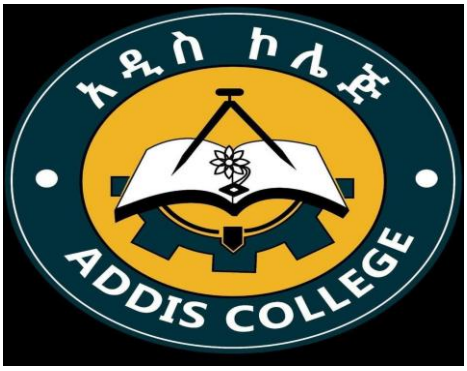

ADDIS COLLEGE

SCHOOL OF POSTGRADUATE STUDIES

DEPARTMENT OF CONSTRUCTION TECHNOLOGY AND MANAGEMENT

DESIGN MANAGEMENT PRACTICE OF PUBLIC BUILDING PROJECTS IN THE CASE OF OROMIA REGION, ETHIOPIA

BY

HABTAMU BULTO

A Thesis Submitted to School of Postgraduate Studies of Addis College, for Partial Fulfillment of the Requirements of the Degree of Master of Science in Construction Management.

ADDIS ABABA, ETHIOPIA

OCTOBER 2021

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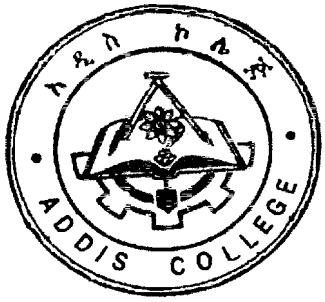
ADVISOR: Dr. WERKU KOSHE HARERU (Ph.D.)



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ABSTRACT

The design has become a cause of escalating project costs and time due to the inconsistent approach to design management. In Oromia, the number of public building construction projects is increasing from time to time. However, it becomes difficult to complete projects in the allocated cost, time, and quality. Taking this into consideration the design process and techniques related is one of the major problems in Oromia public building construction projects. Therefore, this research was carried out to investigate the design management practices during the design, construction, and design construction phase of major building projects clients under Oromia Regional State.

Questionnaire surveys were used to collect data to measure the practice and challenges related to design management. A total of 42 questionnaires from the Client, Consultants, Contractors, and Regulatory bodies were collected and investigated. From the results, it was found that the current design management practices are characterized by Undefined Design deliverables and information (Regulatory and Consultants), the absence of concerned parties' involvement at the right time (Client, Contractors, and Consultants), the underestimate of project cost and time (Contractors and Consultants), Lack of site visiting and site analysis (Regulatory, Contractors, and Consultants) are the major practice that exists in more than parties (combined). In the design phase, Unclear and inadequate details in drawings (Regulatory, Client, and Contractor), Inadequate design data and information evaluations (Regulatory, Contractor, and Consultant), Less Consideration for Value-adding in design phases (Contractor and Consultant), and Right of Way ranked 1st by the Regulatory body and Client while ranked 4th by contractor and Consultant. For the design construction phase; additions, omissions, and change orders highly occurred (regulatory, contractor and consultant), improper supervision of the work and lack of rapid decision (regulatory, client and contractor) and poor techniques of design review and drawing record (regulatory, client, contractor, and consultant). So, the stakeholders should come together to work within those challenges in order to improve the future project performances. And finally, it is expected from stakeholders to work together in order to improve the current practices by discharging their roles responsibly.

Keywords: *Design, Design Management, Design Manager*

DECLARATION

I certify that this research work entitled "Design Management Practice of Public Building Projects in the Case of Oromia Region, Ethiopia" is my original work. The work has not been presented elsewhere for assessment and award of any degree.

Habtamu Bulto _____ _____

Candidate Signature Date

As a thesis research advisor, I hereby certify that I have read and evaluated this MSc Thesis research entitled: **"**Design Management Practice of Public Building Projects in the Case of Oromia Region, Ethiopia**''** and it is his original work and evaluated through my guidance.

I recommend that it can be submitted as fulfilling the MSc. research requirement.

Werku Koshe (Ph.D.) _____ _____

Main Advisor Signature Date

APPROVED BY BOARD OF EXAMINERS

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DEPARTMENT OF CONSTRUCTION TECHNOLOGY & MANAGEMENT

APPROVAL OF THESIS FOR DEFENSE

Student **Habtamu Bulto** has produced research entitled **"Design Management Practice of Public Building Projects in the Case of Oromia Region, Ethiopia**" which has incorporated all the comments given by the board of examiners.

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Post Graduate Director	Signature	Date

Final approval and acceptance of the thesis is contingent up on the submission of the final copy of the thesis to the council of the graduate studies (CGS) through the departmental graduate committee (DGC) of the candidate's major department.

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Acronyms

BIM	Building Information Modeling
CDM	Construction Design and Management
CO	Country Office
CoST	Construction Sector Transparency
CPDMM	Construction Project Design Management Manual
DDM	Design Delivery Manager
DM	Design management
DTL	Design Team Leader
DQI	Design Quality Indicator
ECPMI	Ethiopian Construction Project Management Institute
GGP	Governance Global Practice
OCA	Oromia Construction Authority
ORS	Oromia Regional State
SPSS	Statistical Package for Social Science

CHAPTER ONE

1. Introduction

1.1 Background of the study

The importance of construction projects is for all aspects of rural and urban community development, such as road construction projects, irrigation projects, building construction projects such as health, education, market centers, bus stations, offices and others. The cycle of Construction Projects begins with intellectual thought and ends in a physical structure that serves its tenants for the expected purpose throughout the structure's design life. Designing and building are two independents but related and largely sequential functions within the realization of a building. The design work deals with the creation of the documents, and the construction work includes the interpretation and translation of these documents into the reality that will emerge over a building or a building complex. Buildings are assembled outside by a large number of different builders and craftsmen at a wide variety of destinations and are subject to a wide variety of climatic conditions. Design administration is a new professional discipline, particularly in the construction industry, which isolates the administration of work of a project's design phase from the planning function. It is becoming more and more imperative in today's development projects (Cooper, R., & Press, 1997). It is closely tied to project management, must deliver a finished design on time to meet all of partners' needs, and does so by coordinating, controlling and reviewing design exercises while interfering with other project and external parties. This could be a task that is typically performed by a design manager or a group of managers, depending on the size and complexity of the project. However, (Gray, C., & Hughes, 1967) suggest that while there must be a single point to control the production of design data, they also accept that DM is the responsibility of the entire project team.

Design management can be characterized as the organizational and managerial exercises or skills that optimize design processes. Design management seeks to establish administrative practices that focus on the advancement of design preparation, thus creating opportunities for the advancement of high quality innovative products through effective processes. Despite the fact that size in management is no substitute for high quality creativity and development, it can represent the contrast between success and disappointment in multidimensional and complex project environments (Cooper, R., & Press, 1997).

Building construction is a project-based practice and design is an iterative process in which deviations are inevitable (Mohamad et al., 2012). Rework could be a destructive result of design changes(Abdul-rahman & Wang, 2017). In addition, it has been shown that planning-related issues have negative impact on building projects as a whole in the form of increased costs or lower efficiency (Baldwin et al., 1999). In addition, disappointments in getting client's needs and value adversely affect the value of buildings adversely by not getting what they really require and need (Mikael Hygum Thyssen, Stephen Emmitt, 2010). Value can be seen as something that improves a project, either as a final element or as an effective process that makes a positive contribution. In the early stages of the design phase, the stakeholder impact is greatest and the cost of change is most reduced, making this the best way to realize value (Knut Samet, 2008). This phase is also the most complex to understand, execute, and monitor. Numerous projects fail to realize their potential value and this can be attributed to management problems in the design phase (e.g. (Hamzeh et al., 2009) (Olsson, 2011). One of the reasons for this may be the complexity of the design phase, and particularly the early design phase where cycles are fundamental to value creation (Ballard, 2000). In the case of building design management, where we need to focus on multiple priorities to create value, thus making the early stages of the design phase a complex process to manage.

For a project to be completed successfully, this must be approached in the early project phase, when the solutions are high and the costs for variations are low. This thesis examines building design management in the initial design phase to allow for less impact during the construction phase.

Every year the regional government of Oromia budgets billions of birr for the construction of public facilities (construction projects such as schools, hospitals, offices) and infrastructures (such as roads, water, electricity). Ultimately, those public projects missed their goals and they saw us as one of the problems with good governance due to lack of on-time delivery, poor build quality, over budget, and others. Most of the literatures in the region focus on timeouts, variations, and other related deficiencies that occur during construction. However, if the project is thoroughly researched and planned at an early stage, the problem will be minimized during construction and the project will serve its intended purpose.

1.2 Statement of the Problem

The current practice of the construction project is characterized by poor communication, the need for satisfactory documentation, inadequate or lost input data, poor data management, unequal distribution of assets, the need for coordination between the disciplines, and inconsistent decisions. This is partly due to the complexity and challenge of the design process. It is also very common to see construction projects exceeding budget and over time. From Construction Sector Transparency Initiative, in 2016 and the World Bank Governance Global Practice (GGP) Ethiopia Country Office (CO), in Ethiopia major reasons for project cost and time overruns are attributed to design incompleteness, design changes, changes in scope, variation in work volume, poor initial estimate of completion time, force majeure, and other reasons. As can be seen from this study, most of the reasons arise earlier in the project cycle (gaps in strategic project planning and preparation) and thus show that serious gaps in the feasibility or planning of the project, designs, and tender documents. Furthermore, current practice pays more attention to construction contract management, but during the implementation phase lack of design, management costs the project in all aspects.

This research examines in depth the current design management approaches of the regional state of Oromia public building projects, particularly for at regional level budgeted projects. Most of the construction projects in the Oromia National Regional State proposed and budgeted by the regional government have not been completed within the originally set time targets and pre-agreed budget. Delaying construction completions cost over runs and defect in quality is the main problem that results in the region's development needs not being met.

The pre-construction phase can attract attention beyond the construction phase, as more resources are invested during the construction phases, if the earlier phase is carefully planned and executed, the construction phase will be successful.

1.3 Objectives of the Research

1.3.1 General objective

The general aim of the study was to Review the Practice of Design Management related to Public Building Projects in the Case of the Oromia Region, Ethiopia.

1.3.2 Specific objectives

The specific objectives of the study were;

- To review the design management practices of Oromia Public Buildings projects.
- To identify the limits of the existing design phase management practice.
- To determine the importance of design management in the design construction phase.
- To recommend the possible solutions to improve the design management practice in ORS.

1.3.3 Research Questions

To achieve the study objectives, the following questions were answered in this study:

1. What are the existing design management practices of public building projects?
2. What are the limitations of the existing design phase management practices?
3. To determine the importance of design management for the success of a project?
4. What are the possible solutions to enhance the design management practice in Oromia regional states?

1.4 Significance of the Research

The performance of the design process has a great influence on the success of the subsequent process in building construction projects and also on the quality of the final product. Although each process in construction is crucial to the completion of construction projects on time, on budget, and the required quality, design management practice is a priority (Bibby et.al, 2003). The design management approach must identify and develop tools and practices to overcome

implementation barriers, while at the same time empowering them to manage the design process and improve practice. By integrating the coordination between the design and construction phase errors in design and during construction are reduced and the public sector benefit from projects that are completed on time, in terms of quality, and at the budgeted costs. The main reason for this study is that;

- ✓ The number of studies conducted in our country and our region related to design management is not adequate, while the construction projects are highly expanded.
- ✓ To create awareness for the stake holders about the importance of design management
- ✓ It will serve as a reference for researchers who conduct similar works and
- ✓ It will be used as input for policy makers related to design management for the successful implementation of public projects.

Generally, the research contributed to the general knowledge and attention of those in the research field of building design managements and to show the future needs related to the development of design. Compared to construction management research, this is an under-researched area that stills needs attention and research to evolve.

1.5 Scope of the Study

This study provides more information on the current design management practice of regional public building projects in Oromia, specifically for regional level budgeted projects and those public sectors having a majority of building projects. Also, different pieces of literature state that there is a need and significance of implementing design management tools for the success of a project. However, there is no more specific data on the regulatory frame works for the stakeholders in design management knowledge areas. And it only deals with the design management practice of building projects by the Oromia region. Finally, from observed data to propose specific solutions and approaches are proposed to tackle the resulting existing problems related to the design management of the regional public building projects.

1.6 Limitations of Study

For the sake of making the research manageable, this study has been limited in scope, time, and coverage areas. Accordingly, to conduct the research on the issue Of Design Management Practice of Public Building Projects in The Case of Oromia Region, Ethiopia and identification of its limitations and it needs skills, knowledge, and working standards. Hence, the study has been limited to analyzing the main objective list above only. Moreover, the researcher has considered very limited representative of sample respondents in form of the questioner to supplement the data collected from document reviews. Besides, possible efforts were exerted to overcome the above constraints and to accomplish the desired work successfully

1.7 Organization of the Document

This work was divided into five chapters. Accordingly, the chapter hierarchy is aimed at making the paper have a scientific format. The general sense of each chapter can be summarized as follows. The first chapter is a study with a general Introduction and the chapter closes its discussion by stating the objectives of the study and how the paper is organized.

