Stakeholder Management in Mega Construction Projects: Unveiling Importance and interrelationship of Critical Success Factors

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A Thesis Submitted to the Department of Civil Engineering

School of Civil Engineering and Architecture

Presented in Partial Fulfillment of the Requirement for the Degree of master's in civil engineering (Specialization in Construction Engineering and Management)

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DECLARATION

I hereby declare that this Master Thesis entitled "Stakeholder Management in Mega Construction projects: Unveiling Importance and Interrelationship of Critical Success Factors" is my original work. That is, it has not been submitted for the award of any academic degree, diploma, or certificate in any other university. All sources of materials that are used for this thesis have been duly acknowledged through citation.

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RECOMMENDATION OF ADVISOR

I, the advisor of this thesis, hereby certify that I have read the revised version of the thesis entitled "Stakeholder Management in Mega Construction projects: Unveiling Importance and Interrelationship of Critical Success Factors" prepared under my guidance by Kassahun Terefe, submitted in partial fulfillment of the requirements for the degree of Mater's of Science in Construction Engineering and Management. Therefore, I recommend the submission of the revised version of the thesis to the department following the applicable procedures.

Fikreyesus Demeke (PhD)	_____	_____
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APPROVAL PAGE

I, the advisor of the thesis entitled "Stakeholder Management in Mega Construction projects: Unveiling Importance and Interrelationship of Critical Success Factors" and developed by Kassahun Terefe, hereby certify that the recommendation and suggestions made by the board of examiners are appropriately incorporated into the final version of the thesis.

Major Advisor	Signature	Date

We, the undersigned, members of the Board of Examiners of the thesis by Kassahun Terefe have read and evaluated the thesis entitled “Stakeholder Management in Mega Construction projects: Unveiling Importance and Interrelationship of Critical Success Factors” and examined the candidate during the open defense. This is, therefore, to certify that the thesis is accepted for partial fulfillment of the requirement of the degree of Master of Science in Construction Engineering and Management.

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LIST OF ACRONYMS

AHP	Analytical Hierarchy Process
CLRF	Client Related Factors
CORF	Contractor Related Factors
CSFs	Critical Success Factors
DTRF	Design Team Related Factors
ISM	Interpretive Structural Modeling
MCPs	Mega Construction Projects (MCPs)
MICMAC	Matricce d'impacts croises multiplication applique a classment
PM	Project Manager
PMBOK	Project management Body of Knowledge
PMRF	Project Manager Related Factors
PW	Priority Weight
SM	Stakeholder Management
SMP	Stakeholder Management practices
SRF	Supplier Related Factors
SURF	Sub-Contractor Related Factor

ABSTRACT

The number of mega construction projects has been increasing worldwide, including in Ethiopia. However, the complexity of these projects has made managing stakeholders, minimizing conflicts, and achieving success more challenging. As a result, successful stakeholder management has become increasingly critical in the construction of mega projects. While some studies have explored critical success factors in such projects, they often lack consideration of the interrelationships between these factors. It is important to assess whether less critical factors may influence the criticality of more significant ones. This study aims to identify, prioritize, and develop a hierarchical structure of critical success factors and their interrelationships for mega construction projects. A total of 37 factors were selected from a literature review and pilot studies. These factors were analyzed using an Analytic Hierarchy Process survey, which resulted in identifying the top 16 in rank out of the original 37 factors. These top 16 factors were then used as input for an Interpretative Structural Modeling survey, distributed to professionals, who had responded in the first stage and *involved in mega construction projects. The integrated method of Analytic Hierarchy Process and Interpretative Structural Modeling was conducted using Expert Choice and ISM software to analyze the data. The results show that timely decision-making by the client, risk attitude/willingness to take risks, risk identification and allocation, the ability to make timely decisions, and the client's knowledge about the project are the most important critical success factors. The findings also indicate a strong interrelation between these factors, with design complexity, the project manager's experience with similar projects, leadership abilities, and the contractor's experience in similar projects being the most influential. Considering the combined effects, the contractor's experience with similar projects, cost management without compromising quality, and risk identification and allocation are the most critical factors with strong influence and importance. The finding of this research would help construction practitioners in understanding critical success factors and to improve Stakeholder management practices in mega construction project.*

Keywords*: Critical Success Factors; Analytic Hierarchy Process; Interpretative Structural Modeling; Integrated Hierarchical Structure: Influence; importance: Addis Ababa.*

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

The construction industry serves as a key driver of economic growth, playing a critical role in national economies by influencing output, employment, and income. Globally, the sector accounts for approximately 13% of the gross domestic product (GDP), underscoring its substantial impact on the global economy. Annual construction activities worldwide surpass one trillion dollar (Chitkara, 2014), with the sector in developing countries contributing around 10% of GDP, representing roughly 80% of total capital assets (Tafesse et al., 2022). Additionally, (Wibowo, A., & Wilhelm Alfen, H., 2014) study reveals that the construction sector adds between 3% and 6% to GDP in underdeveloped nations.

Despite its significance, the construction industry is fraught with challenges and unpredictability's. According to (Wiguna and stephen scott, 2005), these challenges frequently result in delays, cost overruns, substandard work, and other issues that compromise project success. As the industry continues to evolve rapidly, it brings with it both critical advancements and unforeseen challenges. A notable challenge is the growing involvement of stakeholders in construction projects, which adds layers of risk and complexity. This growing complexity has heightened the need for improved stakeholder management practices, especially in developing countries where effective management is crucial.

Stakeholders are integral to the success of construction projects. (Freeman, 2007)defines stakeholders as any group or individual who can affect or be affected by the achievement of an organization's objectives a definition widely endorsed by scholars such as (Clarkson, 1995).These stakeholders, encompassing both internal and external individuals and groups, consistently influence project outcomes, regardless of the unique nature of each project. Effective management of these relationships is essential, as stakeholders act according to their needs and wield their influence to shape project results.

The surge in rapid urbanization has led to a rise in mega construction projects in recent years (Hu et al., 2015). These projects are inherently complex (Chan et al., 2004) and typically involve a multitude of stakeholders with varying interests that can affect the project both positively and

negatively. The complexity and type of construction project often determine the number of stakeholders involved. (Cicmil, S., & Marshall, D., 2005) Argue that the more complex a project, the greater the number of stakeholders, thereby increasing uncertainties. (Ward, S., & Chapman, C., 2008) Further suggest that stakeholders are a significant source of uncertainty in construction project management, exposing projects to varying degrees of risk throughout the construction process.

In Ethiopia, the importance of stakeholder management in construction projects has poor, particularly at project sites. This oversight has led to significant issues with construction costs, timelines, and quality, making project performance a major concern. These challenges are particularly pronounced in public building projects, where stakeholder management practices have not received adequate attention (Fayisa, G. W., & Wayessa, S. G., 2021). Effective stakeholder management is essential for minimizing risks and uncertainties and is a critical component of successful project management.

The Ethiopian construction industry is the engine of the national economy, exerting considerable influence on the efficiency and productivity of various sectors (Melesse, 2018). In recent years, the industry has witnessed remarkable growth, characterized by increased investment and the development and expansion of various infrastructure projects (MoUDC., 2012). However, despite this growth, the performance of the Ethiopian construction industry remains subpar. Construction projects in Ethiopia face significant challenges in being completed on schedule, within the allocated budget, and according to quality and safety standards. Mega projects, due to their intricate nature, are particularly vulnerable to these issues. As a result, countries forfeit substantial revenue, job opportunities, and other economic and social benefits (Callegari et al., 2018).Given the importance of these projects, there has been limited research on the role of stakeholder management practices and their impact on the success or failure of construction projects in Ethiopia, whether in the private or public sector. Effective stakeholder management is more crucial than ever, as the time, cost, and quality of construction projects are heavily influenced by the stakeholders involved, either directly or indirectly. Many projects in Ethiopia have encountered significant challenges due to inadequate stakeholder management. This research seeks to explore how stakeholder management practices influence the performance of construction projects within Ethiopia's local construction industry, from the initiation phase

through to the operation phase. By doing so, the study aims to raise awareness and promote better stakeholder management practices within the construction industry.

Previous research on stakeholder management in mega construction projects has often overlooked the intricate interrelationships between various influencing factors. While there is a general understanding of stakeholder management practices, there is a notable gap in examining how these factors such as stakeholder influence, project complexity, and management strategies interact and impact overall project efficiency. This issue is particularly pronounced in developing countries like Ethiopia, where the complexity of mega projects and unique socio-economic conditions present additional challenges. Addressing this gap is crucial for understanding how these interrelationships affect project success. This study aims to explore and rank these interrelationships in the context of Addis Ababa, providing insights into optimizing stakeholder management strategies and enhancing the performance of mega construction projects in Ethiopia.

1.2. Statement of the Problem

In the construction industry, particularly with mega projects, effective stakeholder management is crucial and depends significantly on identifying and managing critical success factors (CSFs). In Ethiopia, the construction sector is rapidly expanding and engaging in increasingly complex and resource-intensive mega projects (MoUDC., 2012). Managing a diverse array of stakeholders with varied interests is essential due to the complexity and volatility of these projects. Effective stakeholder management (SM) is recognized as a key strategy for addressing these challenges by highlighting stakeholder concerns and fostering robust relationships in complex project environments (Bourne, L., & Walker, D. H., 2005).

(Ward, S., & Chapman, C., 2008) Note that stakeholders contribute significantly to uncertainty in large construction projects. The complex web of stakeholder claims and interrelationships introduces considerable uncertainties at each project phase. Mega construction projects (MCPs), with their greater complexity and larger number of stakeholders, face heightened uncertainties and risks (Cicmil, S., & Marshall, D., 2005) Despite this, research specific to mega construction projects in Ethiopia is limited.

Existing studies on mega construction projects typically assess and prioritize CSFs based solely on their direct importance to project success. However, CSFs are interdependent, and their interactions can affect project outcomes in complex ways (Liu el al., 2015). Thus, prioritizing CSFs only by their direct importance is insufficient. Less critical factors can influence more

crucial ones, while more influential factors may not necessarily be the most important to overall stakeholder management success. Current Ethiopian research often overlooks these interdependencies, focusing primarily on direct importance rather than the nuanced interplay between factors.

This study aims to address this gap by analyzing and structuring CSFs for stakeholder management in Addis Ababa's mega construction projects, incorporating both their relative importance and their interrelationships. This comprehensive approach will enhance understanding of stakeholder management practices and improve project delivery efficiency and effectiveness in Ethiopia's construction industry.

1.3. Objectives of the Study

1.3.1. General Objective of the Study

The general objective of this study is to investigate the importance & interplay between different critical success factors and their combined impact on enhancing stakeholder management in mega construction projects.

1.3.2. Specific Objectives of the Study

1. To identify key critical success factors (CSFs) that enhance Stakeholder management practices on mega construction projects based on their relative importance.
2. To identify key critical success factors (CSFs) that enhance Stakeholder management practices on mega construction projects based on influence & interrelationship.
3. To develop combined critical success factors (CSFs) & customized frame works that enhance Stakeholder management practices on mega construction projects based on relative to each other.

1.4. Research Questions

1. What are the key critical success factors (CSFs) that enhance stakeholder management practices in mega construction projects based on their relative importance?
2. How do the key critical success factors (CSFs) that enhance stakeholder management practices in mega construction projects on influence & interrelationship?

3. How can combined critical success factors (CSFs) & customized frame works be developed to enhance stakeholder management practices in mega construction projects, considering both their importance and influence?

1.5. Significance of the Study

The findings of this study will be valuable to various stakeholders, including contractors, clients, consultants, external bodies, and future researchers. The research will provide insights into the current state of stakeholder management in project planning and management, highlighting strengths and identifying weaknesses to inform improvements. This study will contribute to the knowledge base of stakeholders, emphasizing the importance of effective stakeholder management practices in the efficient use of resources in construction projects. Moreover, this study may serve as a foundation for future research in this area and guide further studies.

1.6. Scope of the Study

This study provides valuable insights for various stakeholders in the construction industry regarding the critical success factors for effective stakeholder management in mega construction projects. It offers empirical evidence to decision-makers and other stakeholders on which factors significantly impact project success and which should be prioritized. Additionally, the study highlights potential research areas and serves as a foundation for further studies. The findings will serve as crucial guidelines for managing stakeholder relationships and ensuring the success of mega construction projects.

1.7. Limitation of the study

The significant limitation of the study was the difficulty in obtaining properly organized and compiled data from the Addis Ababa City mega project controlling office, which made it difficult and time-consuming to find the number of the population for the study.

1.8. Structure of the study

This thesis is divided into five chapters as follows:

Chapter one intended to give a brief background of the study, a statement of the problem, objectives of the study, research question, significance of the study, scope of the study and limitation of the study.

Chapter two includes a compressive relevant related literature on the concept and overview of mega construction project, stakeholder management and critical success factors for stakeholder management, grouping critical success factors for stakeholder management, literature summary and research gaps of the study and conceptual frame work.

Chapter three covers how the research is carried out and covers the research method, target population, instruments of data collection, data collection techniques, and procedures, and the data analysis method.

Chapter four presents the analysis of data that is collected from the AHP & ISM questionnaires. Presents detailed analysis of the AHP and ISM calculation, and results from the analysis.

Chapter five presents the conclusion based on the result and the recommendation drawn based on the conclusion and recommendation for further study.

CHAPTER TWO

LITRATURE REVIEW

2.1. Introduction

This chapter delves into the concept of stakeholders, their roles in management, and the various types of stakeholders involved in construction projects. It covers the stakeholder management process, particularly within construction projects, and explores critical success factors for effective stakeholder management. Additionally, it discusses practical approaches for analyzing and engaging stakeholders and formulating strategies for successful stakeholder management.

2.2. Stakeholder Definitions

Stakeholder management is a crucial aspect of project management, as projects function as temporary coalitions of stakeholders working toward a common goal. According to the (Guidelines, 2011), managing stakeholders is essential for project success. In construction projects, key participants such as clients, architects or consultants, and contractors play significant roles, and their interactions largely determine project performance and success (Cleland, 2008) Effective stakeholder management involves identifying and engaging with key stakeholders, assessing their potential responses, and strategically managing their contributions (Jepsen, A. L.; Eskerod, P., 2008). (Lim, G., Ahn, H., 2005) defines stakeholder management as "effective management of relationships with stakeholders," while (Karlsen, 2002) highlight activities such as stakeholder identification, influence analysis, and communication as crucial for achieving project goals and maximizing benefits.

Stakeholders are broadly defined as individuals or groups that can influence or be influenced by a project's objectives. (Ward, S., & Chapman, C., 2008) Describe stakeholders as those affected by or affecting an organization's deliverables. R. J Yang et al., 2014) further explains that stakeholders impact project activities or outcomes and derive benefits from the project. (Olander, 2007) views stakeholders as those with a vested interest in the project's success and its operational environment, representing various interests throughout different project stages. (Walker et al., 2008) define them as individuals with interest or ownership in the project, who can contribute to or be affected by the project's results. The (PMI (Project Management

Institute), 2004) sees stakeholders as individuals or organizations involved in or influenced by the project's execution or completion.

(Takim, 2009) Identifies stakeholders as those who can affect or be affected by the project's activities and results, and who receive benefits from the project. He categorizes them into five groups: clients, consultants, contractors, end-users, and the community. (Newcombe, 2003) Notes that the list of stakeholders in a construction project is extensive and includes owners, users, project managers, designers, suppliers, legal authorities, employees, subcontractors, and service providers. This broad array of stakeholders can impact and be impacted by the project in various ways. Stakeholders can be categorized into direct and indirect representatives of interests, including:

- Clients: Both public and private clients, whose interests include ensuring the project aligns with organizational strategy, effective use of resources, financial support, and successful procurement.
- Consultants: In-house or external professionals such as architects, quantity surveyors, engineers, and construction managers.
- Contractors/Suppliers: Main contractors, sub-contractors, and suppliers, who focus on executing work as specified and fulfilling contractual obligations.
- Project Manager: the person ultimately in charge of overseeing and directing the project to a successful end (Gardner, 2005).
- External Bodies: Regulatory bodies, government entities, customers, or end-users.

2.3. Types of stakeholders

In construction projects, the stakeholder list is comprehensive, encompassing a wide range of individuals and groups including facility users and owners, facilities managers, project managers, legal authorities, designers, shareholders, suppliers, employees, subcontractors, service providers, insurance companies, competitors, neighbors, banks, media, community representatives, the general public, and regional development agencies, among others (Newcombe, 2003). This extensive list highlights the complex network of stakeholders involved in construction projects and the need for effective stakeholder management strategies to address

their diverse interests and impacts. (Winch et al., 2007) uses the contractual relationship and the client to classify construction stakeholders into internal and external stakeholders. Internal stakeholders are those who have legal contractual relationship with the project owner and those assembled around the client on the demand side (e.g. employees, customers, end-users and financiers) and on the supply side (contractors, engineers, architect, material suppliers and trade contractors). External stakeholders don't have any legal binding relationship with the project owner, however, have some rights and interests in the project and are grouped into side of private and public stakeholders. (Lutchman et al., 2012) Primary Stakeholders: are those persons or groups on the project team who have a contractual or legal obligation to the project team and have the responsibility and authority to manage and commit resources according to schedule, cost, and technical performance objectives. And Secondary Stakeholders: are those who have no formal contractual relationship to the project but can have a strong interest in what is going on regarding the project. And also based on their level of participation stakeholders can be also classified into Direct stakeholders: Those who involved with the day today activities of the projects and Indirect Stakeholders: Those who do not involve on the day today activities of the project and mostly interested in the final output of the project (Lutchman et al., 2012).

2.4. Stakeholder management

Stakeholder management is one of project management knowledge which important issue as a project can be seen as a temporary union of stakeholders to do something together. (Cleland, 2008) Provide an outline of the important constituents of project management methods and find eleven key features that should be applied through the project Lifecycle, and the stakeholder management is one of the key elements in the project management practice, in order to confirm the success of the project. The process in describing a construction stakeholder management practice consists of performing the management roles of planning, motivating, organizing, directing and monitoring the resources used to cope with approaches from stakeholders with the following stages: Identification of stakeholders, collecting information, documentation of mission, defining strong point and weaknesses, identification of stakeholder strategy, forecast of stakeholder behavior, and applying stakeholder management strategy. (Karlsen, 2002) Provided a recursive six step process of stakeholder management, plus initial planning, identification, analysis, communication, deeds, and follow-up. (Elias et al., 2002) proposed eight phases for managing the stakeholder route started by: Evolving a stakeholder map of project; preparing a

chart of particular stakeholders; identifying the rewards of stakeholders; preparing a power against stake grid; conducting process steps of stakeholder analysis; conducting a deal level stakeholder analysis; defining the stakeholder management of the research & development projects capability; analyzing of stakeholder interactions dynamics.

2.5. Critical success factors (CSFs) for stakeholder management

Many researchers (Jefferies, M. (n.d.).); (R. J Yang et al., 2014) have used the critical success factors (CSFs) as a means to improve the performance of the management process. CSFs can be defined as areas, in which consequences, "if they are adequate, will ensure effective competitive performance for the organization (R. J. Yang et al., 2014). (Saraph et al. , 1989) viewed them as "those critical areas of action and managerial planning that must be practiced in to succeed effectiveness". (Cleland, 2008) Consider essential that the project team have to know whether or not it is successful "managing" construction stakeholders.

2.6. Grouping of Critical Success Factors for Stakeholder management

Until the first effort by (Pinto, J. K., & Slevin, D. P., 1988) to classify success factors into different groups, success factors were not classified and the list of success factors was considered in one group which is a critical success factor. This became problematic since the majority, if not all, of these lists, including factors relating to the project manager and the company to which the project belongs, while ignoring project characteristics, team member characteristics, and external influences. For example, in construction projects, weather conditions are circumstances outside the control of project managers or organizations; however, it might be a key element in completing the project on time (Belassi, W., & Tukel, O. I. , 2001). To address this issue, (Belassi, W., & Tukel, O. I. , 2001)stated that identifying the groups to which the critical factors belong would be sufficient for better project evaluation. Then project managers would clearly understand which aspects of projects might be critical for their successful completion. By doing that, factors belonging to a different group will have equal opportunity to of being considered critical.

After the classification of success factor became evident success factor for stakeholder management were also classified into different group. (El-Sawalhi, N. I., & Hammad, S., 2015) identified five major categories of critical success factors affecting stakeholder management: Stakeholder Assessment, Continuous Support, Action and Evaluation, Management Support, and

Information Input and Decision-Making. Similarly, (Waghmare et al., 2016) used the same categories. However, despite the similarities (El-Sawalhi, N. I., & Hammad, S., 2015) study included additional and distinct factors within these groups. This approach to classifying critical success factors for stakeholder management has become common and is frequently replicated in many articles.

Similarly, critical success factors for stakeholder management have also been classified into four major components. According to (Rafeh et al., 2023), these factors include Stakeholders' Reactions and Relationships, Refining Goals and Managing Stakeholders' Needs, Identifying and Engaging Stakeholders, and Stakeholders' Social Responsibilities. Although this classification is less conventional and can be seen as a novel approach, it suggests that traditional methods can be adapted. This new approach may be beneficial in addressing the fast-changing dynamics of the construction industry and the evolving relationships between stakeholders.

