qualification

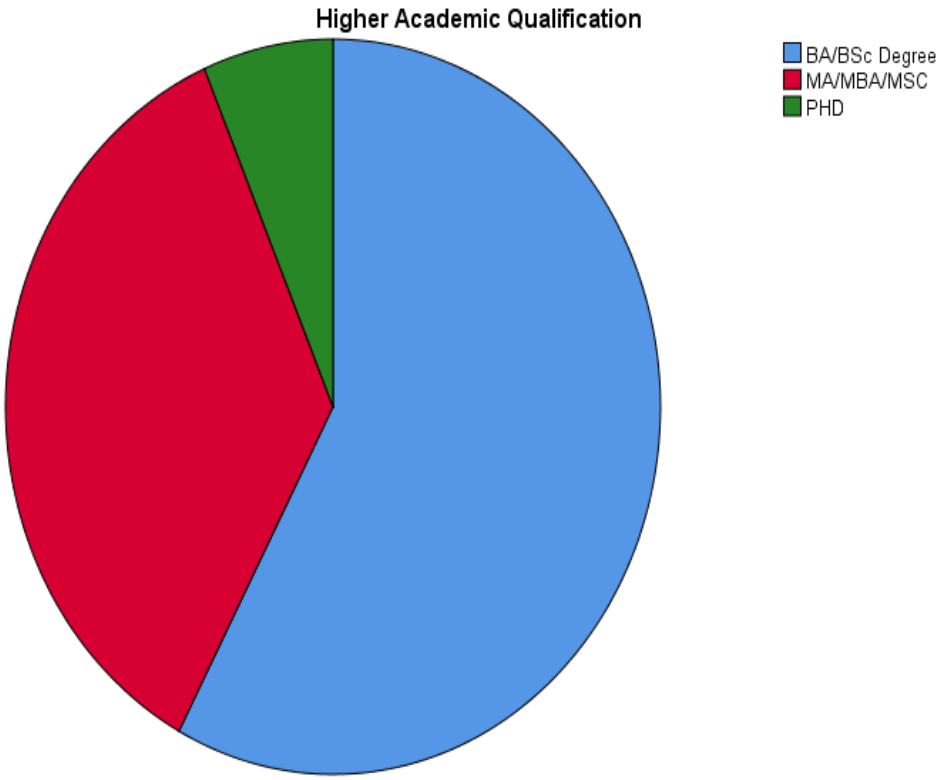
Table 4-1:-Classification of respondents based on their Education level

	Description	**Frequency**	**Percent**
Educational level	BA/BSc Degree	63	57.8
	MA/MBA/MSC	39	35.8
	PHD	7	6.4
	Total	109	100.0

Source: Own Survey (2024)

The educational background helps to show how the data was collected from the respondents who have better knowhow of the construction industry and helps in the clarity of the response.

As per Table 3, about 57.8 % of them are degree holders, 35.8% of them are Masters and the rest 6.4 % are Ph.D. holders. This implies that degree holders are the leaders in the Administration.



Source: Own Survey (2024)

Figure 4-3:-Respondents Educational Level

4.1.5. Classification of respondents based on their Work position

Table 4-1:-Classification of respondents based on their Work position

	Description	Frequency	Percent
Work Position	Junior Engineer	10	9.2
	Senior Engineer	6	5.5
	Construction Engineer	36	33.0
	Lead Engineer	8	7.3
	Team Leader	17	15.6
	Office Engineer	8	7.3
	Project Manager	15	13.8
	Resident Engineer	5	4.6
	General Manager	4	3.7
	Total	109	100.0

Source: Own Survey (2024)

Regarding the position of the respondents, Table 4.4 above indicates that 9.20 % of them are Junior Engineers, 5.5% of them are Senior Engineers, 33.0 % of them are Construction Engineers, 7.3% of them are Lead Engineers, 15.6% of them are Team Leaders, 7.3% of them are Office Engineers, 13.8%, of them are Project Managers, 4.6% are Resident Engineers and 3.7% are General Managers.