Chapter two gives an overview of the building projects' design process. Chapter three deals with methodology, data presentation, and discussion related issues. Chapter four deals with the research methodology, it gives an overview of the research process, the approach, and tools used by the researcher, the questionnaire design and justification for the questions, the selection of the research sample, and the methods of data analysis. Chapter five presents an analysis of the research data, research findings, and discussions. The last chapter is devoted to the researcher's conclusions and recommendations of the researcher.

CHAPTER TWO

2. LITERATURE REVIEW

Reviewing the present day literature on the issue is crucial to better recognize the concern under the study, to layout the scope, and also to recognize the relevance of the studies to others (Cresswell et al., 2003). Being up to date on the topics researched helps us better design and execute what we want to do. So as per the specific objective of the study, reviewing the application of design management tools and practices, identifying the limits of the existing design management practice, and determining the importance of design management for the success of a project is essential.

2.1 Evolution of Design Management as a field

The term 'Design Management' was introduced in England by the Royal Society of Arts in 1965 (Best, 2006), and the following year the first book on design management was published by Michael Farr (FARR, 1966). The first academic Cambridge Design Management conferences were primarily for practitioners.

2.2 Concepts of Design Management

Compared to project management, there are only a few books written about building design management describing specific challenges in design management. A simplified definition is to say that design management is about managing people and information (Emmitt, S., & Ruikar, K. 2013). People in this context are stakeholders in a building project and information being deliverables among stakeholders. The final part of deliverables as drawings, models etc. are concrete and easier to manage than for instance ideas or evolving concepts from the creative minds of designers. "Design management is a complex social situation as value can be a socially constructed phenomenon and decision making to that end can be inherently unpredictable (Kestle & London, 2002b).

Design Management is an increasingly important function in the construction industry. Projects are becoming more complex and global and new contractual arrangements, which require alliances and partnerships between designers and constructors, are increasingly used. Previously

in developed nations, design management is being done by construction companies since of the disappointment of other existing frameworks to realize appropriate integration of the design and construction forms.Design management is an element of the product development process focused on organizing the design team and understanding its nature, stages and activities, aiming to support communication, coordination and improve the integration of information flows. According to the Design Management Institute (DMI), design management includes the processes, decisions and strategies that enable the creation and innovation of product and services that provide organizational success and improve quality of life (https://www.dmi.org/). As such, "design management endeavors to establish managerial practices focused on improving the design process, thus creating opportunities for the development of high-quality innovative products through effective processes" (Tzortzopoulos et al., 2020).

Besides, it points to supply practices and strategies to design, including choice making, controlling processes, keeping up costs inside the anticipated and ensuring benefit.

Accordingly, Design Management Institutes states that plan administration cultivates the collaboration and synergy between design and business viewpoints, pointing to progress the adequacy of the method

2.3 The Construction Design Process

In the planning of facilities, it is important to recognize the close relationship between design and construction. These processes can best be viewed as an integrated system. Design is a process of creating the description of a new facility, usually represented by detailed plans and specifications as per the requirements of client; construction planning is a process of identifying activities and resources required to make the design a physical reality. Hence, construction is the implementation of a design envisioned by architects and engineers. In both design and construction, numerous operational tasks must be performed with a variety of precedence and other relationships among the different tasks.

During the design stage, stakeholders' (Owners/Client) needs and prerequisites are conceptualized into a physical model of procedures, drawings and technical details that empower the built environment.

The only reason for the need of design process performance measurement activities is seen that design process has been moderately ignored within the construction industry. A few lie within the nature of the design process itself.

2.4 The Process of Building Design

It is a specialized and highly demanding form of problem solving. It is where stakeholders' needs and requirements are conceptualized into a physical model of procedures, drawings and technical specifications (Freire, 2000). The design process is a dynamic and complex multidisciplinary process, involving numerous parties and performed in a arrangement of iterative steps to conceive, depict and legitimize progressively detailed arrangements to meet stakeholder needs and expectations (Shah et al., 2012). It is the key project process that defines the final product cost and adding value by delivering functionality, quality, enhanced services, reduced whole life costs, construction time and defects as well as delivering wider social and environmental benefits (Egan, 2003).

2.5 Stakeholders of the Building Design Process

Construction projects require the combined efforts of numerous people (stakeholders), working and planning collaboratively to supply value to their clients requirement and finally for the end user of the projects. The construction industry is a fragmented industry from the concept development and relies on many different stakeholders to complete a project as per the pre agreed documents. Each one has a unique perception of the goal and success of the task and those stakeholders will most really attempt to optimize their personal operation. This ends in sub-optimization of tasks (Zidane et al., 2016). The proper stakeholder involvement may be very critical to create a value inside the project.

So, to have a project that meets the public demand and increase the satisfaction level of the occupants, each of the party must dispose their responsibility accordingly. At the end successful project will be provided for the intended purpose.

2.6 Theoretical Literature

Design is the application of human creativity to a purpose. And it also implies the choice and configurations of space, elements, materials and components that give integrated final product particularly attributes of form, presentation, function, method of production, etc.

There has been very little empirical research on design management, even that undertaken in traditional design consultancies, and almost nothing in relation to design management in complex one-off projects involving fast tracking and new types of contractual relationships.

Most developed countries have their own Design Management Hand books which serve as a design guide for the regulatory bodies. Due to that they use integrated design management approaches. In case of Ethiopia, Ethiopian Construction Project Management Institute in 2019 publishes Construction Project Design Management Manual (ECPMMS, 2019) under Operation or Implementation based. Previously due to lack of such important regulation tools the construction industry was characterized by fragmented and conventional activities which cost the time, quality, budget and public satisfactions and trusts.

The gaps identified from the industry work experience as well as from literatures, attention towards project implementation management/Construction contract management is highly prioritized. But if the conventional design management techniques are replaced by integrated one, it eases the duty of the project manager. In our case Most of the designers are currently implementing the conventional designing approach, resulting in substandard property, fragmented building design process, errors and omissions in paper communication resulting in project period delays being the major gap, additional financial expense and reduction of quality are also taken major portion, resulting in undesirable friction between involved parties. The documents are fragmented and take a longer time to prepare. The major challenges of the building design process are very low project fee, no permanent staff, incomplete design with fewer details, limitation on accessing licensed software, expensive and unaffordable database infrastructure and lack of adequate training centers are also partly concluded as challenges. So, from a design management perspective this paper maybe the first for the region and as a country level also a little paper was done. So, if successfully accomplish the task, it may give a new project planning and delivery approaches for the public bodies of the region.

2.6.1 Design process

The effectiveness of the design process in the building industry has a great influence on the success of subsequent processes in the construction of projects and also on the quality of the environment. Several studies have also pointed out that a large percentage of defects in building arise through decisions or actions taken in the design stages. Hence, poor design has a very strong impact on the level of efficiency during the production stage. It is further noted that, the increasing complexity of modern buildings in a very competitive market–place in recent years has significantly increased the pressure for improving the performance of the design process in terms of time and quality.

The design construction process carries these few fundamental stages:

I. Schematic Design
II. Design Development
III. Construction Documents

I. Schematic Design

Schematic Design is all about understanding what you are looking for. This is the first step that you take long before the construction documents or even the actual construction begins. During this phase, we are in 'consideration' mode and there's a good chance that what concept you have in mind is either too complex almost on the verge of being fantastical or too premature. Schematic designing, hence, allows reaching a greater clarity and conclusion on whether they should even proceed to the next stage. In the schematic design phase, at least 2-3 design options based on our initial ideation are developed. The designs are mostly rough sketches with a rudimentary understanding of the different routes that we could take as well as rough budget.

This way, you get a bigger picture and can reach a more authentic conclusion based on your aesthetic and financial satisfaction. Once the conclusion is drawn, the design team shifts to the next stage – the design development phase.

II. Design Development

Once you do determine to work with a design documentation expert, you attain the design improvement phase. Here, the basic simple form of the design is chosen further to complete the work. The design is delicate with the assist of several layers and components. Several adjustments are done to align the design together along with your finances (budget) and aesthetics. The design development stage takes lengthy to finish which means there are various adjustments, adjustments in addition to freezing of costs and design. Post this finalization the drawings, Interior Drafting, and Three-D modeling begin. This brings us to the subsequent large phase of the design method.

III. Construction Documentation

By this time, we've locked our very last to the final design. This phase is important for making ready notes, drawings and technical specifications important for making use of permits, bidding and construction. The detailed drawings created right here are for the subsequent phase within the architectural design methods. This is the very last phase earlier than construction begins, consequently the client's inputs on this degree is of maximum importance. Any changes throughout the real construction method can cause to extra costs, rework and delays in project competition. These documents are created for everyone concerned within the project and maintain all stakeholders on the identical page.

2.7 Design Management Perspectives by stakeholders

The goal of design management is to offer the design crew with the leadership, management systems, information, guide and training to permit the success in their targets of quality, value for money and timeliness. Effective management allows the design crew to integrate with procurement and execution personnel's to most advantage. It is likewise flexible, being tailor-made to the needs of each project and client. The proprietor "owns" the project and hires the contractor. The contractor coordinates the project construction activities. The representative "consultant" typically advices each the owner and the contractor on diverse questions and problems that can be encountered throughout the making plans phase and construction phase. The consultant in a construction project is typically an architect; however there may be different experts on a project who're now no longer as per the nature of the project. The architect's

workplace typically generates the blueprints of the project. Role of those three parties on a project are generally as:

- Contractor typically coordinates the entire project. Getting plans and permits. Getting subcontractors employed and scheduled. Handling inspections, paying subcontractors and ensuring they have got finished their work satisfactorily. Coordinate and communicate with the proprietor / owner. Inspecting the work at each stage and having corrections completed if wanted alongside the way. Facilitate and schedule any changes that occur. Get the task finished on time and get task wiped clean up at completion. Collect payments on time from the customer or financial institution to pay all parties
- Owner / Purchaser typically choose the architect/ planners, contractors, and other experts. Secures loans or give monies for payments to all parties. Selects the property for the building site. Communicates often with the contractor and consultants.
- Consultant typically advises the customer on all areas of the constructing method. This might be referring architects, engineers, contractors, financial institutions, or different entities. Also inspects task to make certain customer is getting what they agreed on. Often a construction consultant is an experienced representative. The query you want to ask yourself before working with a consultant is this, how do consultants help improve my project's?

Consultants can save money by making construction project more effective, less resource-intensive, and increase the value of building now and in the future? The role of consultants in construction projects can be identified by answering the following questions

- ✓ What are the typical tasks for consultants in construction projects?
- ✓ What can consultants do for your construction project?
- ✓ What to look for in a consultant?

Choose consultants based on their qualifications, experience, and results rather than the lowest price. After all, their impact can be tremendous- but they make up a fraction of the overall development budget. Consultants are the non-negotiable for technical accuracy, Quality of services and Effective communication.

2.8 Design Review

Design review is a critical detail of the complete design method and has to be explicitly covered within side the design time table. The reviewers need to diligence of observation,

multidisciplinary knowledge, and senior know-how within side the design they're reviewing. The review method can move alongside the design activities within the consulting firm as well as by the client relying on reviewing the deliverables and presentations for panel of specialists as required. If the client does now on longer have the required expertise to conduct the design review, additional staff should be hired from other institutions.

The Importance of the design reviews is to ensure:

- Quality and efficiency of the design
- Identification and corrections of errors and omissions
- Compliance with building, safety, social, environmental, and other relevant codes and regulations
- Meeting of functional and operational requirements
- Coordination among engineering disciplines
- Consistency of cost estimates to the budget
- Provision of timely feedback to designers
- Constructability and cost-effectiveness of the design and
- Interface compatibility with adjacent project elements and the existing infrastructure.

Design reviews comprise a formalized, organized method to enable that the reviews are comprehensive, objective, and well documented. Reviews should include the contract administration team of the Client, design team of the consultant, invited senior experts and construction management staff to ensure that project objectives are met.

The review comments should be formally communicated to the consultant through a standard form for consideration and action. In general, the consultant categorizes the comments provided in the pre-submittal and final review phases into three parts and dispose as follows:

1. Comments incorporated into the design
2. Comments, which conflict with a previous determination or with other comments and recommend a resolution and
3. Comments, which are not incorporated into the design with good reasons.

2.8.1 Review Meeting

The Client may call for a review meeting with the consultant to ensure that the above categorized comments are understood and resolved to the ultimate project success. Web based tracking database system could be implemented to facilitate the review of all outstanding comments and manage the design review process.