On the other hand, there are classifications of critical success factors for stakeholder management that differ from the commonly used ones and may be more applicable to real-world projects. Just as success factors for overall project success are categorized, factors affecting stakeholder management can also be grouped based on the stakeholders involved in the project. The traditional classification of critical success factors for project success includes categories such as Project-Related Factors, Project Management-Related Factors, Contractor-Related Factors, External Factors, Consultant-Related Factors, and Client-Related Factors (Belay et al., 2022). However, this classification might not fully encompass all key stakeholders and could leave gaps in addressing critical success factors for stakeholder management. Considering the major stakeholders in the construction industry, critical success factors for stakeholder management can be classified as Sub-Contractor Factors, Project Manager-Related Factors, Client-Related Factors, Contractor-Related Factors, Design Team-Related Factors, and Supplier-Related Factors. This classification considers the key roles and responsibilities of each stakeholder group, providing a more comprehensive approach to managing stakeholder success in construction projects.

2.7. Interrelationship among Critical Success Factors

To discuss the interrelation of critical success factors, it is essential to first consider their grouping. The grouping is typically based on the relationships between these factors. However, the relationship among factors is not limited to those within the same group. Factors from

different groups may also interrelate and influence each other. As a result, factors that may not seem critical to project outcomes on their own can become crucial due to their impact on other critical factors. This interconnectedness highlights the importance of understanding the broader network of relationships among success factors in a project. (Liu et al., 2015) argue that the critical success factors for construction innovation are strongly interrelated. According to their study, all 19 success factors examined exhibit strong direct or indirect relationships with each other. These interrelationships can manifest in two ways: one factor may influence others, or it may be influenced by other factors (Iyer, K. C., & Sagheer, M. , 2010). Among the 19 success factors identified by (Liu et al., 2016), four are particularly influential: owners' judgment, external support, top management commitment, and the strategic importance of innovation. On the other hand, three success factors—clear identification of users' needs, responsiveness to change, and proper strategies for knowledge transfer—are the most impacted by other success factors.

According to (Ghuzdewan et al., 2023), the critical success factors affecting stakeholder management are interconnected, with influences extending beyond factors within the same group to those in other groups. They emphasize that any factor impacting the performance of a particular stakeholder will also directly or indirectly influence factors affecting other stakeholders. This suggests that factors across different groups can affect each other and, in turn, impact the overall success of stakeholder management, thereby influencing project implementation. Therefore, success factors should be viewed as interrelated elements rather than standalone items. This approach provides a deeper understanding of the dynamics between different success factors, identifies more critical factors, and enhances the overall effectiveness of stakeholder management.

2.8. Importance of Identifying Critical Success Factors

Numerous global studies have examined critical success factors (CSFs) in projects, raising the question of their broader purpose beyond mere analysis. These studies aim to identify key areas that can enhance project performance. According to (Cooper et al., 2008), identifying and assessing CSFs helps ensure that essential aspects for project success are effectively addressed by focusing on critical factors impacting performance. Similarly, (Saqib et al., 2008) argue that analyzing and prioritizing CSFs can serve as a forecasting tool, enabling stakeholders to predict a

project's potential success more accurately. This forecasting ability allows project participants to avoid projects with low success probabilities, concentrate on promising ones, and address issues in current projects to improve outcomes.

In the context of project management, particularly in construction, the effective management of stakeholder interests is crucial. A project manager must navigate the complex landscape of construction projects, where diverse stakeholders have varying levels of investment and interest (Lim, G., Ahn, H., 2005). Although general management principles apply across various fields, the unique characteristics of construction necessitate specialized stakeholder management approaches based on empirical research. (Bourne, L., & Walker, D. H., 2005) emphasizes that project success or f**a**ilure is significantly influenced by stakeholder expectations and perceptions, as well as the project manager's ability to handle organizational politics. Ineffective stakeholder management can lead to issues such as unclear scope, poor communication, inadequate resources, scope changes, and unforeseen regulatory challenges (Karlsen, J. T., 2002) , potentially causing delays and cost overruns. To address these challenges, (Olander, S. and Landin, A., 2005) stress the importance of thoroughly identifying and analyzing stakeholders, addressing their interests and conflicts, and assessing their commitment and power. Understanding the project's purpose and incorporating stakeholder feedback are essential for aligning stakeholders with the project team and achieving success (Jergeas et al., 2000).

2.9. Critical Success Factors for stakeholder management of Construction Projects in Different Countries

2.9.1. Critical Success Factors for stakeholder management of Construction Projects in Developing Countries

Critical success factors (CSFs) can vary from country to country, but similarities often emerge among nations with similar levels of development (Silva et al., 2015). Construction activities and their outcomes are vital to development (Anaman, K. A., & Osei-Amponsah, C.. , 2007). Developing countries such as Ethiopia and the Gaza Strip, classified as such by the World Bank (Fantom, N. J., & Serajuddin, U., 2016), show comparable CSF patterns with minor differences. For instance, a study in Ethiopia by (Haile, 2020) identified the top factors affecting stakeholder management as setting common goals and objectives, project manager competence, strong communication, and identifying relevant stakeholders during the planning phase. Similarly, (El-

Sawalhi, N. I., & Hammad, S., 2015) found in Gaza that key factors include hiring a competent project manager, transparent evaluation of alternative solutions, effective communication with stakeholders, setting common goals and objectives, and understanding stakeholder needs and expectations. Both studies highlight the importance of project manager competency, communication, and goal setting. However, they differ in (El-Sawalhi, N. I., & Hammad, S., 2015) prioritize transparent evaluation of alternatives, while (Haile, 2020) underscores the need to identify relevant stakeholders during the planning phase for Ethiopia.

Similarly, in other developing countries like Nigeria and Ghana, critical success factors for construction projects tend to align with each other and previous studies. According to (ALAYANDE, 2021), the most critical success factors in Nigeria are poor knowledge of stakeholder management procedures and the absence of proper stakeholder management, particularly in areas like effective communication, project meetings, communication planning, and stakeholder analysis and mapping. In Ghana, (Amoatey, C., & Hayibor, M. , 2017) identified the most important factors as engaging and communicating with stakeholders, properly identifying them, formulating a clear project mission statement, maintaining good relationships, and analyzing stakeholder conflicts and coalitions. Comparing the two, the factors are largely similar, except for Ghana, where the additional factor of a clear project mission statement was highlighted (Amoatey, C., & Hayibor, M. , 2017). Both countries focus primarily on stakeholder-related factors, particularly communication, mapping, and identification of stakeholders.

Critical success factors (CSFs) for construction projects show common patterns across developing countries, with some differences. In Ethiopia, (Haile, 2020)identified key factors like setting common goals, project manager competence, strong communication, and identifying relevant stakeholders. In Gaza, (El-Sawalhi, N. I., & Hammad, S., 2015)emphasized similar factors but added the importance of transparent evaluation of alternatives. Both studies highlight the significance of project manager competency, communication, and goal-setting. In Nigeria, (ALAYANDE, 2021) pointed to poor knowledge of stakeholder management and emphasized communication and planning. In Ghana, (Amoatey, C., & Hayibor, M. , 2017)identified similar factors but added the importance of a clear project mission statement. Across these countries, stakeholder-related factors like communication, identification, and mapping are central to project success.

2.9.2. Critical Success Factors for Stakeholder Management of Construction Projects in Developed Countries

In the previous section, it was noted that countries with similar development levels tend to exhibit comparable critical success factors (CSFs) in construction projects. As countries advance up the development ladder, the focus of their CSFs also evolves. While developing nations tend to prioritize stakeholder identification and mapping, more developed countries shift towards broader stakeholder engagement practices, incorporating advanced factors such as communication, need assessment, and conflict resolution. This evolution reflects the growing complexity of construction projects in developed economies, where stakeholder dynamics play a critical role in ensuring project success.

Research conducted by (Molwus, 2014) in the United Kingdom and (J. Yang et al., 2009) in Hong Kong illustrates this shift in focus. In Hong Kong, (J. Yanget al., 2009) found that managing stakeholders with social responsibilities, assessing their needs and constraints, and maintaining frequent, effective communication were key CSFs for construction projects. This demonstrates that in developed regions, stakeholder management goes beyond mere identification to actively understanding and addressing stakeholders' needs throughout the project. Stakeholders are not only engaged but are integrated into the project's decision-making process, ensuring that their social and economic expectations are met.

Similarly, (Molwus, 2014) highlighted that in the United Kingdom, the most critical factors for stakeholder management include involving relevant stakeholders from the project's inception, properly identifying and understanding their interests, maintaining open communication channels, and effectively resolving conflicts. These factors emphasize the importance of early engagement and continuous communication with stakeholders, ensuring that their expectations are consistently managed and any potential conflicts are addressed swiftly. The ability to handle stakeholder conflicts effectively becomes particularly important in developed countries, where the complexities of large-scale projects require proactive and transparent stakeholder management.

In comparison, developing countries tend to focus more on the basics of stakeholder identification and mapping, while countries like the UK and Hong Kong emphasize deeper engagement and collaboration. The shift towards communication, need assessment, and conflict

resolution in more developed nations reflects the higher expectations and greater involvement of stakeholders in construction projects. As countries move up the development ladder, their construction projects become more integrated into the broader socio-economic landscape, requiring more strategic, sophisticated approaches to stakeholder management to ensure long-term success. This evolution demonstrates how CSFs adapt to the changing dynamics of development, with developed countries focusing on the social and collaborative aspects of construction management.

2.10. Mega Construction Projects

Mega construction projects: Mega construction projects are complex building projects and infrastructural projects which aid the production process of goods and services, translating to increased economic growth of countries (Jia et al., 2011) various terms are used in the literature to describe large projects, such as complex projects, major projects, giant projects and megaprojects. Despite differing definitions and perspectives, all agree that mega construction projects (MCPs) are substantial investments aimed at helping governments achieve social and economic development goals. These projects often attract significant public and political attention due to their extensive impact on communities, the environment, and government budgets (Othman, E., & Ahmed, A., 2013). Typically, MCPs are government-owned and executed by large construction companies. They are high-risk ventures that require significant time, resources, and financial investment. The success of these projects hinges on the expertise of highly skilled professionals in design, construction, and management. Due to their scale, MCPs play a crucial role in national development, significantly contributing to infrastructure and economic growth.

According to (Mok et al., 2015a), MCPs are characterized by contract sums exceeding $130 million, involving numerous participants, and having substantial social and economic impacts. They cover extensive geographical areas and are closely linked to other major developments. (Eyiah-Botwe et al., 2016a) define MCPs as large-scale, significant, and complex projects that transform landscapes, enhance city attractiveness, and drive economic growth. These projects can include green or brownfield sites and encompass roads, stadia, shopping malls, housing, and educational infrastructure. They require advanced design knowledge, skilled personnel, and robust managerial capabilities, involving massive investments and coordination with large construction firms and partners.

2.10.1. The Trend of Mega Construction Project

Despite their inherent complexity, Mega Construction Projects (MCPs) are pivotal for advancing sustainable development in developing countries. Ethiopia exemplifies this strategic approach, as evidenced by the Addis Ababa City Mega Projects Construction Office's 2023 activities, which include signing contracts for two major MCPs and completing seven others. This focus on large-scale infrastructure projects highlights Ethiopia's commitment to economic growth and urban development. By investing in MCPs, Ethiopia aims to address critical infrastructure needs, stimulate economic activity, and enhance overall quality of life, demonstrating the essential role of such projects in achieving long-term developmental goals. Consequently, the number of MCPs has increased, and trends suggest a continued rise in such projects, reflecting the growing emphasis on infrastructure development in the country.

2.11. Critical Success Factors for Mega Construction Projects

As previously mentioned, Critical Success Factors (CSFs) are key elements that significantly contribute to the success of a project, playing an essential role in achieving project goals. In the context of mega construction projects, these factors are often categorized under the broader umbrella of CSFs for large or major construction projects, particularly in developed countries. While some studies focus explicitly on the CSFs for stakeholder management in mega construction projects, these studies remain limited in number. A few of these studies, which offer detailed insights, are discussed further below.

A study conducted by (Park et al., 2017) on critical success factors for mega construction projects in South Korea aimed to identify the key stakeholder management factors. The research utilized factor analysis and focus-group interviews with project management experts to develop a systematic and strategic framework for stakeholder management in large-scale construction projects. The study identified 31 critical success factors and prioritized them. The results highlighted that a clear understanding of stakeholders, a well-defined project scope, effective communication, responsiveness to environmental changes, and social cooperation are the most critical factors for successful stakeholder management, suggesting these areas require greater focus for project success.

Another study on critical success factors for stakeholder management in the context of mega construction projects was conducted by (Wang et al., 2023). This research focused on Australia,

the USA, the UK, China, and Hong Kong and employed a methodical and systematic analysis of 38 selected journal articles. Using descriptive analysis, the study examined publication trends, contributors' origins, research focus areas, methods used, and performed thematic analysis to identify and categorize success criteria and CSFs. The review identified 20 success criteria grouped into five constructs and 36 CSFs categorized into five groups. These were then integrated into two conceptual frameworks. The top five CSFs identified were adequate resource availability, strong partnerships/relationships with key stakeholders, effective communication and coordination, public support or acceptance, and a clear strategic vision.

The complex and volatile nature of mega construction projects demands systematic approaches and skilled project managers to balance stakeholder interests and achieve optimal project outcomes. Stakeholder management (SM) is recognized as an effective strategy to address this challenge by highlighting stakeholder concerns and fostering strong relationships in complex project environments (Wang et al., 2023). From the reviewed studies, three common factors consistently emerged among the top five most critical success factors: effective communication, a clear and strategic project scope, and proper stakeholder identification and relationships. These factors are crucial due to the complexity of mega projects, which involve numerous workers, intensive equipment usage, and extensive stakeholder involvement.

2.12. Literature Summary and Research Gaps of the Study

The literature on Critical Success Factors (CSFs) in construction projects reveals a nuanced understanding of their importance across various contexts. Initially, CSFs were broadly categorized, making it challenging to assess their specific impact on project outcomes. (Pinto & Slevin, 1988) were pioneers in addressing this by grouping CSFs into different categories, a refinement further developed by (Belassi, W., & Tukel, O. I. , 2001) who emphasized the need to classify CSFs based on project characteristics, team member traits, and external influences. This evolution in classification has provided clearer insights into the factors crucial for project success.

The classification of CSFs has continued to evolve, with recent studies offering more refined categories for stakeholder management. (El-Sawalhi, N. I., & Hammad, S., 2015) Identified five major categories, while (Rafeh et al., 2023) proposed a novel approach with four components, reflecting the dynamic nature of stakeholder relationships in construction projects. The interrelationship among CSFs has been highlighted by (Chen et al., 2012) and (Ghuzdewan et al.,

2023), showing that factors are interconnected and influence one another, underscoring the importance of understanding CSFs as part of a broader network. Identifying and assessing CSFs is crucial for improving project performance and forecasting potential outcomes. Research by (Cooper et al., 2008) and (Saqib et al., 2008) demonstrates that a clear understanding of CSFs helps stakeholders address key areas essential for project success and avoid potential pitfalls. In construction projects, effective stakeholder management is particularly vital, as diverse interests and organizational politics significantly impact project success ((Bourne, L., & Walker, D. H., 2005); (Karlsen, J. T., 2002); (Olander, S. and Landin, A., 2005)).

The focus of CSFs varies between developing and developed countries. In developing nations like Ethiopia, Gaza, Nigeria, and Ghana, there is a strong emphasis on stakeholder identification, communication, and goal setting. Studies by (Haile, 2020) and (El-Sawalhi, N. I., & Hammad, S., 2015)highlight these factors, which are critical for managing projects in these regions. In contrast, developed countries such as the UK and Hong Kong focus on advanced practices, including early stakeholder engagement and conflict resolution, as demonstrated by research from (Yang, J., Shen, G. Q., Ho, M., Drew, D. S., & Chan, A. P. C., 2009) and (Molwus, 2014). This shift reflects the greater complexity and higher expectations of projects in developed economies.

Mega Construction Projects (MCPs), characterized by substantial investment and extensive coordination, play a crucial role in national development. In Ethiopia, for example, the emphasis on MCPs reflects a commitment to infrastructure development and economic growth. For high rise building projects, which are a subset of MCPs, specific CSFs such as effective communication, clear project scope, and stakeholder relationships are essential, as identified by studies from (Park, H., Kim, K., Kim, Y.-W., & Kim, H., 2017) and (Wang, T., Xu, J., He, Q., Chan, A. P. C., & Owusu, E. K., 2023). These factors are vital for managing the complexity and ensuring the success of high rise building projects. Overall, the literature underscores the importance of adapting CSFs to the development level and complexity of construction projects. Understanding and applying these factors effectively is key to enhancing project performance and achieving long-term success. From the literature reviewed 42 critical success factor affecting stakeholder management were identified as summarized in table 1. The existing literature on Critical Success Factors (CSFs) for stakeholder management in mega construction projects highlights several key gaps that need addressing:

- Firstly, there is a notable lack of research that examines how different CSFs influence one another beyond their individual importance to project success. This gap is significant because CSFs are interrelated, and less critical factors can impact more pivotal ones, thereby affecting overall project outcomes. Understanding these interdependencies is crucial for a comprehensive approach to managing stakeholder success.
- Secondly, there is a scarcity of studies focusing specifically on CSFs for stakeholder management in mega construction projects within Addis Ababa or generally in Ethiopia. Despite the city's growing engagement in large-scale projects, research that addresses the unique challenges and factors influencing stakeholder management in this context remains limited. Addressing this gap could provide valuable insights tailored to the local construction environment and its specific dynamics.
- Thirdly, the application of appropriate analytical methods in studying CSFs is often lacking. With various groupings and classifications of CSFs, employing advanced analytical techniques such as multi-criteria analysis methods is essential. However, there is a notable absence of studies in Ethiopia that utilize these sophisticated methods to analyze mega construction projects. Integrating such methods could enhance the understanding of CSFs and improve stakeholder management strategies in the Ethiopian context, thereby contributing to more effective project outcomes and successful management practices. The Details regarding the CSF's through literature review used in this study is given in table 2.1. (A K Munns and B F Bjeirmi, 1996)

Table 2-1 Process Identified Critical Success factors through literature review used in this study

No.				Reference												
	Goal	Categories	Critical success factors (CSFs)	(Yang et al., 2009)	(Nguyen et al., (2004)	(Gudienė et al., 2014)	(Fummey, 2016)	(A K Munns and B F Bjeirmi, 1996)	(Abraham, 2003)	(Saqib et al., 2008)	(Eyassu, A., 2020a)	(Chen et al., 2012)	Pankaj, (2016)	(Kog et al., 2012)	No of Repetition
1	Success Factors	**Supplier- related factor**	• In time delivery of the materials	√	√	√	√								4
2			• Previous records of quality	√		√	√								4
3			• Material according to the specifications	√		√	√				√	√			5
4			• Rate of the materials	√		√	√				√	√			5
5			• Availability of stock	√	√	√	√					√			5
6			• Transportation charges/distance from the site	√		√	√								3
7		**Design Team related factors**	• Previous experience of similar projects	√		√	√							√	4
8			• Delay in sorting out design error	√		√	√							√	4
9			• Complexities of design	√		√	√		√					√	5

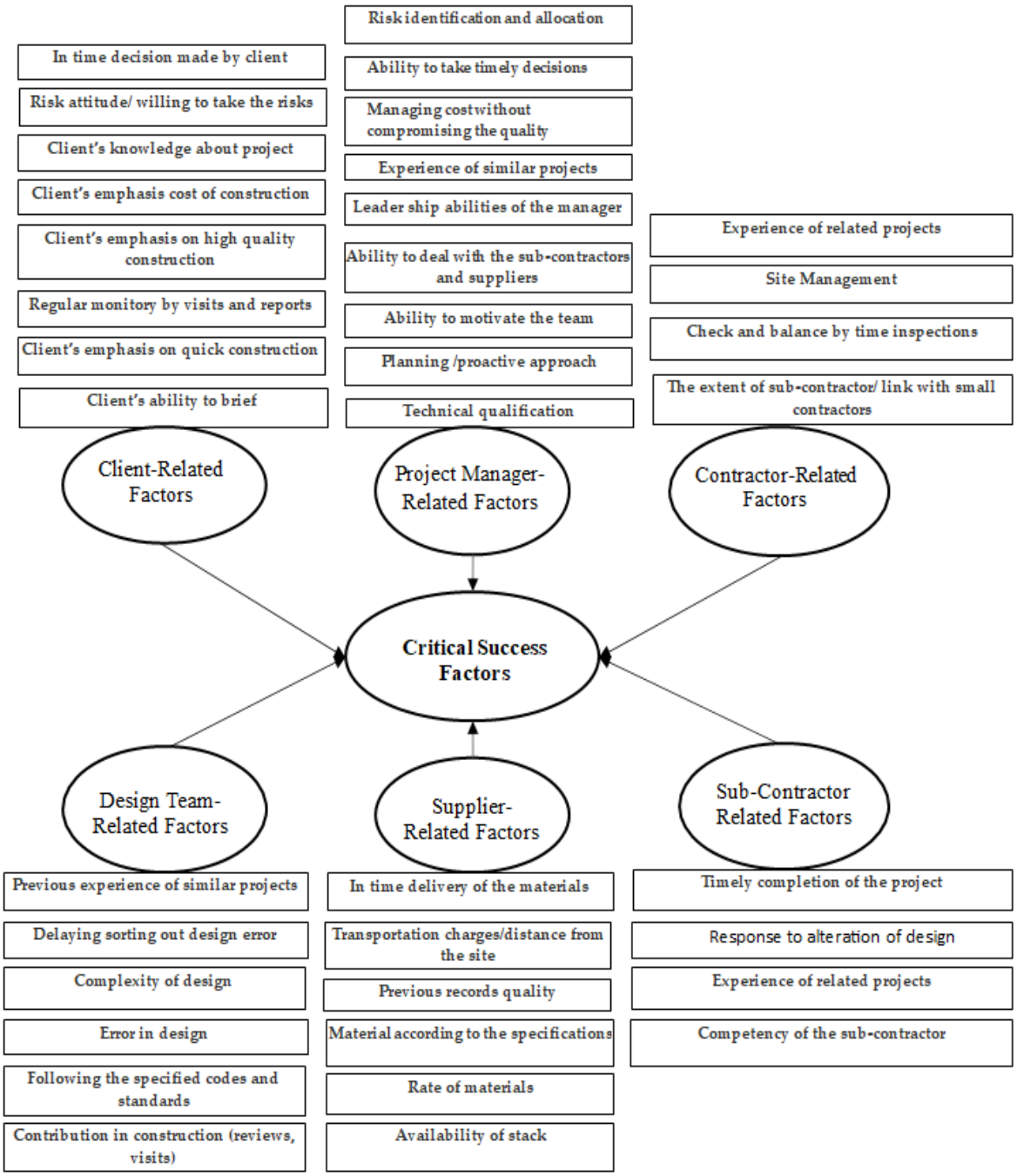
10			• Error in design	√		√	√		√					√	5
11			• Following the specified codes and standards	√		√	√						√		4
12			• Contribution in construction (reviews, visits)	√			√	√						√	4
13			• Motivating skills	√		√	√								3
14		**Contractor- related factor**	• Experience of related projects	√		√	√			√			√		5
15			• Site management	√		√	√			√			√		5
16			• Check and balance by timely inspections	√		√	√					√	√		5
17			• Supervision	√			√								2
18			• Effective use of economy	√			√								2
19			• The extent of subcontracting /links with small contractors	√		√	√					√	√		5
20		**Client relate**	• In time decision made by client	√		√	√								3

21			• Risk attitude/Willing to take the risks	√		√	√				√	√			5
22	Success Factors		• Client's knowledge about project	√			√					√		√	4
23			• Clients emphasis on low cost construction	√		√	√					√		√	5
24			• Clients emphasis on high quality construction	√		√	√					√		√	5
25			• Regular monitory by visits and reports	√	√	√	√								4
26			• Client emphasis on quick construction	√	√	√	√								4
27			• Client ability to brief	√			√					√			3
28		**Project manager-related factor**	• Risk identification and allocation	√		√	√				√				4
29			• Ability to take timely decisions	√		√	√			√				√	5
30			• Managing cost without compromising the quality	√	√	√	√							√	5
31			• Feedback capabilities and methods	√			√								2
32			• Selection of the key members	√			√								2
33			• Experience of similar projects	√		√	√								3

34			• Leadership abilities of the manager	√		√	√				√					4
35			• Ability to deal with the subcontractors and suppliers.	√		√	√									3
36			• Ability to motivate the team	√			√					√				3
37			• Technical Qualification	√			√		√							3
38			• Planning/proactive approach	√			√				√					3
39		**Sub-contractor factors**	• Timely completion of the project.	√		√	√								√	4
40			• Response to alteration of design	√			√			√					√	4
41			• Experience of related projects	√			√		√			√				4
42			• Competency of the sub-contractor	√	√		√								√	4

2.13. Conceptual Framework

The conceptual framework for effective stakeholder management practices in this thesis was used to show various factors that are important, influence & combine effect on effective stakeholder management in mega construction projects, starting from proper implementation of stakeholder management process from initiation phase through to operation phase. Figure 2.1 below provides detailed conceptual frame work of the Study.