Figure 4-4:-Respondents Wok Position

Source: Own Survey (2024)

4.1.6. Classification of respondents based on their Work Experience

Table 4-1:-Classification of respondents based on their Work Experience

	Description	Frequency	Percent
Work Experience	<3 Years	19	17.4
	3-8 Years	50	45.9
	9-12 Years	26	23.9
	>12 years	14	12.8
	Total	109	100.0

Source: Own Survey (2024)

Based on the data in Table 4.5, 17.4 % of the respondents have an experience of less than 3 years, 45.9% have experience of 3 to 8 years, and 23.9.% of them have 9 to 12 years of experience, and 12.8 % of the have an experience of more than 12 years. This shows employees with work experiences of 3-12 years take a major part in the administration.

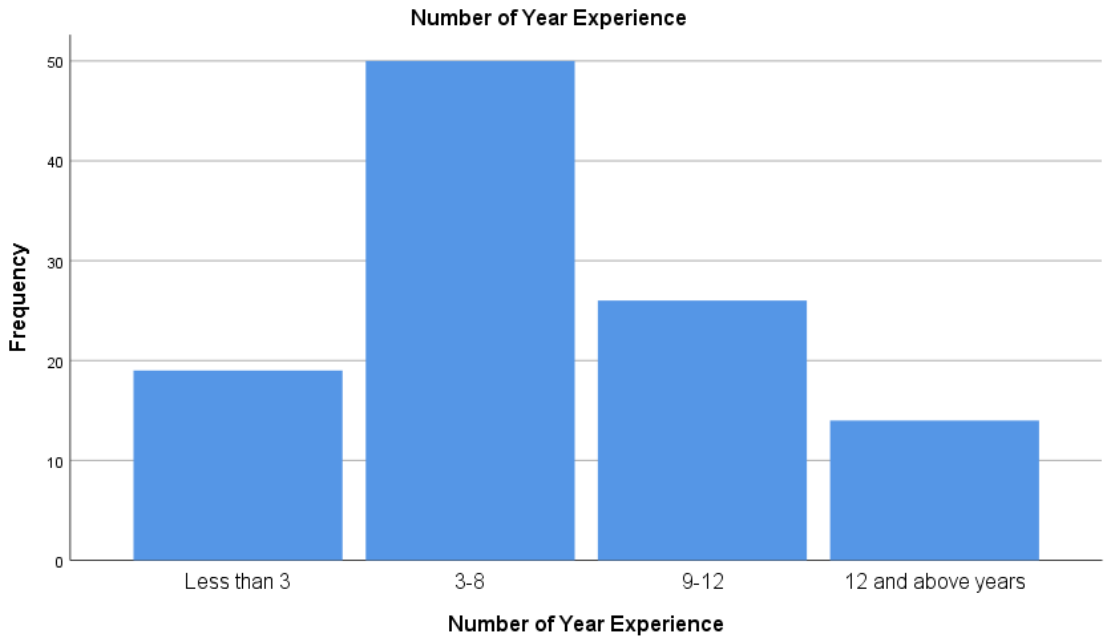


Figure 4-5:-Respondents Work Experience

4.2. Analysis on the effectiveness of the contract administration practice ERA

4.2.1. Analysis based on Questionnaire Responses

Based on section 2.1 of the conceptual framework, the researcher constructed 20 parameters that are bases for effective contract administration practice. Based on these parameters primary data were collected by using Likert scale questionnaires (1-Strongly Disagree, 2- Disagree, 3-Neutral, 4-Agree, 5- Strongly agree) and the analyzed as follows.

According to (Chileshe and John Kikwasi 2014) the mean values which are driven by the 5-point Likert scale can be rated and categorized as follows.

- $0 \geq 1.80$ indicates a very low extent or it is not very important.
- $1.8 \geq 2.6$ indicated low extent or not important
- $2.6 \geq 3.4$ indicates average or moderate value
- $3.4 \geq 4.2$ indicates an important or large extent
- $4.2 \geq 5.0$ indicates a very large extent or very important

Based on the criteria above the researcher evaluated the effectiveness of the contract administration practice of Ethiopian Roads Administration. Table 4.6, below shows analyses of the data collected from ERA staff, who have a direct relation with the contract administration practice, and their response is coded and extracted in the SPSS Version 26.0

software. So, the table below indicates the descriptive statistics results based on the parameters that can help to evaluate the effectiveness of contract administration practice.