When the Consultant is directed to make a meeting presentation, the display and handout materials shall be prepared and be consistent with the meeting scope. The Consultant shall also prepare minutes of meetings attended with other stakeholders. The minutes shall document the participants and all problems, determinations and conclusions, with areas of responsibilities noted. The Consultant shall submit the Minutes to the Client within seven calendar days for approval.

The overall review process can be categorized into pre-submission review and final design review.

2.8.2 Pre-submission review

The review is on board review while the design work is in progress. This helps to determine the final design is likely to meet the scope of the services stated in the TOR and advice the consultant recommended action if design is incomplete or does not meet the required standards.

The preliminary design submittals are reviewed for their design approaches, evaluation of alternatives along with their economic comparison, utility conflicts, affected parties and utility owners.

Finally, the review will demonstrate that all major design concepts and features are properly considered and finally design can started.

2.8.3 Final Design review

A typical design review distribution is when the design reaches 30, 60, 90, and 100 percent levels of completion. The contract administrator of the Client should specify the minimum design analysis documents drawings, and specifications, which are to be submitted at each design review level and the extent of completion of each to be reviewed.

The 30 percent review documents decisions to resolve any changed conditions of design criteria. It also includes updated design analysis reports, topographic data, geotechnical investigations and cost estimates. This category of design may not be required if pre-submittal review has included the previous documents and data.

The 60 percent review is to ensure that all major features of design are progressing according to the schedule, major architectural and engineering decisions are made, and drawings, specifications, and related documents are advanced and checked. At this review phase any outstanding issues are resolved so that detained design and preparation of tender documents can proceed with limited need for changes.

At 90 percent review, the drawings and specifications are completed checked. Subsequent to this review, only incorporation of comments arising from this review, plus sign-off and approval should be required to complete these documents.

Final verification is made at 100 percent review stage if all the previous review comments are resolved and cost estimates are in line with the budget.

2.8.4 Quality Assurance/Quality Control in Design

Value Engineering

Value Engineering (VE) is a systematic, multi-disciplined optimization process that increases the functionality and quality a project without additional money. It is activity applied by an independent team of experts, who analyze and establish a value for a function of an item or system starting from the inception of the project.

VE is an organized effort and creative which analyzes the requirements of a project for achieving the essential functions at the lowest total costs over the life of the project. Through a group investigation, using experienced, multi-disciplinary teams, study alternate design concepts, materials, and methods without compromising the functional and value objectives of the client.

In design phase of a project, comparison of design solutions gives the greatest opportunity to value engineering. For instance, by the use of intelligence-based Computer Aided Design (CAD) technology, engineering analysis procedures support achieving most economical, structurally sound options. Lay out of electrical, mechanical, and plumbing systems can also benefit from value engineering.

2.8.5 Design Project Close Up

Prior to closing up a contract agreement of a design service, the client shall verify the following points are addressed:

1. The scope of the design service
2. All comments provided to the consultant at various stages of the design phases
3. All deliverables and project related materials submittal
4. Claims and retentions

Finally, the contract agreement for the design services is considered as closed when financial obligations are accounted and settled by both the Client and the Consultant.

2.9 Design Errors

During construction time, error relative to design may be happen and to solve this type of problem, there is an agreement between the contractor and client / consultant to solve them by adding in bid or specification. Therefore, the relation between contractor and client / consultant has a great role in design management perspectives. Therefore, based on the above relation of contractor, consultant and owner, Design management is important as to Defines what, how, when and by whom work is done

- ✓ Establishes an efficient timeline for all parties to follow
- ✓ Identifies program interfaces, interdependencies and resource clashes
- ✓ Encourages individuals to deliver within schedule

To successfully manage the designing process, the following should be considered:

- ✓ Each work milestone should be centered on one person based in the design team
- ✓ The design management team should work as part of the design team
- ✓ The design management team should achieve good working relationships
- ✓ Management should be proactive rather than reactive
- ✓ The process should be objective, relying on critical assessments of design process and rigorous forecasts of project cost
- ✓ The process should also be flexible, being tailored to the needs of each project and each client
- ✓ Processes and management services should facilitate the design team

In order to oversee and link the client – contractors – designers' heads, the construction industry requires inculcating a position of Design managers. The design managers initially emerged in construction organizations as they started undertaking a part of design, which involved their specialist sub-contractors. The design manager has a coordinating role, but does not act as a designer themselves. The role is different from that of the lead designer, who heads the decision making and co-ordination of the actual design, or with the lead consultant, who directs the work of the entire consultant team.

The important tasks of the design manager are to:

- ✓ Establish clear communication and collaborate between relevant parties and thereby an effective flow of design, procurement, and execution methods information.
- ✓ De-risk design problems by finding solutions before they materialize.
- ✓ Contribute to planning and co-ordination in a way that adds value to the processes.
- ✓ Manage and secure all-heads ownership of an integrated design program.

This requires a great deal of experience, and it is important that design managers are good forward planners, capable of managing project timescales, and with the requisite knowledge for ensuring the design process is in accordance with current legislation, standards and codes of practice.

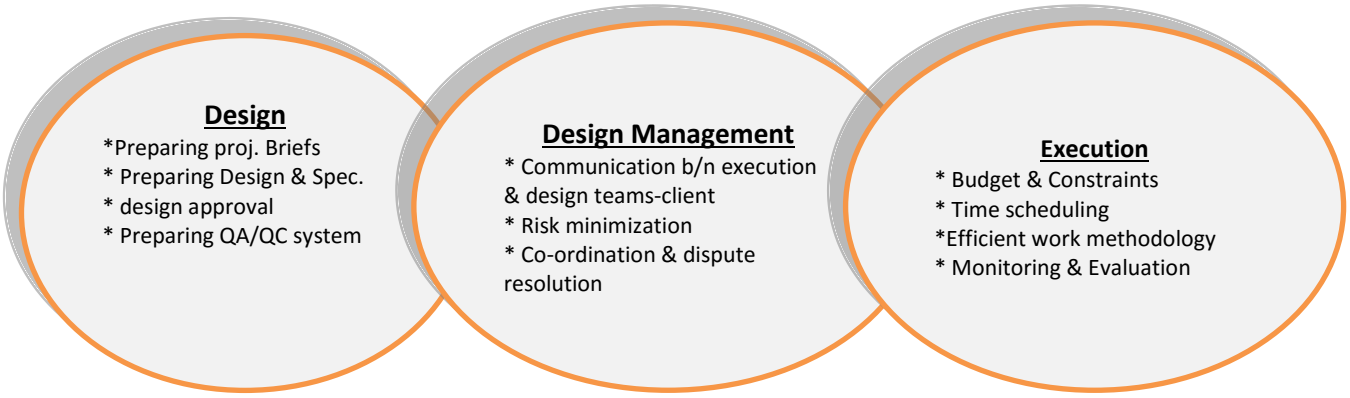

Figure 2. 1 *Design-management-execution integrations* ***(Necessity of design Management)***

2.10 Advanced Design Management Tools

2.10.1 Building Information Modeling (BIM)

BIM application has great influence in design management. BIM is a technology, and not a specific program, that offers an integrated platform to improve design, increase the speed of delivery for design and construction, and provide a flow of information without breaks. Nevertheless, due to the technological maturity and interoperability issues, industrial culture change requirements, lack of BIM standards, and training and education needs, there is a common consensus that BIM is currently still immature for its full adoption over the construction life-cycle. BIM supports the renovation, refurbishment and maintenance of the built environment of the largest share of the sector. Despite the fact that one of the goals of the BIM implementation in construction projects was to reduce the number of design errors, design changes seem to be inevitable in the process of model development and improvement. BIM, as a technology, should provide both the possibility to present and analyze the consequences of the changes. The potential of BIM should be used to automate or semi-automate the execution of analyses (Juszczyk et al., 2016). As (Adinew, 2020) reviewed that BIM is a methodology that provide integrated platform for designing which enable the multi-disciplinary working under a collaborative environment. As Design management process has been improved through better communication and collaboration, visualization, design coordination and included constructability and maintainability.

Fundamentally a technology-driven concept, BIM, when combined with issues pertaining to people, processes and organizations, has the potential to significantly impact the industry. It has to be understood as a mechanism that allows the creation, storage and sharing of project information by a project team that is far superior to current methods of information generation, sharing and use (Ahuja et al., 2014).

2.10.2 Lean construction

A majority of Lean practitioners increase efficiency by undertaking offsite prefabrication (90%) and Just-In-Time material delivery (78%). Lean experts agree that their ability to succeed in a competitive market is the most important benefit they gain from Lean, due to a combination of factors such as improved reliability of outcome and profit margin, higher quality construction, greater customer satisfaction, and reduced costs and schedules (Bernstein & Jones, 2010). Lean design addresses design as a production process, in which information is transformed, value added to it continually informed by clients, as opposed to the transformation of physical materials. Then importance of design has been highlighted in lean as the main means to generate value to clients. However, the adoption of lean thinking is still modest in design. Attempts to implement lean design highlighted the need to integrate design and production, emphasizing the adoption of lean thinking from briefing and conceptual design throughout the whole development process (Emmitt et al., 2004).

Lean process: designers are able to plan design process more effective and efficient considering all the user needs and expectations.

Lean construction can be described/ summarized in design management practice as follow.

Table 2. 1 *The conceptual framework for improving building design processes and design management practices*

Dimensions	**Contributing Concepts**
Lean Design as Part of Production	Transformation, flow, and value theory of design production
Lean Design Management	Design, operation, and improvement of design production systems Strategies, principles, methods, and tools compatible with the flow and value view
Design theory	Causality and interpretation Technical object- and social subject-oriented activities Method of analysis and design rhetoric

2.10.3 BIM and Lean construction:

Subsequently, BIM and lean functions such as 4D simulation integrated with Look ahead planning, Quantity take off, Clash detection during look-ahead and weekly work planning, to reduce change orders and RFIs for additional value to customer were applied in an integrated fashion. This improvised BIM-Lean process facilitates the design coordination during construction phase for all project stakeholders (Raol et al., 2020) . At the design and detail stage, there are two functions that are served by Lean and BIM implementation. These are value retention and creation, and waste minimization in current and later stages.

- BIM provides a sophisticated toolset that helps capture value (also retaining value from the earlier stages) and also helps further value development.
- The Lean processes, along with the BIM toolset, help minimize waste throughout the design stage by improved design reviews and clash detection and by early involvement of project stakeholders.

The collaborative design processes help minimize delays and compress the overall time taken. Given the current considerations and UK Government priorities regarding the measurement of carbon, it should be noted that there are examples of integrating carbon calculations while designing the building and possibly also through operations (Dave et al., 2013).

2.10.4 Royal Institute of British Architect (RIBA):

The RIBA publishes a ‘plan of work’ that describes the stages necessary to complete the design and construction of a building. These stages are sometimes taken as the basis for stage payments. The definition of these stages was changed in 2013 to:

- Stage 0: Strategic Definition (0 -SD).
- Stage 1: Preparation and Briefing (1 - PB)
- Stage 2: Concept Design (2 - CD).
- Stage 3: Spatial Coordination (3- SC)
- Stage 4: Technical Design (4 - TD)
- Stage 5: Manufacturing and Construction (5 - MC)

- Stage 6: Handover and Close Out (6 - H)
- In Use.

There is also a BIM overlay and a sustainability overlay for the plan of work, but these do not seem to have been updated to reflect the 2013 work stage definitions (Fletcher & Satchwell, 2013).

2.11 Empirical Literature

- **Construction Design and Management Regulations 2015**

The Construction (Design and Management) Regulations 2015, also known as CDM Regulations or CDM 2015, which came into force on 6 April 2015, are regulations governing the way construction projects of all sizes and types are planned in the UK. Replacing Construction (Design and Management) Regulations 2007, CDM 2015 is the latest update to the regulations that aim to improve the overall health, safety and welfare of those working in construction. These regulations offer a very broad definition of what construction works are. Everyone involved in a construction project, including home maintenance and improvement works, has responsibility for health and safety. (Birchall & Ramus, 2020) CDM 2015 aims to ensure health and safety issues are appropriately considered during the development of construction projects. The overall goal is to reduce the risk of harm to those who have to build, use and maintain structures. The regulations were originally introduced in 1994 in compliance with European Directive 92/57/EEC and were previously revised in the CDM Regulations 2007.

CDM Regulations 2015 define responsibilities according to particular roles from client, designer and contractor. The main changes from the CDM Regulations 2007 are:

- The regulations now apply to all clients of construction projects, whether or not a person is acting in the course or furtherance of a business.
- Pre-construction archaeological investigations are not included within the scope of the definition of construction work.
- The role of CDM coordinator has been removed and various duties have been recast including client duties and general duties.

