SCHOOL OF GRADUATE STUDIES

DEPARTMENT OF CONSTRUCTION TECHNOLOGY AND MANAGEMENT

ASSESSMENT OF FACTORS AFFECTING THE CONSTRUCTION SUCCESS OF TOWNS' WATER SUPPLY AND SANITATION PROJECTS IN SOUTHERN ETHIOPIA

BY: MENGIST BIREGA

A Thesis Submitted to School of Graduate Studies, Construction Technology and Management, In Partial Fulfillment of the Requirements for the Degree of Master of Science in Construction Technology and Management

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Addis Ababa, Ethiopia

School of Graduate studies

Department of Construction Technology and Management

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Declaration

I, the undersigned, declare that the study entitled "Assessment of Factors Affecting the Construction Success of Towns' Water Supply and Sanitation Projects in Southern Ethiopia" is the result of my own effort and study that all sources of materials used for the study acknowledged. I have conducted the study independently with the guidance and comments of the research advisor. This study not been submitted for any degree in any other university. It is all sources of material used for thesis has been fully acknowledged and conducted for the partial fulfilment of the Degree of Master of Science in Construction Technology and Management.

NAME – MENGIST BIREGA Date of submission- August, 2023

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Statement of Certification

This is to certify that MENGIST BIREGA WAJE has carried out his project work entitled "Assessment of Factors Affecting the Construction Success of Towns' Water Supply and Sanitation Projects in Southern Ethiopia". This work is original in nature and is suitable for submission for the award of Master of Science in Construction Technology and Management.

AMLAKU MELESE	_____	_____
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Mengist Birega

ABSTRACT

Access to clean drinking water and sanitation in Ethiopia, particularly in southern part, is critically low, making it one of the leading causes of death in the region. Despite significant investments in water supply and sanitation infrastructure in southern Ethiopia, many towns water supply and sanitation projects have experienced delays, cost overruns, and quality problems, leading to incomplete or inadequate service delivery. In light of this, the objective of this study is to identify the major ***construction project success factors*** *that affect the success of Water Supply and Sanitation (WSS) projects in southern Ethiopian towns. To do this, both quantitative and qualitative research methods were applied, with data gathered via purposive sampling and analyzed using SPSS software. According to the data obtained, the researcher identified fifteen very important factors recognized based on respondents' insight of primary data. Further analysis from a case study revealed another set of top ten challenges. Upon triangulating the above results from respondents' insight and case study, five key factors were highlighted: fluctuation in construction material prices, delays in importing materials, a shortage of construction materials in the market, overall economic inflation, and budget constraints. Additionally, the study noted the construction* ***project management success*** *and the least effective five management practices among twenty observed in the study areas were highlighted. The study's most significant contribution was the proposal of a* ***strategic framework solutions*** *for the success of future Towns' Water Supply and Sanitary Projects. This framework is designed to effectively counter the identified challenges and streamline the implementation process of WSS projects. The ultimate objective of these efforts is to significantly improve the execution of WSS projects. By doing so, it aims to enhance the availability and access to safe drinking water and sanitation services in southern Ethiopia.*

Keywords: **Construction Project Success Factors, Project Management Success, Strategic Framework Solutions**

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LIST OF ABBREVIATION AND ACRONYMS

CWA	Clean Water Act
DFID	Development French International Development
GTP II	Growth and Transport Plan II
MOWIE	Ministry of Water, Irrigation & Energy
OWNP	One Wash National Program
SNNPR	Southern Nations & Nationality Peoples Republic
UN	United Nations
UNICEF	United Nations International Children's Education Fund
UNEP	United Nation Environmental Programme
WASH	Water Supply, Sanitation and Hygiene
WHO	World Health Organization
WSSP	Water Supply & Sanitation Project
WSS	Water Supply and Sanitation
ANOVA	Analysis of Variance
LC	Letter of Credit
TQM	Total Quality Management
ISO	International Organization for Standardization

CHAPTER ONE

INTRODUCTION

The chapter contains background of the study, statement of the problem, significance of the study, objectives of the study and research questions related to construction success of the towns' water supply and sanitation projects in Southern Ethiopia.

1.1 Background of the Study

Water is one of the most crucial and non-renewable environmental resources. It is one of the essential necessities of life next to oxygen. However, many people across the world do not have access to safe and adequate water supply services which affects their life in various ways (Yibeltal, 2011). According to WHO-UNICEF (2014), providing potable water shortage is a serious challenge of the twenty-first century world considering that more than 2.5 billion people live without access to improved sanitation and about 0.9 billion survive without access to improved water supply.

Taking into account the UN-Water Global Analysis and Assessment of Sanitation and Drinking Water (GLAAS, 2014) led by WHO on behalf of UN-Water, drew data from 94 countries and 23 external support agencies in the years 1990 and 2012. In this data, it was stated that 2.3 billion people around the world gained access to an improved drinking-water source but, the number of children who died from diarrheal diseases in this same period is strongly associated with poor water, sanitation, and hygiene which fell approximately 1.5 million.

Despite many years of development efforts, access to clean potable water supplies and sanitation services in the world continues to be extremely marginal. Over 1.2 billion people worldwide; the majority live in developing nations, particularly in sub-Saharan Africa, 300 million of which 80% live in rural areas and still do not have access to clean water facilities (Prokopy, 2015).

The African continent faces the most difficult challenge for achieving the water and sanitation MDG targets. Recent projections show that Sub-Saharan Africa would only reach the MDG targets for water services by 2040, and those for sanitation by 2076 (United Nations Development Programme (UNDP, 2006) if the current pace of expansion is not increased.

With respect to Ethiopia, as per the research report of Seifu, et Al. (2012) the access to safe drinking water supplies and sanitation services in Ethiopia are among the lowest in Sub-Saharan Africa. Safe potable water access for the urban areas was 68 percent, while the access to potable water in rural Ethiopia is about 55 percent (within 1.5 km) in the year 2010. Considering the systems in the region as they are frequently broken and not functioning with poor arrangements for maintenance and repair, access to sanitation facilities is reported to be 56%. Despite this high figure for sanitation in the country, latrines are virtually non-existent in rural communities with defecation taking place in fields, bushes or along drainage ditches. Hand washing practice is reported as 7% and open defecation is about 15%. Water and sanitation-related diarrheal disease is among the top three causes of all deaths in Ethiopia, and southern Ethiopia is one of the regions that have faced this life-threatening challenge for many years.

Increasing the number of people with access to safe water supply, sanitation and hygiene has proven to be a tremendous challenge throughout the developing world. Despite huge investments over the years in the water and sanitation sector in the country, millions of rural poor communities still remain without adequate water supply and lack improved sanitation services. Although numerous schemes have been planned and implemented in Ethiopia, only a proportion of these schemes continue to provide water to the communities that they were intended to serve. The failure in service may have been caused by a multitude of reasons including poor technology selection, insufficient maintenance, malfunctioning equipment, inadequate planning or participation, and many others. By recognizing the combination of factors that have led to the success or failure of a water scheme, more meaningful and enhanced strategies can be arranged and employed for the preparation and implementation of more successful schemes. Therefore, the chief factors of each water supply and sanitation project should be fully documented by implementers, other partners, and the communities being served by them in order to better explore a scheme's likelihood of remaining functional and challenges to its sustainability (Seifu, Amy & Manayahshal 2012).

Therefore, this research meticulously evaluated the elements that have an impact on the successful implementation of water supply and sanitation projects in towns across Southern Ethiopia.

1.2 Statement of the Problem

Ethiopia being one of the countries with plenty of water resources is still with one of the lowest safe drinking water and improved sanitation.

Unsuccessful completion of projects is a common problem in the construction industry not only with an immeasurable cost to society but also with debilitating effects on the contracting parties. Failure to achieve targeted time, budgeted cost and specified quality results in various unexpected negative effects on the projects. Most projects face problems with completion (Edwin, 2016).

In the Southern part of Ethiopia, attempts have been made towards increasing water coverage through the construction of new water supply systems through the regional development framework of the Basket Fund program, and the One WASH national program. However, the water coverage did not increase as planned due to various factors that affect the construction performance.

As reported in the ministry of water, irrigation and energy of one wash national program of Ethiopia (MWIE,2017),the major factors that affect the construction success are: (i) high cost escalation of proposed urban WASH activities due to increase in service level standards introduced in the GTP II; (ii) reduction of available budget due to diversion of US$26 million equivalent of OWNP-CWA resources (from DFID and UNICEF in 2016) to address emergency humanitarian efforts; (iii) the complexity of urban water schemes that require large quantities of imported goods such as electromechanical equipment, steel casings, pipes and fittings and timely availability of hard currency to procure imported goods; and (iv) volatile security situation that hindered access to some project sites and discouraged contractors from mobilizing machinery to finalize activities.

Despite significant investments in water supply and sanitation infrastructure in southern Ethiopia, many towns water supply and sanitation projects have experienced delays, cost overruns, and quality problems, leading to incomplete or inadequate service delivery. This research aims to assess the factors that affect the success of town water supply and sanitation projects in southern Ethiopia and to formulate a strategic framework solution to improve the construction success of future town water supply projects in the country.

1.3 Objectives of the Study

1.3.1 General Objective of the Study

The general objective of this research is to assess the factors that affect the construction success of towns' Water Supply and Sanitation projects in Southern Ethiopia.

1.3.2 Specific Objectives of the Study

- To assess the recent overall construction success of town WSS projects in Southern Ethiopia.
- To identify the challenges faced in the construction of towns' WSS projects in Southern Ethiopia.
- To investigate the effectiveness of project management practices in ensuring the construction success of town WSS projects in Southern Ethiopia
- To formulate a strategic framework solution to improve the construction success of future towns' WSS projects in Southern Ethiopia.

1.4 Research Questions

1. Where are the recent overall construction success of towns' WSS projects in Southern Ethiopia?
2. What are the challenges faced in the construction of towns' WSS projects in Southern Ethiopia?
3. How effective are the project management practices in ensuring the success of towns' WSS projects in Southern Ethiopia?
4. What are the best strategic framework solution to improve the construction success of future towns' WSS projects in Southern Ethiopia?

1.5 Significance of the Study

Water supply and sanitation construction projects are vulnerable to cost overrun, delay in completion as scheduled, inferior quality products, and disputes caused by unmet responsibilities by either party. All these and other unstated conditions are aggravated by poor time management and improper planning among other causes. So, this research contributes to filling the gap in the water supply and sanitation project construction success, and based on the output of this study, the researcher provides a practical mitigation strategy in controlling the factors affecting the construction success of water supply and sanitation projects.

This study is believed to be important to the government in the formulation of construction industry policies and water supply and sanitation policy in the process of these policies are implemented. An informed policy provides useful guidelines to the industry which minimize project failures, reduce risks, and severally enable order in the construction industry.

Consequently, the results found in this research can help with minor adjustments as per the context of all other regions across the country. It complements the overall management elements of town water supply systems. The results of the research and its strategic framework solution and given recommendations can serve as a reference for policymakers and humanitarian organizations operating in water supply system services provision to Ethiopia in the general and southern part of the country in particular. Finally, the researcher believes that this study can contribute a lot for other researchers for further studies in the area where there is problem of access to clean drinking water and sanitation across the country.

1.6 Scope of the Study

1.6.1 Thematic scope

This study focuses on identifying and examining the factors that challenges the successful construction of towns' water supply and sanitation projects. The themes explored within this study include the roles and responsibilities of the major clients, the issues arising in projects initiated in the last five years, and the perceptions of the project participants towards the factors affecting successful construction. The research also delve into strategies for overcoming obstacles and enhancing the success rates of such projects. This thematic analysis is crucial for understanding

the broader impacts and implications of the water supply project's success on the communities involved.