Table 4-2.1:-Descriptive statistics

Factors for the effectiveness	N	Minimum	Maximum	Mean	Std. Deviation
Following up manuals and guideline	109	1	5	4.06	.905
As a member of the board of directorship used to feel responsible and devote sufficient time to carry out my responsibilities	109	1	5	3.68	1.231
Skilled and experienced staffs	109	1	5	3.72	1.131
Risk identification and management	109	1	5	3.26	1.125
Scope change management	109	1	5	3.90	1.018
Appropriate scheduling of project completion time.	109	1	5	3.74	1.243
Quality assurance procedures	109	1	6	4.05	.985
Appropriate allocation of project costs	109	1	5	3.94	1.239
Dispute resolution management	109	1	5	3.82	.964
Updating manuals and guidelines using best practices	109	2	5	3.89	.906
Consistently using Consistently using Ethiopian Roads Administration Management System ERAMS	109	1	5	3.08	1.256
Training of staff on contract administration practices	109	1	5	3.00	1.009
Monitoring and evaluation	109	1	5	3.01	1.151
Well organized contract filing system	109	1	5	3.03	0.995
Problem in clearing Right of way (ROW)	109	1	5	2.85	1.112
Absenteeism and turnover of the staffs(Consultant & Contractor)	109	1	5	3.13	1.072
Delay in effecting payments	109	1	5	3.00	1.018
Clear role and relationship of contract parties	109	1	5	3.16	.992
Top management support	109	2	2	1.65	.479
Timely response to a contracting parties	109	1	5	3.74	1.243
Contract close out procedures	109	1	5	3.60	1.306
Valid N (list wise)	109				

Source: Own Survey (2024)

This indicates that the authority updates the manuals and procedures and the role of the contracting parties (contractor consultant and employer) is clearly stated in their contract documents. There is also a high top management support to the staff. Through these activities the authority contract implementation on design-build practice is effective.

Based on the above 4 performance categories, the contract implementation on design-build was not effective in the activities of top management support And the contract implementation on design-build practice is at a moderate level of effectiveness in the activities of Risk identification and management, consistently using ERAMS, Training of staff on contract administration practices, Monitoring and evaluation, Well organized contract filing system, Problem in clearing Right of way (ROW, Absenteeism and turnover of the staffs(Consultant & Contractor), Delay in effecting payments and Clear role and relationship of contract parties. finally, the project contract implementation on design-build practice was effective in the activities of Following manuals and guidelines, As a member of the board of directorship used to feel responsible and devote sufficient time to carry out my responsibilities, Skilled and experienced staff, Scope change management, Appropriate scheduling of project completion time, Quality assurance procedures, Appropriate allocation of project costs, Dispute resolution management, Updating manuals and guidelines using best practices, Timely response to contracting parties and Contract close out procedures monitoring and evaluation of a contract and timely response to contracting.

Standard deviation implies that deviation from the mean. In statistics data that have a small standard deviation indicates that values in a data are close to the mean and a higher standard deviation means values in a data are far away from the mean. Based on this, Table 4.06 above indicates that there is a high standard deviation for the top management support (1.65), which indicates there is a high variability between the responses given in measuring such variables when compared to the lower ones. The rest variables have an average standard deviation.

4.3. Time, Quality and Cost Performance

4.3.1 Time Performance

Time is one critical that measures project performance which all stakeholders of a project carefully consider. It also measures the success and failure of the project. Time is one of the natural resources and it is also considered money. A Project was delayed because of

cost overrun claims. This delay in time cannot come from one party in the construction industry. After a review of the literature cause of delay or time growth is categorized into

- Delay that arises due to the owner's responsibility
- Delay that comes from the consultant's responsibility
- Delay that comes from the contractor's responsibility
- Delay that comes from beyond the control of parties (usually natural and manmade).

Ranking the results obtained from the questionnaire of time overruns (delay) For the DB project delivery system are (top three factors): - changes in laws and regulations, Lack of experience, and Lack of experience on the part of the consultant's site staff.