- A client is required to appoint a principal designer as well as a principal contractor in any project where there is, or it is reasonably foreseeable that there will be, more than one contractor working on the project.
- Under the 2007 Regulations appointments for similar roles were required for notify able projects. The duty to notify now lies with a client and the threshold for notification is raised.

The principal implication of CDM 2015 is that the person or business, for which the construction services are carried out, 'the client', is accountable for health, safety and welfare on the project. Property owners appointing professionals to perform maintenance work will face additional costs from designers and contractors for this added work and responsibility.

As (Tilley, 2005) for some time, the construction industry has been portrayed as being uncompetitive and inefficient when compared to other industries. Projects running over budget, over time and plagued with rework, variations and disputation, still occur all too frequently. Poor design and documentation quality standards have often been identified as major contributors to these project ailments. With design and documentation quality having such a major influence on the overall performance and efficiency of construction projects, any improvements can only lead to corresponding improvements in the efficiency of the construction process. The causes of design and documentation deficiencies, a number of studies have identified a variety of external factors; including low design fees, insufficient design time, inexperienced staff, inappropriate procurement methodologies and poor communications, to name a few.

Lean Construction is a term used to describe the adoption of "lean production" philosophies to try to improve the efficiency of the construction process and there is a growing volume of literature documenting the success of Lean Construction implementation. By introducing lean production principles to the process of design, it is felt that an improved management strategy can be developed that will improve the quality of design and documentation produced (Tilley, 2005).

(Tilley, 2005)state that, Poor design and documentation quality has been identified as being a major factor in reducing the overall performance and efficiency of construction projects as well

as being directly responsible for many projects running over budget, over time and being plagued with rework, variations and disputation. Recent studies show that this problem is not only widespread, but continues to get worse in spite of the negative impact it's having on the construction industry. In a similar way, project management deficiencies have also been shown to have a negative impact on construction process efficiency. However, by adapting Lean Production principles and viewing construction in terms of "production" as opposed to "transformation", the concept of Lean Construction has been promoted as being successful in improving overall construction process efficiency, by improving the management of construction project operations.

- **Ethiopia**

According to Study report 2017 (Tadesse et al., 2017), by World Bank and ECPMI about the Construction contract Expectations and Actual Performance Gap identifications in the construction industry of Ethiopia summarized as below;

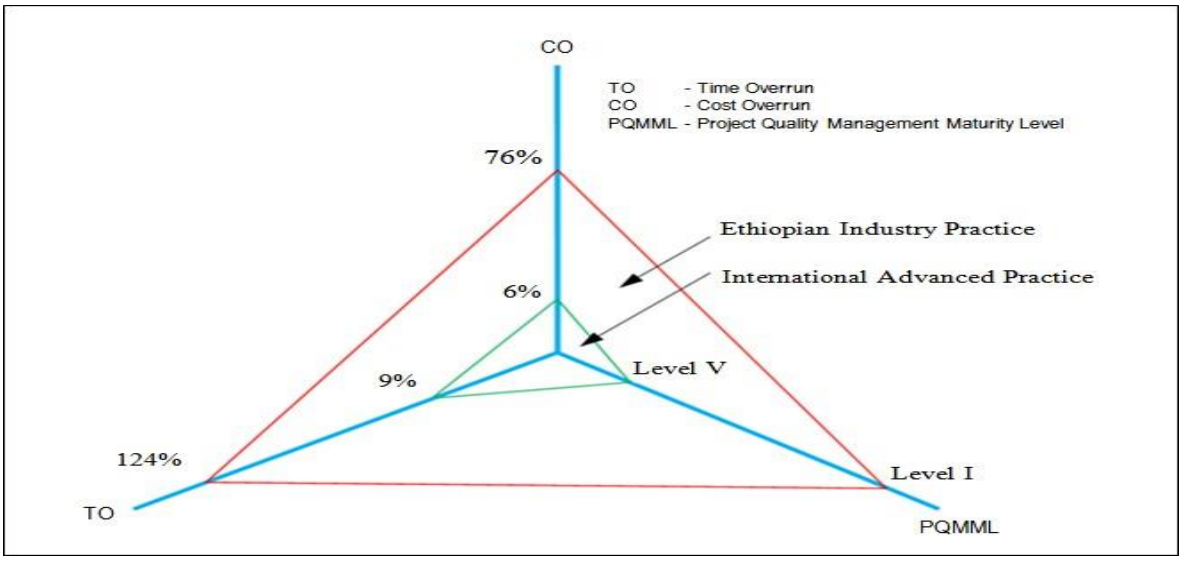

Figure 2. 2 Comparison of Performances with the International Good Practices

(Source- Asmerom Taddese, 2016)

Reasons for cost and time overruns of projects are attributed to design incompleteness, design changes, scope changes, changes in volume of work, poor initial estimation of completion time, force majeure and other reasons. As can be noted from this Study, most of the reasons arise at earlier stages of the project cycle (gaps in strategic project planning and preparation)

thus showing more serious gaps related to project feasibility/planning, design and tender documents preparation. Equally important gap is associated with ineffective contracts implementation management that includes risks management and performance monitoring practices.

A recent study entitled Project Management Maturity in the construction industry of developing countries (the case of Ethiopian contractors) shows that the average maturity level of the Ethiopian construction companies is at an informal practice level; this is roughly equivalent to Level-I in the of project maturity models.

So, based on these findings the CPMI establish "Construction Project Design Management Manual (CPDMM).

- **Ethiopian Construction Project Design Management Manual**

In 2019, the ECPMI launches the Nineteen working Manuals which enables to integrate the process and knowledge areas of project management skills. By applying those bodies of project management knowledge, the result will be a modern and unified construction project management system in the country.

The basic purpose of the manual is in order to develop standardized CPDSM Manuals that guides the implementation framework for one among the necessary CPMMs and apply the as a basis to plan and Implement; use CP design services and /or works; and Monitor and control CP Performances to successfully complete CPs (Manual, 2019).

The Scope of the manual includes the detail development of design service management for building and road construction projects (service and works).

According to CPDMM, the design process is divided in to five stages;

a. Planning for design
b. Concept/Basic/outline design
c. Preliminary design
d. Detail design
e. Close design (Feedback from operation).

Design management process

The design management process consists of the management of all projects assigned associated design activities, people, processes, and resources such as:

- Permitting the powerful flow and production of design information
- contributing to reaching the success delivery of the finished project, on time, on budget and in fulfilment of the client's necessities on high-satisfactory and characteristics in a sustainable manner
- delivering value through integration, planning, coordination, risk reduction and innovation
- achieving through collaborative and integrated working and value management processes

However, there's plenty debate over the scope and obligation for handling the design. This is due to the fact at the same time as the design group and the DTL (design team leader) are usually ultimately responsible for the production and drawing of the design, making sure that the drawings are brought to the project team and the relevant supply chain is usually the responsibility of the DDM (design delivery manager). This process of design delivery is an activity of project management.

Where the project is performed beneath a design and build contract, the DDM can be part of the contractor`s organisation or the related design company.

CHAPTER THREE

3. RESEARCH METHODOLOGY

Research Methodology is a functional framework through which certain facts are placed so that their meaning may be seen more clearly. Therefore, deals with the procedure of the research process, data collection, analysis, and presentation to achieve research objectives.

3.1. Study Flow Chart

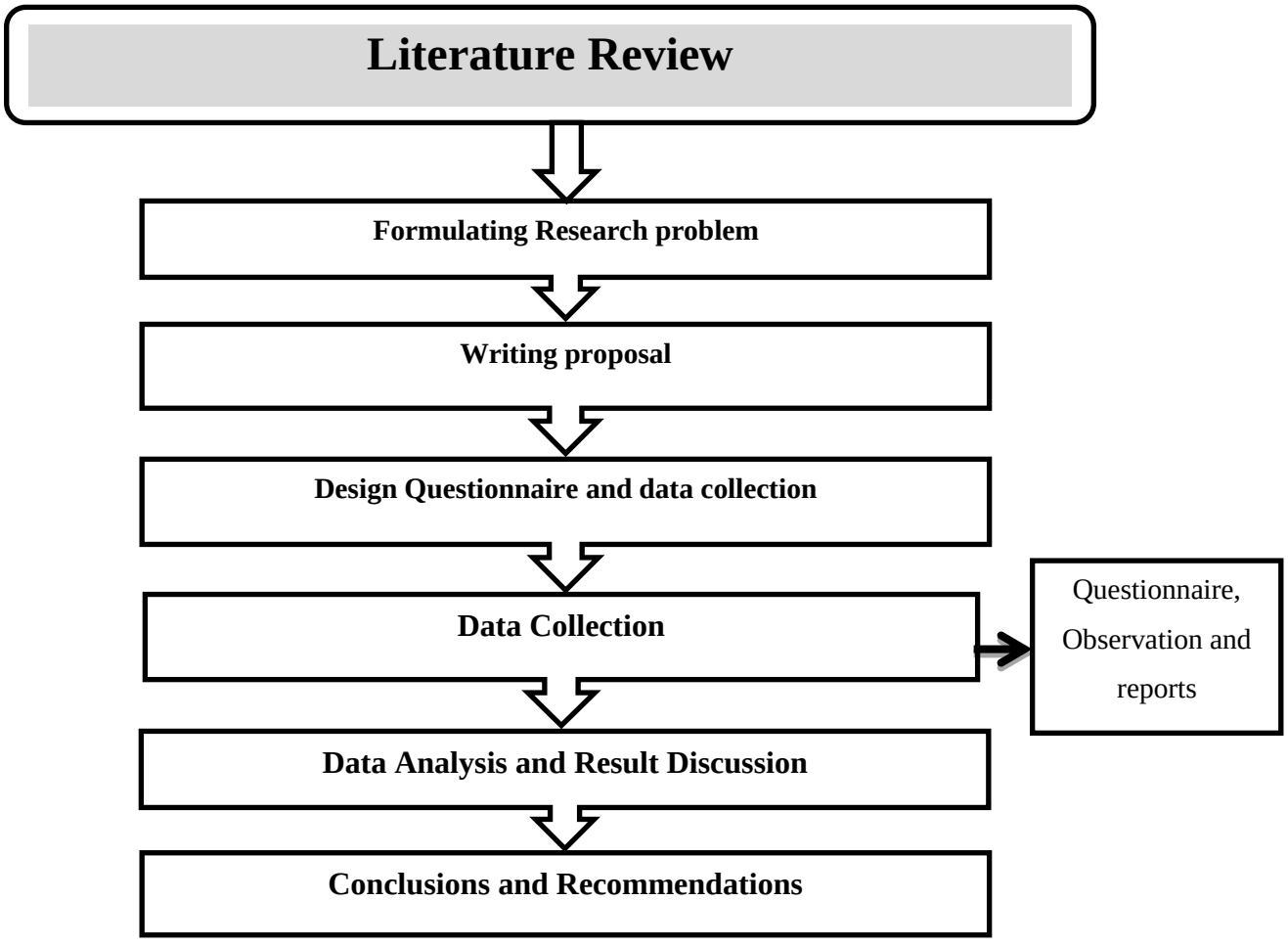

Figure 3. 1 Study Flow Chart

Research Design is the procedures and techniques employed to answer the research problem or question. It entails choosing the subjects who would participate in the study, the techniques and approaches for collecting data from the subjects, and the procedures for collecting the information. Research

methodology describes the overall approach to research design (Cresswell et al., 2003). (C.R. Kothari, 2004), argues that a research design constitutes the blueprint for the collection, management, measurement and analysis of data.

3.2. Study area

This thesis refers to assessments of design management practices in public building projects of Oromia regional states at a bureau level. The governmental sectors have a varying amount of building projects for various functions to mitigate public problems. So, those sectorial bureaus are located in Addis Ababa at various locations mainly at Sarbet.