1.6.2 Spatial scope

The physical or geographical sphere for this study is the Southern part of Ethiopia, primarily focusing on the towns where water supply and sanitation projects are currently underway. The specific regions include those under the jurisdiction of the SNNPRS Water, Irrigation and Mine Development Bureau, Sidama Regional State Water, Mine and Energy Development Bureau, and Southwest Ethiopian People's Regional State Water, Mine, and Energy Development Bureau. As a result, the research encompasses various geographical contexts and a multitude of project environments found across these regions. While the study is concentrated in this area, its findings may also provide valuable insights applicable to similar projects in other regions.

1.7 Limitation of the Study

This study was faced time shortage as only few months are allocated to come up with reasonably important research result and limitations in relation with up-to date theoretical literature resources.

This study is conducted with an objective of assessing the factors that affect the construction success of towns' water supply and sanitation projects in southern part of Ethiopia. Despite the number of water supply and sanitation projects in the research area, this research focusses only towns' water supply and sanitation in southern Ethiopia. Although different water supply and sanitation projects in the research area were constructed, this study focuses only on projects that are currently under construction to easily access the targeted respondents.

The other limitation is that, due to time and budget constraints, the case study focusses on a certain selected town water supply and sanitation projects in the region.

1.8 Organization of the document

The thesis is structured and organized in five chapters. The first chapter describes the basic research background as an introduction part of the research. The second chapter contains the basic literature review. This part of the thesis discusses the conceptual, theoretical and empirical reviews. It also reviews the existing literature on factors that affect the success of water supply and

sanitation projects in developed and developing countries, including Ethiopia. This chapter also identifies and describes the specific factors that have been found to contribute to project success or failure and finally developed the conceptual framework of the study. The third part covers the Research design and methodology. Analyses of findings, interpretations, and discussion on the basis of results are presented in detail in the fourth part of the study. The last part of the study contains the conclusions and recommendations forwarded. The following diagram shows the flow of chapters that are compiled in the study

Chapter I: Introduction; this part contains discussions on background, statement of the problem, general and specific objectives and research questions, scope of the study and significance of the.

Chapter II: Literature Review; This part of the thesis discusses the conceptual, theoretical and empirical reviews. It also reviews the existing literature on factors that affect the success of water supply and sanitation projects in developed and developing countries, including Ethiopia. This chapter also Identifies and describes the specific factors that have been found to contribute to project success or failure. In addition, this chapter analyzes the similarities and differences between the factors identified in the literature and those that may be relevant to the research topic in southern Ethiopia.

Chapter III: Research Methodology; It covers the research methodology as a single chapter. The methodological approach consists of the overall research design and approach, the research areas, research techniques, tools, and the method of data analysis and measurement.

Chapter IV: Result and discussion; this part of the study also contains results, interpretation and discussion of the assessment factors that affect the construction success of town water supply projects in Southern Ethiopia.

Chapter V: Conclusions and Recommendations; at the end based on the data collected and analyzed first conclusions and strategic framework solution for the most important factors then recommendations are forwarded.

CHAPTER TWO

LITERATURE REVIEW

This chapter reviews published data and research findings relevant to the topic under the subheadings of Three-dimensional frameworks of conceptual, theoretical, and empirical perspectives. It described how various researchers approached the problem and different tools and techniques used to identify and analyze the factors that affect the success in the construction project of various countries.

2.1. Conceptual and Operational Definition

2.1.1 Definition of Project

There are many written definitions of a project. Merriam-Webster for instance defines project as a planned undertaking: such as a definitely formulated piece of research, a large usually government-supported undertaking, or a task of problem engaged in usually by a group of student to supplement and apply classroom studies.

As per the Project Management Institute (PMI), the term project alludes to a transitory undertaking embraced to make a novel item, administration, or result (PMI, 2017). The impermanent idea of project shows a clear start and end. The end is arrived at when the project's destinations have been accomplished or when the venture is ended in light of the fact that its targets can't be met, or when the requirement for the project no longer exists. Another definition, a project can be viewed as any series of activities and assignments that: have a particular goal to be finished inside specific details, have characterized start and end dates, have financing limits (if pertinent), burn-through human and nonhuman assets (i.e., cash, individuals, gear) and are multi-functional (for example cut across a few useful lines).

As clarified before, hardly any definitions were chosen since they are genuinely illustrative of most ordinarily acknowledged meanings of the term 'project.' More authoritative explicit definitions can likewise be found. While inspecting different definitions, a few shared traits start to arise; three qualities that are regularly acknowledged as the characterizing highlights of projects:

- **Temporary**
- **Unique**
- **Creating Output**

Temporary – The temporary idea of a project shows that a task has a positive start and a clear end. The start is set apart by the beginning of the project and the end is arrived at when the project's goals have been accomplished or when the task is ended for some other explanation. 'Temporary' is likewise one of the attributes recognizing a project from ordinary activities. Temporary doesn't really imply that the length of a project is short. It just alludes to the commitment of a project, and not to the item, administration, or coming about the deliverable. The temporary aspect of the project can be conceptualized in consideration of the construction project. The construction of the building requires a certain time. However, after the construction project is completed, the building will remain in place for a longer period of time.

Unique – Every project is unique. This is another aspect that distinguishes the project from normal operations. There may be duplicate elements in project deliverables and activities, but these elements or their combinations are always different. Similarly, water supply and sanitary construction projects can be used as conceptual examples. A specific structure can be designed by the person who designs other infrastructure construction projects, or it can be built by the person who constructs other similar projects and made of the same materials as other similar projects. However, a single architectural project combines these elements in a unique way. Combine specific buildings with specific designs using selected materials to create unique architectural projects.

Creating Output – Each project creates a certain type of product, service, or end result. These products are called deliverables and are the reason for the existence and occurrence of the project.

A project is defined as a temporary endeavor that is undertaken to create a unique product or service Project Management Institute (2017). A project is also defined as a complex, non-routine, one-time effort limited by time, budget and resource, and performance specifications designed to meet customer needs.

Many organizations use projects to respond to requests that cannot be handled within the normal organizational limits. The size and length of a project can vary from one person to thousands and from a few weeks to more than five years (PMI, 2017).

A project ends when the objective has been reached, when it becomes clear that the objective cannot be met, or when the need for the project no longer exists. The fact that a project is temporary does not mean that the result of the project also be temporary. Most projects are undertaken to create long-lasting results (PMI, 2017).

2.1.2 Definition of Construction Project

Construction is an act or a process of construction. It consists of a series of actions to produce either a new set of buildings and infrastructure or may involve alterations in the existing buildings and infrastructure. A construction project is a part of construction work that is being attempted or undertaken. A project involves a series of complex or interrelated activities and tasks that consume resources to achieve some specific objectives. It has to be completed within a set of specifications under a limited budget and fixed time (Tilahun, 2020).

2.1.3 Water Supply Project

The planning and design of the water supply project aims to provide safe drinking water and good sanitary conditions, so it is essential to protect the health of the community by limiting the spread of infectious diseases and helping to maintain a hygienic home environment. At the same time, they free people (mainly women and children) from the monotony of carrying water and give them more time to devote to other activities, thus greatly promoting human dignity and economic opportunities.

2.1.4 Components of Water Supply Project

There are four components of water supply project or water supply scheme.

• **Collection work**: Collection works collect water from sources. There are two main sources of water: surface water and groundwater. Dams and barrages are built to collect surface water, but Tube Well is used to collect groundwater.

• **Treatment work**: Treatment treats water obtained from the source. Most of the surface water needs treatment, since it is contaminated by suspended particles. Underground water may not

require treatment. One of the problems with groundwater is a high salt concentration. Treating this one is more expensive. In such cases, surface water is used if the groundwater contains a high salt concentration. The subway water can also include elements such as iron, magnesium. If the water collected is contaminated with a pathogen, it should be treated to kill the bacteria. Therefore, treatment work may not be part of a water supply project.

• **Transmission work**: If you are away from the water source, there need an energy transmission operation to transport the treatment plants and then transport the treated water from the treatment plant. In some cases, the transmission work can be eliminated.

• **Distribution work**: In distribution work, processing water is supplied to consumers when using air tank. The following two requirements must be met while distributed to the community: the first requirement is the amount of water should be sufficient depending on demand. Whereas the second requirement is the pressure should be sufficient.

2.1.5 Impacts of Water Inaccessibility

Although water is a primary need of human being, unimproved water service has many negative impacts on people livelihood. Among which; health, socio-economic, environmental degradation and poor educational performance are the major.

Health Impacts

The improvement of water and sanitation in developing countries is largely driven by the need to reduce the incidence and prevalence of infectious disease caused by pathogenic microorganisms. The majority of pathogens that affect humans are derived from feces and transmitted by the fecal-oral route. Pathogen transmission may occur through a variety of routes including food, water, poor personal hygiene and flies (Chala, 2011). According to USAID/E Statement of Work (SOW) for the Millennium Water Alliance (MWA) Water, Sanitation & Hygiene (WASH) program evaluation, "approximately 3.1% of deaths worldwide are attributed to unsafe water, sanitation and hygiene practices. Africa carries the heaviest burden, with 4 to 8% of all disease in Africa being related to poor water, sanitation and hygiene. In Ethiopia, water and sanitation related diarrhea accounts for approximately 20% of all deaths in children under the age of five, taking the lives of close to 100,000 children annually. Thirty two percent of this diarrhea could be prevented by improving sanitation interventions such as pit latrines, septic tanks and composting toilets."

According to FDRE (2005) Demographic and Health survey, only 8% of Ethiopian households have water on their premises and only 38% have a toilet. In addition, poor water and sanitation is the source for many other health problems including chronic intestinal parasites that attribute to high prevalence of malnutrition, anemia, diarrhea, cholera, malaria, trachoma, intestinal helminthes retarded growth.

Socio-Economic Impacts

Poor access to water supply and sanitation limits opportunities to escape poverty and exacerbates the problems of vulnerable and marginalized groups especially those affected by HIV/AIDS and other diseases (Chala, 2011). According to Ethiopian Ministry of Health (2005), the well-known negative synergy of diarrheal disease, malnutrition and opportunistic infections are known to have short-term health impacts and long-term debilitating effects. In the long term, child development is impaired resulting in growth retardation and diminished learning abilities. It is estimated that 4 in 10 children cannot realize their educational potential which ultimately inhibits socio-economic development. In addition, there is a potential productive time lost to illness caring for the sick and attending clinics. There are also the financial costs of treatment for medicines and clinic attendance.

Environmental Degradation Impacts

Besides being pollutants of surface waters (necessitating higher treatment costs), faces and urine are a potential (under-exploited) source of compost and fertilizer which could help address decreasing soil fertility and reduce the high cost (both financial and environmental) of chemical fertilizers. They can also be used to produce biogas (a renewable energy source) which as well as safely containing excreta could contribute to reducing deforestation which is a key environmental issue. Biogas digesters can also be ‘fed’ with organic solid waste in urban areas as an efficient treatment and use of ‘waste’ (MoH, 2005).

Poor Educational Performance

According to the Federal Democratic Republic of Ethiopia National Hygiene and Sanitation Strategy of MoH, (2005), Ministry of Health 2005 as well as the diminished learning abilities mentioned above, it is widely believed that a significant number of school days are lost due to diarrhea. This mainly affects girls who end up staying at home to care for siblings. Worm infestations, anemia and vitamin A loss have been shown to decrease learning abilities. Lack of

separate, private, secure, hygienic latrines, particularly in adolescence (during menstruation) is associated with a high dropout rate of girls.