The causes of schedule growth arise from all participants or parties of the project and may differ from one project to another. (Kikwasi 2012) indicate seven highly ranked causes of delay or time growth as design changes, delays in payment to contractors, information delays, funding problems, poor project management, compensation issues/right of problem, and disagreement on the valuation of work done.

Table 4.3.1:-Factors for delayed of DB project delivery method

Causes(factors) for time (schedule) growth in road project	DB	
	RII	Rank
changes in laws and regulations	0.81	1
Lack of experience	0.80	2
Lack of experience on the part of the consultant's site staff	0.80	3

Source: Own Survey (2024)

4.3.2. Cost growth Performance

Cost overruns (cost growth) are presented in the bottom table. As per the respondent, the main causes for cost overrun (cost growth) of design-build (DB) projects were additional work; time delay, and inadequate pre-planning, taking the top three causes for cost growth. Cost overrun is described as the ratio of the change in the original contract amount to the original contract award amount. Causes of cost overrun may vary from project to project since every project is unique a study conducted on causes of cost overrun in construction industries in developing countries, as it has been found that all the factors are not similar to

every project in developing countries though some of them are common such as poor management, fluctuation of material prices inaccurate material estimates and financial status of the contractor.

The most important causes of cost overrun were found to be inflation or increase in the cost of construction materials, poor planning and coordination, change orders due to enhancement required by clients, and excess quantity during construction (Nega 2008).

Table 4.3.2:-Factors for cost growth of DB project delivery method

No.	Causes for Cost growth in road projects	DB	
		RII	Rank
1	Additional works;	0.80	1
2	Time delay (client and contractor)	0.79	2
3	Material, machinery and labor cost increment	0.78	3
4	Inaccuracy of material take-off and estimation	0.75	4
5	Inadequate pre-planning	0.78	3
6	Fraudulent practices	0.73	5

Source: Own Survey (2024)

4.3.3 Quality Performance

Additional works (80%);2nd Time delay (client and contractor)(79%),3rd rank Material, machinery and labor cost increment and Inadequate pre-planning(78%) and the 4th and 5th are Inaccuracy of material take-off and estimation (75%), Fraudulent practices (73%). As described in the table below main factors that measure quality in DB projects are: - Quality assurance of materials and equipment used for construction, Pleasing to look;(aesthetic value), Free from defects on completion, Project with good service quality, Fit for the purpose, Satisfactory durability, Conformance to standard, Quality assurance of materials.

Table 4-3:-Factors which Measures Project quality DB delivery methods

No	Factors which Measures Project quality	DB	
		RII	Rank
1	Pleasing to look;(aesthetic value)	0.78	2
2	Project with good service quality;	0.76	4
3	Free from defects on completion;	0.77	3

4	Fit for the purpose	0.75	5
5	Satisfactory durability	0.61	6
6	Conformance to standard (product made exactly like designer and employers' requirement)	0.58	7
7	Quality assurance of materials and equipment usedfor construction	0.80	1

Source: Own Survey (2024)

4.4. Challenges

This study attempted to assess the effectiveness of contract implementation on design-build federal road projects in Ethiopia and tried to evaluate the effectiveness of the contract on design-build administration practices. It also tried to measure the performance of the design-build implementation on design-build federal road projects concerning time, cost, and quality. Furthermore, the study tried to identify the challenges in the implementation of design-build federal road projects the study employed both interviews and questionnaires to collect primary data. The interview was held with the project Engineers and management of the administration, contractor, and consultant to triangulate the data collected using the survey. The information gathered was further analyzed descriptively by comparing it with the conceptual and theoretical frameworks. Thus based on such analysis the following result are drawn:

- Results have shown that the administration conducts the major part of its contract administration (works contract) through the supervision consultant. The administration expects the supervision consultant to act as per the contract agreement accordingly. ERA, as an Employer in the contract, administers the overall performance of the implementation process. The employer will act on limited issues that are identified in the contract. The consultant administers the overall site implementation process.