Source: Own Model, 2024

Figure 2-1 The conceptual frame work of the Project Critical Success Factors

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter deals with the various methods or sources of data used in obtaining materials and information needed for the research for writing the project to obtain and achieve meaningful, accurate, and correct results in carrying out the research work. It covers the research approach, study area, target population, Sampling techniques, sample size, data collection methods, and analytical techniques employed to ensure the consistency and reliability of the study's outcomes.

3.2 Study Area

The research was carried out in Addis Ababa, the capital city of Ethiopia, with high number of mega construction projects. With its 11 sub-cities as given in figure 3.1, Addis Ababa serves as the focal point for Ethiopia's infrastructure development, including a variety of ongoing mega construction projects. This study specifically focused on mega construction projects that are at least 75% complete and above, as these projects offer valuable insights into stakeholder management practices.

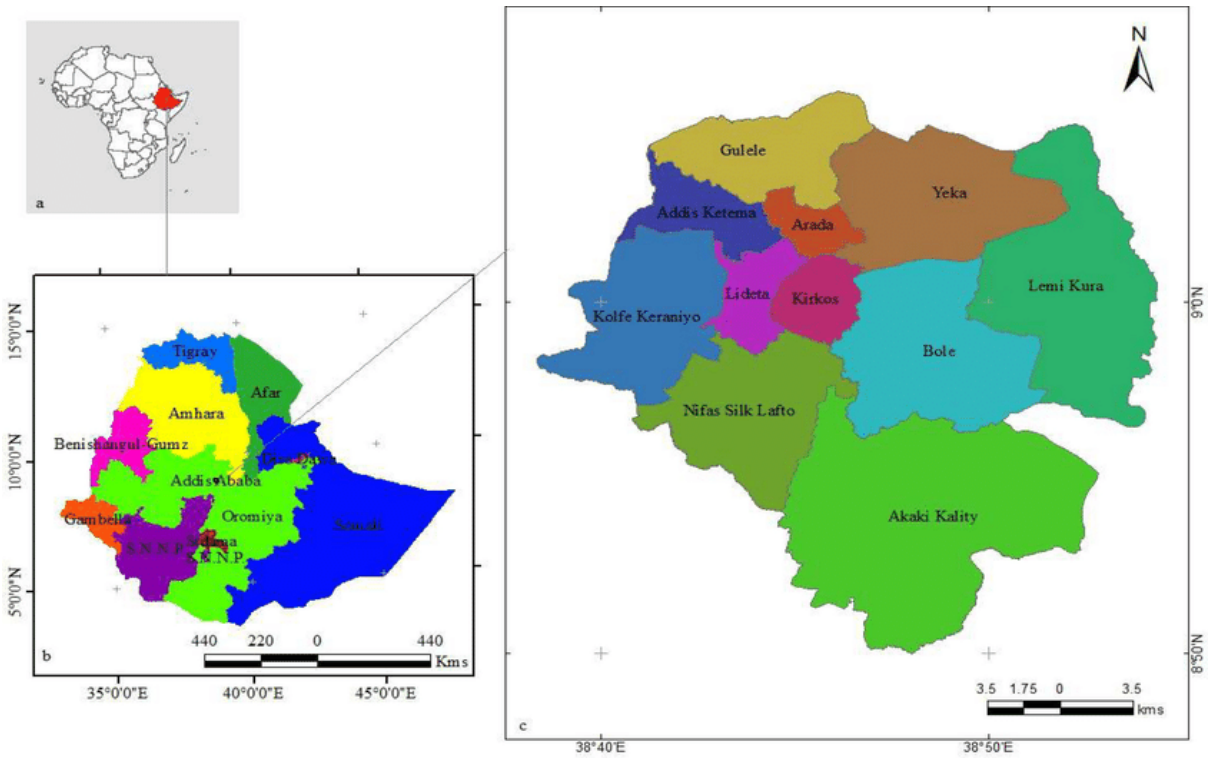
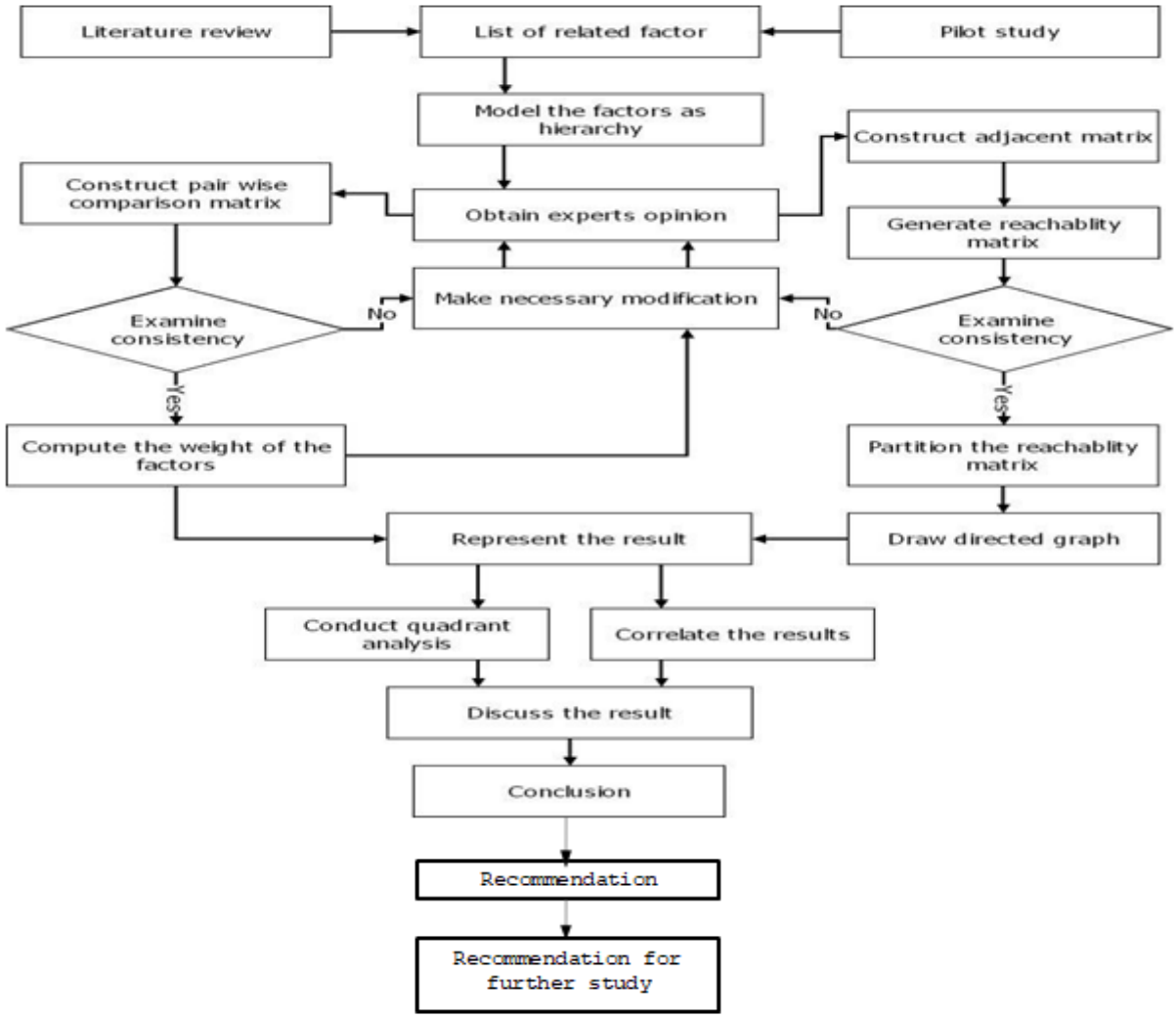


Figure 3-1 Map of Addis Ababa, with Sub-Cities. Source: Ethio GIS (2022)

3.3 Study Design

A mixed-method approach, combining both qualitative and quantitative data collection methods, was employed in this research. The study is descriptive and comparative in nature, utilizing the Analytical Hierarchy Process and Interpretative Structural Modeling to establish a hierarchical structure of critical success factors related to stakeholder management. Analytical Hierarchy Process was used to determine the relative importance of each critical success factors, while Interpretative Structural Modeling helped to explore the interrelationships among these factors. Quadrant Analysis was then applied to combine or integrate the findings, and Spearman's Rank Correlation was used to correlate or assess the relationship between the importance and influence of the critical success factors. The overall design flow of work is given in figure 3.2 below.



Source: Own Model, 2024

Figure 3-2 Research Methodology Flow Diagram for AHP, ISM & Integrated Hierarchical Structure Method

3.4 Target population & Sampling Techniques

3.4.1 Target Population

The target population for this study consisted of ongoing mega construction projects in Addis Ababa city. The research focused on 16 mega projects that are over 75% complete and above. Key respondents or main source of information's were selected from critical positions within mega construction projects and staffs who have ample experiences in stakeholder management in mega construction projects, including clients, construction engineers, project managers, site engineers and office engineers. These professionals were chosen because of their pivotal roles in project execution, stakeholder management, and decision-making processes.

3.4.2 Sampling Technique

Purposive sampling was used to select the sample for this study. This non-probabilistic sampling method (Purposive sampling) was chosen to ensure that the projects and professionals most relevant to the research objectives were included. In this study, Out of a total 29 mega construction projects, all 16 projects that are over 75 % were selected based on their completion status and current activity levels. Furthermore, by selecting these 16 projects, which represent 55.17% of the population, the sample meets the minimum recommended threshold of 30% for purposive sampling, which was recommended by (Mugenda, Mugenda &, 2003); (Ogeno, 2016).The criteria ensured that the sample size was representative of the target population and sufficient for thorough analysis.

3.5 Source of Data

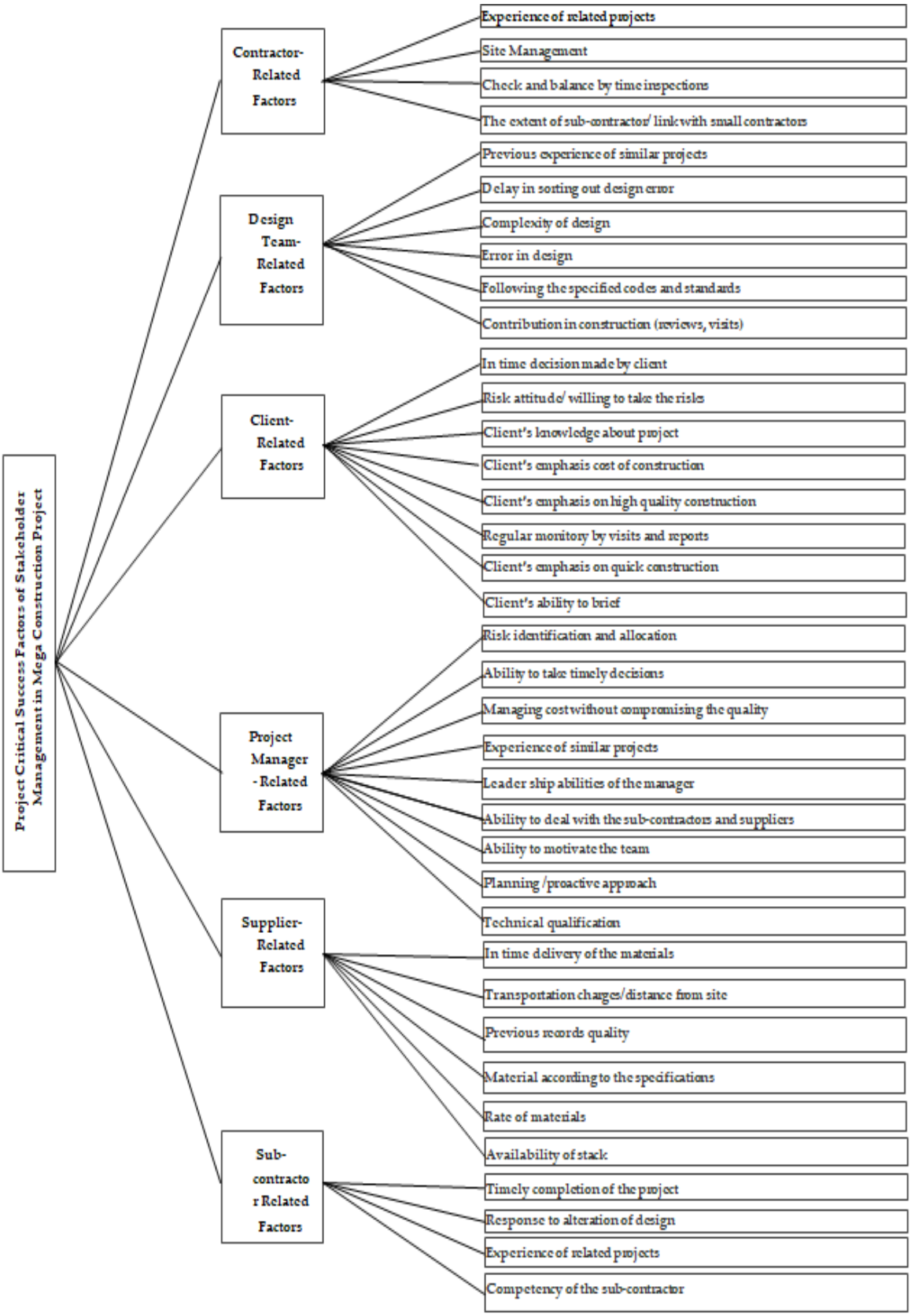
The study utilized both primary and secondary data sources. Primary data was collected directly from professionals involved in the selected mega construction projects such as Construction Engineer, Project Manager, Site Engineer, Office Engineer, & Client while secondary data was obtained from books, articles, journals, conference papers, and other relevant sources.

3.6 Method of Data Collection

3.6.1 Pilot Study

A pilot study was conducted to refine the questionnaire and identify the most critical success factors for stakeholder management. Initially, 42 factors were identified from the literature review, and through consultation with Ethiopian construction professionals who are working in large scale (mega) construction projects for more than 20 years, this list was refined to 37 factors. These factors were then categorized into six groups: supplier related factors, subcontractor-related factors, project manager-related factors, client-related factors, contractor-related factors, and design team-related factors and developing a hierarchical

structure with a goal or objective at the left level, the attributes or criteria at the middle and the sub criteria or alternatives at the right level as shown in figure 3.3 below.



Source: Own Model, 2024

Figure 3-3 AHP Hierarchy figure of criteria and alternatives of Critical Success Factors

3.6.2 Questionnaires

The main tool for data collection was a structured questionnaire distributed to the selected professionals. The first stage of the questionnaire focused on pairwise comparisons for Analytical Hierarchy Process analysis. After the Analytical Hierarchy Process analysis, the second stage concentrated on Interpretative Structural Modeling analysis. The final questionnaire included top 16 in rank critical success factors, selected based on their relevance and importance as identified by the Analytical Hierarchy Process analysis.

3.7 Method of Data Analysis

In this research, four types of data analysis techniques were used. The first one is Analytic Hierarchy Process, which is a multi-criteria decision-making method that was used to rank the success factors based on their importance. The second one was Interpretive Structural Modeling, which is also a multi-criteria decision-making method that ranks and structures the critical success factors based on their influence. The third one was spearman's correlation, which was done to know the level of relation between the prioritization based on importance and influence. Finally, by combining or integrating the two, the data collected was processed and gives a structure that ranks these factors based on their importance and influence which was conducted using quadrant analysis.

3.7.1 Analytic Hierarchy Process

The Analytic Hierarchy Process is a decision-making framework that allows complex problems to be broken down into more manageable sub problems. Each of these sub problems can be analyzed individually, making it easier to evaluate them subjectively. These subjective judgments are then transformed into numerical values that are used to rate each alternative on a numerical scale. The process involves several key steps:

Step 1: The problem is first decomposed into a hierarchy of goals, criteria, sub-criteria, and options. This hierarchical structure is crucial as it establishes the relationships between different elements of the problem. The elements on each level of the hierarchy are connected to those on the level below, forming an interrelated structure that ultimately ties back to the overall goal.

Step 2: Next, data is collected from experts or decision-makers who perform pairwise comparisons of the options on a qualitative scale. The experts categorize the comparisons using a scale that ranges from equal to extremely strong, as depicted in Table 3.1. These opinions are then recorded in a specially prepared format.

Step 3: A square matrix is then created from the pairwise comparisons generated in the previous step. In this matrix, the diagonal entries are all 1. If the value of the element (i,j) is

greater than 1, it indicates that the criterion in the ith row is preferred over the criterion in the jth column. The reciprocal relationship between the (i,j) and (j,i) elements is maintained to ensure consistency.

Step 4: The principal eigenvalue of this comparison matrix is calculated, and the corresponding normalized right eigenvector is used to determine the relative importance of the various criteria. The elements of this normalized eigenvector represent the weights assigned to each criterion or sub-criterion, which are then used to rate the alternatives.

Step 5: Consistency of the matrix is checked by calculating the consistency index (CI) and consistency ratio (CR). The CI is computed using the maximum eigenvalue (λmax) of the judgment matrix and is compared against a random index (RI) to determine the CR. If the CR is less than 0.1, the matrix is considered consistent; otherwise, the comparisons may need to be reviewed.

Step 6: Finally, the ratings for each alternative are computed by multiplying them with the weights of the sub-criteria. These local ratings are then aggregated with the criteria weights to produce global ratings, which are used to make the final decision.

In the current study, the Analytic Hierarchy Process (AHP) was used to identify the most critical success factors affecting stakeholder management in mega construction projects. This was achieved through pairwise comparison to assess the relative importance of each factor. For this analysis Expert Choice software will be used.

Table 3-1 Scale of preference in Analytic Hierarchy Process

Intensity of Importance	Definition	Description
1	Equally	Two factors contribute equally to the objective
3	Moderately	Experience and judgment slightly favor one factor over the other
5	Strictly	Experience and judgment strongly favor one activity over the other
7	Very strictly	Experience and judgment very strongly favor one over the other
9	Extremely	The evidence favoring one over another is of the highest possible order of affirmation

3.7.2 Interpretive Structural Modeling

The Interpretive Structural Modeling approach, initially introduced by (Warfield J.W., 1974), is a method used to address complex systems by structuring a set of unique, interrelated variables into a comprehensive systemic model depicted as a hierarchical graph. Interpretive Structural Modeling facilitates the synthesis of an objective hierarchy of factors through

mathematical deduction, based on pair-wise relationships among those factors (Gao, X. K., & Yang, J. Y., 2013). The core concept of ISM involves leveraging the practical experience and knowledge of experts to break down a complex system into several simpler subsystems, which are then organized into a multilevel structural model (Liu, H., Skibniewski, M. J., & Wang, M., 2015).