2.2 Theoretical Review

2.2.1 Definition of Project Management

Project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements. Project management is accomplished through the appropriate application and integration of the project management processes identified for the project. Project management enables organizations to execute projects effectively and efficiently. Effective project management helps individuals, groups, and public and private organizations to: Meet business objectives; Satisfy stakeholder expectations; Be more predictable; Increase chances of success; Deliver the right products at the right time; Resolve problems and issues; Respond to risks in a timely manner; Optimize the use of organizational resources; Identify, recover, or terminate failing projects; Manage constraints (e.g., scope, quality, schedule, costs, resources); Balance the influence of constraints on the project (e.g., an increased scope may increase cost or schedule); and Manage change in a better manner. Poorly managed projects or the absence of project management may result in Missed deadlines, Cost overruns, Poor quality, Rework, Uncontrolled expansion of the project, Loss of reputation for the organization, unsatisfied stakeholders, and Failure in achieving the objectives for which the project was undertaken. Effective and efficient project management should be considered a strategic competency within organizations. It enables organizations to: Tie project results to business goals, compete more effectively in their markets, Sustain the organization, and Respond to the impact of business environment changes on projects by appropriately adjusting project management plans (PMI, 2017).

Walker defined construction project management as the planning, coordination, and control of a project from inception to completion on behalf of a client requiring the identification of the clients objective in terms of utilities, function quality, time and cost and the establishment of relationships between resources, integrating, monitoring, and controlling the contributors to the project and their output and evaluating and selecting alternatives in pursuit of the client's satisfaction with the project result (Walker, 2007).

In addition, Kerzner (2003) defines project management as the planning, organizing, directing, and controlling of company resources for a relatively short-term objective that has been established to complete specific goals and objectives.

A Knowledge Area is an identified area of project management defined by its knowledge requirements and described in terms of its component processes, practices, inputs, outputs, tools, and techniques. Although the Knowledge Areas are interrelated, they are defined separately from the project management perspective. The ten Knowledge Areas are:

Project Integration Management. In all areas of a project, Project Integration Management is all about maintaining stability, such as time, scope, cost, quality, human resources, communication, risk, procurement, stakeholders, and others. These are interconnected processes, and a single team cannot perform them. It is a vital area of knowledge and a highly valued component of the PMI. It is a process, which involves constant monitoring of the procedures that are performed during the project's life cycle. One key feature of project integration management is that it focuses entirely on a given project, keeping a watchful eye from initiation to project completion. (PMI, 2017)

According (PMI, 2017) Project integration management involves the processes and activities within the project management process groups to identify, define, combine, unify, and coordinate the different processes and project management activities. In the context of project management, integration includes features of unification, consolidation, communication and integrative actions that are crucial for the completion of controlled project execution, the successful management of stakeholder expectations and the fulfillment of requirements.

Project Scope Management. Scope is, when the specific criteria for the final product or service are collected. Also need to specify the limits in a scope statement. During the project, the limits of the administration must be established and verified, which means that supplies must be approved. The scope may change depending on the current state of the project. According to (PMI, 2017) the management of the project scope contains the processes needed to ensure that the project is armed with all suitable efforts to achieve the project as needed. In other way, the scope of the project is a document that defines the parameters that describe a system and determine the project's behavior, what work is done within the project's limits, and the work that is external to the project's limits (Saylor.org, 2009).

Project Schedule Management. The project is subdivided into start dates, deadlines and budgets for each project to achieve the desire project success. In addition, circumstances change from time to time at any stage of the project, which means they are often reviewed. This includes project management, which includes creating a schedule for the project and deciding who is responsible. That means describing activities is not the same as doing WBS, but it is the same. So, create a to-do list that affects every aspect of the project. Definition of project 9 success often involves completing the project on time, according to (Saylor.org, 2009). A key message in project time management is the importance of ensuring work proceeds effectively within individual tasks, along with the interaction of related tasks (Pasian, 2011). Project success, based on effective control of time management processes, instruments and practices, is the ultimate measure. The project manager is primarily responsible for developing and managing a realistic project schedule and project plan to complete the project on time.

Project Cost Management. This area covers the total budget of the project; the cost management plan determines the method used to establish the budget, how and when it is changed, and what methods are used to control it. Each project must be costly, including labor, materials, equipment, and all the resources needed to complete the project. This will determine the budget of the project after you have taken all the operating costs and combined them. Based on the data analysis, there is a desire to control costs. This is routinely done within the project to ensure that estimated costs are in line with actual expenditures. (Befkadu, 2017)

Project Quality Management.: (PMI, 2017) stated that Project quality management works to ensure that the project requirements, including product requirements, are met and validated. A project can be completed punctually and on financial plan, but if the quality does not meet the set standards, it is a failure for the project. The management of plan quality is part of the overall project management plan, although it can be an independent document if it contains the product or service with quality details. Quality assurance must be included in the process, which is the only way to ensure quality standards are met. Therefore, quality control must be monitored and assigned to ensure that these standards in the quality management plan are met.

Project Human Resource Management. Human resource management is a branch of management, which deals with people at work in an organization. Human resource as a strategic and articulate method to the management of an organization's most treasured assets, the people working there individually and collectively contribute to the achievement of its objectives. Chism

and Armstrong (2010) believes that Human resource management can be regarded as a 'set of interrelated policies with an ideological and philosophical underpinning'. (Mathis and Jackson, 2006) stated human resource management involves several activities such as human resource Planning and Analysis, equal Employment Opportunity, staffing, human resource development, compensation and benefits, health, safety, and security, employee and labor/management relations. Project humans are as one wing of human resource management. The management of resources involves the organization, administration and leadership of the project team. The project team consists of individuals with assigned roles and responsibilities for the project's implementation. It is an important responsibility of the project management team to staff the project with the right skills, at the right place, and at the right time.

Project Communications Management. Communication-The characteristics and actions of the leader are human elements that have a major impact on the outcome of a project. The human component is a critical part of project management and can include the behaviors of people, the social system, political issues and problems with communication (Chiocchio and Hobbs, 2014). Communication is an essential leadership skill in (Gladden, 2014). Communication is a gentle and subjective ability that project managers need to have (Chiocchio and Hobbs, 2014). For project success, communication is necessary and communication skills include reporting, presentation, relationship management and interpersonal skills (Ahsan, K., Ho, M., and Khan, S, 2013). Communications issues are a part of known challenges in project management. One of the ten knowledge areas of the Project Management Body of Knowledge (PMBOK) guide is project communications management. Communication planning, communication management, and communication control are the primary processes for communication management. Communication activities vary in size and include internal and external, formal and informal, vertical and horizontal reporting, official and unofficial reporting, written reporting, oral reporting, verbal reporting and nonverbal reporting (PMI, 2017).

Project Risk Management. Risk management process is a system in which the risks of the project are regularly identified and managed during the project. The process involves a number of steps and warnings to reduce the risk and risk of each accident. An emergency procedure used to ensure that all hazards are regularly identified, quantified, monitored, transmitted and / or facilitated. The key project risk management discipline lacks the optimality that is assumed in the standards of best practice. In this context (Kutsch, 2008) the set of assumptions of a risk analysis that is

primarily objective "is a virtue as much as it is a shortcoming." Project risk management is the highest ranked factor for project failure (Kutsch, 2008), the systematic procedure of classifying, evaluating and responding to risks as project-related events or conditions that are not definitely known and that have the potential for adverse effects on an objective project (PMI, 2017). Thus, care must be taken to properly manage risk management.

Project Procurement Management. This involves with outside procurement, which is part of many projects such as hiring small contractors. If not implemented properly, it will clearly affect the budget and schedule. Planning is important for procurement management in identifying the additional needs of the project and the way that those contractors will participate. Next, hire the contractors to make those purchases, it is important to choose a job description, reference terms, feedback questions and seller. Individual processes need to be managed and supervised, and then the work is completed and everyone is satisfied. (PMI, 2017) stated that Project Procurement Management includes the procedures necessary from outside the project team to buy or acquire products, services, or results needed. The company can be either the buyer or seller of the goods, services, or outcomes of a project. Nevertheless, the procurement effort on projects varies widely and depends on the type of project, as (Saylor.org, 2009) explained.

Project Stakeholder Management. Includes the processes required to identify the people, groups, or organizations that could impact or be impacted by the project, to analyze stakeholder expectations and their impact on the project, and to develop appropriate management strategies for effectively engaging stakeholders in project decisions and execution. The needs of a specific project may require one or more additional Knowledge Areas, for example, construction may require financial management or safety and health management. (PMI, 2017)

2.2.2 Construction Project Success

Project success has well defined as the completion of an activity within the constraints of time, cost and performance. The definition of project cusses has been modified to include the completion of project with acceptance by the customer, within allocated time, witan the budget cost, at the proper performance specification level, and with minimum or mutually agreed upon scope changes (Babu, 2015).

The success criteria for a construction project is not only to evaluate the cost, time and quality as success factors but also to include successful project management, organizational success and the customer satisfaction (Siguroursan, 2009). Reviewing of the relevant literature suggests that different criteria were hypothesized by different researchers (Chan, Scott, & Lam, 2002). These scholars have summarized ten Critical Success Factors (CSFs) of projects through their research. Those CSFs are known as Cost, Time, Quality, Satisfaction, Management, Safety, Technology, Organization, Environment, and Resources (Ramlee, Tammy & Noor 2015).

Project success can be defined as meeting the required expectation of the stakeholders and achieving its intended purpose. PMI 2017 states that as projects are temporary in nature, the success of the project should be measured in terms of completing the project within the constraints of scope, time, cost, quality, resources, and risk as approved initially.

Based on Kerzner (2009) the earlier definition of project success has been modified to include completion: Within the allocated time period

- Within the budgeted cost
- At the proper performance or specification level
- With the acceptance by the customer/user
- With minimum or mutually agreed upon scope changes
- Without disturbing the main workflow of the organization
- Without changing the corporate culture

Ibrahim (2013), indicated that time, cost, and quality have proven importance as prime measures for project success. And construction projects are commonly measured by the achievement of the above specifications.

2.2.3 Factors Affecting the Success of Construction Projects Implementation

Since the success of projects is measured mainly in terms of the three primary forces which are cost, quality, and time, there exist different factors that have an influence on each of these measures. Time is the available time to deliver the project, cost represents the amount of money or resources available and quality represents the fit-to-purpose that the project must achieve to be a success.

The concept of success in a construction project according to some researchers is corresponding to efficiency and effectiveness measures. Efficiency measures deal with time, budget, and specifications; effectiveness measures refer to the achievement of project objectives, user satisfaction, and the use of the project. (Takim & Adnan, 2008).

According to Silva et. Al (2016), success factors can be categorized as Internal factors (those one can have control over) and External factors in which one can't control.

The following are considered internal success factors according to their study: Adequate communication among team members, top management support and commitment to the program, availability of advanced technology, detailed project planning, estimating, and scheduling, frequent project monitoring, implementing an effective safety program managing and controlling of subcontractor's work, adequate fund or cash flow management, availability of resources as planned throughout the project , clear and detailed procurement process & strategy, clearly defined scope/goals and objectives, effective project risk management system, availability of skilled full workforce, effective allocation and control of manpower, effective Site Management, Control and Coordination, contractor's Experience, establishing an effective document control system, adequate training and skill development programs, effective contract management system and team member commitment.