- From the findings, the effectiveness of contract implementation on the design-build practice of the authority is not effective in the activities of following up on manuals guidelines, Quality assurance procedures, and Appropriate allocation of project costs the administration has contract administration manuals but no mechanism are in place to make sure that existing guidelines and procedures are consistently being followed while administration the contracts. The findings showed that the effectiveness of contract implementation on design-build practice is its moderate level of effectiveness in the activities of using ERAMS, cleaning of Right of way problems, dispute resolution

management, training of staff on contract administration practices, appropriate estimating of contract costs and scope change management (this means the project accomplish these activities with an average performance).

- Besides the project contract administration practice was effective in the activities of monitoring and evaluation of a contract and timely response to contracting parties 'activities. Finally, it is very effective in top management support, updating manuals and guidelines, and clear roles and relationships of contract parties.

- For the DB project delivery system, the main factors (top four) that the project owners consider are the size and complexity of the project, Urgency of completing the project, Available budget for the project, and Time.

- The main cause of schedule growth for DB project delivery systems are (top three factors): - changes in laws and regulations, Lack of experience, and Lack of experience on the part of the consultant's site staff.

- Similarly, the main causes for cost overrun (cost growth) of design and build (DB) projects were additional work; time delay, and inadequate pre-planning are the top three causes for cost growth.

CHAPTER FIVE

Summary Conclusion and Recommendation

5.1. Summary and Key Findings

- Results have shown that the administration conducts the major part of its contract administration (works contract) through the supervision consultant. The administration expects the supervision consultant to act as per the contract agreement accordingly. ERA, as an Employer in the contract, administers the overall performance of the implementation process. The employer will act on limited issues that are identified in the contract. The consultant administers the overall site implementation process.
- From the findings, the effectiveness of contract implementation on the design-build practice of the authority is not effective in the activities of following up on manuals guidelines, Quality assurance procedures, and Appropriate allocation of project costs the administration has contract administration manuals but no mechanism are in place to make sure that existing guidelines and procedures are consistently being followed while administration the contracts. The findings showed that the effectiveness of contract implementation on design-build practice is its moderate level of effectiveness in the activities of using ERAMS, cleaning of Right of way problems, dispute resolution management, training of staff on contract administration practices, appropriate estimating of contract costs and scope change management (this means the project accomplish these activities with an average performance).
- Besides the project contract administration practice was effective in the activities of monitoring and evaluation of a contract and timely response to contracting parties ‘activities. Finally, it is very effective in top management support, updating manuals and guidelines, and clear roles and relationships of contract parties.
- For the DB project delivery system, the main factors (top four) that the project owners consider are the size and complexity of the project, Urgency of completing the project, Available budget for the project, and Time.
- The main cause of schedule growth for DB project delivery systems are (top three factors): - changes in laws and regulations, Lack of experience, and Lack of experience on the part of the consultant’s site staff.

- Similarly, the main causes for cost overrun (cost growth) of design and build (DB) projects were additional work; time delay, and inadequate pre-planning are the top three causes for cost growth.

5.2. Conclusion

Based on the findings presented in previous sections, the study drawn the following conclusions.

- Results have shown that the administration conducts the major part of its contract administration (works contract) through the supervision consultant. The administration expects the supervision consultant to act as per the contract agreement accordingly. ERA, as an Employer in the contract, administers the overall performance of the implementation process. The employer will act on limited issues that are identified in the contract. The consultant administers the overall site implementation process.

- The findings showed that the effectiveness of contract implementation on design-build practice is its moderate level of effectiveness in the activities of using ERAMS, cleaning of Right of way problems, dispute resolution management, training of staff on contract administration practices, appropriate estimating of contract costs and scope change management (this means the project accomplish these activities with an average performance).

- Besides the project contract administration practice was effective in the activities of monitoring and evaluation of a contract and timely response to contracting parties 'activities. Finally, it is very effective in top management support, updating manuals and guidelines, and clear roles and relationships of contract parties.

- For the DB project delivery system, the main factors (top four) that the project owners consider are the size and complexity of the project, Urgency of completing the project, Available budget for the project, and Time.

- The main cause of schedule growth for DB project delivery systems are (top three factors): - changes in laws and regulations, Lack of experience, and Lack of experience on the part of the consultant's site staff.

- Similarly, the main causes for cost overrun (cost growth) of design and build (DB) projects were additional work; time delay, and inadequate pre-planning are the top three causes for cost growth.