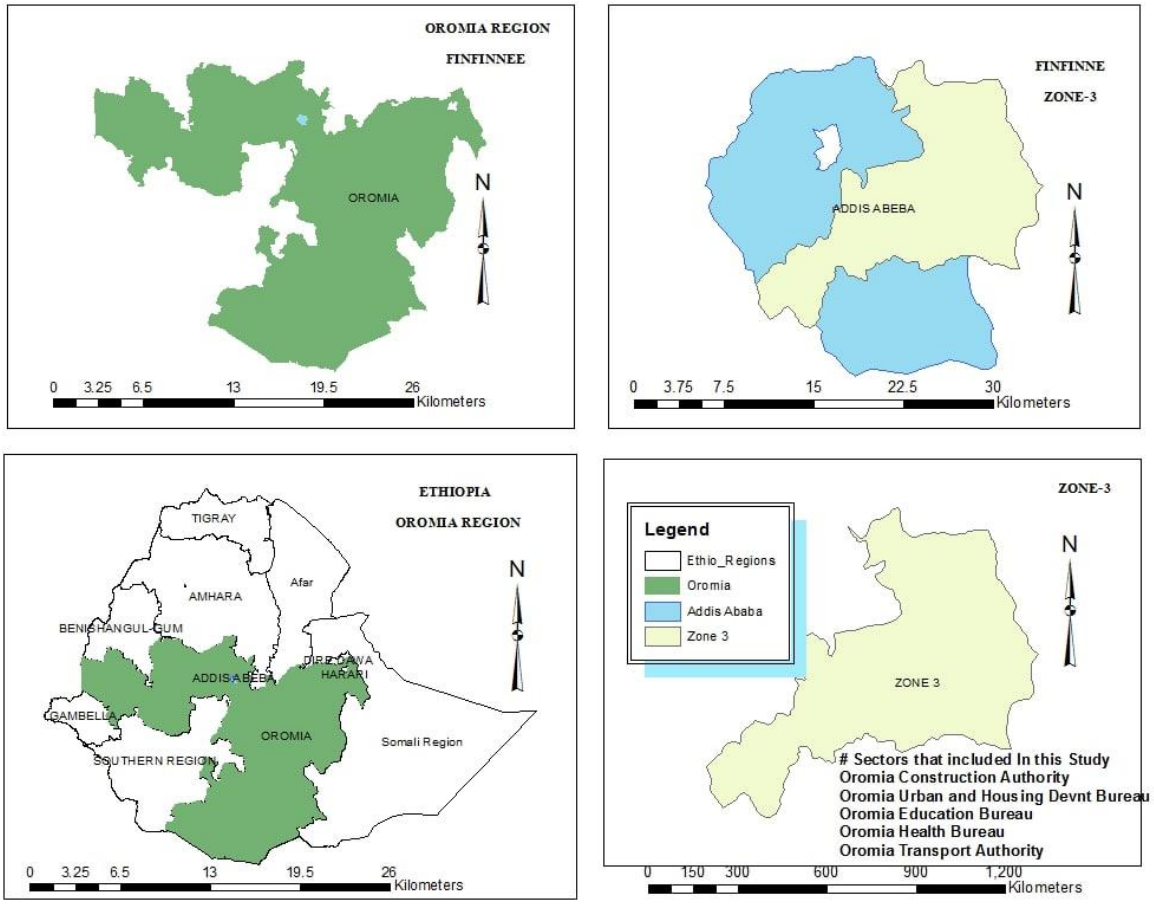

Figure 3. 2 Map of Study Areas/Location Map **(Oromia Region administrative map, Aug 2017)**

3.3. Data types

To achieve the objectives of the study, both quantitative and qualitative will be gathered from primary and secondary data sources. Necessary primary data will be collected from the clients, contractors, regulatory bodies and consultant office. On the other hand, secondary data sources will be obtained from sources like reports, annual plans, websites, books, and the internet to make the study more effective and efficient.

3.4 Data sources

In this study, the researcher uses both primary and secondary sources to gather data that enables successfully meets the objectives of the research.

3.4.1 Primary Data Sources

Several instruments and tools through which primary data will be collected such as, questionnaires and personal observation which consist of close and open-ended, and semi-structured questionnaires were applied.

3.4.2 Secondary Data Sources

Secondary data will be gathered from relevant secondary sources, like books, articles, and unpublished annual performance reports, journals, publications, magazines, and related documents.

3.5. The population of the study

The populations of the study are limited to public sectors having more budgets for building projects. The total populations of the study area are 5 sectorial bureaus having widely building projects (Oromia Education bureau, Oromia Transport Authority, Oromia Health Bureau, and Oromia Urban Development and Housing Bureau), contractors, Engineers from the regulatory body (Oromia Construction Authority), and consultants. The total populations including active professionals from public sectors, Contractors, and Consultants are stated below;

Table 3. 1 Population of the study area

It. No.	Public Sectors	No. of Professionals in building department	No. of Contractors working in the sector	No of Consultants in the sector
1	Oromia Construction Authority	10	-	-
2	Oromia Urban and Housing Development Bureau	5	5	1
3	Oromia Education Bureau	6	6	1
4	Oromia Health Bureau	7	6	1
5	Oromia Transport Authority	4	5	7
	Sub-total	**32**	**22**	**10**
	Overall total		**64**	

3.6. Sample Size

To achieve the objectives of this study, the total number involved in this research were identified as below. For small to moderate population and know all of the key values, we should use (Joskow & Yamane, 1965)standard formula.

$$Sample\ Size = \frac{\frac{z2\ * p(1-p)}{e2}}{1 + (\frac{z2 * p(1-p)}{e2N})}$$

The sample size (n) is calculated according to the formula:

n = [z2 * p * (1 - p) / e2] / [1 + (z2 * p * (1 - p) / (e2 * N))]

Where: z = 1.645 for a confidence level (α) of 90%, p = proportion (expressed as a decimal),

N = population size, e = margin of error (5%), Population Proportion (p) (50%).

z = 1.645, p = 0.5, N = 64, e = 0.05

n = [1.6452 * 0.5 * (1 - 0.5) / 0.052] / [1 + (1.6452 * 0.5 * (1 - 0.5) / (0.052 * 64))]

n = 270.6025 / 5.2282 = 51.759

n ≈ 52

3.7. Sampling Technique

In order to meet the objectives, the study was used simple random sampling.

3.7.1. Sampling Frame

The list from the study area is the sample frame. The sector bureaus include the Oromia Education Bureau, Oromia Transport Authority, Oromia Health Bureau, Oromia Urban Development and Housing Bureau, and Oromia Construction Authority.

Table 3. 2 Table Sampling Frame

It. No.	Public Sectors	No. of Professionals in building department	No. of Active Contractors working in the sector	No of Consultants in the sector
1	Oromia Construction Authority	10		
2	Oromia Urban and Housing Development Bureau	5	2	1
3	Oromia Education Bureau	4	8	1
4	Oromia Health Bureau	4	8	1
5	Oromia Transport Authority	3	2	3
	Sub-total	**26**	**20**	**6**
	Overall total	**52**		

3.7.2. Sampling Unit

The sample units of this research were a public body, contractors, regulatory body, and consultants.

3.7.3. Sample Selection

Consultant and contractors Participants of the research will be selected from the list of Oromia Construction Authority (Regulatory body) based on their active participation while all public bodies having frequently building projects will be assigned as a client is included. Accordingly, the questionnaire was prepared and delivered to all participants. To find out what activities

design management currently manage, participate in, or are not involved in; what they would like to manage, participate in, or be not involved in; what is considered time-consuming activities, and what are considered important activities. The functions of design management from these surveys are to be compared each other and to confirm or dispute the survey results. Another survey was carried out which will also be used to help to determine design management's role.

3.8. Data analysis method

(Yin, 2014) argued for research strategies and methods that are transparent and replicable and a strategy for analyzing the findings of a case study. The method of data analysis is according to the nature of the data. The qualitative data will be interpreted using discussion. The quantitative data on the other hand will be analyzed by using percentages, ratios, and other statistical data analysis**.** Software like SPSS 25, MS-Excel 2010 will be used for data analysis purpose

The rating scale is one of the most common formats for questioning respondents on their views or opinions of an event or attribute. In this regard, participants were asked to indicate the importance or level of influence of factors (research variables) by rating them on a five-point scale, (1= strongly disagree 2 = Disagree 3 =Neutral 4 =Agree 5= strongly agree important).
This statistical technique is intended to establish the importance of the factors. Each of the factors has been assigned an importance index or severity index, to help rank them according to their importance, as follows.

$$\text{RII} = \text{Relative importance index} = \frac{(\Sigma\ \text{Wi x} * \text{f} * \text{i}) * (100)}{\text{A} * \text{n}}$$

Where Wi= weight given to ith response; i = 1, 2, 3, 4, 5

F*i = Response's frequency

A = highest weight value

n = total No of responses

The ranking format was used for analyzing questions in which respondents were asked to place a set of attitudes in ranking order, indicating their importance or preferences.

3.9. Data presentation methods

Depending on the nature of the data collected from the sources, it used the quantitative and qualitative methods of data analysis. The quantitative data collected was presented by charts, graphs, and tables while qualitative data were interpreted in explanatory.

CHAPTER FOUR

4. RESULT AND DISCUSSION

This chapter describes the results and discussion of responses given by the key stakeholders including the general information about their profiles, necessary information from the firms and professionals related to the design management. A total of **52** questionnaires were sent to a randomly selected sample of participants on public building construction in the Oromia Region. A sample of the questionnaires is attached in **Appendix A**. The key stakeholders and all participants of public building projects that are considered to have a direct relation with the objectives of the research were considered under this research. These include clients, contractors, consultants, and the regulatory body. Finally, data were captured and the responses were analyzed using Microsoft office excel and a relative importance index (RII and Ranking) by using Statistical Package for the Social Sciences (SPSS) 25.0 version.

4.1 Analysis and Discussions

4.1.1 Response Rates

As mentioned in section 3.6, the questionnaire form was distributed to 52 participants and out of which 42 have returned completed forms, representing an 81% response rate. According to Sekaran (2001), a response rate of 30% is acceptable for most studies; therefore, the response rate of this study is measured as adequate for the study.

Table 4. 1 Response Rate

It. No.	Public Sectors	No. of Professionals in building department		No. of Contractors working in the sector		No of Consultants in the sector	
		Distributed	Collected	Distributed	Collected	Distributed	Collected
1	Oromia Construction Authority	11	10	--	--	--	--
2	Oromia Urban and Housing Development Bureau	5	3	2	2	1	1
3	Oromia Education Bureau	4	3	9	8	1	1
4	Oromia Health Bureau	4	2	8	6	1	1
5	Oromia Transport Authority	3	2	2	2	3	2
	Sub-total	27	20	21	17	5	5
	Total Distributed			**52**	**Total Collected**		**42**
							81%

4.1.2 Respondents Profile

As the questionaries distirbuted to all the 3Cs including the regulatory bodies, the majority of respondents were from the contractors 40.47%, Regulatory body 23.8%, Client 23.8% and the remaining 11.9% were from the Consultants.

Table 4. 2 Respondents Profile

It. No.	Organization Type	No. of respondent
1	Regulatory Body	10
2	Client	10
3	Consultant	5
4	Contractor	17
	Total	**42**

4.1.3 Respondents Job Designation

The questionnaire was prepared by targeting design management practices of the key building project owners of Oromia regional State Public Sectors. Among the respondents 8 were titled as Supervisor and 7 Resident Engineers majorly. 4 respondents were architects with a title of design team leader (1 design Manager) and 3 Architect. Other respondents who have participated on the survey were; structural engineers (2 respondents), Project Mangers (5 respondents), Sanitary Engineer (4 respondents), Electrical Engineers (3 respondents), Surveyor (2 Respondents) and Structural Engineer (2 Respondents). From this the Design manager was not recognized well.

Table 4. 3 Respondents Job Title

Job Designation					
		Frequency	Percent	Valid %	Cumulative %
Valid	Owner/Manager	5	11.9	11.9	11.9
	Resident Engineer	7	16.7	16.7	28.6
	Project manager	5	11.9	11.9	40.5
	Design Manager	1	2.4	2.4	42.9
	Architect	3	7.1	7.1	50.0
	Sanitary Eng.	4	9.5	9.5	59.5
	Electrical Eng.	3	7.1	7.1	66.7
	Surveyor	2	4.8	4.8	71.4
	Structural Eng.	2	4.8	4.8	76.2
	Supervisor	8	19.0	19.0	95.2
	Others	2	4.8	4.8	100.0
	Total	**42**	**100.0**	**100.0**	

4.1.4 Professional Background

As stated under the tables 4.4 of below the majority of the respondents were from Civil Engineering 16 and 13 respondents were Construction Technology and Management professionals. Also 4 Architect, 7 Electrical Engineer and 2 other professional experts was participated. As design service and construction works require multidiscipline professions.

Table 4. 4 Professional Background

Professional Background					
		Frequency	Percent	Valid %	Cumulative %
Valid	Civil Engineering	16	38.1	38.1	38.1
	Architecture	4	9.5	9.5	47.6
	CoTM	13	31.0	31.0	78.6
	Electrical Eng.	7	16.7	16.7	95.2
	Others	2	4.8	4.8	100.0
	Total	42	100.0	100.0	

4.1.5 Education Level

The academic qualifications of the respondents were assessed. Accordingly, out of 42 participants 55% respondents have BSC and 45% have Master's Degree. The remaining 5% states that other level of Education which is not specified.