While below is the list of external Factors: Political instability, delay of payments, design and material changes by clients, rapid changes in the economic environment, inefficiency of government policies, limited allocation of funds, high inflation rate, project nature-related factors, influence of nature like weather conditions, high labor turnover and inadequate support from the banking sector

2.2.4 Factors Impacting the Budget of a Project

In General, the cost is believed to be an indicator of the performance of project management. The project budget is very important and influences all areas in both the planning and execution of a project. Poor cost performance in a construction project is a common problem worldwide resulting in a significant amount of cost overrun. Different studies have revealed that there are various factors responsible for the cost overrun of Construction projects and project cost management is important. Project cost management includes the processes of cost estimating, cost budgeting, and

cost control. The main objective of cost management is to complete the project within the approved budget (PMI, 2017).

Completion of construction project with intended budget is frequently seen as major criteria of project success by client, contractors and consultants and related stakeholders. Construction industry nowadays, is facing severe problem of poor cost management resulting in huge amount of cost overrun. The problem of poor cost management and overrun in project cost is serious issue in both developed and developing countries (Zinabu & Getacher, 2015).

Mukuka (2014) in his study identified a number of important factors, which cause project cost overruns. Such as fluctuation of prices of material, cash flow and financial difficulties faced by the contractor, poor site management and supervision, lack of experience, and extension of project time due to project delay, additional cost, budget shortfall, adversarial relationship between partnerships of the projects, delayed payment to contractors, poor quality workmanship and dissatisfaction by project owners and consequently by end user as the major effect of cost overrun.

Gomez (2012) suggested list of critical success factors that influence cost performance in construction projects in UK. The factors identified are: project manager competency, contractor's competence, client commitment to getting the job done, good relationship between project partied, accuracy of plans and initial information, adequate specification, early involvement of the contractor, accurate selection form of the contract, client's involvement and feedback, availability of funding, initial identification of all the risks, and architect's competency.

Research conducted by Olawale (2010) on main cause of cost overrun in the UK construction project. The following are the factors identified by this research: design change, risk and uncertainty, associated with projects, inaccurate evaluation of project's time, nonperformance of subcontractors and nominated suppliers, complexity of works, conflict between project parties, discrepancy in project documentation, contract and specification interpretations, inflation of prices, financing and payment for completed works, lack of proper training and experience of project management, in addition to this, low skilled manpower, unpredictable weather conditions, dependency on imported materials, lack of appropriate planning, unstable interest rate, fluctuation of currency/exchange rate, week regulation and control, project fraud and corruption.

Research, which conducted in India by Subramanian & Shanmugapria (2013) identified the factors that affect the project cost, by labeling the factors in eight groups. Financial groups, construction

parties, construction items group, environmental group, political group, material group, labor and equipment group, and owner's responsibility group. Material market rate, contract modification, high level of quality requirement, project location, rework of bad quality performance, often changing subcontractors company, lack of technical skill, lack of experience in similar projects, shortage of experienced staff and labor, high quality of work required, labor strike, lack of subcontractors skill, unclear specification, owners delay in freeing the contractors financial payment, equipment shortage, poor productivity of material and labor, poor scheduling of labor and material for work, and poor documentation and no detailed written procedure.

The most common causes of cost overrun are: supplementary agreement, price fluctuation of construction materials particularly cement, reinforcement bar, fuel, and so on. In addition to these, change orders or variation due to enhancements initiated by client, excess quantity during construction, unexpected ground condition, mistakes during planning, design and contract document preparation.

Factors which change costs overtime

Once implementation begins, a project's costs rarely remain static. As further information becomes available the costs may be further defined. Yet, even when a cost has become firmly fixed, there are numerous factors that can lead to the cost increasing. Delays are a major factor. Whatever the reason, delays almost invariably increase budget costs. Many events may have contributed to the delay – some which could have been foreseen and others which could not. (Understanding and Monitoring the Cost-Determining Factors of Infrastructure Projects, A User's guide- online)

(Source: urban development and construction bureau).

Design Changes

A change in a project's design can arise for several reasons. It may be that the project sponsor wants additional elements to be included in the project or changes to existing ones. Usually, these design changes require additional time inputs from architects and engineers as well as the additional time and cost inputs from the contractor and for additional materials.

(Source: design and supervision work enterprise).

Inflation

Inflation can act to increase the original estimates of construction costs. Inflation may have been considered in the original estimates, but if the rate of inflation increases above the predicted level during the construction period, then the original cost estimate could be exceeded. Obviously, any other factor that delays a project expose the project to the risk of further inflationary cost increases. Inflation may not be the only cause of price rises. Political or technological factors may affect one or more element of costs.

(Source: urban development and construction bureau).

Shortages of Material and Plant

During periods where the level of development activity is unusually high in a particular region, there may be shortage of some construction materials, construction plant (machines and equipment used during construction) and service plant (equipment used in the operation of the infrastructure project). If this was not anticipated in the original cost estimate, delays may occur and/or the prices of these elements increase. (Source: urban development and construction bureau).

Exchange Rates

The exchange rate is particularly relevant if contracting services or other elements of the project are being purchased from foreign countries. If exchange rates change beyond the level predicted by the project sponsor (and the companies providing the services) then the cost of the project can increase. It can of course operate in the opposite way where the project sponsor takes advantage of a strengthening of his own currency.

(Source: urban development and construction bureau).

Inappropriate Contractors

Contractors are selected based on price, experience in undertaking types of projects and their track record in producing high quality work within budget and on time. Problems may arise where there is a high level of development activity being undertaken in a region and the better contractors are not available to bid for the work at that time. Alternatively, the tender review process may not have been undertaken by the personnel with the best understanding of the services required.

Consequently, firms which are not the most experienced in that field of activity are chosen, often with implications for the quality and cost of a project. Delays in project implementation and increases in costs can arise using ineffective or inappropriate labor, or errors in calculating how productive the labor can be. This can happen especially when sub-contractors are used whose quality is not controlled in the main project contract. In most cases there is a trade-off between price, experience and track record but the desire to accept the lowest tender does not always lead to a project that is completed within time and budget. There are cases of contractors and sub-contractors who go into liquidation during the construction period. This can lead to significant delays and extra costs arising as the project sponsor has to re-tender the remaining work. Identifying a new contractor to complete another contractor's work is difficult because of the possible liabilities that the new contractor would have to accept for another company's work. (Source: urban development and construction bureau).

Funding Problems

The overall lack of finance to complete a project, or delays in the payment for services by the project sponsor can lead to significant problems arising. If the costs of a project have increased significantly beyond the original estimate, then work on the project may have to stop or be delayed until additional funds can be found. Funding problems can also arise if funds allocated to one project have been diverted to other projects within a program of development. If the payment of invoices by a project sponsor is low, the contractor may begin to commit less resource to a project and may even cease work if cash flow becomes a problem. In some cases, even when a project is expected to be entirely profitable, project sponsors may understate the availability of local funding simply to maximize the level of grant. This can happen with revenue-generating projects particularly. Such practices can reduce the availability of funding for other projects.

(Source: urban development and construction bureau).

Other Factors

In addition to all the categories listed above, experience shows that problems also arise from premeditated under-estimation of initial costs simply to obtain initial approval for a project. This can lead to major projects being approved, and started, in the knowledge that actual costs can be very much higher than the "agreed" estimate. Once started, a high-profile infrastructure project is often politically difficult to stop. So, when the true costs do become apparent, it is difficult for

authorities to refuse the additional funding required to complete the project. (Understanding and Monitoring the Cost-Determining Factors of Infrastructure Projects, A User's guide- online). (Source: urban development and construction bureau).

2.2.5 Factors Impacting the Schedule of a Project

According to Abbas (2006), late completion of works as compared to the planned schedule or contract schedule is what is known as a delay. There is a number of definitions for the delay: to make something happen later than expected; to cause something to be performed later than planned; or to not act timely each of these definitions can describe a delay to an activity of work in a schedule. The type of delay the researcher focus on in this study is the time overrun beyond the date for completion specified by the contract not considering whether an extension of time has been granted.

Previous studies on construction delays have been done by a number of authors from a variety of countries. Factors that cause delays on construction projects are a universal problem and often occur. By identifying possible delays, there is a better chance to manage and control possible causes through the life cycle of a project (Afshari, 2011).

There are a number of factors that play a role leading to these delays. Not only do site related challenges cause delays, the parties involved can contribute as well (Frodell and Josephson, 2009). And delays often cause disputes, as both the client and the contractor are affected in a negative way because of the delay.

Research that was conductred in Saudi Arabia by Assaf & Al-Hejji (2006) on time performance of different types of construction projects to determine the cause of delay to construction project. Seventy-three caused of delay were identified and grouped in nine by the researcher.

Project related cause: - Original contract duration is to short, legal dispute between various parties, inadequate definition of substantial completion, ineffective delay penalty, type of construction of contract, type of project binding and award (lowest bidder).

Owner related cause: - Delay in progress payment by owner, delay to furnish and deliver the site to the contractor by the owner, change order by owner during construction, late in revising and approving design document by owner, delay in approving show drawings and sample materials, poor communication and coordination by owners and other parties. In addition, slowness in

decision making process by owner, conflicts between joint-ownership of the project, unavailability of incentives for contractor for finishing ahead of schedule, suspension of work by owner.

Contractor related factors: - difficulties in financing project by contractor, conflict in sub-contractors' schedule in execution of project, rework due to errors during construction, conflict between contractor and other parties (consultant), poor site management and supervision by contractor, poor communication and coordination by contractor with other parties, ineffective planning and scheduling of projects by contractor. In addition, improper construction methods implemented by contractor, delay in sub-contractor work, inadequate sub-contractor's work, frequent change of sub-contractors because of ineffective work, poor qualification of contractors' technical staff, and delay in site mobilization.

Consultant related: - delay in performing inspection and testing by consultant, delay in approving major change in the scope of work by consultant, inflexibility (rigidity) of consultants, poor communication and coordination between consultant and other parties, late in reviewing and approving design documents by consultants, and conflicts between consultant and contractor.

Design related cause: - Mistake and discrepancy in design document, delays in producing design document, unclear and inadequate detain in drawing, complexity project design, insufficient data collection and survey before design, misunderstanding of owner's requirements by design engineer, inadequate design-team experience, and un-use of advanced engineering software.

Material related cause: - Shortage of construction materials in market, change in material types and specification during construction, delay in material delivery, damage of sorted material while they needed urgently, delay in manufacturing special building materials, late procurement of materials. And late in selection of finishing materials due to availability of many types of market.

Equipment related cause: - equipment breakdowns, shortage of equipment, low level of equipment operator's skill, low productivity and engineering, low efficiency of equipment's, lack of high technology mechanical equipment.

Labors related cause: - shortage of labors, unqualified workforce, nationality of labors, low productivity level of labors, and personal conflict among labors.

External factor:- effect of subsurface conditions, delay in obtaining permits from municipality, hot weather effects on construction activities, rain effects on construction activities, unavailability of utilities in site, effect of social and cultural factors, traffic control and restriction at jobs site,

additionally, accidents during construction, differing site conditions, change in government regulations and laws, delay in providing service from utilities, delay in performing finals inspection and certification by third party.