5.3 Recommendation

The following recommendations are provided based on the findings and conclusions made on the effectiveness of contract implementation on the design-build federal road projects practice of the Ethiopian Roads Administration.

- The Administration should develop a mechanism of verification to ensure that the manuals, guidelines, and procedures of different contracts are followed by the contract administrator of the project
- The design builds project delivery system is still new in Ethiopian construction industry. Therefore, from the research output the effectiveness of contract implementation on design-build federal road projects is recommended to use the DB system rather than other systems from the point of time and cost growth factors.
- The research recommended that ERA and other clients establish some standards for the determination of actual project completion & intended completion date by considering factors like topography, weather, project size & complexity, internal and external factors, and others for each project.
- Research also recommended that the clients compare other performance factors like safety and health, Environmental and community-related factors (Problems with adjacent Community, Neighbors, and site conditions problems), productivity, employer satisfaction, innovation and learning, community satisfaction, environmental impact assessment
- The Scheduled training programs should be developed to educate clients and consulting firms' Engineers, and other decision-makers on the benefits and boundaries of all project delivery methods, and their proper utilization for successful implementation and utilization of project delivery systems.in the case of DB projects where client staff is less involved.it is difficult to control qualities (design & construction) since the Consultant work on behalf of the contractor. So, the client and its representative should be proactive in controlling the qualities.

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APPENDIX A

Master's Thesis Data Collection Questionnaires

Dear respondent,

I would like to thank you in advance for the time and effort involved in your participation in this research. This questionnaire is prepared to obtain information from key informants. The information is required for the academic research entitled "Assessment of the Effectiveness of Contract Implementation on Design Build Federal Road Projects, the Case of Ajire-Keraker-Ketema Nigus Road Project, Ethiopia", which is being conducted as partial fulfillment of MSc. in Construction Technology and Management. The main objective of the research is to assess the effectiveness of contract implementation on design-build federal road projects in Ethiopia, focusing on the Ajire- keraker -Ketema Nigus road project. This questionnaire guide is divided into two sections; General profile of the respondent and project characteristics.

In the questions, I ask for detailed information on project characteristics and performance. Please do what you can to assemble this information as fully as possible. Your detailed responses will allow me to understand to what extent these project characteristics and performance measurements have influence in the effectiveness of contract implementation on design-build federal road projects in Ethiopia, focusing on the Ajire- keraker -Ketema Nigus road project.

I would like to thank you in advance for your cooperation and for scarifying your precious time.

Researcher Name: Mitiku Tefera

Address: +251-910-26-49-22

Email: - mitikutefera77@gmail.com

General instruction:

- Please put a (✓) mark that appropriately represents your response to the multiple-choice questions.
- For the open-ended questions, please write your response in the space provided.

PART ONE: GENERAL BACKGROUND INFORMATION

1. Name of the respondent (if possible)_____

2. You're Age (in years):

a) Under 25 ☐
b) 25- 34 ☐
c) 35- 44 ☐
d) 45- 54 ☐
e) 55 and above ☐

3. Higher Academic Qualification

A. College Diploma/ TVTE ☐
B. BA/BSc Degree ☐
C. MA/MBA/MSC ☐
D. PHD ☐
E. Other (please state) ----------

4. Which position in the project have you been involved in?

a) Junior Engineer ☐
b) Senior Engineer ☐
c) Construction Engineer ☐
d) Lead Engineer ☐
e) Team Leader ☐
f) Office Engineer ☐
g) Project Manager ☐
h) Resident Engineer ☐
i) General Manager ☐

5. Number of Year Experience

a) Less than 3 yrs. ☐
b) 3-8 yrs. ☐
c) 9-12 yrs. ☐
d) 12 and above years ☐

PART TWO: - **Close Ended Questionnaires**

1	2	3	4	5
Not Slightly	Slightly Significant	Moderately Significant	Very Significant	Extremely significant

Pease use a tick (√) mark for your thought and where appropriate give your opinion for the open ended questions.