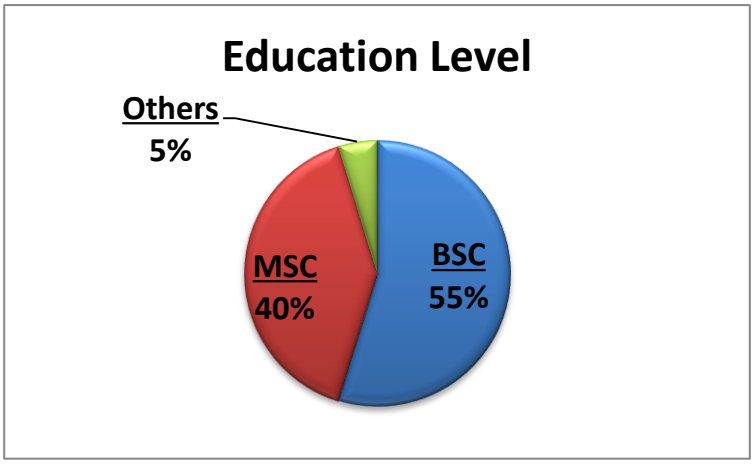

Figure 4. 1 Education Level

4.1.6 Experience in Construction Industry

Industry Experience of the respondents enables us to understand how they practice. The more experienced, the more reliable information will be gathered. From the table about 62% of the respondents were in the industry from 6-15 years.

Table 4.5 Industry Experience

Experience in the construction industry					
		Frequency	Percent	Valid %	Cumulative %
Valid	0-5	10	23.8	23.8	23.8
	6–10	13	31.0	31.0	54.8
	11 – 15	13	31.0	31.0	85.7
	16 – 20	4	9.5	9.5	95.2
	20 +	2	4.8	4.8	100.0
	Total	42	100.0	100.0	

4.1.7 Experience in Design

When comes back to specific experience in design management, 18 respondents were 3-5 years, 7 respondents were 6-8 years. As the main objective of the study was about design practice and management of building projects, related experience is a key data gathering tool.

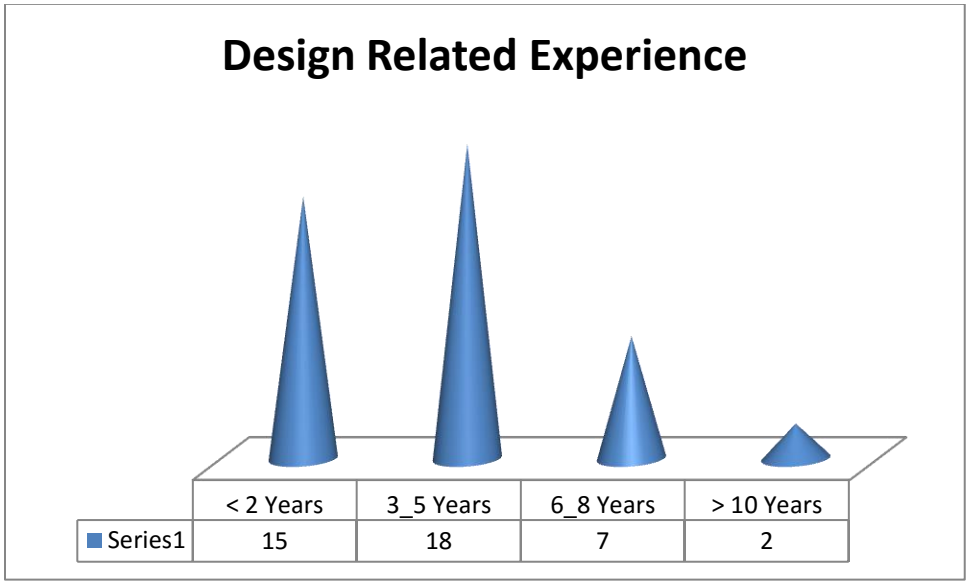

Figure 4. 2 Design Experience

4.2 Design management Practices

If we gather adequate data on the practices carried out by the key stakeholders, we can recommend strong solutions for each party that is expected from them.

As per the respondents under Section II of the question to measure the satisfaction levels of current design management practices by stakeholders, 38.1% Low, 35.7 % moderately and 26.2% were highly satisfied. So, this figure tells us there are poor practices and unsatisfied needs of design management practices were exist and it demands an improvements.

Table 4. 5 DM Practices

Descriptions	Rank	RII
1.Undefined owner scope	8	0.82
2. Lack of defined Stake holder's requirement	13	0.78
3. Lack of adequate time and resources for design work	3	0.85
4. Poor Coordination of design information	9	0.81
5. Poor Continuous design improvement process	9	0.81
6. Undefined Design deliverables and information (AR- 3D, section, ST, MEP...)	7	0.83
7. Absence concerned parties' involvement at the right time	9	0.81
8. Inadequate control tools of change	9	0.81
9. Ineffective design review practice	**2**	**0.86**
10. The underestimate of project cost and time	**3**	**0.85**
11. Lack of site visiting and site analysis	**1**	**0.87**
12. Absence of feasibility study	5	0.84
13. Lack of design management manuals and processes	5	0.84

In order to see the overall practices of design management in the region, questionnaires were designed and distributed to all key stake holders. The survey focuses on design management practice and their challenges.

The top three design management practice rated by the respondents were Lack of site visit and analysis, poor design review techniques and underestimate of time and cost by having RII value of 0.87, 0.86 and 0.85 respectively. So, when we don't have in depth investigation of the site, it results with incomplete design, poor time and cost estimation and other defects will occur. Also Lack of design review culture affects the performance/constructability of a design as per the design and contract. In addition design review culture was also an important tool in order to have a complete design for construction and to minimize the rate of change during construction phase.

A. Regulatory body Practices

In Oromia Regional Government, the Regulatory body was named as Oromia Construction Authority which was established in 2008 E.C in order to regulate the overall construction activities throughout the region. The respondents from the Regulatory part states that undefined design deliverables, absence of site visit and absence of design management manuals are the futures of current building projects design by ranking from 1-3. As the building projects are government budgeted, their most focus was to immediately respond the public demands.

Here the major role expected from the Regulatory was to establish design management manuals and procedures are not yet established.

Table 4. 6 Regulatory DM Practices

Description	Rank	RII
1.Undefined owner scope	7	0.84
2. Lack of defined Stake holder's requirement	7	0.84
3. Lack of adequate time and resources for design work	7	0.84
4. Poor Coordination of design information	12	0.80
5. Poor Continuous design improvement process	4	0.86
6. Undefined Design deliverables and information (AR- 3D, section, ST, MEP...)	**1**	**0.88**
7. Absence concerned parties' involvement at the right time	4	0.86
8. Inadequate control tools of change	13	0.78
9. Ineffective design review practice	4	0.86
10. The underestimate of project cost and time	7	0.84
11. Lack of site visiting and site analysis	**1**	**0.88**
12. Absence of feasibility study	11	0.82
13. Lack of design management manuals and processes	**1**	**0.88**

B. Owner Practices

When coming back to the Owners perspective, as a client either for education or transportation or Health projects, the success of the project is determined by completion on time, budget and quality. From current practices, Most of their building projects don't meet their objectives.

As all of the projects were Design Bid Build contract type, the Owner is responsible to deliver complete design to the Contractor. Ineffective design review, absence of parties involved in the design, and absence of feasibility study are the top-ranked design management exercise by the Owner.

Table 4. 7 Owners DM Practices

Description	Rank	RII
1.Undefined owner scope	9	0.840
2. Lack of defined Stake holder's requirement	12	0.800
3. Lack of adequate time and resources for design work	4	0.880
4. Poor Coordination of design information	7	0.860
5. Poor Continuous design improvement process	11	0.820
6. Undefined Design deliverables and information (AR- 3D, section, ST, MEP...)	13	0.780
7. Absence concerned parties' involvement at the right time	**1**	**0.940**
8. Inadequate control tools of change	4	0.880
9. Ineffective design review practice	**1**	**0.940**
10. The underestimate of project cost and time	7	0.860
11. Lack of site visiting and site analysis	4	0.880
12. Absence of feasibility study	**3**	**0.900**
13. Lack of design management manuals and processes	9	0.840

C. Contractors Practices

Most of the building constructions projects carried out by the Oromia Regional Government were DBB type of Contracts. So, the Contractor is mostly expected for the construction activities. Lack of adequate time and resources for design work, Lack of site visiting and site analysis, Absence of concerned parties' involvement at the right time, and the underestimation of project cost and time are the top-ranked practices of design by the contractors. As stated above, the staff of the contractors was highly construction-related and less consideration is given to the

design activity. Under site visit it's a must meet criteria while the bid competition phase but it's only checking local material availability purpose. In addition, the contractors don't involve in the design process. As they don't involve in the design phase the allocated time and budget during the design phase doesn't much within the construction phase.

Table 4. 8 Contractors DM Practices

Description	Rank	RII
1.Undefined owner scope	11	0.800
2. Lack of defined Stake holder's requirement	13	0.718
3. Lack of adequate time and resources for design work	**1**	**0.859**
4. Poor Coordination of design information	10	0.812
5. Poor Continuous design improvement process	12	0.753
6. Undefined Design deliverables and information (AR- 3D, section, ST, MEP...)	6	0.835
7. Absence concerned parties' involvement at the right time	**1**	**0.859**
8. Inadequate control tools of change	6	0.835
9. Ineffective design review practice	5	0.847
10. The underestimate of project cost and time	**1**	**0.859**
11. Lack of site visiting and site analysis	**1**	**0.859**
12. Absence of feasibility study	6	0.835
13. Lack of design management manuals and processes	9	0.824

D. Consultants Practices

From the practice of the consultants, the absence of concerned parties' involvement at the right time ranked as 1st. Because at each design phase if the concerned parties like professionals, regulatory bodies, and other concerned are involved, the final design may be complete and that meets its purposes. Poor Continuous design improvement process is ranked as 2nd and it tells us design is a process and continuously developed the concept. But without giving adequate time and concern for design review the final will be produced. The most available limitation and ranked as 3rd is undefined design deliverables and information. This must be clearly stated during the contract formation by the client. Due to stating clearly what is delivered at the final stage, the information is not fully presented.

Table 4. 9 Consultants DM Practices

Description	Rank	RII
1.Undefined owner scope	**3**	0.840
2. Lack of defined Stake holder's requirement	7	0.800
3. Lack of adequate time and resources for design work	9	0.760
4. Poor Coordination of design information	11	0.720
5. Poor Continuous design improvement process	**2**	0.880
6. Undefined Design deliverables and information (AR- 3D, section, ST, MEP...)	**3**	0.840
7. Absence concerned parties' involvement at the right time	**1**	0.920
8. Inadequate control tools of change	13	0.640
9. Ineffective design review practice	11	0.720
10. The underestimate of project cost and time	**3**	0.840
11. Lack of site visiting and site analysis	**3**	0.840
12. Absence of feasibility study	9	0.760
13. Lack of design management manuals and processes	7	0.800

E. Combined Stakeholders Practices

From the table below, the spearman's correlation with respect to design management practices, the contractor has strong correlation with consultant and Owner by 0.67 and 0.668 values respectively. As per the type of the contract, the client is responsible for project initiation and design documentation with the technical support of the consultants. And the Regulator body by values of 0.58 has significant correlation with the consultants. As the regulatory bodies are responsible for design development procedures and building permit, they met early from design development to the final building permits.

Table 4. 10 Combined DM Practices

Correlations						
			CONTRACTOR	CONSULTANT	OWNER	REGULATORY
Spearman's rho	CONTRACTOR	Correlation Coefficient	1.000	.067	**.668***	.184
		Sig. (2-tailed)	.	.828	.013	**.548**
		N	13	13	13	13
	CONSULTANT	Correlation Coefficient	**.067**	1.000	-.284	.580*
		Sig. (2-tailed)	.828	.	.347	.038
		N	13	13	13	13
	OWNER	Correlation Coefficient	**.668***	-.284	1.000	-.199
		Sig. (2-tailed)	.013	.347	.	.514
		N	13	13	13	13
	REGULATORY	Correlation Coefficient	.184	.580*	-.199	1.000
		Sig. (2-tailed)	.548	.038	.514	.
		N	13	13	13	13
*. Correlation is significant at the 0.05 level (2-tailed).						

4.3 Design phase

The effectiveness of the design process in the building industry has a great influence on the success of subsequent processes in the construction of projects and also on the quality of the environment. Poor design has a very strong impact on the level of efficiency during the production stage. Schematic Design, Design Development and Construction Documents are fundamental stages in the process of design construction. The top three factors design management practice was with their level of constraints as rated by considering all responses depend on the table are: Right of way, inadequate design data and information evaluations and Unclear and inadequate details in drawings.

From different research papers, Right of Way is a major challenge and a major reason for the delay, variations, claims, and poor project performances. Here also during the design phase, clearing the construction site from any Right of Way is an important task. In addition evaluation of data and information enables to produce complete and free from error design works. As once

the design phase is completed the construction phase begun and the drawing must compile adequate information and detailed construction drawings needed.