As per the research conducted by (Doloi, 2012) construction project delay in India through questionnaire and personal interview as a research method, identified the most critical factors for construction delay were identified as: - lack of commitment, inefficient site management, poor site coordination, improper planning, lack of clarity in project scope, lack of communication, and substandard contract. Regression modeling indicates slow decision from owner, poor labor productivity, archtects reluctance for change and rework. According (Henry, Dan & Ruth, 2013) the five most important causes of delays in construction projects in Uganda's public construction projects were found to be: change of work scope, delayed payment, poor monitoring and controlling, high cost of capital, political instability/insecurity, and due to mistakes in construction.

Other research that is conducted by (Endale, 2016) on majer causes of delay in construction of 40/60 saving house project in Addis Ababa, identified ten major causes: late material supply, financial difficulties faced by the contractor, problem of electric supply, problem of water supply, equipment and its availability, delayed payment to contractor, poor site management, ineffective planning and scheduling, late design review and approval, and slowness in decision making process.

2.2.6 Factors Affecting Quality Performance of a Project

Quality can be assured by identifying and eliminating the factors that causes poor project performance. Project manager's competence and top management support are found to contribute significantly in enhancing the quality performance of construction project. Lack of contractor experience top the quality related causes of project failure (Iyer and Jha 2006)

Pheng and Chuan (2006), through case studies, have shown that total quality management a successful management philosophy in the manufacturing and service industry could be replicated in the construction industry with similar benefits. The benefits may be in terms of reduction in quality costs, and better employee job satisfaction. Iyer and Jha (2006) observe that a contractor's quality assurance system, which ensures consistent quality, is essential in preventing problems and the reoccurrence of problems. His survey also points to the lack of documentation of a quality system for the majority of the contractors.

2.3 Possible Measures to Minimize Cost and Schedule Overrun

Different mitigation measures against delay and cost overrun of construction projects have been suggested by different professionals. According to Memon, Rahman and Azis (2012) study on" Time and Cost Performance in Construction Projects in Southern and Central Regions of Malaysia", propose thirteen mitigation measures to improve time performance and fifteen mitigation measures to improve cost performance of construction projects which were classified into 3 categories as proactive, reactive and organization.

2.3.1 Mitigation Measures to Improve Time Performance

Below are the 13 measures stated in Memon, Rahman and Azis (2012) study: Proper planning work, committed leadership and management, send clear and complete message to worker to ensure effective communication, hire skilled workers to achieve good progress, avoid poor quality of work, more rectification and double handling, close monitoring, training and development of all participant to support delivery process, focus on the quality, cost and delivery of the project, use new construction technologies (IBS-Industrialize Building System), adoption of tools and techniques i.e.: Value Management, Lean Thinking, Total Quality Management, provide knowledge/training to unskilled workers based on their scope of work, fully utilize the construction team and focus on client's need

2.3.2 Mitigation Measure to Improve Cost Performance

The following are the 15 measures identified in the study of Memon, Rahman and Azis (2012) study: Effective strategic planning, proper project planning and scheduling, effective Site management and supervision, frequent progress meeting, proper emphasis on past experience, use of experienced subcontractors and suppliers, use of appropriate construction methods, use up to date technology utilization, clear information and communication channels, frequent coordination between the parties, perform a preconstruction planning of project tasks and resources needs, developing human resources in the construction industry, comprehensive contract administration, systematic control mechanism and improving contract award procedure by giving less weight to prices and more weight to the capabilities and past performance of contractors.

2.3.3 Quality Improvement in Construction Projects

Quality improvement in construction project focused on increasing the ability to fulfill the quality requirement (Agbenyega, 2014) defined quality improvement as a philosophy which emphasizes that quality is the responsibility of every one in an organization; as a process of managing, as a strategy to improve organizational competitiveness and effectiveness as a value system that emphasizes striving for quality in product or services.

Based on research conducted by Agbenyega (2014) quality improvement in construction project is concentrating on improving the company's capacity to meet quality standards. Quality improvement according to (Cianfrani, Tsiakals & West, 2009) is a philosophy that emphasize quality is everyone's responsibility in an organization: a change management process, a strategy to improve organizational competitiveness and effectiveness, and a value system that emphasizes striving for quality in products and services,

According to Total Quality Management (TQM) philosophy the goal of continuous improvement is specifies a specific step-by-step process to achieve. This process consist of nine steps as follow: identify the process, organize a multi-disciplinary team to study the process and recommend improvements, define areas where data is needed, and collect data on the process, analyze the collected data and brainstorm for improvement, determine recommendations and methods of implementation, implement the recommendations out lined in step six, collect new data on the process after the proposed changes have been implemented to verify their effectiveness, and circle back to step five again analyze the data and brainstorm for further improvement.

2.3.4 Quality Management System

The international standard requirements are generic and are intended to be applied to all organizations, regardless of type, size and product provided. According to ISO, the certification procedure is supposed to give people trust that the company has a quality management system that meets ISO 9001's requirements. It is intended, in particular, that the organization:

- Ensures that product characteristics have been specified in order to meet customers' and statutory/regulatory requirement;
- Analyses and understands customer need and expectations, as well as the relevant statutory and regulatory requirements related to its products;

- Has established a quality management system that is suitable for its products and processes, and appropriate for its certification scope;
- Has determined and manages the process needed to achieve the expected outcomes (conforming products and enhanced customer satisfaction);
- Has endured the availability of resources necessary to support the operation and monitoring of these processes;
- Monitors and controls the defined product characteristics;

2.3.5 Effective Project Control System

Delay and cost overrun are inherent part of most projects despite the much-acquired knowledge in project management. Given the high level of uncertainty within projects, proper monitoring and control of project performance is vital to avoid cost overruns, limit financial losses, any quality issues and improve predictability. The utilization of a project control system that measures and evaluates the variance between the project plan and actual project performance plays an essential role in achieving successful outcomes. A project control system involves data gathering, analysis, and management processes that are used to forecast, predict, and understand the time and cost and quality outcomes of a project or program. Project control system is the process of integrating all aspects of the project plan, validating that the plans are comprehensive and consistent with requirements, initiating mechanisms for project control, and communicating the integrated project plan to those responsible for the project's work packages. Project planning and control mechanisms are generally considered as a root cause of many enablers and barriers of project control system implementation. Backlund (2000) suggests three criteria for successful project control system implementation: (1) planning and controlling process, (2) the experience and analytical ability of project personnel, and (3) the commitment of a high management. The measurements that underlie project controls have several purposes:

• They quantify an evaluation of feasibility.

• They represent a benchmark for performance.

• They measure interim performance to highlight needed improvements.

Project controls can be a key to project success. Effective controls provide a core means of communication about the metrics of project success and a means to facilitate that success. Well-

designed controls systems are relevant to the project management and scalable to the needs of the project.

To be used in successful projects, controls systems must avoid:

• Arbitrary imposition of project goals that do not reflective of reality.

• Overly simplistic views of the project and influences upon it.

• The trap of mistaking the tools of project controls for their application.

In conclusion, Project controls are relevant to the extent they help us arrive at better decisions, better allocate the project resources, and initiate better actions.

2.4 Empirical Review

2.4.1 Critical Success Factors of construction Projects

As the theory suggests, effective project management is essential for a successful project. Various scholars and researchers seen different problems that projects could face and investigated the relationship between project management success factors and project success. Hence, in this section review of some of the most important studies is presented.

Different researchers in different countries investigated project success factors and success criteria from different industries perspectives. In this sub section, the methodology used and findings identified on studies conducted on project success, success factors and success criteria are reviewed.

Alias Za. Yu. Ar. (2014) have conducted a study to identify the relationship between critical success factors of project and project performance. The authors building their theoretical framework on five critical success factors as variables and investigated their influence on project performance using cost, time, quality and client satisfaction as performance measures. Project management action, project procedures, human factors, external issues and project related factors are the success criteria used as variables in the study. At the completion of the study, the authors proved there is a positive relationship between project performance and all the five critical success factors.

Nguyen (2004) studied project success factors in large construction projects in Vietnam. Nguyen started his investigation with 20 success factors and identified five of critical success factors by the completion of the study. Among the 20 success factors he started his study with, competent project manager, adequate funding until project completion, multidisciplinary/competent project team, commitment to project, and availability of resources are found to be the critical ones. Nguyen's study also grouped the success factors into one of four components which are comfort, competence, commitment and communication. His findings found to be supportive to that of Ashley's study.

Gudiene (2014) used multiple criteria approaches taking in to consideration seven groups of factors from different dimensions. A conceptual model that includes the grouped critical success factors affecting project success was developed. According to the authors' findings, the seven major groups of factors, namely external factors, institutional factors, projects related factors, project management/team members related factors, project manager related factors, client related factors and contractor related factors are proved to influence construction project success in Lithuania.

Research was conducted in Brunei Darussalam by a researcher called Rohaniyati Salleh in 2009 to identify success and delay factors which can help project parties reach their intended goals with greater efficiency. Data were collected and evaluated by statistical methods to identify the most significant causes of delay and to measure the strength and direction of the relationship between critical success factors and delay factors in order to examine project parties' evaluation of projects' critical success and delay factors, and to evaluate the influence of critical success factors on critical delay factors. According to the research the following are seven most important causes of delay which contributed to the failure of building construction projects: On the other hand, the researcher has identified the most important critical success factors for building construction projects based on rank: Project manager's capabilities and experience, Clarity of project scope and work definition, Organizational Planning, Use of control systems, Project manager's goal commitment, Project team motivation and goal orientation, Safety precaution and applied procedures

Henok (2021) studied factors affecting the success of road projects in Addis Ababa city roads Authority. The study found that the four independent variables /factors/ i.e. capital availability, management skills, organizational culture and technical skills, availability of capital are found the greatest factor that influences the time, cost and quality of road projects in AACRA. Problems related to Availability of Capital which is Bureaucracies from the steps involved in funding

payment, Lack of financial management prudence and an availability of capital sources and loans greatly affecting the success of Addis Ababa city road authority.

Kidu (2019) studied an investigation of critical success factors that affects the success of public building construction projects: a case of Mekelle city. The study was indicating that attention must be paid to the eleven most important critical success factors that affect the success of public building construction projects in Mekelle city that agreed by the contractors, consultants and clients. 1. Client knowledge of construction project organization, 2. Project managers commitment to meet quality, cost and time, 3. Working relationship with others, 4. Understanding project objective, 5. Knowledge of workers in the project work, 6. Application of communication technology, 7. Project risk categorization, 8. Management – labor relationship, 9. Adequacy of plans and specification, 10. Effective resource management in the project site and 11. Waste around the site.

Koshe & Jha (2016) studied causes of delay in construction of Ethiopia. They have identified 88 delay causing factors under eight broad categories namely: client related, consultant/supervisor related, contractor related, designer related, labor related material related equipment, and external related. Accordingly, major causes of project delay in Ethiopian construction industry were identified as fallows 1. Difficulties in financing project by contractors 2. Escalation of materials price 3. Ineffective project planning 4. Delay in progress payment for completing work 5. Lack of skilled professional in construction management 6. Fluctuating labor availability season to season 7. Late delivery and shortage of materials 8. Low productivity of labor 9. Unqualified/inadequate experienced labor 10. Insufficient data collection and survey before design

According to Mathiwos (2018), the top ten factors causing delay of water supply construction project in Ethiopia were 1. Adverse weather condition 2. Delay in approval of documents 3. Equipment failure 4. Scarcity of materials in the market 5. Poor supervision 6. Poor site management 7. Fluctuation of prices/rising cost of materials 8. Change in subsurface conditions 9. Slowness in decision making process 10. Low skills of labor

Derege (2021) study cause of delay in medium town water supply projects in the case of Ethiopian one wash national program. In his research he has identified the top ten most important causes of delay in the water supply construction were in their descending order are: fluctuation of price/rising cost of materials; late materials supply; delayed payment to the contractor; ineffective planning and scheduling; less emphasis to planning; clients financial shortage; unrealistic contract

duration; delayed payment to suppliers & subcontractors and underestimating of the complexity of the project.