A. Factors for the effectiveness of a DB contract administration practice of ERA

NO	**Factors for the effectiveness**	1	2	3	4	5
1	Following up manuals and guideline					
2	Skilled and experienced staffs.					
3	Risk identification and management.					
4	Scope change management					
5	Appropriate scheduling of project completion time..					
6	Quality assurance procedures					
7	Appropriate Estimation of project costs.					
8	Dispute resolution management					
9	Updating manuals and guidelines using best practices					
10	Consistently using ERAMS (Ethiopian Roads Administration Management System)					
11	Training of staff on contract administration practices					
12	Monitoring and evaluation					
13	Well organized contract filing system					
14	Problem in clearing Right of way (ROW)					
15	Absenteeism and turnover of the staffs (Consultant & Contractor)					

16	Delay in effecting payments					
17	Clear role and relationship of contract parties					
18	Top management support					
19	Timely response to a contracting parties					
20	Contract close out procedures					

PART –THREE; - Factors which affect time, **Quality and Cost Growth**

The purpose of this survey is to rank the factors to causes of time growth (delay), cost growth and measures factors which affect quality.

In the following survey you are kindly asked to circle the appropriate point you think reasonably from (1-5). Only for the bottom four tables.

1	2	3	4	5
very low	low	medium	high	very high

A. Factors which affect time (schedule) growth

No.	Project type- DB (design-build)	Pease use a tick (√) mark on the appropriate point (only one)				
	Causes(factors) for time (schedule) growth DB project	1	2	3	4	5
	The factors that related to owner's responsibility					
1	Financial problem(delayed payments, financial difficulties, and economic problems)					
2	lack of coordination with contractors					
3	Slow decision making					
4	Contract scope change/modification					
5	Right of way problem (client unable to clear construction site on time)					
6	Inadequate planning					
7	Lack of coordination with local authorities					
	Factors that related to contractor's responsibility					
8	Lack of experience					
9	poor site management					

10	Lack of machinery and equipment on market					
11	Delay in delivery of materials to site					
12	Shortage of materials on site					
13	lack of subcontractor’s skills					
14	coordination problems with others;					
15	financial problems					
16	Shortage and low productivity of labor					
	The factors that related to consultant's responsibility					
17	Lack of experience on the part of the consultant’s site staff.					
18	Poor supervision and slowness to give instruction					
19	incomplete documents					
20	absence on site					
21	delayed and slow supervision in making decisions					
	Factors that related to external factors					
22	Adverse weather condition					
23	Poor site condition (unforeseen ground condition)					
24	Lack of materials, equipment and tools on the market					
25	Poor economic conditions (currency, inflation rate, etc.);					
26	changes in laws and regulations;					

B. Factors which affect cost growth

No.	Project type-DB(design-build)	Pease use a tick (√) mark on the appropriate point (only one)				
	Causes for Cost growth in road projects	1	2	3	4	5
1	Additional works;					
2	Time delay (client and contractor)					
3	Material, machinery and labor cost increment					
4	Inaccuracy of material take-off and estimation					
5	Inadequate pre-planning					
6	Fraudulent practices					

C. Factors which Measures Project quality

No.	Project type-DB (design-build)	Please tick (√) on the appropriate point (only one)				
	Factors which Measures Project quality	1	2	3	4	5
1	Pleasing to look;(aesthetic value)					
2	Project with good service quality;					
3	Free from defects on completion;					
4	Fit for the purpose					
5	Satisfactory durability					
6	Conformance to standard (product made exactly like designer and employers' requirement)					
7	Quality assurance of materials and equipment used for construction					

PART –FOUR: - **Interview Questions (Case analysis)**

Causes of Delay

……

……

……

Cause of cost over run (if exist)

……

……

……

Quality (performance specification) deviation

……

……

……..

Causes of change order (variation if exist)

……

……

……

Effectiveness of DB (design-build)

……

……

Your conclusion and recommendation:

……

……

APPENDIX B

Cronbach's alpha	**Internal consistency**
$\alpha \geq 0.9$	Excellent
$0.8 \leq \alpha \leq 0.9$	Very Good
$0.7 \leq \alpha < 0.8$	Good Acceptable
$0.6 \leq \alpha < 7$	Acceptable (for exploratory studies only)
$0.5 \leq \alpha < 0.6$	Poor
$\alpha < 0.5$	Unacceptable