Table 4. 11 DM in the design phase

Descriptions	RANK	RII
1.Unclear and inadequate details in drawings	**3**	**0.871**
2. Inadequate design data and information evaluations	**2**	**0.886**
3. Lack of coordination inside the design team	7	0.838
4. Designers lacking required skills	4	0.843
5. Time limitation in the design phase	7	0.838
6. Lack of contractor involvement during the design phase	13	0.724
7. Less Consideration for Value- adding in design phases	5	0.857
8. Lack of Advanced design technological tools	11	0.781
9. Low design consultants fee	12	0.729
10. Poor design integration process result errors and mismatched: (Architectural, Structural, Sanitary, Electrical …)	6	0.852
11. Poor Quality of design and reports	9	0.786
12. Right of way	**1**	**0.890**
13. Poor Quality Control tools in Design	7	0.786

A. Perspective of Regulatory body on the design phase

By the Regulatory body Right of Way also ranked 1st. while Unclear and inadequate details in drawings, Designers lacking required skills and inadequate design data and information evaluations ranked 2nd and 3rd. As the Regulatory body they are responsible for design approval and building permit, they must ensure the plan agreement as per the proposed construction projects. And the submitted drawing must meet the standard and full of adequate information. Also while the design is reviewed and permitted must be as per the design requirement and functions. The other important element in design is considering Value Engineering concepts. This enables to increase the function of the project with reasonable time and budget

Table 4. 12 DM in design phase form Regulatory

Description	RANK	RII
1.Unclear and inadequate details in drawings	**2**	**0.860**
2. Inadequate design data and information evaluations	7	0.820

3. Lack of coordination inside the design team	7	0.820
4. Designers lacking required skills	**2**	**0.860**
5. Time limitation in the design phase	**2**	**0.860**
6. Lack of contractor involvement during the design phase	11	0.760
7. Less Consideration for Value- adding in design phases	**2**	**0.860**
8. Lack of Advanced design technological tools	7	0.820
9. Low design consultants fee	13	0.700
10. Poor design integration process result errors and mismatched: (Architectural, Structural, Sanitary, Electrical …)	6	0.840
11. Poor Quality of design and reports	10	0.800
12. Right of way	**1**	**0.920**
13. Poor Quality Control tools in Design	12	0.740

B. Perspective of Owners on the design phase

In our case, as the project was initiated by the owner of the project in order to mitigate public demands, and the design phase is with the help of consultant submitted to the owner. Right of way, Unclear and inadequate details in drawings and Lack of coordination inside the design team are the top 3 factors avail in design phase by client point of view. The Right of Way issue is a client responsibility mainly but also it's a challenge within other stakeholders also. As the design work is carried out by in dependent professional firms (Consultant), lack of clear and adequate detail drawings frequently occurred. The other important factor in design phase is coordination between various professions and disciplines. Related with this, lack of coordination between the design team results poorly integrated design that results with change orders and poor project performance.

Table 4. 13 DM in design phase form Owner

Description	RANK	RII
1.Unclear and inadequate details in drawings	**2**	**0.900**
2. Inadequate design data and information evaluations	4	**0.860**
3. Lack of coordination inside the design team	**3**	**0.880**

4. Designers lacking required skills	6	**0.840**
5. Time limitation in the design phase	9	**0.820**
6. Lack of contractor involvement during the design phase	13	**0.740**
7. Less Consideration for Value- adding in design phases	9	**0.800**
8. Lack of Advanced design technological tools	4	**0.860**
9. Low design consultants fee	12	**0.780**
10. Poor design integration process result errors and mismatched: (Architectural, Structural, Sanitary, Electrical …)	8	**0.840**
11. Poor Quality of design and reports	9	**0.820**
12. Right of way	**1**	**0.920**
13. Poor Quality Control tools in Design	6	**0.860**

C. Perspective of Contractors on the design phase

The Contractor is expected to complete the building projects as per the contract specification and time. Inadequate design data and information evaluations, Unclear and inadequate details in drawings and Less Consideration for Value-adding in design phases are ranked as the top 3 factors in design phase.

As they doesn't involve in design phase, from the final design what they observe is the design drawing was not cleared and not adequate information is exist how to create the built environment. In addition some design may save cost, space and add value if value engineering concept was considered in design phase by the consultant and client.

Table 4. 14 DM in design phase form Contractor

Description	RANK	RII
1.Unclear and inadequate details in drawings	**2**	**0.847**
2. Inadequate design data and information evaluations	**1**	**0.882**
3. Lack of coordination inside the design team	6	**0.812**

4. Designers lacking required skills	8	**0.800**
5. Time limitation in the design phase	8	**0.800**
6. Lack of contractor involvement during the design phase	13	**0.706**
7. Less Consideration for Value-adding in design phases	**2**	**0.847**
8. Lack of Advanced design technological tools	12	**0.753**
9. Low design consultants fee	10	**0.776**
10. Poor design integration process result errors and mismatched: (Architectural, Structural, Sanitary, Electrical …)	6	**0.812**
11. Poor Quality of design and reports	4	**0.824**
12. Right of way	4	**0.824**
13. Poor Quality Control tools in Design	11	**0.765**

D. Perspectives of Consultants on the design phase

The main stakeholder next to the client in design phase is the consultant. Less Consideration for Value- adding in design phases, Time limitation in the design phase and inadequate design data and information evaluations are the top three factors consultants facing during the design phase respectively. Alternative design competition (budget, time, function and space), adequate time to gather information for the design and evaluating the design data and information as per the standard is an important techniques to produce complete and adequate design documents.

Table 4. 15 DM in design phase form Consultant

Description	RANK	RII
1.Unclear and inadequate details in drawings	8	**0.800**
2. Inadequate design data and information evaluations	**2**	**0.920**
3. Lack of coordination inside the design team	8	**0.800**
4. Designers lacking required skills	7	**0.840**
5. Time limitation in the design phase	**2**	**0.920**
6. Lack of contractor involvement during the design phase	12	**0.720**
7. Less Consideration for Value- adding in design phases	**1**	**0.960**
8. Lack of Advanced design technological tools	13	**0.680**

9. Low design consultants fee	8	**0.800**
10. Poor design integration process result errors and mismatched: (Architectural, Structural, Sanitary, Electrical …)	4	**0.880**
11. Poor Quality of design and reports	4	**0.880**
12. Right of way	4	**0.880**
13. Poor Quality Control tools in Design	8	**0.800**

E. Combined stakeholders relations

With the design phase, design preparation and development tasks the client, consultant and Regulatory bodies were highly correlated and work together up to the final design. The client initiate the project and the consultant will be responsible to submit the complete and buildable design with detain information and the regulatory body reviews as per the standard and code. The contractor is mostly doesn't early defined and due to that it has perfectly negative correlation.

Table 4. 16 DM in design phase Combined

Correlations

			Client	Consultant	Contractor	Regulatory
Spearman's rho	Client	Correlation Coefficient	1.000	.501	-.098	.695**
		Sig. (2-tailed)	.	.081	.751	.008
		N	13	13	13	13
	Consultant	Correlation Coefficient	.501	1.000	.407	.504
		Sig. (2-tailed)	.081	.	.168	.079
		N	13	13	13	13
	Contractor	Correlation Coefficient	-.098	.407	1.000	.359
		Sig. (2-tailed)	.751	.168	.	.228
		N	13	13	13	13
	Regulatory	Correlation Coefficient	.695**	.504	.359	1.000
		Sig. (2-tailed)	.008	.079	.228	.
		N	13	13	13	13

**. Correlation is significant at the 0.01 level (2-tailed).

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.761	.789	4

From the Reliability analysis we understand that the internal consistencies are .76 which is positively reliable.

4.4 Design construction phase

The Design and Construction Phases are two independent and integrated stages of construction projects. Design is for the purpose of constructions. If there not construction activity the function of design is also null.

From table 4.17 the top three factors design management practice was with their level of constraints as rated by considering all responses depend on the table are: Addition, omission and change orders highly occur, Poor techniques of design review and drawing records and improper supervision of the work and lack of rapid decision. Majority of the Oromia Regional Government projects are characterized by extra cost additions (Variations). Also the culture of design review is poor which is appropriate to minimize additional construction costs. And there is limitation in scheduled monitoring and rapid decision making in any project management agenda.

Table 4. 17 DM in design Construction phase

Description	Rank	RII
1. Design lacks Constructability	8	0.80
2. Delay in approvals by government authorities	5	0.85
3. Lack of professional experience and judgment	4	0.86
4. Additions, Omissions, and Change orders highly occur	**1**	**0.92**
5. Ineffective design document review and conflicts between contract documents	6	0.84
6. Improper supervision of the work and lack of rapid decision	**3**	**0.87**
7. Changes initiated by contractors to improve quality and constructability	11	0.70
8. Uncontrolled construction program	9	0.78
9. Substantial scope change management	7	0.80
10. Poor techniques of design review and drawing record	**2**	**0.90**
11. Conflicts between consultant and contractor	10	0.76

A. Design Construction phase: Regulatory body

As a Regulatory body, is responsible for design approval (building permit) they also check and approve building occupancy permit at the close out phase of the project. Also as stated under table 4.18, the factors are ranked the same.

Table 4. 18 DM in design Construction phase Regulatory

Description	Rank	RII
1. Design lacks Constructability	6	**0.820**
2. Delay in approvals by government authorities	5	**0.840**
3. Lack of professional experience and judgment	6	**0.820**
4. Additions, Omissions, and Change orders highly occur	**1**	**0.900**
5. Ineffective design document review and conflicts between contract documents	9	**0.800**
6. Improper supervision of the work and lack of rapid decision	**3**	**0.860**
7. Changes initiated by contractors to improve quality and constructability	11	**0.740**
8. Uncontrolled construction program	3	**0.860**
9. Substantial scope change management	6	**0.820**
10. Poor techniques of design review and drawing record	**2**	**0.880**
11. Conflicts between consultant and contractor	10	**0.780**

B. Design Construction phase: Owners

The Owner from the initiation of the project up to the facility management phase involves at a great share. The difficulty in design phase also happens here if they not properly managed.

From the table below, Delay in approvals by government authorities, improper supervision of the work and lack of rapid decision and Poor techniques of design review and drawing record are the top 3 factors identified by the Owners. As the design approval and construction permission is by the regulatory body the requirements to be submitted for approval was not fully delivered and due to that there is delay in approvals. Absence of supervision and rapid decision also challenges for the success of the project. Design review and records also affects the performance of the project by initiating the project with incomplete design and information.

Table 4. 19 DM in design Construction phase Owner

Description	Rank	RII
1. Design lacks Constructability	10	**0.800**
2. Delay in approvals by government authorities	**1**	**0.960**
3. Lack of professional experience and judgment	4	**0.940**
4. Additions, Omissions, and Change orders highly occur	4	**0.940**
5. Ineffective design document review and conflicts between contract documents	6	**0.920**
6. Improper supervision of the work and lack of rapid decision	**1**	**0.960**
7. Changes initiated by contractors to improve quality and constructability	7	**0.900**
8. Uncontrolled construction program	8	**0.880**
9. Substantial scope change management	9	**0.820**
10. Poor techniques of design review and drawing record	**1**	**0.960**
11. Conflicts between consultant and contractor	11	**0.780**

C. Design Construction Phase: contractor

As the main responsible party to change the design into built environment, the contractor faced with various design challenges. From the response data the top 3 ranked factors are, Additions, Omissions, and Change orders highly occur, improper supervision of the work and lack of rapid decision and Poor techniques of design review and drawing records.

Table 4. 20 DM in design Construction phase Contractor

Description	Rank	RII
1. Design lacks Constructability	8	**0.753**
2. Delay in approvals by government authorities	6	**0.800**
3. Lack of professional experience and judgment	3	**0.847**
4. Additions, Omissions, and Change orders highly occur	**1**	**0.906**
5. Ineffective design document review and conflicts between contract documents	5	**0.812**
6. Improper supervision of the work and lack of rapid decision	**4**	**0.835**
7. Changes initiated by contractors to improve quality and constructability	10	**0.624**
8. Uncontrolled construction program	10	**0.624**

9. Substantial scope change management	4	**0.776**
10. Poor techniques of design review and drawing record	**2**	**0.894**
11. Conflicts between consultant and contractor	9	**0.718**

D. Design Construction Phase: Consultant

The Consulting firm may have the responsibility of design or/and Construction contract Administration role. Also sometimes they have design review roles. As per their specific roles from the table below the top 3 ranked factors are, Additions, Omissions, and Change orders highly occur, uncontrolled construction program, Design lacks Constructability and Poor techniques of design review and drawing record. As the same to other stakeholders those factors needs improvement by the consulting firms.