Alemayehu (2020) studied causes and effects for the delay of water supply and sanitation projects in the case of 15 towns' water supply and sanitation projects in Ethiopia. The factors were categorized under project related, Client/owner related cause, contractor related causes, consultant related causes, design related causes, material related, equipment related, labor related and external related. The findings identified material import delay, insufficient planning& scheduling, slow decision making, financial difficulties in accurate site management & supervision as five most significant determinants of project delays in 15 towns WSS construction projects in Ethiopia.

2.4.2 Research Gaps

A research was conducted in Brunei Darussalam by a researcher called Rohaniyati (2009) to identify success and delay factors which can help project parties reach their intended goals with greater efficiency, Derege (2021) study cause of delay in medium town water supply projects in the case of Ethiopian one wash national program and Alemayehu (2020) studied causes and effects for the delay of water supply and sanitation projects in the case of 15 towns' water supply and sanitation projects in Ethiopia.

However, as far as the venture of the researcher is concerned, no published study is available that devotes its attention on investigating what factors influence the overall construction success of towns' water supply and sanitation project construction in southern part of the country.

This research focused on towns' water supply and sanitation projects which has unique challenges as compared to building and road development projects which have been done by other many researchers.

2.5 Conceptual framework

A conceptual framework is a written or visual presentation that explains either graphically or in narrative form, the main things to be studied, the key factors, concepts or variables and the presumed relationship among them. The conceptual framework is the blue print of the research work that guides the researcher to conceptually understand the research and outline and

operationalize the dependent and the interpretation of the result been easy and meaning-full. The proposed framework for this research is illustrated in figure below.

The conceptual framework would help in understanding the relationships among components the specific objectives and their influence on the construction success of towns' water supply and sanitation project in southern Ethiopia. The goal of the research would be to identify the critical factors affecting the construction success and provide recommendations for improving the planning, implementation, and management of water supply and sanitation project in Southern Ethiopia.

The proposed conceptual framework for this study comprises independent and dependent variables.

Independent Variables: These are variables that can be manipulated or changed in order to analyze their effects on the dependent variables. For this study, the independent variables include elements like design change, material availability or quality, labor availability or skills, equipment availability or maintenance, financial resources, management systems, contractual issues, external factors (e.g., weather, market conditions, regulatory issues), and project management success measures (e.g., adherence to project management principles, effective use of project management tools). These variables are selected as they are considered the key factors that may influence the success of construction projects.

Dependent Variables: These are the outcomes that the study aims to predict or explain. In this study, dependent variables are the indicators of construction success: adherence to the schedule (time), adherence to the budget (cost), achievement of desired quality, minimal variation in scope, and customer satisfaction. These are the key performance indicators typically used to measure the success of construction projects.

Conceptually, this framework posits that manipulating or changing any of the independent variables, either positively or negatively, will subsequently have an impact on the dependent variables, thus affecting the overall success of a construction project. The aim of the study is to investigate the nature and magnitude of these relationships.

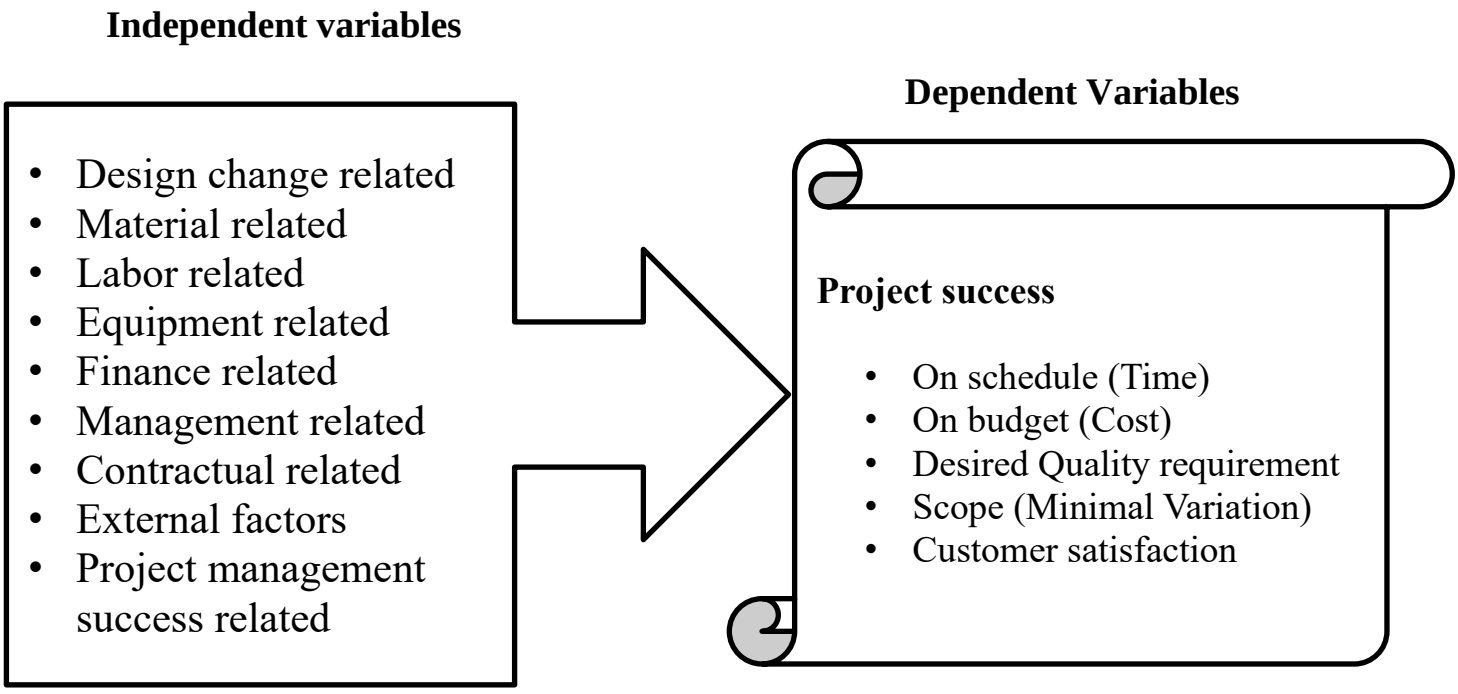

Figure 2.1 Conceptual Framework (Prepared by the Researcher)

CHAPTER THREE

RESEARCH METHODOLOGY

In this chapter the details of all information regarding the methods used to carry out the research, the type of research design that should be implemented, the target population, the sample size, sampling techniques, the procedure applied to obtain samples and the research instruments and method of data collection also be discussed. It also indicates how the data analyzed and presented.

3.1 Location of the Study Area

The study area is situated in the Southern Nations, Nationalities, and Peoples' Region (SNNPR), located in the southern part of Ethiopia and is one of the nine ethnically based regional states in the country. Sidama Region was part of the SNNPR and is located in the southern part of the region, but it became its own self-administrating region in 2020. Likewise, the Southwest People's Regional State was part of the SNNPR and is located in the southwest part of the region, but it became its own self-administrating region in 2021. Therefore, the study is conducted in the above mentioned three regions situated in southern part of the country.

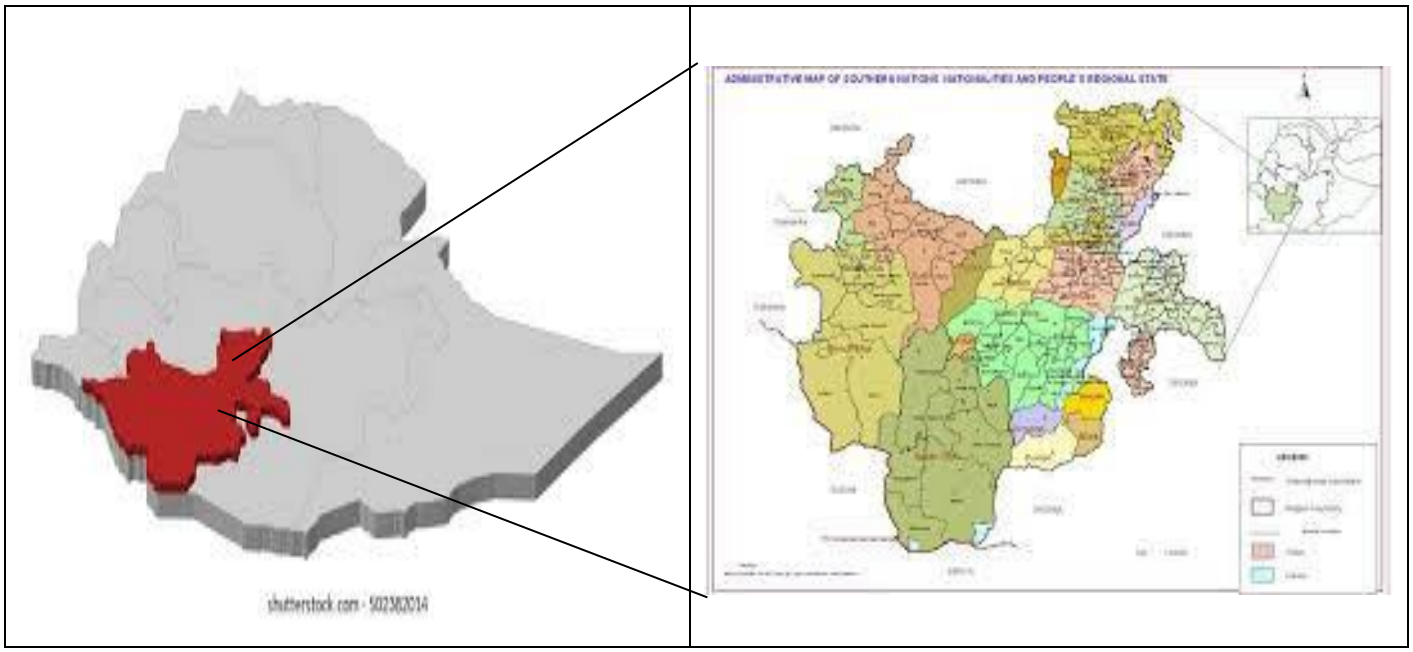

Figure 3.1 Locatin of the Study Area

3.2 Research Approach and Design

A combination of both quantitative and qualitative research methods was employed in this study. Qualitative method helped to measure opinion, knowledge or attitude of respondents related to evaluate the overall performance and determine the most important factors which were organized in Likert scale response and some open questions. Such methodologies answer questions related to how much, how often, how many, when, and who. The qualitative aspect of the study provided an in-depth analysis of the factors responsible for the success or failure of the towns' WSS projects and their impact on the projects, whereas quantitative design provided consistent results of the collected data as the data gathered was quantified and analyzed using SPSS version 26 statistical tools. A mixed method allows the collection and analysis of qualitative and quantitative information in a single study. The major tenet of mixed method is pragmatism that assumes quantitative and qualitative methods are compatible and can be utilized in a useful way.

The methodology that was considered and adopted for this research work focus on literature review and, questionnaire survey designed and employed to assess the knowledge and practice to analyze the factors affecting the construction success of the towns' water supply and sanitation projects in the study area.

✓ The quantifiable responses analyzed through a quantitative method as the name implies.