Following the ISM analysis, the results are further refined using MICMAC analysis. The MICMAC method examines the influence and interdependencies among Critical Success Factors (CSFs) and classifies them into different clusters based on their driving power and dependence power (Mandal, A., & Deshmukh, S. G. , 1994).Together, ISM and MICMAC analysis offer a structured hierarchy of factors, clarifying individual relationships that might be difficult to organize intuitively. This approach helps practitioners better understand the dependencies among factors and prioritize them effectively.

3.7.3 Steps in Interpretive Structural Modeling

Interpretive Structural Modeling provides a systematic approach to synthesize an objective hierarchy of factors through mathematical deduction based on pairwise relationships. The process for developing ISM, as outlined by (Liu, H., Skibniewski, M. J., & Wang, M., 2015) and (Song et al., 2017), involves the following steps:

Step 1: Determine the Success Factors Set

Begin by defining a set of variables that impact success. These relevant parameters are identified and developed using various research tools.

Step 2: Establish Pairwise Comparisons and Build an Adjacency Matrix

Compare all items pairwise to establish directed relationships between them based on expert perceptions and create an Adjacency Matrix. The relationship is determined based on the "leads to" contextual relation, following this rule:

If factor E_i influence/leads to factorE_j, then $E_{ij=}1$

If factor E_i not influence/leads to factorE_j, then $E_{ij=}0$

Step 3: Generate the Reachability Matrix

Construct the reachability matrix based on the transition law. This means that if E1E_1E1 can reach E_2E_2E2 through one unit of length, and E2E_2E2 can reach E3E_3E3 through another unit, then E1E_1E1 can reach E3E_3E3 by passing through two units of length (Azevedo et al., 2013).

Step 4: Partition the Reachability Matrix and Construct a Multilevel Structural Model

Partition the reachability matrix by identifying factors where the row relation subsets

correspond to their column relations and assign them a hierarchical level. Factors with more relations are placed higher in the hierarchy than those with fewer.

Step 5: Develop a Directed Graph (Digraph)
Create a directed graph (digraph) to represent the hierarchical relationships among variables, with nodes and edge lines. The highest-level factor appears at the top of the hierarchy, and the second-level factor is placed slightly below it. This process continues until the lowest-level factors are at the bottom of the hierarchy.

Step 6: Conduct MICMAC Analysis
Finally, perform MICMAC analysis by plotting the dependency and driver power of elements from the reachability matrix as coordinates, helping to further understand and classify the relationships between factors.

In the current study, the Interpretative Structural Modeling (ISM) methodology was employed to analyze the interrelationships among critical success factors for stakeholder management in mega construction projects. This approach was used to determine the most influential factors and establish their role as root causes impacting the remaining factors. For this analysis Expro ISM software will be used.

3.7.4 Spearman's Rank Correlation

Spearman's rank correlation, introduced by Spearman, is one of the oldest and most widely recognized nonparametric methods (Zar, 1972). This correlation coefficient is used to evaluate the strength of the relationship between ranked variables (Szmidt, E., & Kacprzyk, J., 2010). The formula for calculating the Spearman correlation coefficient is provided in Equation 3.4, as referenced by (Wiki, 1988):

$$r_s = \frac{1-6\Sigma\, d_i^2}{n(n^2-1)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{ Equation 3.1}$$

Where:

$d_i = R(xi) - R(y)_i$, is the difference between the two ranks of each observation,

n = the number of observations.

Spearman's correlation ranges from -1, indicating complete disagreement, to +1, indicating complete agreement, with the minimum value being zero. The strength of the relationship increases as the coefficient approaches either -1 or +1 (Griffiths, 1980). In this study, Spearman's rank correlation was employed to assess the relationship between prioritizations based on importance and influence. For this analysis Micro Soft Excel will be used.

3.7.5 Quadrant Analysis

Quadrant analysis is a technique used to define four management action quadrants, derived from a 2×2 matrix of influence and importance mean ratings obtained from respondents. The quadrants are labeled as follows: priority for improvement (low influence, high importance), keep up the good work (high influence, high importance), possible overkill (high influence, low importance), and low priority (low influence, low importance) (Wibowo, A., & Wilhelm Alfen, H., 2014). Since quadrant analysis is centered on data, the positioning of the vertical and horizontal axes is determined by the overall mean of importance and influence ratings (Bacon, 2003); (Taplin, 2012). This method was applied in the current study to combine the prioritizations based on both influence and importance, identifying factors that are simultaneously significant and impactful.

3.8 Data Validity and Reliability

Ensuring the accuracy and consistency of survey data is a critical aspect of the research methodology, commonly referred to as the validity and reliability of data. In this study, validity was addressed by having experts familiar with the subject matter review the questionnaire. These experts evaluated the content, and their feedback was used to modify the questionnaire, accordingly, ensuring that it accurately captured the necessary information.

Reliability, on the other hand, was assessed by checking the consistency of the data collected. For this, the reliability of the data was verified using the consistency ratio, a key component of the AHP method. The consistency ratio was calculated as part of the AHP process to ensure that the judgments made in the pairwise comparisons were consistent. Similarly, for the ISM analysis, the consistency of the data was checked using the CI (Consistency Index) ratio integrated into the ISM software.

The calculations for ensuring data consistency are embedded within the AHP methodology. Specifically, the consistency is calculated using Equation 3.1, where λmax represents the maximum eigenvalue, and n is the size of the matrix. The consistency ratio is then derived using Equation 3.2, with the RI (Random Index) value obtained from a standard table (Table 3.2) developed by (Saaty, 1990), which is used as a benchmark for comparison. This rigorous approach to validity and reliability ensures that the survey data is both accurate and consistent, thereby strengthening the overall quality of the research findings.

Table 3-2 Random consistency index value

N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RI	0	0	0.52	0.89	1.11	1.25	1.35	1.4	1.45	1.49	1.52	1.54	1.56	1.58	1.59

After calculating the consistency ratio, it is compared to the standard threshold of 0.1. If the ratio is less than or equal to this threshold, the study can continue; otherwise, a reassessment is required (Rajesh, 2020). In this study, the consistency ratio was 0.06, which falls within the acceptable limit. For ISM analysis, a minimum of 70% data consistency is necessary (Alawamleh, M., & Popplewell, K., 2011). To further verify the consistency of the ISM data, Cronbach's alpha was used, with coefficients above 0.7 deemed acceptable (Levett-Joneset al., 2011). The Cronbach's alpha for this study was 0.929, indicating a high level of consistency.

3.9 Ethical Consideration

The researcher provided a brief overview of the study to inform participants about its purpose, benefits, and the confidentiality of their information. Participants were asked for their consent to participate, and their full agreement was obtained. They were also informed of their right to withdraw from the study or interrupt their participation at any time. Personal information was kept confidential, with data used solely for research purposes. Careful measures were taken to ensure the privacy, confidentiality, and anonymity of all participants, as ethics is a fundamental aspect of the research process.

CHAPTER FOUR

RESULT AND DISCUSSION

4.1. Introduction

This chapter discusses and analyses the data gathered intended to attain the objectives of this research. This chapter mainly has four components. The first part includes the demographic distribution of the respondent based on education level, place in the organization, and experiences. The second part covers the result and interpretation of the Analytical Hierarchy Process analysis, and the third part discusses the output of the Interpretive Structural Modeling analysis. Finally, the last one of all covers the interpretation based on the combination or integration of analytical hierarchal process and interpretive structural modeling analysis.

4.2. Respondent Profile

4.2.1. Respondent Profile for Frist Stage

The questionnaire distribution process was conducted in two phases. In the first phase, the questionnaires for the Analytical Hierarchy Process were distributed. Following this, the questionnaires for Interpretive Structural Modeling were distributed and subsequently collected. Initially, 71 questionnaires were distributed, and 61 were returned. Out of these, 60 were correctly completed, while one was incomplete. Detailed information regarding the respondents is presented in Table 4.1 below.

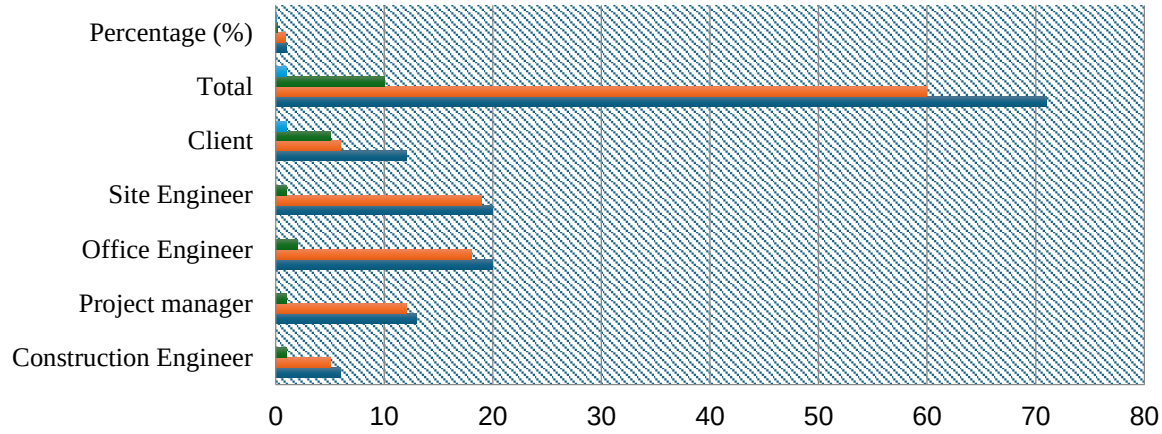
Table 4-1 Respondent Distribution for First Stage

	Total Questionnaires	Successfully Returned	Not Responded	In complete
Construction Engineer	6	5	1	0
Project manager	13	12	1	0
Office Engineer	20	18	2	0
Site Engineer	20	19	1	0
Client	12	6	5	1
Total	**71**	**60**	**10**	**1**
Percentage (%)	**100%**	**84.51%**	**14.08%**	**1.41%**

Source: Own survey result, 2024

The response rate of survey study for the Construction Engineer were 83.33% (5 out of 6 respondents), Project manager 92.31% (12 out of 13 respondents), Office Engineer 90% (18 out of 20 respondents), Site Engineer 95% (19 out of 20 respondents) and 50% (6 out of 12 respondents) for Client and almost half of the client representatives were unable to respond the

questionnaires to the researcher. And the Detailed information regarding the distribution of questionnaires and the response rates for the first stage can be found in Figures 4.1.

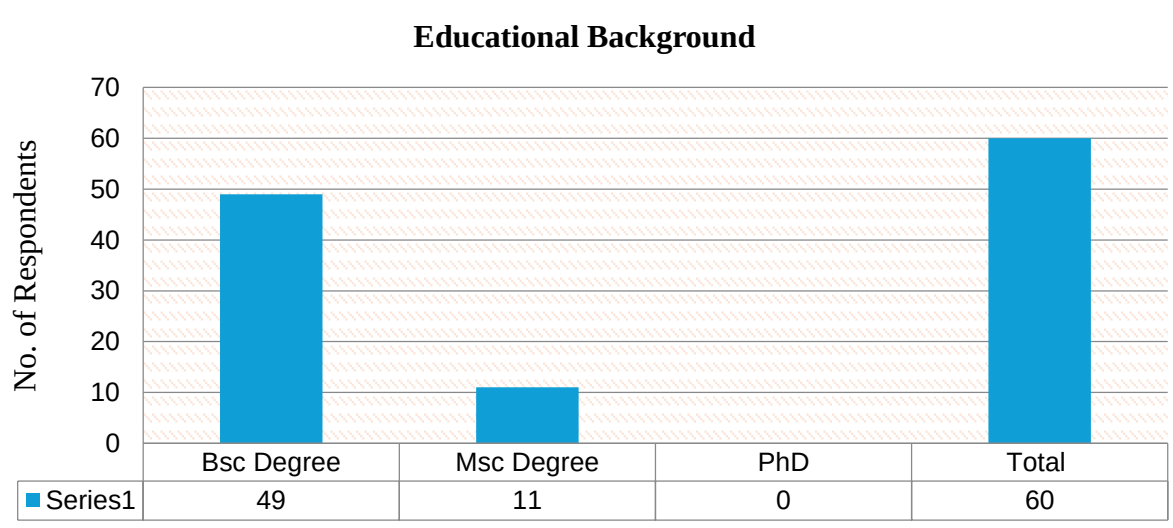


	Construction Engineer	Project manager	Office Engineer	Site Engineer	Client	Total	Percentage (%)
In complete	0	0	0	0	1	1	1.41%
Not Responded	1	1	2	1	5	10	14.08%
Successfully Returned	5	12	18	19	6	60	84.51%
Total Questionnaires	6	13	20	20	12	71	100%

Source: Own survey result, 2024

Figure 4-1 Questionnaires distributed for first stage

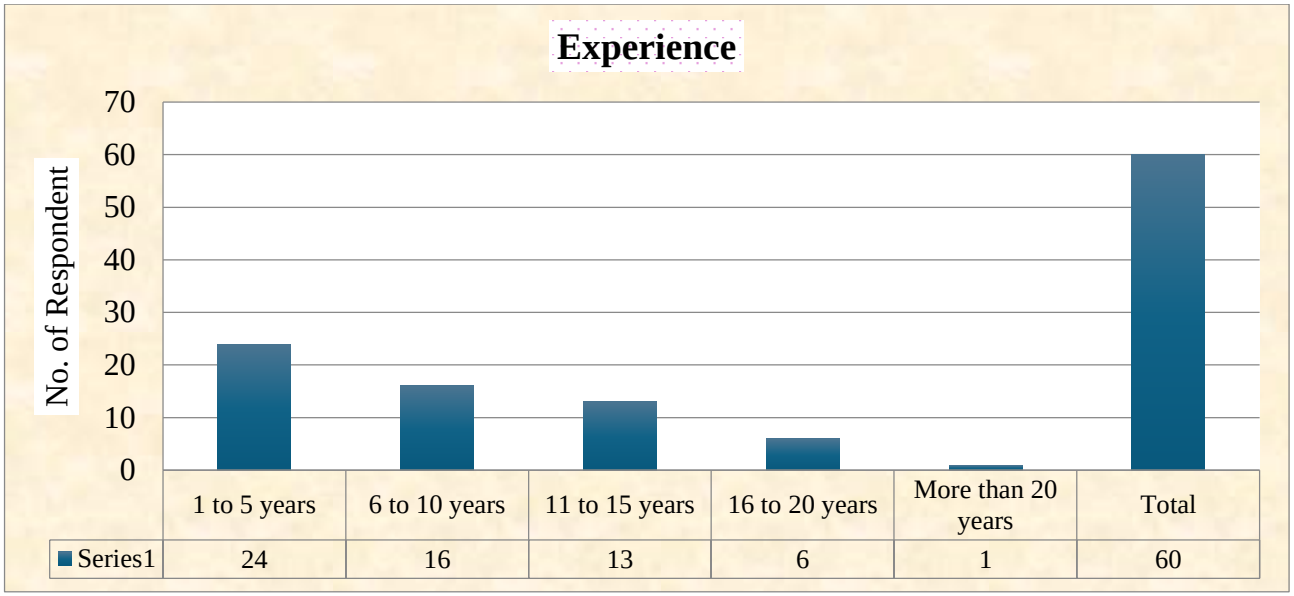
Most of the respondents who took part in filling the questionnaires have a bachelor's degree and a few others have master's degrees. Out of the 60 respondents who took part in filling the questionnaires, 18.33% of the respondents are master's degree holders. The rest 81.66% are Bachelor's degree graduates. Detailed information about the educational backgrounds of the respondents can be found in Figure 4.2.



Source: Own survey result, 2024

Figure 4-2 Educational Backgrounds of the Respondents

The Experience of this respondent varies from 1 to 5 years to over 20 years. Out of the total, 40% have experience ranging from 1 to 5 years. On the contrary, 1.67% has over 20 years of experience. Detailed information regarding the experience levels of the respondents is given in Figure 4.3.



Source: Own survey result, 2024

Figure 4-3 Experiences of the respondents

4.2.2. Respondent Profile for Second Stage

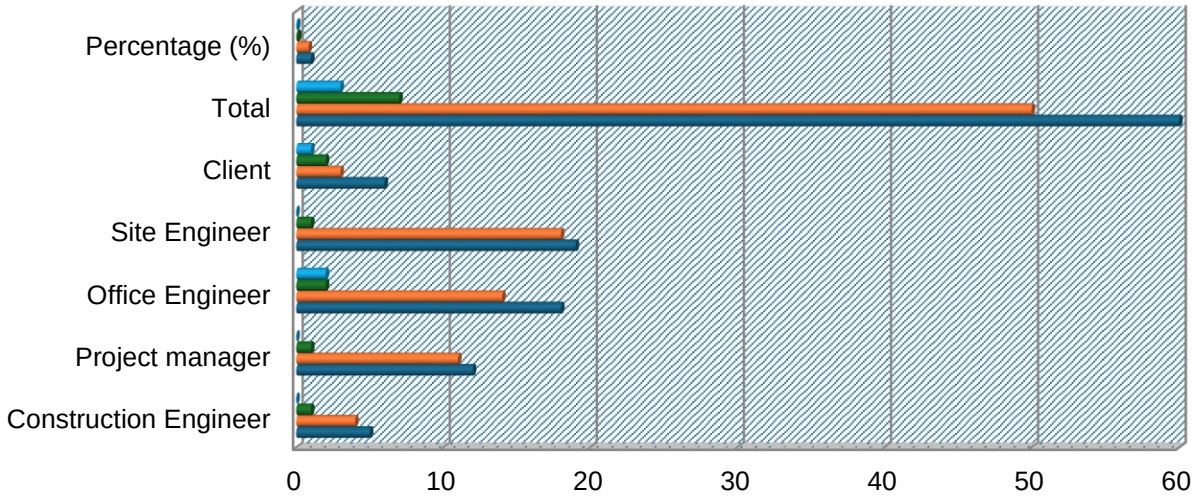
After completing the first stage, the second stage commenced with the distribution and collection of ISM-based questionnaires. A total of 60 questionnaires were distributed to the participants who had responded in the first stage and 53 were returned, Out of these, 50 were correctly completed, while three were incomplete. Detailed information regarding the respondents in this second stage is presented in Table 4.2 below.

Table 4-2 Respondent Distribution for Second Stage

	Total Questionnaires	Successfully Returned	Not Responded	In complete
Construction Engineer	5	4	1	0
Project manager	12	11	1	0
Office Engineer	18	14	2	2
Site Engineer	19	18	1	0
Client	6	3	2	1
Total	**60**	**50**	**7**	**3**
Percentage (%)	**100%**	**83.33%**	**11.67%**	**5%**

Source: Own survey result, 2024

The response rate of survey study for the Construction Engineer were 80% (4 out of 5 respondents), Project manager 91.67% (11 out of 12 respondents), Office Engineer 77.77% (14 out of 18 respondents), Site Engineer 94.74% (18 out of 19 respondents) and 50% (3 out of 6 respondents) for Client and about 22% Office Engineer & almost half of the Client representatives were unable to respond the questionnaires to the researcher. And the detailed data regarding the questionnaires distribution & response rate for second stage is given in the figure 4.4.