Table 4. 21 DM in design Construction phase Consultant

Description	Rank	RII
1. Design lacks Constructability	**3**	**0.880**
2. Delay in approvals by government authorities	8	**0.800**
3. Lack of professional experience and judgment	8	**0.800**
4. Additions, Omissions, and Change orders highly occur	**1**	**0.960**
5. Ineffective design document review and conflicts between contract documents	5	**0.840**
6. Improper supervision of the work and lack of rapid decision	5	**0.840**
7. Changes initiated by contractors to improve quality and constructability	11	**0.440**
8. Uncontrolled construction program	**1**	**0.960**
9. Substantial scope change management	5	**0.840**
10. Poor techniques of design review and drawing record	**3**	**0.880**
11. Conflicts between consultant and contractor	8	**0.800**

E. Combined stakeholders Design Construction phase

From the table 4.22, Additions, Omissions, and Change orders highly occur (Regulatory, Contractor and Consultant), Improper supervision of the work and lack of rapid decision (Regulatory, Client and Contractor) and Poor techniques of design review and drawing records

(Regulatory, Client, Contractor and Consultant). So, the stakeholders should come together to work within those challenges in order to improve the performance of projects. As the design as well as construction requires interdisciplinary professions, coordination and communication at every stage is important

Table 4. 22 DM in design Construction phase Combined

Correlations

			client	Consultant	Contractor	Regulatory
Spearman's rho	client	Correlation Coefficient	1.000	.012	.696*	.586
		Sig. (2-tailed)	.	.973	.017	.058
		N	11	11	11	11
	Consultant	Correlation Coefficient	.012	1.000	.277	.737**
		Sig. (2-tailed)	.973	.	.409	.010
		N	11	11	11	11
	Contractor	Correlation Coefficient	.696*	.277	1.000	.611*
		Sig. (2-tailed)	.017	.409	.	.046
		N	11	11	11	11
	Regulatory	Correlation Coefficient	.586	.737**	.611*	1.000
		Sig. (2-tailed)	.058	.010	.046	.
		N	11	11	11	11

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.691	.788	4

From the Reliability analysis we understand that the internal consistencies are .76 which is positively reliable.

CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The research aimed to demonstrate design management and to assess the design management practice and challenges of public building projects of Oromia. The research list findings for the four research questions/Objectives and the result is as follow:

The research aimed to demonstrate the design management practice and to assess the design management practice and challenges of public building projects of Oromia, to identify problems or drawbacks associated with the practice and to forward recommendations which can assist in overcoming or minimizing the consequences of the problems. In this research detailed assessments were made on the defining tasks, managing and evaluating information through planning, monitoring and controlling practices and, consequently, particular issues which demand improvement interventions were clearly pointed out. Moreover, consultants‟ performance with regard to defining the tasks, managing and evaluating information were also explored. These issues are crucial to consultants, for ensuring continuity and sustainability of business and even for ensuring their survival. The research's findings and conclusions made with respect to the four research questions/Objectives and the result are as follow:

- **Design management practices:**

  Before any construction projects put in a bid or tender for construction, the design phase enables to determine who was to do the design for tender. This involved selecting the design team, establishing contractual relationship with the design team, drawing up a schedule for design, financial and estimating reviews, tender submission and establishing facilities in order to do this.

  The major focus areas of the public project owner/government intend to launch a project without providing adequate time for the planning and design. Due to this most of projects

fails to meet their intended purposes. Issues like undefined scope, undefined deliverables, less party involvement at development stage, poor design review culture and Lack of site visit and analysis are among the features of the current design management practices as stated under Table 4.11 of above.

- **Limits of the existing design phase management practice:**

Once if the design development is clearly established, the remaining activity will be well managed. The different design phases enable to create and communicate with the client what they really want to do. So, at each and every phase the timely involvement for the development of design is crucial. From Table 4.17, Unclear and inadequate details in drawings, Inadequate design data and information evaluations, Less Consideration for Value- adding in design phases and Right of way are the major Limitations in order to produce a complete design at a level of allowable and tolerable design discrepancies

- **Importance of design management in the design construction:**

Reduce change (Additions, Omissions) during construction, rapid decision and improved quality of work, well organized project documentations and at the end successful project management approaches will exist. When come back to the characteristics of the Oromia Regional building projects, the Time, Cost and Quality measurements are inefficient and dis satisfaction by the community.

- **Possible solutions to improve the design management practice:**

  - Capacitating design professionals like design experts and Design Managers.
  - Well organized and coordinated approach of design management approaches (Advanced design management techniques like BIM,)
  - The Regulatory bodies must organize and deliver rules, regulations and manuals related to Design management.

5.2 Recommendations

This section presents the research's practical recommendations that are targeted at design management practice, minimizing the consequences of the challenges and problems, which owner, consultants, contractor and regulatory body with regard to managing design projects and Improving those design management capacity helps them to assume better quality design, which intern enable them achieve firm and project objectives. From the study, the design management practices by all the stake holders are at a poor level. To some extent the consulting firms has improvements but still they also require improving their status. Timely Coordination and integration between the stake holders will result a complete and adequate design.

The recommendations forwarded by this research are from three perspectives, from the point of view of government body, consultant firm and contractors.

5.2.1 Recommendation to government bodies

i. Client

From the study Right of way is the major challenges and a source of project failure. So, contractually the client main responsibility is to secure the land for the project with adequate budget, the issue of land must be prior to design phase must be secured. But currently also during the construction stage the issue of right of way is avail.

Involving the concerned parties which may add value to the design before the final design is produced also better if they engaged timely.

Developing the culture of design review also improves the quality of the design and hiring consulting firms is also an important function to add values of the construction projects.

ii. Regulatory Body

As the Regulatory body was responsible for design approval and building permit, they must prepare a clear regulations, manuals for design management and capacitate the professionals.

- Giving on time design comments and approvals also save the time.
- Design Implementation Manual:

  From Early design development phase till facility management stage, the design management manuals must prepared in order to clearly state the roles and responsibilities of each stake holders. The design deliverables also clearly established.
- Design Quality Indicator (DQI):

  Stating measuring parameters for design quality enables to control the quality, change and project purpose. So, establishing key performance indicators to measure the quality of design delivered is an important task that improves the design.

5.2.2 Recommendation to Consultant Office

The role of client is vital for any project success so it's advisable for the consultant office to cooperate and engage clients at every design stage decision. As the design and design review responsibly was in the hand of the consulting firms, they should give adequate time and resource in order to produce detail, well information intensive, economical, functional and at a minimum change occurrence to realize the project. Here also the issue of professionalism also needs attention.

- To improve design coordination
- To improve design team collaboration
- To apply Value Engineering and design Alternatives
- To use alternative design development tools and techniques

5.2.3 Recommendation to Contractors

As a contractor, before engaging in any bidding process it is better to evaluate by expertise of the company or from other sources. If there are any discrepancies between the design and specification, as per the procurement regulation it's an important to request any clarification.
In addition before carrying out any construction activity, it is important to review the design and produce shop drawings in detail.

5.2.4 Recommendation for further studies

As the regional level it is the first research paper which entitled to assess the design management practices of the major stake holders (Regulatory body, Client, Contractor, and Consultant). So, more research and investigation is required to improve the performance of the construction industry at regional as well as national level. Some of future focus areas will be at industry level (building, Road, Infrastructure, water works);

- Alternative design management and Integrated design delivery
- The Practice of design management by each stakeholders solely
- Evaluating the design management over construction management

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Annex 1 Research Questionnaires

ADDIS COLLEGE

DEPARTMENT OF CONSTRUCTION TECHNOLOGY & MANAGEMENT

Design Management Practices of Public Building Projects in the case of Oromia region, Ethiopia.

Questionnaires

Dear Sir/Madam,

My name is Habtamu Bulto Terefe, a prospective graduate student of Addis College. I am conducting a research on "*Design Management Practices of Public Building Projects in the case of Oromia region, Ethiopia*". The aim of the research is to study the practices related to design Managements (not construction contract management) regarding to the public building construction projects in Oromia region.

I kindly invite you to be a part of this research and request you to assist me in completing the brief questionnaires. I would kindly request your cooperation in providing the required information in the questionnaire, as well as to thank you for your valuable time and efforts. All information, including all results and personal information from participating individuals will be kept strictly confidential and be used only for this research purposes by me.

Yours Sincerely,

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Advisor: **Dr. Werku Koshe** (Ph.D)

PART I

SECTION - I

A. General Information

Please Tick the most accurately describes:

1. Organization type

☐ Owner/Client ☐ Contractor ☐ Consultant ☐ Regulatory Body

2. Job Designation

☐ Owner/Manager ☐ Resident Engineer ☐ Project manager ☐ Design Manager

☐ Architect ☐ Sanitary Eng. ☐ Electrical Eng. ☐ Mechanical Eng.

☐ Surveyor ☐ Quantity Surveyor ☐ Urban Eng Others (please specify) _____

3. Professional Background

☐ Civil Engineering ☐ Architecture ☐ Construction Technology & Management

☐ Surveyor ☐ Urban Engineering other (please specify) _____

4. Educational Level

☐ BSc ☐ MSc ☐ PhD Other (Specify) _____

5. Total experience in the construction industry in years

☐ 0 – 5 ☐ 6 – 10 ☐ 11 – 15 ☐ 16 – 20 ☐ 20 $^{+}$

6. Experience in preparation /approval any design team member of building design projects

☐ Less than 2 year ☐ 3-5 years ☐ 6-8 years ☐ above 10 years

SECTION II

Tick the appropriate selection (*You can select more than 1 option*)

1. Select the most commonly used design management tools by your Organization

☐ Meetings ☐ Project program ☐ Information release schedule ☐ Milestone dates

☐ Design deliverable schedule ☐ None Other (Specify) _____

2. At what stage of the design process does your company apply the design review?

☐ Schematic design stage ☐ Detail design stage ☐ Final design st ☐ **None**

3. If design management practices and tools are applied to the Construction industry, the expected result will be; (***You can select more than 1 option)***

☐ Design delivered on time/e ☐ Design met all client requirements

☐ integrated design will deli ☐ Less design changes will occur

4. Please rate the overall performance of your Organizations project in terms of Design quality.

☐ Excellent performance ☐ Moderate Performance

☐ Poor performance ☐ Very poor

5. Rate the Level of Satisfaction of Stakeholders by current design management practices.

☐ Very High ☐ Moderate

☐ High ☐ Low

6. Do you consider *Value Engineering and alternative design options* for any proposed design works?

☐ Yes ☐ No

7. Who do you think is responsible to manage the overall building projects design process?

☐ Client ☐ Contractor ☐ Consultant ☐ Regulatory Body

SECTION – III

1. How are your organization practice design managements? Also state the challenges.

Design management practices: _____

_____

_____

Design Management Challenges: _____

_____

2. If any design management tools and techniques you recommend for improving the current practice _____

_____

_____

3. Do you have adequate skill, knowledge and practice towards Design management process?

☐ **Yes** ☐ **No**

4. If **NO**! Please recommend ways to improve the limitations you have regarding Design Management

_____

_____

PART II

SECTION – I

Please indicate the level of agreement of the practice and challenges related with design management given below in the case of Oromia regional state by ticking the appropriate boxes and add remark relating to each factor on the last column.

Item No.	A. DESIGN MANAGEMENT PRACTICE	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	REMARK
1	Undefined owner scope						
2	Lack of defined Stakeholders requirement						
3	Lack of adequate time and resources for design work						
4	Poor Coordination of design information						
5	Poor Continuous design improvement process						
6	Undefined Design deliverables and information (AR- 3D, section, ST, MEP...)						
7	Absence concerned parties involvement at the right time						
8	Inadequate control tools of change						
9	Ineffective design review practice						
10	The underestimate of project cost and time						
11	Lack of site visiting and site analysis						
12	Absence of feasibility study						
13	Lack of design management manuals and processes						

Item No.	A. Design phase	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	REMARK
1	Unclear and inadequate details in drawings						
2	Inadequate design data and information evaluations						
3	Lack of coordination inside the design team						
4	Designers lacking required skills						
5	Time limitation in the design phase						
6	Lack of contractor involvement during the design phase						
7	Less Consideration for Value adding in design phases						

8	Lack of Advanced design technological tools						
9	Low design consultants fee						
10	Poor design integration process result errors and mismatched: (Architectural, Structural, Sanitary, Electrical …)						
11	Poor Quality of design and reports						
12	Right of way						
13	Poor Quality Control tools in Design						
Item No.	**B. Design–construction phase**	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**	**REMARK**
1	Design lacks Constructability						
2	Delay in approvals by government authorities						
3	Lack of professional experience and judgment						
4	Additions, Omissions and Change orders highly occur						
5	In effective design document review and conflicts between contract documents						
6	Improper supervision of the work and lack of rapid decisions						
7	Changes initiated by contractors to improve quality and constructability						
8	Uncontrolled construction program						
9	Substantial scope change management						
10	Poor techniques of design review and drawing record						
11	Conflicts between consultant and contractor						

Thank you in advance for your valuable time and efforts