✓ The qualitative data gives more emphasis to the non-quantifiable responses and it is chosen due to its flexible nature. In recent time, the responses gathered through questionnaires are becoming less reliable as the respondents did not give due attention to the outcomes, it is essential to strengthen through interviews, desk study and case study.

Therefore, the qualitative method used to support the quantitative data that was collected and analyzed in the research process. Finally, based on the obtained data and results of the analysis, the researcher provides conclusions and recommendations. So that, the design has a two-phase procedure that helped the researcher to organize the research process. It started with descriptive and correlation (quantitative) phase to understand the phenomenon from the point of view of respondents from the three parties (Client, Consultant and contractor) projects managers, consultants, contractors, supervisors and the like of different sites then moved onto a qualitative

phase, at least 5 sites selected for case study and analyzed and the result be integrated with the quantitative one for final frame work solutions and conclusions.

3.3 Target Population and Sampling Design

3.3.1 Target Population

The research population for the study was those towns water supply and sanitation projects which have been under construction in the last five years in the study area. These projects are implemented under the supervision of SNNP Regional state water, irrigating and mine developments bureau and the newly established Sidama People Regional State and South West Ethiopian People's Regional State Water, Mine and Energy development bureau. During the time of this study, there were more than 30 town WSS projects administered by these three clients. There was a total of 100 respondents designed for the data collection, among those 32 individuals are administering the project implementation on the client side; 34 from the contractor side and 34 from the consultant side were taken as sample.

Totally they are project managers, team leaders, resident engineers, site engineers, office engineers, contract administrator and other stakeholders which are directly related to the project works are the researcher populations.

3.3.2 Sampling Design

The subset of the population chosen to participate in the study is referred to as sampling, and it represents the entire population. Due to small size of population purposive sampling technique was used to select representative from the entire population. purposive sampling was also used because the respondents to the survey were selectively chosen based on their experience with water supply projects and their professional background.

The following are the groups of respondents who were chosen for this study as sample respondents:

Employees of the SNNPRS Water, Mineral, and Energy development Bureau, South West Ethiopian Peoples Regional state water, mine and Energy Bureau and Sidama People Regional State Water, mine and energy bureau; these are the employees of the water supply project's initiators and financiers. A total of thirty-two (32) respondents were surveyed.

Employees of Consultants of Water Supply Project Designers and Construction Project Supervision (Consultancy firms): These are Engineers who design the facility to be built and those who monitor its completion. Employees participating in the planning and supervision of the water supply project are the target population. A total of thirty-four (34) respondents were surveyed.

Employees of water supply project contractors: these are the employees of the construction company that carries out the implementation of the WSS project in southern Ethiopia. A total of thirty-four (34) expertise were surveyed for this study.

3.4 Data Source and Types

The main data used in this research to achieve the research objective and research question was both primary data and secondary data.

3.4.1 Primary Data

A questionnaire was designed to assess the opinion of the project managers, Water Supply Engineers, Contract Administrators, Resident Engineers, Assistant Resident Engineers and Site Engineers on the factors that affect the construction success of towns' water supply and sanitation projects in Southern part of Ethiopia.

3.4.2 Secondary Data

Secondary data, on the other hand, is the data that has already been collected, analyzed and published by different researchers. The major secondary data that used in this research is those published and unpublished data. Under published data books, reports and publications of professional associations, reports prepared by research scholars, and universities are used in this research. Unpublished data are that found in unpublished biographies, journals and annual reports of the organization, consultancy firms and contractors. A desk study in research work is a method of conducting research that involves gathering, reviewing, and analyzing information that is already available on a specific topic. This might include reviewing existing literature, analyzing published statistics, or exploring data from previous studies. The data used in desk studies is known as secondary data because it has been collected and analyzed by someone else.

3.4.3 Case Study

The secondary data used for desk study was collected from clients (SNNPR Water, Irrigation and Mine development bureau, Sidama Region Water, Mine and Energy development bureau and Southwest People's Regional State Water, Mine and Energy development bureau) and different consultants who have been supervising the towns' water supply and sanitation projects construction in the study area. From the total around thirty sites in the study area at least five selected sites taken in to consideration for case study to evaluate the success of the projects and to find out the factors that affect the success of the construction of the towns' water supply and sanitation projects.

3.5 Data Collection Technique

The required data collected by using a well prepared and pretested questionnaire. A questionnaire was developed in order to assess the perceptions of different parties involved in the construction process in the study area water construction sector, for the evaluation of frequency of occurrence and importance of the identified factors. Data gathering from large sample size participants is time consuming and require high budget. To overcome such challenges, I prefer to collect the required information from those involved in the construction of town water supply projects on behalf of contractor, consultant and client by using closed and open-ended questionnaire.

The questionnaire was designed to be a close ended questions including with few open ended questions. These types of questions have a number of choices of possible answers and the respondents selected whatever they feel can be most appropriate. The reason for selecting a questionnaire method for my research is because it has a merit of giving adequate time for informants to respond, not easily approached respondents can be reached conveniently, large sample members can be addressed, and economically cheap. Similarly, the closed ended questions with very few open-ended questions are also selected because they are easier to assess and answer considering how busy the respondents are.

Generally, the questionnaire for this study consists of four sections:

Part one – this section is general about respondents' profile comprise, type of organization, job title of the respondent in the organization, year of experience in the construction industry and so on. Part two – under this section evaluation of the overall performance of towns' water supply and

sanitation projects in the last five years could be measured based on time overrun, cost overrun, quality issues and other constraints. Both closed ended and open-ended questions were considered in this part of the questionnaire.

Part three – under this section a total of 83 hypothesized factors affecting the success of towns' WSS projects, in eight major group considered in closed ended questions.

Part four – under this section a total of 20 hypothesized management practice to evaluate the effectiveness of project management practice in ensuring the success of towns' WSS projects in the study area considered.

3.6 Data Analysis Techniques

Statistical analysis techniques using SPSS software was used to analyze the data collected. The data analysis was determined to establish the relative importance of various factors that contribute to success/failure. Analysis of data consists of calculating the Relative Importance Index (RII) and ranking of factors in each category based on the Relative Importance Index (RII) and also their mean score.

$$RII = \frac{1n_1+2n_2+3n_3+4n_4+5n_5}{A*N} \quad \text{..... Equation - 1}$$

Where,

- RII = Relative Importance Index, = Number of respondents answer each factor
- 1, 2, 3, 4, 5 = weight given for each factor (ranging from 1 to 5),
- A = highest weight (i.e., 5 in our case),
- N = total number of respondents.

The values of RII ranges from 0 to 1 (0 not inclusive); the higher the RII, the more important the factor for the success of the project construction. The RII is used to rank different factors affecting the success of the project's construction.

Furthermore, One Way ANOVA (Analysis of Variance) is used to compare the means of the groups to determine if there are significant differences between them, in the context of a client, contractor, and consultant.

3.7 Data Presentation Techniques

Results were displayed with the aid of percentages, graphs, tables. Cronbach alpha test were used to test reliability of the data and also independent t- test were used to test the hypothesis. Spearman correlation coefficient also used to see the degree of association between the group of participants.

3.8 Data Measurement

In order to be able to select the appropriate method of analysis, the level of measurement must be understood. In this research, ordinal scales were used. Ordinal scale is a ranking or a rating data that normally uses integers in ascending or descending order. The numbers assigned to the agreement or degree of influence (1, 2, 3, 4, and 5) do not indicate that the interval between scales is equal, nor do they indicate absolute quantities. They are merely numerical labels. Based on this scale, the researcher has the following tables no 3.1 to 3.3 below to measure and present the study output:

Table 3.1 Rating Scale for the Overall Construction Success of Towns' WSS Project

Performance level	**Very low Performance**	**Low Performance**	**Moderate Performance**	**Good Performance**	**Very Good Performance**
Scale	1	2	3	4	5
Mean Range	1-1.8	1.81-2.6	2.61-3.4	3.41-4.2	Greater than 4.21

Table 3.2 Rating Scale for Factors Affecting Project Success

Significance level	Not Significant	Slightly Significant	moderately Significant	Very Significant	Extremely Significant
Scale	1	2	3	4	5
Mean Range	1-1.8	1.81-2.6	2.61-3.4	3.41-4.2	Greater than 4.21
Importance Level	Not Important	Slightly Important	Moderately Important	Important	Highly Important
RII Range	0.00-0.20	0.2-0.40	0.4-0.60	0.6-0.80	0.8-1.0

Table 3.3 Rating Scale for the Evaluation of Project Management Practice

Performance level	**Very low Performance**	**Low Performance**	**Moderate Performance**	**Good Performance**	**Very Good Performance**
Scale	1	2	3	4	5
Mean Range	1-1.8	1.81-2.6	2.61-3.4	3.41-4.2	Greater than 4.21

3.9 Measurements of Relationship

Correlation among variables of different groups refers to the statistical relationship between two or more variables from separate groups. It's essentially a measure of how much one variable depends on another. The correlation can be positive (both variables increase together), negative (one variable decreases as the other increases), or zero (no relationship).

Pearson correlation, or Pearson's correlation coefficient, is a measure of the linear correlation between two variables X and Y. It has a value between +1 and -1, where +1 is total positive linear correlation, 0 is no linear correlation, and -1 is total negative linear correlation. Correlation values between 0 and 0.25 (positive or negative) indicate a weak correlation, Values between 0.25 and 0.75 (positive or negative) indicate a moderate correlation, while values above 0.75 (positive or negative) suggest a strong correlation.

It's named after Karl Pearson, a pioneer in statistics. The Pearson correlation assumes that the variables are normally distributed and is sensitive to outliers. It is a widely used correlation coefficient in the fields of statistics and the social sciences.

3.10 Validity and Reliability of the Research

3.10.1 Validity

Validity is an essential criterion for evaluating the quality and acceptability of research. Generally, researchers use different instruments to collect data. Therefore, the quality of these instruments is very critical because the conclusions researchers draw is based on the information, they obtain using these instruments (Fraenkel & Wallen, 2008). To this end the researcher validated the research instruments in terms of content analysis by forwarding the research instruments and the data to be reviewed by the advisor. Based on his review & comments the unclear and obscure

questions were revised and integrated. Moreover, the internal validity has been done which deals with the degree to which the researcher observes and measures what is supposed to be measured. To strengthen its internal validity data collected and the findings were triangulated using different sources like that of questionnaires. Therefore, information was collected from a variety of sources and with a variety of techniques and confirmed the findings. The similarity of results obtained indicated that the data are valid.

3.10.2 Reliability

Reliability estimates the consistency of the measurements or more simply, the degree of uniformity of the results obtained from repeated measurements. For this purpose, the quality of data was measured, evaluated and guaranteed using appropriate techniques.

The data quality has been assured and measured through internal validity instrument in to correct research instruments application for accurately measuring the variables during the data collection procedures. Besides, data consistency was checked using reliability test (Cronbach's Alpha methods). Cronbach's alpha is used in this study to assess the internal consistency of the research instrument, which is developed questionnaire. Cronbach's α (alpha) is a coefficient of reliability used to measure the internal consistency of a test or scale; it resulted as a number between 0 and 1. As the result approaches to 1 the more is the internal consistency of the items, which means all the items measure the same variable. Based on this the researcher collect 12 sample questionnaires from respondents and use SPSS software to test the reliability of the data and put the result in the table no 3.4 shown below.