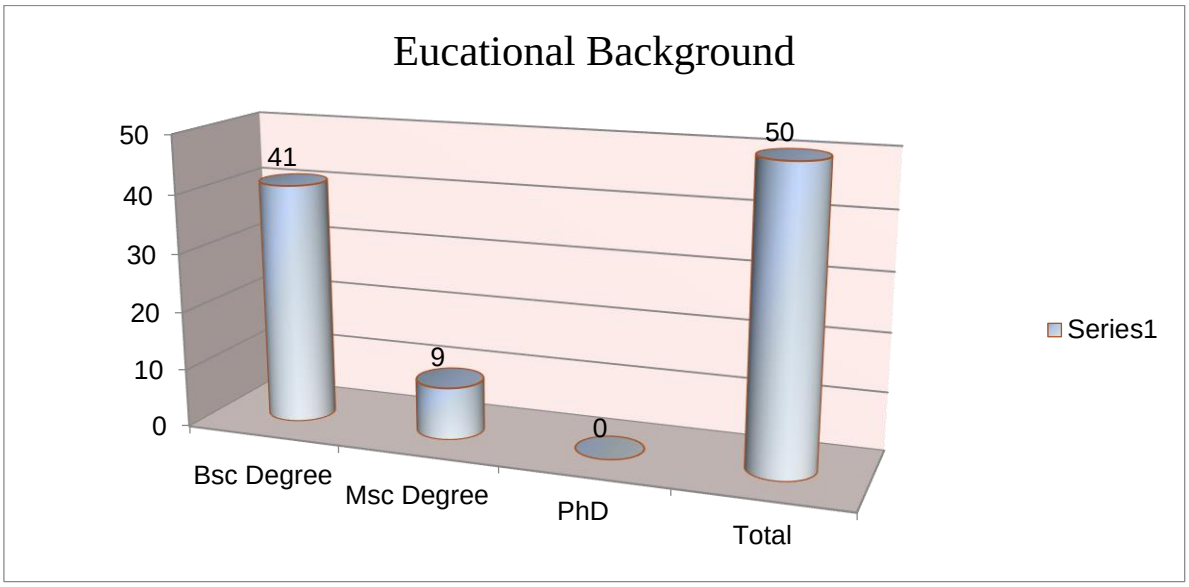


	Construction Engineer	Project manager	Office Engineer	Site Engineer	Client	Total	Percentage (%)
In complete	0	0	2	0	1	3	5%
Not Responded	1	1	2	1	2	7	11.67%
Successfully Returned	4	11	14	18	3	50	83.33%
Total Questionnaires	5	12	18	19	6	60	100%

Source: Own survey result, 2024

Figure 4-4 Questionnaires response rate for second stage

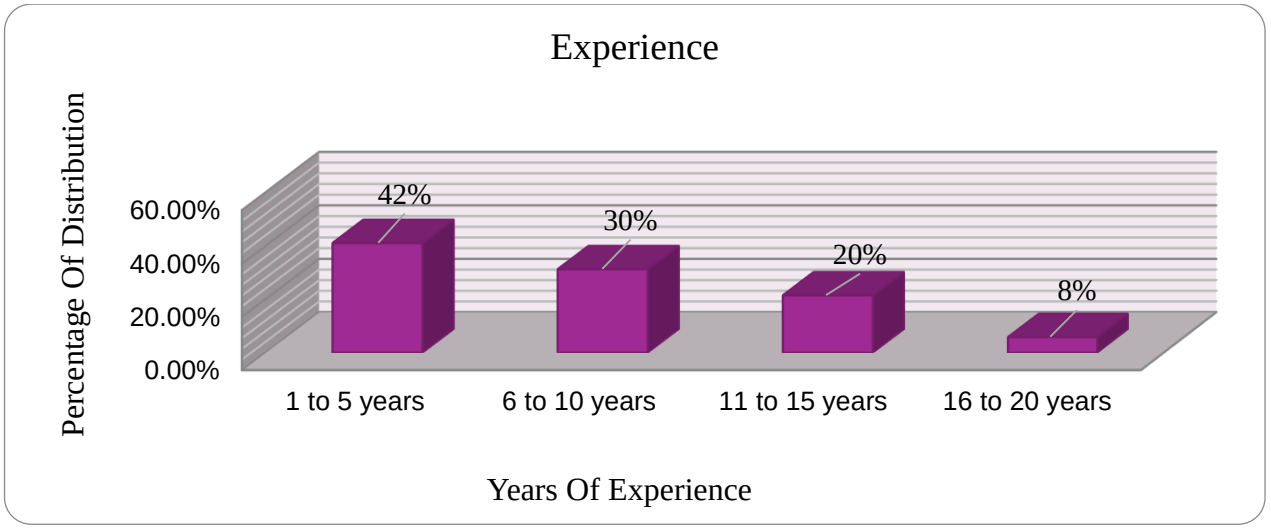
Similar to the first stage, the most of the respondents in this phase also held a bachelor's degree, although a portion possessed master's degrees. Specifically, 18% of the respondents were holders of master's degrees, while the remaining 82% had bachelor's degrees. Detailed information about the educational backgrounds of the respondents is presented in Figure 4.5.



Source: Own survey result, 2024

Figure 4-5 Educational backgrounds of the respondents

The experience of this respondent varies from 1 to 5 years to 16 to 20 years. Out of the total, 42% have experience ranging from 1 to 5 years. On the contrary, 8% have 16 to 20 years of experience. Detailed information regarding the experience levels of the respondents can be found in Figure 4.6.



Source: Own survey result, 2024

Figure 4-6 Experiences of the respondents

4.3. Types of projects which the respondents participating on

Even though there are different types of mega construction projects in the study area, the researcher focus on road and building construction projects. From those two types of mega construction projects which were included in the study area most respondents were under building construction projects.

4.4. Prioritization of Critical Success Factors of Stakeholder Management for Mega Construction Projects using Analytical Hierarchal Process

4.4.1. Prioritization Based on Their Categories

The assessment of the various critical success factor groups revealed a prioritization based on their significance to the overall project success. The client-related factors emerged as the most influential, with a weight of 0.271, indicating the critical role of the client in project outcomes. Following closely are project manager-related factors, weighted at 0.216, underscoring the importance of effective leadership and management in driving project success. Contractor-related factors were also significant, with a weight of 0.155, reflecting the need for capable contractors to ensure quality and timely completion of projects. Design team-related factors, weighted at 0.127, highlight the importance of a skilled and collaborative design team in the planning and execution phases. Supplier-related factors, with a weight of 0.117, and sub-contractor-related factors, at 0.115, also play crucial roles, emphasizing the necessity of reliable suppliers and subcontractors in maintaining the flow of materials and services essential for project progress. This comprehensive analysis highlights the interdependence of these factor groups in achieving successful project outcomes.

4.4.2. Prioritization of Design Team-Related Factors

In the design team-related group, the prioritization of factors highlights their significance to project success. The factors with the highest weights are previous experience of similar projects, delay in sorting out design errors, and complexities of design, each receiving a weight of 0.225 and error in design has a weight of 0.134. This distribution underscores the crucial role of experience, accuracy, timely resolution of issues, and the ability to manage complex design requirements. Following the specified codes and standards has a weight of 0.107, indicating its importance in maintaining compliance and quality. Contribution in construction, which includes design reviews and site visits, is weighted at 0.085, reflecting its supportive yet essential role in ensuring that the design aligns with construction practices. The inconsistency ratio for these weights is 0.06, which is within the acceptable range, indicating reliable weight assignments in the AHP analysis.

4.4.3. Prioritization of Client-Related Factors

Within In the client-related group, the weights of various factors reflect their significance to project success. The most influential factor is in-time decision-making by the client, assigned a weight of 0.206, highlighting its critical role in maintaining project schedules. This is followed by the client's risk attitude and willingness to take risks, which has a weight of 0.174, emphasizing the impact of the client's approach to risk management. The client's

knowledge about the project and emphasis on low-cost construction are weighted at 0.134 and 0.127, respectively, illustrating the importance of the client's understanding and budget priorities. Emphasis on high-quality construction has a weight of 0.107, underlining its role in achieving project quality. Regular monitoring through visits and reports, along with the client's emphasis on quick construction, are weighted at 0.090 and 0.085, showing the need for effective communication. The factor with the lowest weight is the client's ability to brief, at 0.076. The overall inconsistency ratio for these weights is 0.07, indicating a reasonable level of consistency in the comparisons.

4.4.4. Prioritization of Supplier-Related Factors

In the supplier-related group, several factors are crucial for evaluating supplier performance and their impact on project success. Timely delivery of materials, with the highest weight of 0.266, is critical for ensuring that projects adhere to schedules. The availability of stock is valued at 0.113, indicating its importance in preventing delays. Transportation charges and the distance from the site are weighted at 0.213, reflecting the impact of logistics on overall project costs. The quality of materials, with a weight of 0.147, and adherence to specifications, at 0.141, are essential for meeting project standards. The rate of materials, weighted at 0.120, also plays a role in financial considerations. The inconsistency ratio for these factors is 0.08, indicating a strong level of consistency in the evaluations.

4.4.5. Prioritization of Sub-Contractor Related Factors

In the sub-contractor related group, various factors contribute significantly to the overall project success. The most critical factor is the timely completion of the project, with a weight of 0.391, emphasizing its importance in meeting deadlines. Response to alterations in design is also crucial, holding a weight of 0.276, reflecting the need for flexibility and adaptability. Competency of the subcontractor, with a weight of 0.138, and experience with related projects, weighted at 0.195, are important for ensuring quality and reliability. The inconsistency ratio for these factors is 0.05, indicating a well-aligned and consistent assessment across the board.

4.4.6. Prioritization of Contractor-Related Factors

The contractor-related group factors are weighted to emphasize their significance in project success. The contractor's experience with related projects is the most critical factor, receiving a weight of 0.391, which highlights the value of experience in ensuring project effectiveness. Timely inspections and checks follow with a weight of 0.195, reflecting their importance in maintaining quality and adherence to project standards. Site management is weighted at 0.276, showcasing its essential role in overseeing daily project operations. The extent of

subcontracting and connections with smaller contractors is assigned a weight of 0.138, illustrating its impact on overall project execution. The consistency ratio for these weights is 0.05, indicating a high level of consistency in the comparisons.

4.4.7. Prioritization of Project Manager-Related Factors

The project manager-related group emphasizes several key factors critical to project success. The ability to identify and allocate risks stands out with the highest weight of 0.186, highlighting its importance in proactively managing potential issues. Experience in similar projects is valued at 0.107, reflecting the benefit of prior project experience. Leadership abilities, with a weight of 0.103, are crucial for guiding the team effectively. The ability to make timely decisions, weighted at 0.160, is essential for maintaining project momentum. Managing costs while ensuring quality, weighted at 0.138, is critical for balancing financial constraints with project standards. The project manager's ability to motivate the team is weighted at 0.080, and the planning and proactive approach are weighted at 0.078, indicating their role in ensuring smooth project execution. Technical qualifications and the ability to deal with subcontractors and suppliers, with weights of 0.067 and 0.082 respectively, are also important for project success. The inconsistency ratio for these weights is 0.07, demonstrating a high level of consistency in the assessments.

4.4.8. Overall Prioritization of Critical Success Factors

The global weights for the various success factors, determined through AHP, highlight their relative importance in the project's success. The top factors include the in time decision made by client decisions (0.065), the client's risk attitude and willingness to take risks (0.055), and the effectiveness of risk identification and allocation (0.052). The ability to make timely decisions (0.045) and the client's knowledge about the project (0.042) also play crucial roles. Further down the list, factors such as the client's emphasis on low-cost construction (0.040) and managing costs without compromising quality (0.038) are significant, along with the contractor's experience with related projects (0.037) and the client's emphasis on high-quality construction (0.034).

Additional notable factors include the design team's previous experience (0.030), delays in addressing design errors (0.030), complexities in design (0.030), and the project manager’s similar project experience (0.030). Other important aspects are the leadership abilities of the project manager (0.029), regular monitoring by visits and reports (0.028), and timely delivery of materials (0.028). The client's emphasis on quick construction (0.027) and timely project completion (0.027) also contribute significantly. Further down, factors like site management (0.026), the client’s briefing ability (0.024), and the ability to handle subcontractors and

suppliers (0.023) are relevant. Planning and proactive approaches (0.022), transportation charges and distance (0.022) & ability to motivate team (0.022) are also considered.

Finally, the lower-ranked factors include check & balance by timely inspection (0.0019), technical qualifications (0.019), response to design alterations (0.019) and design errors (0.018). Factors such as previous records of quality (0.015), material specification compliance (0.015), and adherence to codes and standards (0.014) follow. Experience of related projects by subcontractors (0.014) and the extent of subcontracting (0.013) are also noted, along with material rates (0.013), contributions in construction reviews (0.012), stock availability (0.012), and subcontractor competency (0.010).the summary of the result is given in table 4.3.

Table 4-3 Output of the Analytical Hierarchal Process Analysis

Level 1: Goal	Level 2: Groups of CFSs	Weights of the group	CFSs	Local weights (Rank)	Global weights (Rank)
1	2	3	4	5	6
	Client related factor	0.271	In time decision made by client	0.206 (1)	0.065 (1)
			Risk attitude/Willing to take the risks	0.174 (2)	0.055 (2)
			Client's knowledge about project	0.134 (3)	0.042 (5)
			Clients' emphasis on low cost construction	0.127 (4)	0.40 (6)
			Clients' emphasis on high quality construction	0.107 (5)	0.034 (9)
			Regular monitory by visits and reports	0.090 (6)	0.028 (12)
			Client emphasis on quick construction	0.085 (7)	0.027 (13)
			Client ability to brief	0.076 (8)	0.024 (15)
	Project manager-related factor	0.216	Risk identification and allocation	0.186 (1)	0.052 (3)
			Ability to take timely decisions	0.160 (2)	0.034 (4)
			Managing cost without compromising the quality	0.138 (3)	0.038 (7)
			Experience of similar projects	0.107 (4)	0.030 (10)

		Leadership abilities of the manager	0.103 (5)	0.029 (11)
		Ability to deal with the subcontractors and suppliers.	0.082 (6)	0.023 (16)
		Ability to motivate the team	0.080 (7)	0.022 (17)
		Planning/proactive approach	0.078 (8)	0.022 (17)
		Technical Qualification	0.067 (9)	0.019 (18)
	Contractor- related factor	0.155	Experience of related projects	0.391 (1)	0.037 (8)
			Site management	0.276 (2)	0.026 (14)
			Check and balance by timely inspections	0.195 (3)	0.019 (18)
			The extent of subcontracting /links with small contractors	0.138 (4)	0.013 (21)
	Design Team related factors	0.127	Previous experience of similar projects	0.225 (1)	0.030 (10)
			Delay in sorting out design error	0.225 (1)	0.030 (10)
			Complexities of design	0.225 (1)	0.030 (10)
			Error in design	0.134 (2)	0.018 (19)
			Following the specified codes and standards	0.107 (3)	0.014 (21)
			Contribution in construction (reviews, visits)	0.085 (4)	0.012 (23)
	Supplier- related factor	0.117	In time delivery of the materials	0.266 (1)	0.028 (12)
			Transportation charges/ distance from the site	0.213 (2)	0.022 (17)
			Previous records of quality	0.147 (3)	0.015 (20)
			Material according to the specifications	0.141 (4)	0.015 (20)
			Rate of the materials	0.120 (5)	0.013 (22)
			Availability of stock	0.113 (6)	0.012 (23)
	Sub-contractor factors	0.115	Timely completion of the project.	0.391 (1)	0.027 (13)
			Response to alteration of design	0.276 (2)	0.019 (18)

	Experience of related projects	0.195 (3)	0.014 (21)
	Competency of the sub-contractor	0.138 (4)	0.010 (24)

Source: Own survey result, 2024

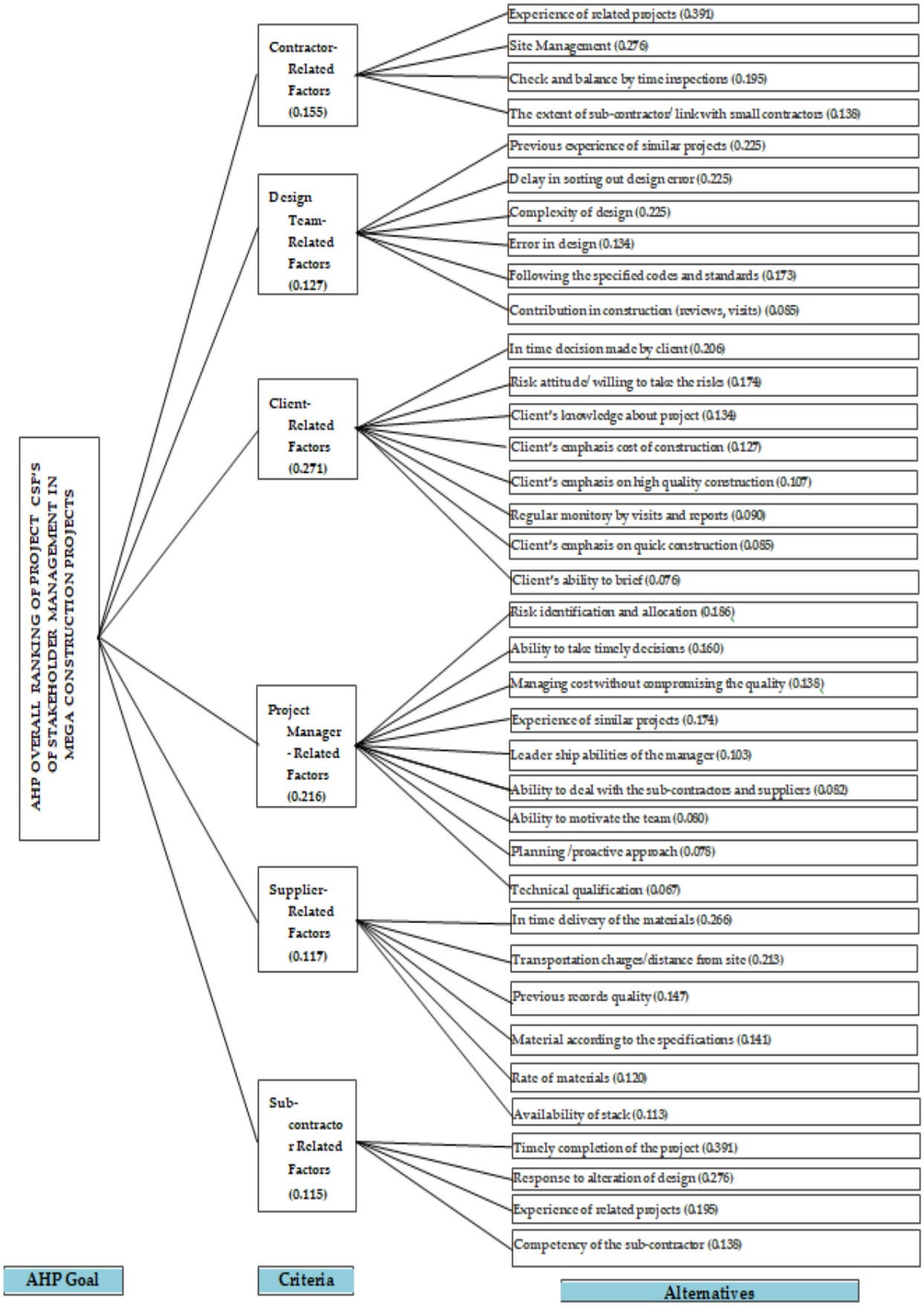
4.5. Discussion Based on the Result of Analytical Hierarchical Process

This study provides an in-depth exploration of success factors critical to stakeholder management in mega construction projects, offering significant insights through the application of the Analytic Hierarchy Process (AHP). The research identifies client-related factors as the most crucial category, with a weight of 0.271, highlighting their paramount importance in large-scale projects, including mega construction initiatives. This finding aligns with the study by (Oyeyipo et al., 2019) which also emphasized the significance of client-related factors. Similarly, (Eyiah-Botwe et al., 2016b) ranked these factors highly, recognizing them as the most critical in such contexts. The current study's focus on client-related factors likely stems from the unique demands of large construction projects, where prompt and accurate decision-making by the client, along with robust client support, is essential for effective stakeholder management.

Project manager-related factors emerged as the second most important category, with a weight of 0.216. This finding is consistent with (Mok et al., 2015b), who also highlighted the importance of effective management practices in mitigating miscommunication and preventing conflicts among stakeholders. The study underscores the significant role of project managers, emphasizing their decision-making capabilities, experience, and leadership skills as vital components for successful stakeholder management a conclusion that aligns with prior research.

When analyzing individual factors, the timeliness of client decisions surfaced as the most critical, with a weight of 0.065. This observation echoes the conclusions of (Kadan, 2024), who stressed the pivotal role of timely client decisions in setting the tone for effective stakeholder management and preventing conflicts among different stakeholders. Additionally, the client's risk attitude and willingness to take risks were ranked second, with a weight of 0.055. This finding underscores the importance of the client's approach to risk in managing stakeholders, as it influences the level of uncertainty other stakeholders face and helps alleviate pressures on them. (Akintoye, A., & Main, J., 2007) also noted that a client's willingness to take risks can pave the way for effective risk allocation and enhance communication among all stakeholders involved in the project.

Furthermore, the study highlights the significance of risk identification and allocation, ranked third with a weight of 0.052. This finding reflects the critical role of the project manager in identifying risks early and ensuring their proper allocation, which leads to higher satisfaction among parties involved and fosters effective communication. This conclusion is supported by (Xia et al., 2018), who argued that early-stage risk identification, coupled with effective communication and allocation among stakeholders, builds trust and enhances stakeholder management effectiveness. Additionally, the timeliness of decisions, with a weight of 0.045, was ranked fourth, underscoring its importance in maintaining effective stakeholder management in mega projects. Just as the client's ability to make timely decisions influences stakeholder management, the project manager's decision-making skills also significantly impact the dynamics among the involved stakeholders. The detail regarding the overall or global AHP Ranking of Critical Success Factors is given in figure 4.7 and table 4.4.



Source: Own Model, 2024

Figure 4-7 Evaluation of the local & global priorities of Critical success factors

Table 4-4 Overall (Global) AHP Ranking of Critical Success Factors

Critical Success Factor	**Overall**	**Rank**
In time decision made by client	0.065	1
Risk attitude/Willing to take the risks	0.055	2
Risk identification and allocation	0.052	3
Ability to take timely decisions	0.045	4
Client's knowledge about project	0.042	5
Clients emphasis on low cost construction	0.040	6
Managing cost without compromising the quality	0.038	7
Experience of related projects of the contractor	0.037	8
Clients emphasis on high quality construction	0.034	9
Previous experience of similar projects similar projects of the design team	0.030	10
Delay in sorting out design error	0.030	10
Complexities of design	0.030	10
Experience of similar projects of the pm	0.030	10
Leadership abilities of the manager	0.029	10
Regular monitory by visits and reports	0.028	12
In time delivery of the materials	0.028	12
Client emphasis on quick construction	0.027	13
Timely completion of the project	0.027	13
Site management	0.026	14
Client ability to brief	0.024	15
Ability to deal with the subcontractors and suppliers	0.023	16
Ability to motivate the team	0.022	17
Planning/proactive approach	0.022	17
Transportation charges/distance from the site	0.022	17
Check and balance by timely inspections	0.019	18
Technical Qualification	0.019	18
Response to alteration of design	0.019	18
Error in design	0.018	19
Previous records of quality	0.015	20
Material according to the specifications	0.015	20
Following the specified codes and standards	0.014	21
Experience of related projects of the related sub-contractor	0.014	21
The extent of subcontracting /links with small contractors	0.013	22
Rate of the materials	0.013	22
Contribution in construction (reviews, visits)	0.012	23
Availability of stock	0.012	23
Competency of the subcontractor	0.010	24

4.6. Prioritization of Critical Success Factors of Stakeholder Management for Mega Construction Projects using Interpretive Structural Modeling

After the prioritization of the success factors using AHP was completed, the top 16 in rank factors were selected for further investigation. These factors were given in Table 4.5 and they were analyzed further using ISM to know their interrelationship and also to know which factors are the most influential.

Table 4-5 Top 16 in rank Critical Success Factors Based on their Relative Importance

Critical Success Factor	Code	Rank
In time decision made by client	E1	1
Risk attitude/Willing to take the risks	E2	2
Risk identification and allocation	E3	3
Ability to take timely decisions	E4	4
Client's knowledge about project	E5	5
Clients emphasis on low cost construction	E6	6
Managing cost without compromising the quality	E7	7
Experience of related projects of the contractor	E8	8
Clients emphasis on high quality construction	E9	9
Previous experience of similar projects similar projects of the design team	E10	10
Delay in sorting out design error	E11	10
Complexities of design	E12	10
Experience of similar projects of the pm	E13	10
Leadership abilities of the manager	E14	10
Regular monitory by visits and reports	E15	12
In time delivery of the materials	E16	12
Client emphasis on quick construction	E17	13
Timely completion of the project	E18	13
Site management	E19	14
Client ability to brief	E20	15
Ability to deal with the subcontractors and suppliers	E21	16

Source: Own survey result, 2024

Based on expert assessments, the influence or leads-to relationships between factors were identified and documented in the Adjacency Matrix (A), which captures the direct effects one factor has on others. The next step was to develop the Reachability Matrix, which accounts for both direct and indirect effects. This matrix was computed using the principle of transitivity, a key assumption in Interpretive Structural Modeling. The Reachability Matrix includes the dependency power (D) and driving power (DP) of each factor.

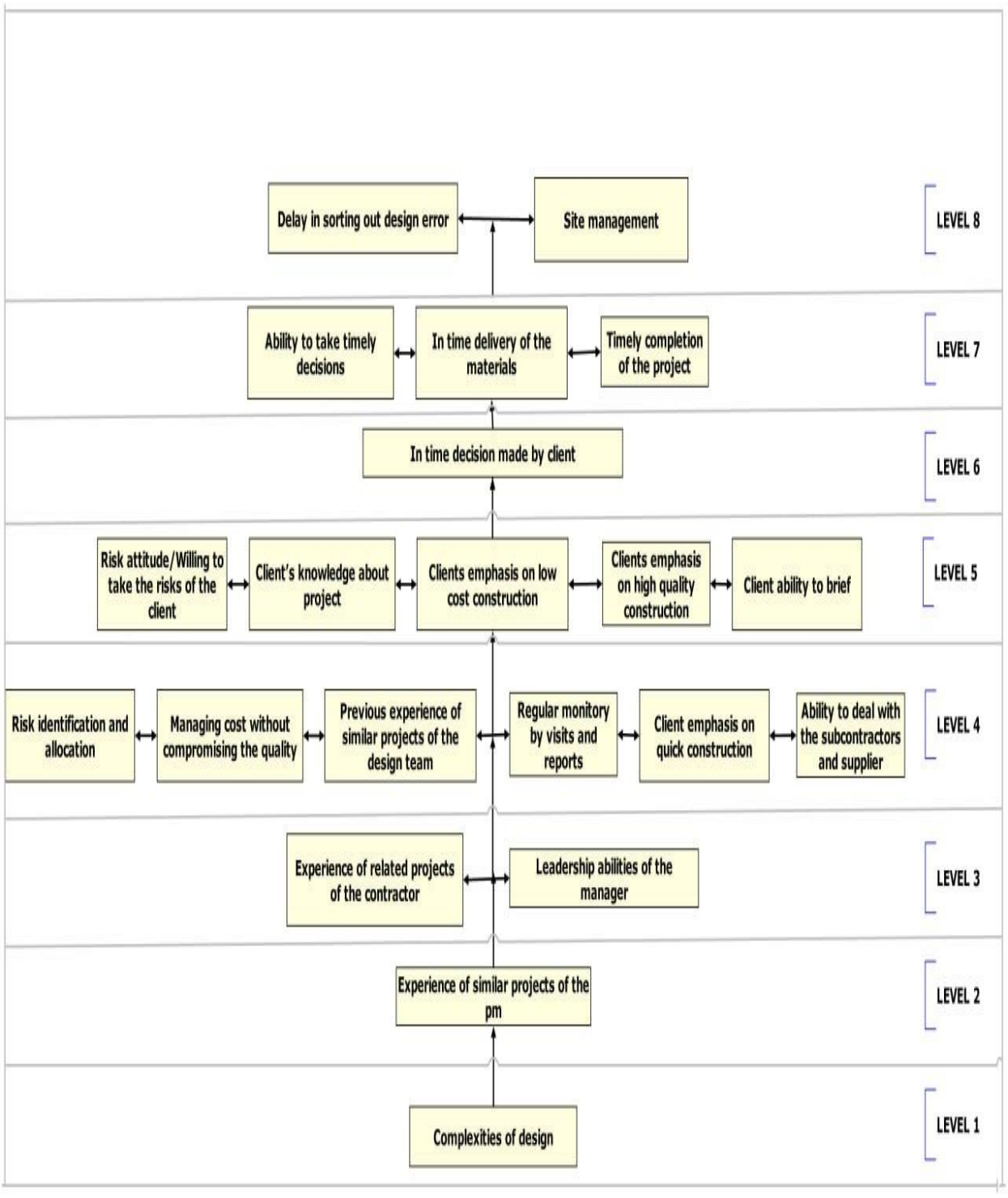
Following this, the factors were organized into different levels. A directed graph (digraph) was created to visually represent these relationships, with factors depicted as nodes and directional arrows illustrating their interconnections. This diagram, presented in Figure 4.8, shows the hierarchical structure and the nature of the relationships between factors. The analysis revealed an inconsistency rate of 26.34%, which is below the maximum permissible limit of 30% (Alawamleh & Popplewell, 2011). Additionally, the Cronbach's alpha coefficient was 0.916, indicating a high level of consistency in the result.

The hierarchical structure of critical success factors in mega construction projects in Addis Ababa is organized into eight levels, each representing a different degree of importance. At the highest priority, Level 1 highlights the complexity of the design, which is deemed the most critical factor influencing project success. This is followed by Level 2, where the project manager's experience in handling similar projects is emphasized, underscoring the importance of relevant expertise in navigating the complexities of mega construction endeavors. Level 3 introduces the contractor's experience in similar projects and the project manager's leadership abilities, pointing to the necessity of both experience and strong leadership to effectively manage these large-scale projects.

As we move to Level 4, the focus shifts to a range of factors that collectively impact project outcomes. These include risk identification and allocation, cost management without compromising quality, the design team's prior experience on similar projects, regular monitoring and visits by the client, the client's emphasis on quick construction, and the ability to effectively manage subcontractors. These factors illustrate the critical role of comprehensive risk management, cost control, and active client involvement. Level 5 further highlights the client's influence, with factors such as the client's risk attitude, project knowledge, emphasis on cost and quality, and ability to provide clear briefs being pivotal. The client's ability to make timely decisions, captured in Level 6, is crucial for maintaining project momentum.

The final levels, 7 and 8, address operational aspects that are essential for project delivery. Level 7 focuses on the project manager's ability to make timely decisions, the timely delivery of materials, and the timely completion of the project—all of which are vital to adhering to the project schedule. Finally, Level 8, while lower in priority, includes factors such as the delay in resolving design errors and effective site management, which remain crucial for ensuring that on-

site issues are addressed efficiently and that the project is completed successfully. This hierarchical framework provides a structured approach to prioritizing resources and decision-making, ultimately enhancing the efficiency and effectiveness of managing mega construction projects in Addis Ababa.



Source: Own survey result, 2024

Figure 4-8 Output of Interpretive Structural Modeling

4.7. Discussion Based on the Result of Interpretive Structural Modeling

The analysis of the interrelationships among the 21 identified critical success factors has revealed a well-defined hierarchy, as depicted in Figure 4.10. A key insight from this analysis is the central role of the design complexity in shaping other critical success factors. The complexity of the design affects the overall intricacy and uniqueness of the project, which in turn influences the associated uncertainties and risks. This finding aligns with (Doloi, 2013), which highlights that complex designs significantly impact both project managers' and contractors' experiences. A complex design often necessitates a higher level of detail in project management, requiring project managers to adopt a more hands-on approach to navigate the increased risks effectively. This increased involvement can directly affect their leadership style, as more complex projects demand meticulous oversight and proactive risk mitigation strategies. Consequently, factors such as the project manager's experience and leadership abilities, as well as the contractor's experience, become foundational elements that influence the effectiveness of other critical success factors.

In addition to the direct impact of design complexity on experience of the project manager in similar projects, along with the experience of the contractor and leadership ability of the project manager, have indirect effects on several critical success factors. These factors include risk identification and allocation, cost management without compromising quality, and the design team's experience with similar projects. The study corroborates the findings of (Smith et al., 2014), who discussed how increased project complexity complicates risk identification and allocation, making it challenging for stakeholders to accept and manage risks effectively. Furthermore, the experience of both the project manager and contractors plays a significant role in shaping the project manager’s leadership style. Experienced project managers are better equipped with the skills and tools necessary for successful project execution, while experienced contractors can simplify the project manager’s role by contributing to more effective project management. This synergy between experienced project managers and contractors facilitates smoother project execution and enhances overall project performance.

The experience of the contractor and the project manager's leadership style significantly influence several key factors, including risk identification and allocation, cost management without compromising quality, the design team's prior experience, regular client monitoring, the

client’s emphasis on timely construction, and the effective management of subcontractors. According to (Turner, J. R., & Müller, R., 2005), the leadership style of the project manager, while it may not directly impact the identification of risks, plays a crucial role in setting the tone for risk allocation. Conservative project managers tend to allocate risks more evenly or assign them to the most responsible parties, while risk-taking managers are more likely to distribute risks more freely. This distinction in risk allocation can affect how risks are managed and mitigated throughout the project. Similarly, the experience of the contractor, coupled with the project manager's leadership style, has a direct impact on cost management while maintaining quality. Experienced contractors bring valuable insights into cost management and efficiency, which, when supported by effective project management leadership, contributes to better control of project expenses without sacrificing quality. The leadership style of the project manager influences how cost management strategies are implemented and how well they align with the contractor's expertise. An experienced project manager can leverage their leadership skills to facilitate effective cost management practices and ensure that the project remains within budget while meeting quality standards.

The MICMAC analysis categorized all 21 factors into a single group within the linkage cluster, indicating that these factors possess both strong driving and dependency powers. This means that changes to any of these factors can have significant impacts on the entire system. However, a comparison between the ISM analysis results and both the literature and the AHP analysis within the current study reveal discrepancies in the prioritization of critical factors. For instance, factors such as the complexity of the design and experience of the project manager, which ranked lower in importance-based assessments, are identified as critical in the ISM analysis due to their profound influence on other factors. This divergence highlights the importance of selecting the appropriate attribute whether importance or influence when assessing critical success factors. The interpretive structural modeling approach is particularly valuable for uncovering root causes that may not be immediately apparent but are crucial for achieving long-term project success, as supported by (Iyer, K. C., & Sagheer, M. , 2010). This approach emphasizes the need to consider both the direct and indirect effects of factors to fully understand their role in the project's success.

4.8. Prioritization of Critical Success Factors of Stakeholder Management for Mega Construction Projects Based on The Integrated Hierarchical Structure

The objective of this paper is to structure critical success factors for stakeholder management in mega construction projects by evaluating their importance and influence, both of which were ranked separately. A Spearman's rank correlation analysis was conducted, revealing a coefficient of -0.176. This weak negative correlation suggests an inverse relationship between the rankings based on importance and those based on influence. Specifically, as factors rank higher in importance, they tend to rank lower in influence, and vice versa. This indicates that factors deemed crucial for project success do not necessarily align with those that have a strong influence on project outcomes, highlighting a subtle but significant divergence in how these factors are prioritized.

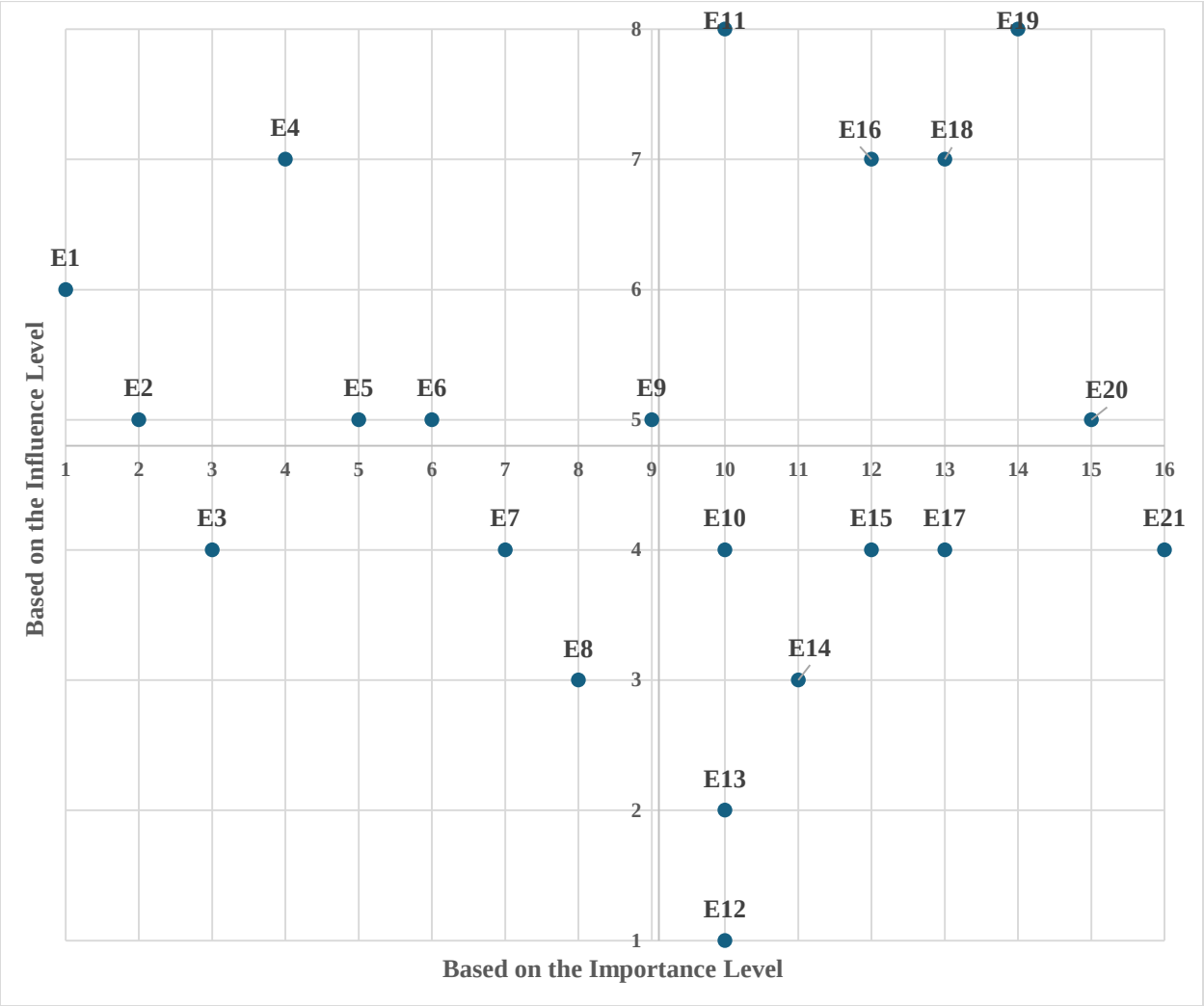
Based on the quadrant analysis given in figure 16, the most critical factors for the project's success are found in the High Importance, High Influence category (keep up the good work). These include key elements such as risk identification and allocation, which are essential for proactively identifying and addressing potential issues before they can disrupt the project. This proactive approach allows the team to anticipate problems and implement solutions that mitigate risks effectively. Another vital factor in this category is cost management without compromising quality. This ensures that the project stays within budget constraints while still meeting the required standards of quality, which is crucial for maintaining the project's integrity and client satisfaction. The contractor's experience in similar projects is also a significant factor in this quadrant, as it brings valuable expertise that can streamline processes, avoid common pitfalls, and ensure that the project is executed smoothly. These factors are central to the project's success and should be given top priority. They require diligent oversight and careful management throughout the project's duration to ensure that the desired outcomes are achieved.

In the High Importance, Low Influence quadrant (priority for improvement), we find factors such as the client's risk attitude, their knowledge about the project, and their emphasis on both low-cost and high-quality construction. While these elements are crucial to the project's success, they currently have less influence on the project's overall progress and outcomes. For example, the client's risk attitude can significantly shape the project's approach to uncertainty, yet if this

attitude is not adequately reflected in decision-making processes or project strategies, its impact is diminished. Similarly, while the client's emphasis on cost-efficiency and quality is vital, these priorities may not fully translate into the project's execution without sufficient influence. Therefore, it is important to enhance the influence of these factors, ensuring that they have a more substantial impact on the project's trajectory. This might involve more active client involvement, clearer communication, or adjustments in project management strategies to better align these priorities with the project's operational framework.

The Low Importance, High Influence (possible over kill) quadrant contains factors such as the complexity of the design. Although this factor has a significant influence on how the project is executed potentially affecting timelines, costs, and the feasibility of certain aspects of the project its overall importance to the project's success is lower. This does not mean that it should be neglected, but rather that it should be managed carefully to ensure that its influence does not negatively impact more critical aspects of the project. Managing design complexity is necessary to avoid complications, but it does not require as much focus or resources as the factors in the High Importance quadrants.

Lastly, the Low Importance, Low Influence (Low priority) quadrant includes factors such as the client's and project manager's ability to make timely decisions, the delay in resolving design errors, timely delivery of materials, the timely completion of the project, effective site management, the client's ability to provide clear briefs, and the management of subcontractors. These factors, while they do play a role in the project's execution, have relatively minor impacts on its overall success. As such, they do not require immediate or intense focus, though they should still be monitored to prevent any potential issues from arising. This monitoring ensures that these elements do not unexpectedly escalate into larger problems that could affect the project's progress. The final integrated model is given figure 4.9.



Source: Own survey result, 2024

Figure 4-9 Output of Quadrant Analysis

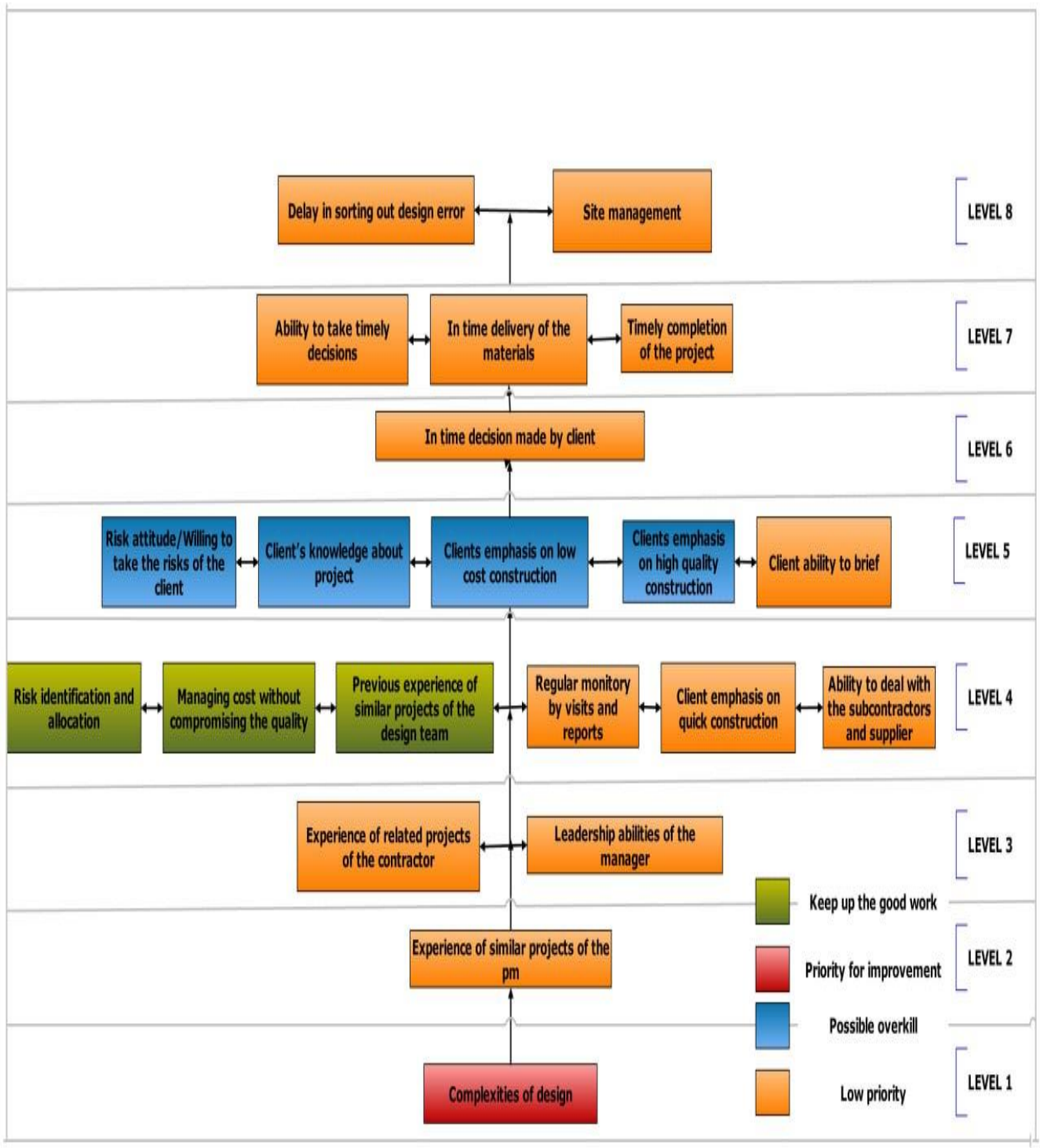
4.9. Discussion Based on the Result of Integrated Hierarchical Structure

Successful stakeholder management forms the foundation for effectively executing, managing, and controlling ongoing projects, as well as planning and guiding future ones. It sets a precedent and helps avoid conflicts by ensuring the project progresses smoothly. Critical success factors for stakeholder management require specific attention to achieve effective stakeholder management and seamless project execution. If these factors are not appropriately managed, the project may fail (Sinesilassie et al., 2019). The discussions presented in AHP and ISM sections focus on either the importance or influence of certain factors, but not both. Since the aim of the study is to identify factors that are both influential and important, the researcher employed quadrant

analysis to determine these factors. The findings revealed that a total of six factors are critical, as shown in Figure 8. These factors include the project manager's experience and leadership abilities, the contractor's experience with similar projects, cost management without compromising quality, and risk identification and allocation.

Among these, risk identification and allocation emerged as the most critical factor. It was ranked third in terms of importance and fourth in terms of influence. According to (Xia et al., 2018), risk identification and allocation is crucial because it minimizes conflict, leads to more efficient resource allocation, and improves mutual management. Additionally, it enhances stakeholders' perception of risk and encourages their active involvement in risk management (Iso, 2009). The second most important and influential factor identified was cost management without compromising quality. For stakeholders, achieving high quality while maintaining cost efficiency is an ideal scenario. (Isaksson, 2005) Highlights that maintaining the quality of construction is essential for stakeholder satisfaction. However, quality often comes with increased costs. By considering the most optimal options, it is possible to balance cost and quality, leading to greater stakeholder satisfaction.

Furthermore, critical success factors in each quadrant have similar characteristics. The first quadrant, which is keep up the good work, contains a factor that is both important and also influential. Factors that fail in this quadrant are the most critical. To commit to achieving success the performance of these factors must be assigned the highest priority. The second one is factors that fall into the priority to improvement quadrant are factors that have higher importance but low influence. These factors are a priority to have immediate improvement of the performance of mega construction projects. On the other hand, factors located in the possible overkill quadrant tend to have higher influence but low importance. These factors are factors that are root causes and require higher resources to achieve but they are still critical to success in the long term. Unlike the factors in the above three quadrants, factors in the low priority quadrant have relatively both lower importance and influence. These factors have a lower impact on success relative to factors in the other quadrants. The final hierarchal structure, which shows the results from ISM, AHP, and quadrant analysis, is given in Figure 4.10.



Source: Own survey result, 2024

Figure 4-10 Output of Integrated Hierarchical Structure or frame work based on importance & influence

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1. Conclusions

Understanding the critical success factors for stakeholder management in mega construction projects is essential for maintaining a high success rate. This study demonstrates how applying the Analytical Hierarchal Process and interpretive structural modeling integrated method can enhance the understanding of how various success factors impact stakeholder management success in such projects. Drawing on a literature review and expert opinions, the study quantifies the relative importance of these success factors and illustrates their interrelationships using the integrated method. The findings revealed that:

- Among the categories, client-related factors are the most critical. Specifically, timely decision-making by the client, risk attitude/willingness to take risks, risk identification and allocation, the ability to make timely decisions, and the client's knowledge about the project are the top five critical success factors influencing stakeholder management in mega construction projects.
- The study concluded that most critical success factors are strongly interrelated. Factors within the independent clusters, characterized by strong driving forces, are particularly influential. The design complexity, the project manager's experience with similar projects, leadership abilities, and the contractor's experience in similar projects were identified as key factors at the lower levels of the ISM-derived digraph. Effectively managing these critical factors maximizes the success of stakeholder management in mega construction projects. Specifically, ensuring that design complexity is manageable is crucial for successful stakeholder management.
- Based on the integrated hierarchical structure, factors such as the contractor's experience with similar projects, cost management without compromising quality, risk identification and allocation are of paramount importance. These factors not only hold significant relative importance but are also foundational in the interpretative structural model. The study concludes that greater emphasis should be placed on these factors.

Finally, the research provides valuable insights into the critical success factors for stakeholder management in mega construction projects, offering participants a conceptual framework for developing strategies to ensure successful stakeholder management.

5.2. Recommendation

Based on the finding of the research the following recommendations are:

- Professionals are advised to utilize the findings of this study to enhance the success rate of stakeholder management in mega projects by concentrating on the most critical success factors.
- Leveraging the hierarchical structure presented in the study, professionals should assess the potential outcomes of their projects and implement corrective measures as needed.

5.3. Recommendation for Further study

- Given the simplicity of the current study, which employed the AHP method to determine factor weights, it is recommended that future research apply the Fuzzy AHP method to better analyze vulnerability factors in stakeholder management for mega Construction projects.
- To further simplify complexity, ISM analysis was conducted in this study; for future research, the use of Fuzzy ISM is recommended.
- Other researchers are encouraged to adopt these methodologies in their studies, particularly when exploring factors related to stakeholder management in large-scale projects.
- Also, Comprehensive research on Ethiopia's mega construction projects, including Real estate buildings, is still in its early stages. Additional studies using diverse methods should be conducted to deepen understanding in this area.

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APPENDIX A: QUESTIONNAIRES OF AHP

Adama Science and Technology University

School of Civil Engineering and Architecture

Department of Construction Engineering and Management

Questionnaire survey for study paper on

Stakeholder Management in Mega Construction Projects: Unveiling Importance and Interrelationship of Critical Success Factors

This research survey is designed to fulfill an academic requirement for MSc program in Construction Engineering and Management at the Adama Science and Technology University. Those who involve in the mega construction projects in Addis Ababa city are kindly requested to contribute to this research work.

The result of this survey is intended to serve only for academic purpose and will be treated with strict confidentiality. The name of institutions participated will be recorded confidentially. Thank you in advance for your willingness to fill the questionnaires and returning them back on time. Your open response is highly appreciated.

With regards

Kassahun Terefe

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Advisor: Fikreyesus D. (PhD)

General information

Name of the organization					
Respondents position in the organization.					
Level of education of the respondent					
Relevant working	1-5 years	6- 10 years	11-15 years	16-21 years	more than 20 years

Objective of the study

The general objective of this study is to identify and prioritize key critical success factors (CSFs) that enhance Stakeholder management practices on mega construction projects based on their relative importance.

Method

Conduct a pair-wise comparison to identify the weight of several success factors which are important to success of stakeholder management in construction project and to calculate an overall score of the factors using the Analytic Hierarchy Process (AHP).

Instruction

The respondent is required to compare these factors based on their importance to the success of stakeholder management in construction projects.

Example

CASE 1: If you think factor **"A"** is extremely important than factor **"B"** circle or mark the numbers **"9"** **to the *left of the center*.**

CASE 2: If you think factor **"B"** is extremely important than factor **"A"** circle or mark the numbers **"9"** **to the *right of the center*.**

Categories	Critical success factors (CSF's)
Design Team-Related Factors	(1) Previous experience of similar projects (2) Error in design (3) Delay in sorting out design error (4) Complexities of design (5) Following the specified codes and standards (6) Contribution in construction (reviews, visits)
Client-Related Factors	(7) Regular monitory by visits and reports (8) Client's knowledge about project (9) In time decision made by client (10) Client ability to brief (11) Risk attitude/Willing to take the risks (12) Clients emphasis on low cost construction (13) Clients emphasis on high quality construction (14) Client emphasis on quick construction
Contractor-Related Factors Related Factors	(15) Experience of related projects (16) Check and balance by timely inspections (17) Site management (18) The extent of subcontracting /links with small contractors
Project Manager-Related Factors	(19) Experience of similar projects , (20) Technical Qualification , (21) Leadership abilities of the manager (22) Ability to take timely decisions (23) Ability to motivate the team (24) Planning/proactive approach (25) Risk identification and allocation (26) Managing cost without compromising the quality (27) Ability to deal with the subcontractors and suppliers.
Suppliers-Related Factors	(28) Previous records of quality (29) In time delivery of the materials, (30) Material according to the specifications, (31) Rate of the materials (32) Availability of stock (33) Transportation charges/distance from the site.
Sub-Contractor-Related Factors	(34) Experience of related projects, (35) Competency of the sub-contractor, (36) Response to alteration of design, (37) Timely completion of the project.

	Level of Importance b/n Design Team Related Factors & Client Related Factors										
Design Team RF	Extremely Important	Very Strongly Important	Strongly Important	Moderately Important		*Equal Important*		Moderately Important	Strongly Important	Very Strongly Important	Extremely Important	**Client RF**
	9	7	5	3		1		3	5	7	9	
										√		

Example-2: Client Related Factor *is Very strongly important* than Design Team Related Factor

1. Comparison between each category on the success of stakeholder management.

		LEVEL OF IMPORTANCE									
		9	***7***	***5***	***3***	***1***	***3***	***5***	***7***	***9***	
1	Design Team Related Factors										Client-Related Factors
2	>>										Contractor-Related Factors
3	>>										Project Manager-Related Factors
4	>>										Suppliers_ Related Factors
5	>>										Sub-Contractor-Related Factors
		9	***7***	***5***	***3***	***1***	***3***	***5***	***7***	***9***	
5	Client Related Factors										Contractor-Related Factors
6	>>										Project Manager-Related Factors
8	>>										Suppliers_ Related Factors
9	>>										Sub-Contractor-Related Factors
		9	***7***	***5***	***3***	***1***	***3***	***5***	***7***	***9***	
10	Contractor-Related Factors										Project Manager-Related Factors
11	>>										Suppliers_ Related Factors
12	>>										Sub-Contractor-Related Factors
		9	***7***	***5***	***3***	***1***	***3***	***5***	***7***	***9***	
13	Project Manager-Related Factors										Suppliers_ Related Factors
14	>>										Sub-Contractor-Related Factors
		9	***7***	***5***	***3***	***1***	***3***	***5***	***7***	***9***	
15	Suppliers_ Related Factors										Sub-Contractor-Related Factors

2. Comparison of Design team related- factors according to their impact on success of stakeholder management

		LEVEL OF IMPORTANCE									
		9	***7***	***5***	***3***	***1***	***3***	***5***	***7***	***9***	
1	Previous experience of similar projects similar projects of the design team										Error in design
2	>>										Delay in sorting out design error
3	>>										Complexities of design
4	>>										Following the specified codes and standards
5	>>										Contribution in construction (reviews, visits)
6	Error in design										Delay in sorting out design error
7	>>										Complexities of design
8	>>										Following the specified codes and standards
9	>>										Contribution in construction (reviews, visits)
10	Delay in sorting out design error										Complexities of design
11	>>										Following the specified codes and standards
12	>>										Contribution in construction (reviews, visits)
13	Complexities of design										Following the specified codes and standards
14	>>										Contribution in construction (reviews, visits)
15	Following the specified codes and standards										Contribution in construction (reviews, visits)

3. Comparison of Client related- factors according to their impact on the success of stakeholder management

		LEVEL OF IMPORTANCE									
		9	***7***	***5***	***3***	***1***	***3***	***5***	***7***	***9***	
1	Regular monitory by visits and reports										Client's knowledge about project
2	>>										In time decision made by client

3	>>										Client ability to brief
4	>>										Risk attitude/Willing to take the risks
5	>>										Clients emphasis on low cost construction
6	>>										Clients emphasis on high quality construction
7	>>										Client emphasis on quick construction
8	Client's knowledge about project										In time decision made by client
9	>>										Client ability to brief
10	>>										Risk attitude/Willing to take the risks
11	>>										Clients emphasis on low cost construction
12	>>										Clients emphasis on high quality construction
13	>>										Client emphasis on quick construction
14	In time decision made by client										Client ability to brief
15	>>										Risk attitude/Willing to take the risks
16	>>										Clients emphasis on low cost construction
17	>>										Clients emphasis on high quality construction
18	>>										Client emphasis on quick construction
19	Client ability to brief										Risk attitude/Willing to take the risks
20	>>										Clients emphasis on low cost construction
21	>>										Clients emphasis on high quality construction
22	>>										Client emphasis on quick construction
23	Risk attitude/Willing to take the risks										Clients emphasis on low cost construction
24	>>										Clients emphasis on high quality construction
25	>>										Client emphasis on quick construction
26	Clients emphasis on low cost construction										Clients emphasis on high quality construction

27	>>										Client emphasis on quick construction
28	Clients emphasis on high quality construction										Client emphasis on quick construction

4. Comparison of Contractor related- factors according to their impact on the success of stakeholder management

		LEVEL OF IMPORTANCE									
		9	***7***	***5***	***3***	***1***	***3***	***5***	***7***	***9***	
1	Experience of related projects of the contractor	9	7	5	3	1	3	5	7	9	Check and balance by timely inspections
2	>>										Site management
3	>>										The extent of subcontracting /links with small contractors
4	Check and balance by timely inspections										Site management
5	>>										The extent of subcontracting /links with small contractors
6	Site management										The extent of subcontracting /links with small contractors

5. Comparison of Project Manager- factors according to their impact on success of stakeholder management

		LEVEL OF IMPORTANCE									
		9	***7***	***5***	***3***	***1***	***3***	***5***	***7***	***9***	
1	Experience of similar projects of the pm										Technical Qualification
2	>>										Leadership abilities of the manager
3	>>										Ability to take timely decisions
4	>>										Ability to motivate the team
5	>>										Planning/proactive approach
6	>>										Risk identification and allocation
7	>>										Managing cost without compromising the quality
8	>>										Ability to deal with the subcontractors and suppliers

9	Technical Qualification										Leadership abilities of the manager
10	>>										Ability to take timely decisions
11	>>										Ability to motivate the team
12	>>										Planning/proactive approach
13	>>										Risk identification and allocation
14	>>										Managing cost without compromising the quality
15	>>										Ability to deal with the subcontractors and suppliers
16	Leadership abilities of the manager										Ability to take timely decisions
17	>>										Ability to motivate the team
18	>>										Planning/proactive approach
19	>>										Risk identification and allocation
20	>>										Managing cost without compromising the quality
21	>>										Ability to deal with the subcontractors and suppliers
22	Ability to take timely decisions										Ability to motivate the team
23	>>										Planning/proactive approach
24	>>										Risk identification and allocation
25	>>										Managing cost without compromising the quality
26	>>										Ability to deal with the subcontractors and suppliers
27	Ability to motivate the team										Planning/proactive approach
28	>>										Risk identification and allocation
29	>>										Managing cost without compromising the quality
30	>>										Ability to deal with the subcontractors and suppliers
31	Planning/proactive approach										Risk identification and allocation
32	>>										Managing cost without compromising the quality
33	>>										Ability to deal with the subcontractors and suppliers
34	Risk identification and										Managing cost without

	allocation										compromising the quality
35	>>										Ability to deal with the subcontractors and suppliers
36	Managing cost without compromising the quality										Ability to deal with the subcontractors and suppliers

6. Comparison of Supplier related- factors according to their impact on success of stakeholder management

		LEVEL OF IMPORTANCE									
		9	***7***	***5***	***3***	***1***	***3***	***5***	***7***	***9***	
1	Previous records of quality										In time delivery of the materials
2	>>										Material according to the specifications
3	>>										Rate of the materials
4	>>										Availability of stock
5	>>										Transportation charges/distance from the site
6	In time delivery of the materials										Material according to the specifications
7	>>										Rate of the materials
8	>>										Availability of stock
9	>>										Transportation charges/distance from the site
10	Material according to the specifications										Rate of the materials
11	>>										Availability of stock
12	>>										Transportation charges/distance from the site
13	Rate of the materials										Availability of stock
14	>>										Transportation charges/distance from the site
15	Availability of stock										Transportation charges/distance from the site

7. Comparison of Sub-contractor related- factors according to their impact on success of stakeholder management

		LEVEL OF IMPORTANCE									
		9	***7***	***5***	***3***	***1***	***3***	***5***	***7***	***9***	
1	Experience of related projects of the related sub- contractor										Competency of the subcontractor

2	>>										Response to alteration of design
3	>>										Timely completion of the project
4	Competency of the subcontractor										Response to alteration of design
5	>>										Timely completion of the project
6	Response to alteration of design										Timely completion of the project

********** *Thank you for your valuable contribution* **********

APPENDIX B: QUESTIONNAIRES OF ISM

Adama Science and Technology University

School of Civil Engineering and Architecture

Department of Construction Engineering and Management

Questionnaire survey for study paper on

Stakeholder Management in Mega Construction Projects: Unveiling Importance and Interrelationship of Critical Success Factors

This research survey is designed to fulfill an academic requirement for MSc program in Construction Engineering and Management at the Adama Science and Technology University. Those who involve in the mega construction projects in Addis Ababa city are kindly requested to contribute to this research work.

The result of this survey is intended to serve only for academic purpose and will be treated with strict confidentiality. The name of institutions participated will be recorded confidentially. Thank you in advance for your willingness to fill the questionnaires and returning them back on time. Your open response is highly appreciated.

With regards

Kassahun Terefe

+2519-13-64-95-00

Advisor: Fikreyesus D. (PhD)

General information

Name of the organization					
Respondents position in the organization.					
Level of education of the respondent					
Relevant working	1-5 years	6- 10 years	11-15 years	16-21 years	more than 20 years

Elements of Critical success factors (CSF's)
1. In time decision made by client
2. Risk attitude/Willing to take the risks
3. Risk identification and allocation
4. Ability to take timely decisions
5. Client's knowledge about project
6. Clients emphasis on low cost construction
7. Managing cost without compromising the quality
8. Experience of related projects of the contractor
9. Clients emphasis on high quality construction
10. Previous experience of similar projects similar projects of the design team
11. Delay in sorting out design error
12. Complexities of design
13. Experience of similar projects of the pm
14. Leadership abilities of the manager
15. Regular monitory by visits and reports
16. In time delivery of the materials
17. Client emphasis on quick construction
18. Timely completion of the project
19. Site management
20. Client ability to brief
21. Ability to deal with the subcontractors and suppliers

Objective of the study

The general objective of this study is to identify and find the interrelationship between this critical success factors (CSFs) that enhance Stakeholder management practices on mega construction projects.

Method

Identify the relationship between several success factors which are influcial to other factors which affect the success of stakeholder management in mega construction projects and calculate their influence on each other using interpretive structural modeling (ISM).

Instruction

The respondent is required to identify only the direct interrelationship between these factors based on which factor leads to the occurrence of the other factor. An Example is given below.

Based on that please fill the rest.

Example

CASE 1: If you think factor "A" leads to or influence "B" mark the relation column by "→"

CASE 2: If you think factor "B" leads to or influence "A" mark the relation column by "←"

CASE 3: If you think both factors lead to or influence one another mark the relation column by "↔"

CASE 4: If you think both factors do not lead to or influence one another mark the relation column by "×"

Case 1	**"A"**	→	**"B"**
Case 2	**"A"**	←	**"B"**
Case 3	**"A"**	↔	**"B"**
Case 4	**"A"**	×	**"B"**

No.	A	**Relation**	B
1	In time decision made by client		Risk attitude/Willing to take the risks
2	>>		Risk identification and allocation
3	>>		Ability to take timely decisions
4	>>		Client's knowledge about project
5	>>		Clients emphasis on low cost construction
6	>>		Managing cost without compromising the quality
7	>>		Experience of related projects of the contractor
8	>>		Clients emphasis on high quality construction

9	>>		Previous experience of similar projects similar projects of the design team
10	>>		Delay in sorting out design error
11	>>		Complexities of design
12	>>		Experience of similar projects of the pm
12	>>		Leadership abilities of the manager
14	>>		Regular monitory by visits and reports
15	>>		In time delivery of the materials
16	>>		Client emphasis on quick construction
17	>>		Timely completion of the project
18	>>		Site management
19	>>		Client ability to brief
20	>>		Ability to deal with the subcontractors and suppliers
1	Risk attitude/Willing to take the risks		Risk identification and allocation
2	>>		Ability to take timely decisions
3	>>		Client's knowledge about project
4	>>		Clients emphasis on low cost construction
5	>>		Managing cost without compromising the quality
6	>>		Experience of related projects of the contractor
7	>>		Clients emphasis on high quality construction
8	>>		Previous experience of similar projects similar projects of the design team
9	>>		Delay in sorting out design error
10	>>		Complexities of design
11	>>		Experience of similar projects of the pm

12	>>		Leadership abilities of the manager
13	>>		Regular monitory by visits and reports
14	>>		In time delivery of the materials
15	>>		Client emphasis on quick construction
16	>>		Timely completion of the project
17	>>		Site management
18	>>		Client ability to brief
19	>>		Ability to deal with the subcontractors and suppliers
1	Risk identification and allocation		Ability to take timely decisions
2	>>		Client's knowledge about project
3	>>		Clients emphasis on low cost construction
4	>>		Managing cost without compromising the quality
5	>>		Experience of related projects of the contractor
6	>>		Clients emphasis on high quality construction
7	>>		Previous experience of similar projects similar projects of the design team
8	>>		Delay in sorting out design error
9	>>		Complexities of design
10	>>		Experience of similar projects of the pm
11	>>		Leadership abilities of the manager
12	>>		Regular monitory by visits and reports
13	>>		In time delivery of the materials
14	>>		Client emphasis on quick construction
15	>>		Timely completion of the project

16	>>		Site management
17	>>		Client ability to brief
18	>>		Ability to deal with the subcontractors and suppliers
1	Ability to take timely decisions		Client's knowledge about project
2	>>		Clients emphasis on low cost construction
3	>>		Managing cost without compromising the quality
4	>>		Experience of related projects of the contractor
5	>>		Clients emphasis on high quality construction
6	>>		Previous experience of similar projects similar projects of the design team
7	>>		Delay in sorting out design error
8	>>		Complexities of design
9	>>		Experience of similar projects of the pm
10	>>		Leadership abilities of the manager
11	>>		Regular monitory by visits and reports
12	>>		In time delivery of the materials
13	>>		Client emphasis on quick construction
14	>>		Timely completion of the project
15	>>		Site management
16	>>		Client ability to brief
17	>>		Ability to deal with the subcontractors and suppliers
1	Client's knowledge about project		Clients emphasis on low cost construction
2	>>		Managing cost without compromising the quality

3	>>		Experience of related projects of the contractor
4	>>		Clients emphasis on high quality construction
5	>>		Previous experience of similar projects similar projects of the design team
6	>>		Delay in sorting out design error
7	>>		Complexities of design
8	>>		Experience of similar projects of the pm
9	>>		Leadership abilities of the manager
10	>>		Regular monitory by visits and reports
11	>>		In time delivery of the materials
12	>>		Client emphasis on quick construction
13	>>		Timely completion of the project
14	>>		Site management
15	>>		Client ability to brief
16	>>		Ability to deal with the subcontractors and suppliers
1	Clients emphasis on low cost construction		Managing cost without compromising the quality
2	>>		Experience of related projects of the contractor
3	>>		Clients emphasis on high quality construction
4	>>		Previous experience of similar projects similar projects of the design team
5	>>		Delay in sorting out design error
6	>>		Complexities of design
7	>>		Experience of similar projects of the pm
8	>>		Leadership abilities of the manager
9	>>		Regular monitory by visits and reports

10	>>		In time delivery of the materials
11	>>		Client emphasis on quick construction
12	>>		Timely completion of the project
13	>>		Site management
14	>>		Client ability to brief
15	>>		Ability to deal with the subcontractors and suppliers
1	Managing cost without compromising the quality		Experience of related projects of the contractor
2	>>		Clients emphasis on high quality construction
3	>>		Previous experience of similar projects similar projects of the design team
4	>>		Delay in sorting out design error
5	>>		Complexities of design
6	>>		Experience of similar projects of the pm
7	>>		Leadership abilities of the manager
8	>>		Regular monitory by visits and reports
9	>>		In time delivery of the materials
10	>>		Client emphasis on quick construction
11	>>		Timely completion of the project
12	>>		Site management
13	>>		Client ability to brief
14	>>		Ability to deal with the subcontractors and suppliers
1	Experience of related projects of the contractor		Clients emphasis on high quality construction
2	>>		Previous experience of similar projects similar

			projects of the design team
3	>>		Delay in sorting out design error
4	>>		Complexities of design
5	>>		Experience of similar projects of the pm
6	>>		Leadership abilities of the manager
7	>>		Regular monitory by visits and reports
8	>>		In time delivery of the materials
9	>>		Client emphasis on quick construction
10	>>		Timely completion of the project
11	>>		Site management
12	>>		Client ability to brief
13	>>		Ability to deal with the subcontractors and suppliers
1	Clients emphasis on high quality construction		Previous experience of similar projects similar projects of the design team
2	>>		Delay in sorting out design error
3	>>		Complexities of design
4	>>		Experience of similar projects of the pm
5	>>		Leadership abilities of the manager
6	>>		Regular monitory by visits and reports
7	>>		In time delivery of the materials
8	>>		Client emphasis on quick construction
9	>>		Timely completion of the project
10	>>		Site management

11	>>		Client ability to brief
12	>>		Ability to deal with the subcontractors and suppliers
1	Previous experience of similar projects similar projects of the design team		Delay in sorting out design error
2	>>		Complexities of design
3	>>		Experience of similar projects of the pm
4	>>		Leadership abilities of the manager
5	>>		Regular monitory by visits and reports
6	>>		In time delivery of the materials
7	>>		Client emphasis on quick construction
8	>>		Timely completion of the project
9	>>		Site management
10	>>		Client ability to brief
11	>>		Ability to deal with the subcontractors and suppliers
1	Delay in sorting out design error		Complexities of design
2	>>		Experience of similar projects of the pm
3	>>		Leadership abilities of the manager
4	>>		Regular monitory by visits and reports
5	>>		In time delivery of the materials
6	>>		Client emphasis on quick construction
7	>>		Timely completion of the project
8	>>		Site management
9	>>		Client ability to brief

10	>>		Ability to deal with the subcontractors and suppliers

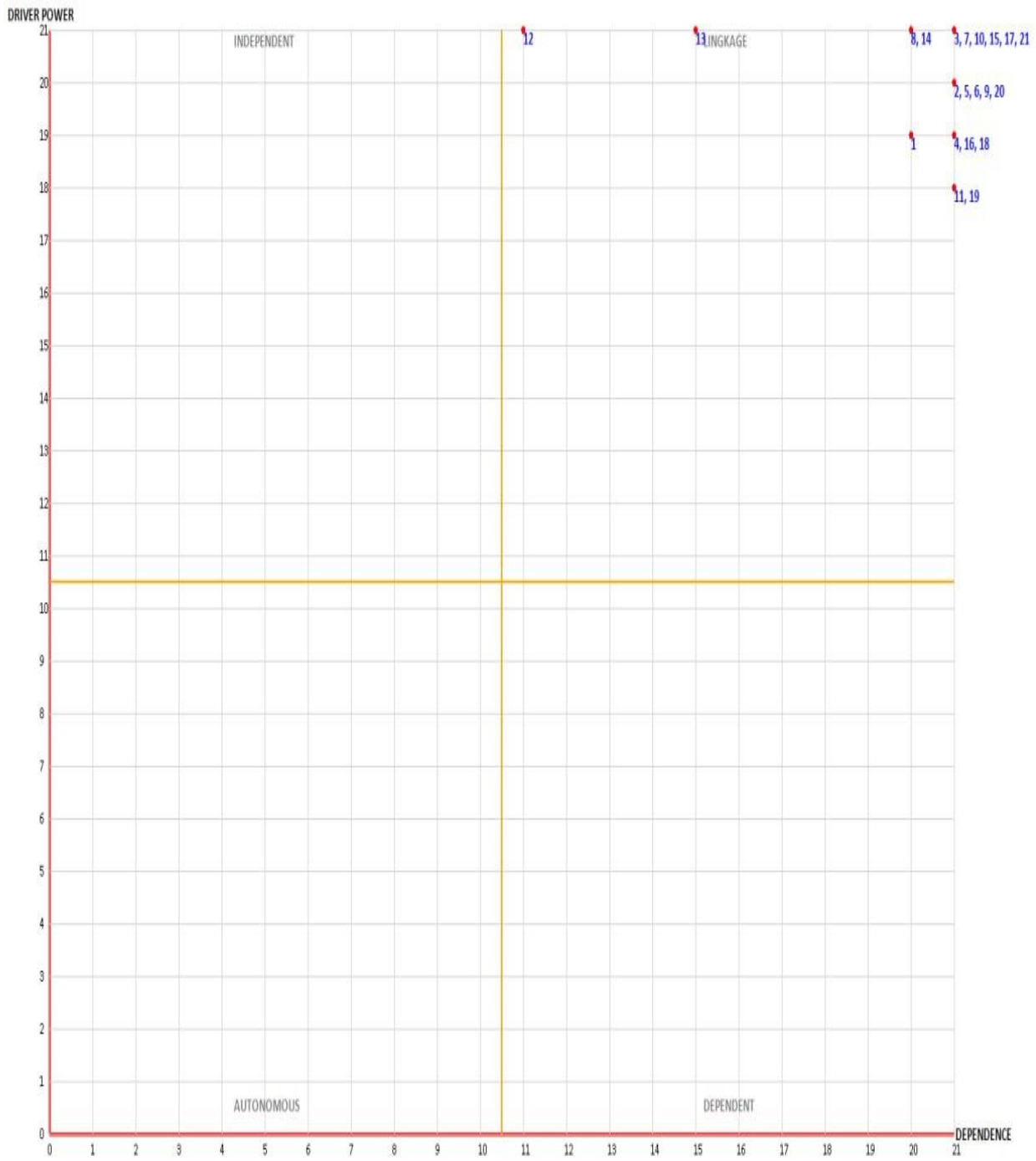
1	Complexities of design		Experience of similar projects of the pm
2	>>		Leadership abilities of the manager
3	>>		Regular monitory by visits and reports
4	>>		In time delivery of the materials
5	>>		Client emphasis on quick construction
6	>>		Timely completion of the project
7	>>		Site management
8	>>		Client ability to brief
9	>>		Ability to deal with the subcontractors and suppliers
1	Experience of similar projects of the pm		Leadership abilities of the manager
2	>>		Regular monitory by visits and reports
3	>>		In time delivery of the materials
4	>>		Client emphasis on quick construction
5	>>		Timely completion of the project
6	>>		Site management
7	>>		Client ability to brief
8	>>		Ability to deal with the subcontractors and suppliers
1	Leadership abilities of the manager		Regular monitory by visits and reports
2	>>		In time delivery of the materials
3	>>		Client emphasis on quick construction

4	>>		Timely completion of the project
5	>>		Site management
6	>>		Client ability to brief
7	>>		Ability to deal with the subcontractors and suppliers
1	Regular monitory by visits and reports		In time delivery of the materials
2	>>		Client emphasis on quick construction
3	>>		Timely completion of the project
4	>>		Site management
5	>>		Client ability to brief
6	>>		Ability to deal with the subcontractors and suppliers
1	In time delivery of the materials		Client emphasis on quick construction
2	>>		Timely completion of the project
3	>>		Site management
4	>>		Client ability to brief
5	>>		Ability to deal with the subcontractors and suppliers
1	Client emphasis on quick construction		Timely completion of the project
2	>>		Site management
3	>>		Client ability to brief
4	>>		Ability to deal with the subcontractors and suppliers
1	Timely completion of the project		Site management
2	>>		Client ability to brief
3	>>		Ability to deal with the subcontractors and suppliers
1	Site management		Client ability to brief

2	>>		Ability to deal with the subcontractors and suppliers
1	Client ability to brief		Ability to deal with the subcontractors and suppliers

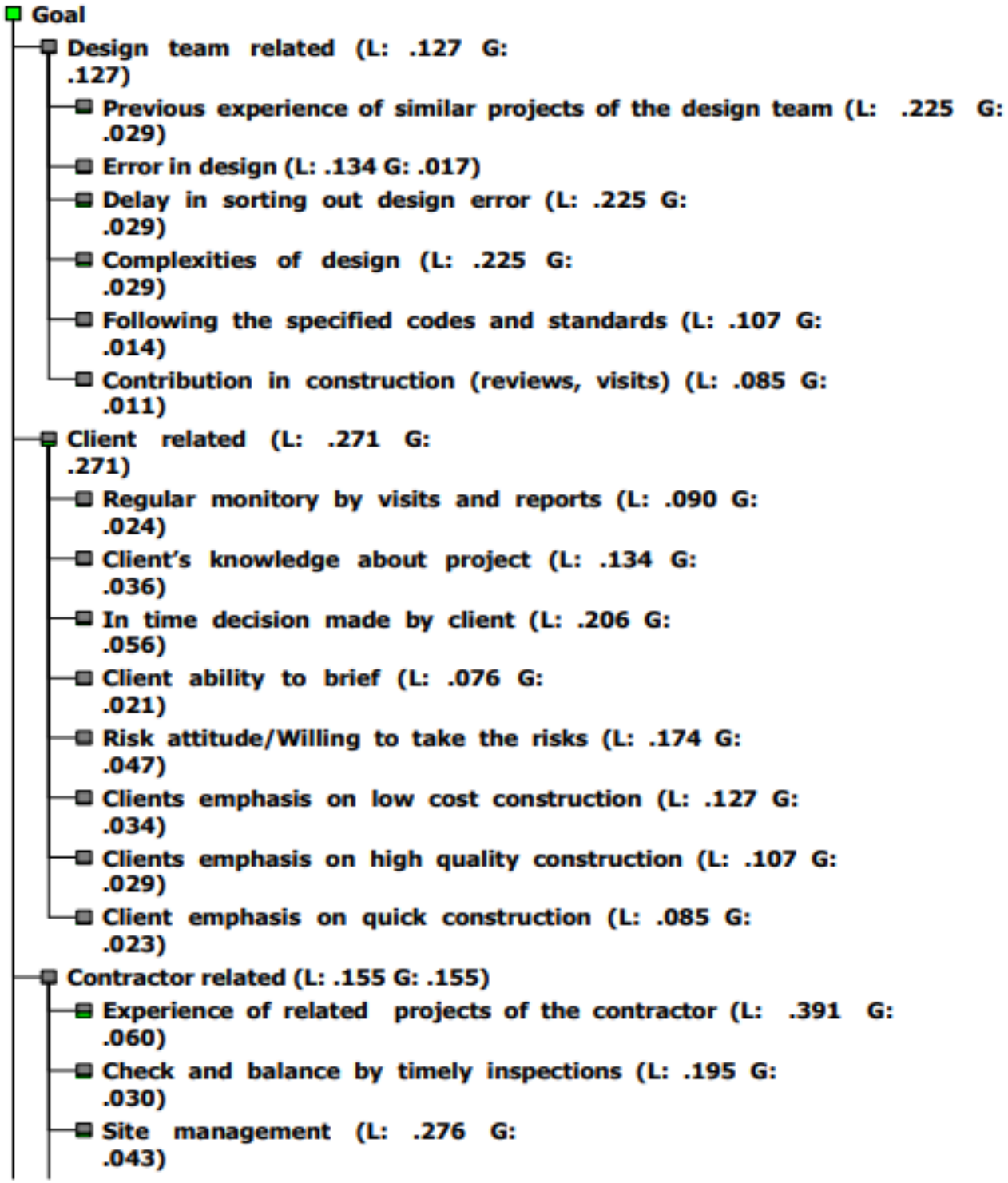
********** *Thank you for your valuable contribution* **********

APPENDIX C: SOFTWARE OUTPUT



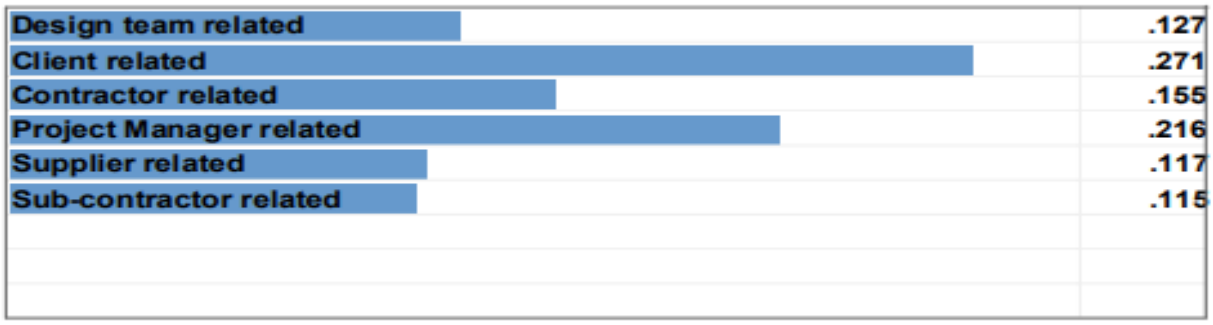
Model Name: kasa 2

Treeview



- The extent of subcontracting /links with small contractors (L: .138 G: .021)
- Project Manager related (L: .216 G: .216)
  - Experience of similar projects of the pm (L: .107 G: .023)
  - Technical Qualification (L: .067 G: .014)
  - Leadership abilities of the manager (L: .103 G: .022)
  - Ability to take timely decisions (L: .160 G: .034)
  - Ability to motivate the team (L: .080 G: .017)
  - Planning/proactive approach (L: .078 G: .017)
  - Risk identification and allocation (L: .186 G: .040)
  - Managing cost without compromising the quality (L: .138 G: .030)
  - Ability to deal with the subcontractors and suppliers (L: .082 G: .018)
- Supplier related (L: .117 G: .117)
  - Previous records of quality (L: .147 G: .017)
  - In time delivery of the materials (L: .266 G: .031)
  - Material according to the specifications (L: .141 G: .017)
  - Rate of the materials (L: .120 G: .014)
  - Availability of stock (L: .113 G: .013)
  - Transportation charges/distance from the site (L: .213 G: .025)
- Sub-contractor related (L: .115 G: .115)
  - Experience of related projects of the sub contractor (L: .195 G: .022)
  - Competency of the subcontractor (L: .138 G: .016)
  - Response to alteration of design (L: .276 G: .032)
  - Timely completion of the project (L: .391 G: .045)

Alternatives



Model Name: kasa 2

Synthesis: Summary

In time decision made by client	.065
Risk attitude/Willing to take the risks	.055
Risk identification and allocation	.052
Ability to take timely decisions	.045
Client's knowledge about project	.042
Clients emphasis on low cost construction	.040
Managing cost without compromising the quality	.038
Experience of related projects of the contractor	.037
Clients emphasis on high quality construction	.034
Previous experience of similar projects of the design team	.030
Delay in sorting out design error	.030
Complexities of design	.030
Experience of similar projects of the pm	.030
Leadership abilities of the manager	.029
Regular monitory by visits and reports	.028
In time delivery of the materials	.028
Client emphasis on quick construction	.027
Timely completion of the project	.027
Site management	.026
Client ability to brief	.024
Ability to deal with the subcontractors and suppliers	.023
Ability to motivate the team	.022
Planning/proactive approach	.022
Transportation charges/distance from the site	.022
Check and balance by timely inspections	.019
Technical Qualification	.019
Response to alteration of design	.019
Error in design	.018
Previous records of quality	.015
Material according to the specifications	.015
Following the specified codes and standards	.014
Experience of related projects of the sub contractor	.014
The extent of subcontracting /links with small contractors	.013
Rate of the materials	.013
Contribution in construction (reviews, visits)	.012
Availability of stock	.012
Competency of the subcontractor	.010

Rank summary of AHP

APPENDIX D- SAMPLE PROJECT OF MEGA CONSTRUCTION PROJECTS IN ADDIA ABABA

Population of the study

Population (List of Mega Construction Projects)	Status	Contract Amount
Entoto Park	100%	8.4 Billion USD
Addis Africa International Convention & Exhibition Center(AAICEC)	100%	50 Billion USD
Abrehot Grand public library	100%	1.1 Billion Birr
Push Kin- Gotera Road Project	100%	1.5 Billion Birr
Commercial Bank of Ethiopia Head Quarters	100%	303.5 Million USD
Adwa memorial Museum/ADWA Zero Km Mega Project	100%	90.56 Million USD
Unity Park	100%	170 Million USD
Renovation: Prime Minister's Office and Grand Menelik Palace	100%	120 Million USD
Renovation of Addis Ababa City Hall	100%	2.2 Billion Birr
Meskel square renovation work	100%	2.6 Billion Birr
Science & Technology Museum	100%	2.7 Billion Birr
Defense Force Head Quarters	100%	1 Billion USD
Africa CDC head quarters	100%	100 Million USD
Friend ship park phase I	100%	50 Million USD
Construction of prime Minister new palace (Chaka project)	>75%	10 Billion USD
Corrider sides Phase I	>75%	99Billion Birr
Sheger river side project phase I or Beautifying Sheger	<75%	900 Million USD
La Gare Real estate project	>>	1.9 Million USD
Ethiopia digital foundations project	>>	200 Million USD
Friend ship park phase II	>>	50 Million USD
Friend ship phase I Sheger river side project	>>	29 Million USD
AA Bole international Airport (The Largest International Airport in Africa)	>>	5 Billion USD
Mesob Tower project	>>	681 Million USD
Bank of Abyssina	>>	2 Billion Birr
Addis Ababa Largest Private Housing Project	>>	8 Billion USD
Sheger river side project phase II	>>	7 Billion USD
Mass Transportation System Improvement Program	>>	2 Billion Birr
Addis Ababa Largest Private Housing Project	>>	8 Billion USD
Safaricom Data Center Close To Addis Ababa	>>	130 Million USD
Total No. of Mega Construction projects in Addis Ababa = 29		

Purposive sampling of Mega Construction buildings

Population (List of Mega Construction Projects)	**Status**	**Contract Amount**
Entoto Park	100%	8.4 Billion USD
Addis Africa International Convention & Exhibition Center(AAICEC)	100%	50 Billion USD
Abrehot Grand public library	100%	1.1 Billion Birr
Push Kin- Gotera Road Project	100%	1.5 Billion Birr
Commercial Bank of Ethiopia Head Quarters	100%	303.5 Million USD
Adwa memorial Museum/ADWA Zero Km Mega Project	100%	90.56 Million USD
Unity Park	100%	170 Million USD
Renovation: Prime Minister's Office and Grand Menelik Palace	100%	120 Million USD
Renovation of Addis Ababa City Hall	100%	2.2 Billion Birr
Meskel square renovation work	100%	2.6 Billion Birr
Science & Technology Museum	100%	2.7 Billion Birr
Defense Force Head Quarters	100%	1 Billion USD
Africa CDC head quarters	100%	100 Million USD
Friend ship park phase I	100%	50 Million USD
Construction of prime Minister new palace (Chaka project)	>75%	10 Billion USD
Corrider sides Phase I	>75%	99Billion Birr

APPENDIX E: LIST OF PICTURES

Picture 1: Adowa Center

Picture 2: Addis-Africa International Convention and Exhibition Canter (AAICEC)

Picture 3: Mesob Tower Project

Picture 4: La Gare Real estate Project

Picture 5: Bole International Airport

Picture 6: Africa CDC head quarters