Table 3.4 Reliability Statics of Internal Consistency

Item No	Variables	Representative sample size	No of Items	Cronbach's alpha result
1	Project Construction success evaluation	12	5	0.862
2	Design change related factors	12	11	0.898
3	Material related factors	12	12	0.801
4	Labor related factors	12	10	0.894
5	Machinery and equipment related factors	12	8	0.946
6	Finance related factors	12	10	0.861
7	Management related factors	12	13	0.914
8	Contractual related factors	12	11	0.911
9	External factors	12	8	0.886
10	Evaluate project management practice	12	21	0.963

Source: Own Survey (2023)

Cronbach`s Alpha is a statistical test used to examine the internal consistency of the attributes determined for each dimension. As shown in above table, the value of the Cronbach's Alpha for variables was found to be above 0.7 which is an indication of acceptability of the scale for further analysis.

3.11 Ethical Consideration

Ethics is one of the major considerations in research. The researcher of this study is also subject to the following ethical considerations. Ethical permission form was attached to each questionnaire which explains about the purpose of the study, confidentiality and respondents full right to take part or not in the study plus the researcher has declared that all participants were voluntarily participated in the data collection by collaborating in filling of the questionnaire.

While assessing the information, the respondent's perception was respected. Respondents were clearly communicated about the objective of the research before they are asked to give their answer. The participant's consents were solicited and they are told that their personal answers would be kept confidential. Moreover, the responsibility on scientific research was maintained to the level best possible.

There was no any physical or psychological damage to them because of the research. Respondent were not asked about their name, race, religion, etc.

CHAPTER FOUR

RESULT AND DISCUSSION

This chapter deals with the presentation of the data collected from respondents through questionnaire and document review. An attempt was made to collect relevant data from targeted contractors, Clients, and consultants through designed questionnaire. The questionnaire used in this study has five questions in one group to evaluate the Towns' WSS projects construction success, eighty-three questions in eight group to assess the factors that affect the construction success of the projects and twenty-one questions to evaluate the management practice of in Towns' WSS projects in southern Ethiopia.

4.1 Respondents Characteristics and Response Rate

Among the one hundred questionnaire survey distributed to respondents twelve of them were not filled and invalid. 30% of the responses were from the contractor group, 28% of the responses were from clients and 30% from consultants' group. The overall response rate is 88% which is sufficient to find out the perceptive of the relative importance of project success factors (refer table 4.1)

Table 4.1 Response Rate

Respondent	**Questionnaires Distributed**	**Questionnaire Collected**		**Response from total (%)**
		Invalid/Not Filled Questionnaires	**Completed/Valid responses**	
Client	32	4	**28**	28
Contractor	34	4	**30**	30
Consultant	34	4	**30**	30
Total	**100**	**12**	**88**	**88%**

Source: Own Survey (2023)

Table 4.1 illustrates the distribution, collection, and response rates of questionnaires given to Clients, Contractors, and Consultants in a survey. 32 questionnaires were distributed to Client's representatives. 4 of these questionnaires were invalid or not filled out, leaving 28 completed and

valid responses. Clients accounted for 28% of the total responses in the survey. 34 questionnaires were distributed to Contractors. 4 of these questionnaires were invalid or not filled out, leaving 30 completed and valid responses. Contractors accounted for 30% of the total responses in the survey. 34 questionnaires were distributed to consultants. 4 of these questionnaires were invalid or not filled out, leaving 30 completed and valid responses. Consultants also accounted for 30% of the total responses in the survey. 100 questionnaires were distributed in total. 12 of these questionnaires were invalid or not filled out, resulting in 88 completed and valid responses. The overall response rate for the survey was 88%.

In summary, the largest group of respondents were from Contractors and Consultants, both accounting for 34.1% of the total responses. Clients made up 31.8% of the responses. Out of the 100 questionnaires distributed, 88 were completed and valid, while 12 were invalid or not filled out.

4.1.1 Profile of the Respondents

Respondents Job Position

The respondent's role within the project or organization refers to the specific duties and obligations that he/she holds in ensuring the successful execution and completion of the project (refer fig 4.1).

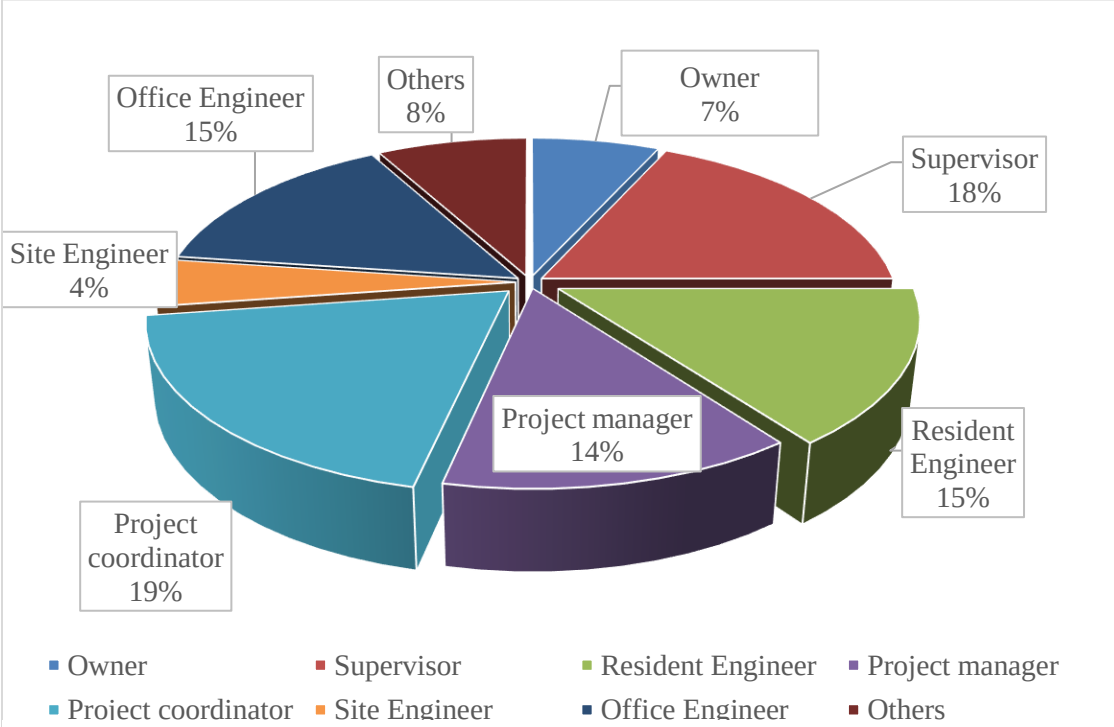

Figure 4.1 Respondents Role in Their Organization

Figure 4.1 presents the distribution of respondent positions within a project or organization. It shows percentage of each position, the position of an owner, representing 7% of the cumulative total, 18% of the total are supervisors, 15% of the total have the role of a resident engineer, 14% of the total are project managers, 19% of the total hold the position of a project coordinator, 4% of the total are site engineers, 15% of the total have the role of an office engineer, 8% of the total hold other positions, completing the 100% cumulative percentage.

In total, there are 88 respondents in the survey, with their positions distributed across various roles within the project or organization. The most common position is the project coordinator, followed by the supervisor and resident engineer. The least common position is the site engineer.

Respondent's academic qualification

The term "Respondent Academics qualification" refers to the educational background, degrees, or certifications held by the respondents who participated in the survey. This information is typically used to analyze the level of education and expertise of the survey participants in relation to the topic being studied (refer fig 4.2).

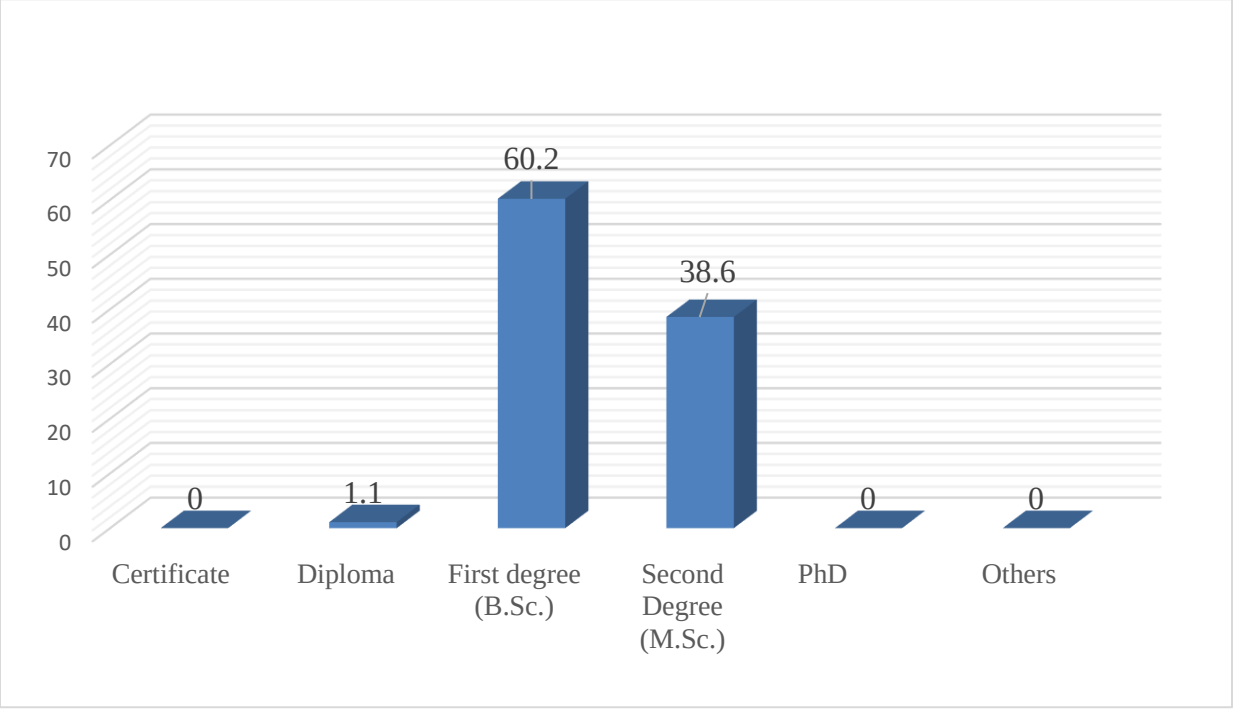

Figure 4.2 Respondents Academics Qualification

Figure 4.2 provides a summary of the educational qualifications of respondents who participated in a survey. The data is presented in terms of percentage for each qualification level. No respondents reported having a Certificate qualification. This represents 0% of the total respondents. Only 1.1% of the total, reported having a Diploma. 60.2% of the total, reported having a First Degree (B.Sc.). 38.6% of the total, reported having a Second Degree (M.Sc.). The cumulative percentage of respondents with a Second Degree (M.Sc.) or lower is 100%. No respondents reported having a PhD qualification. Moreover, no respondents reported having other qualifications. The total number of respondents is 88. The overall percentage sums up to 100%.

In summary, the overall result shows that the majority of the respondents hold a First Degree (B.Sc.) with 60.2%, followed by those with a Second Degree (M.Sc.) at 38.6%. Only 1.1% of the respondents have a Diploma, and there are no respondents with a Certificate, PhD, or other qualifications.

Respondent's years of work experience

In a questionnaire survey, "respondent years of work experience" refers to the number of years that the respondent, or the person answering the survey, has been working in Water supply and sanitation projects. The years of work experience in towns' water supply and sanitation projects can provide valuable information about the expertise and skills of professionals involved in this research (refer fig 4.3).

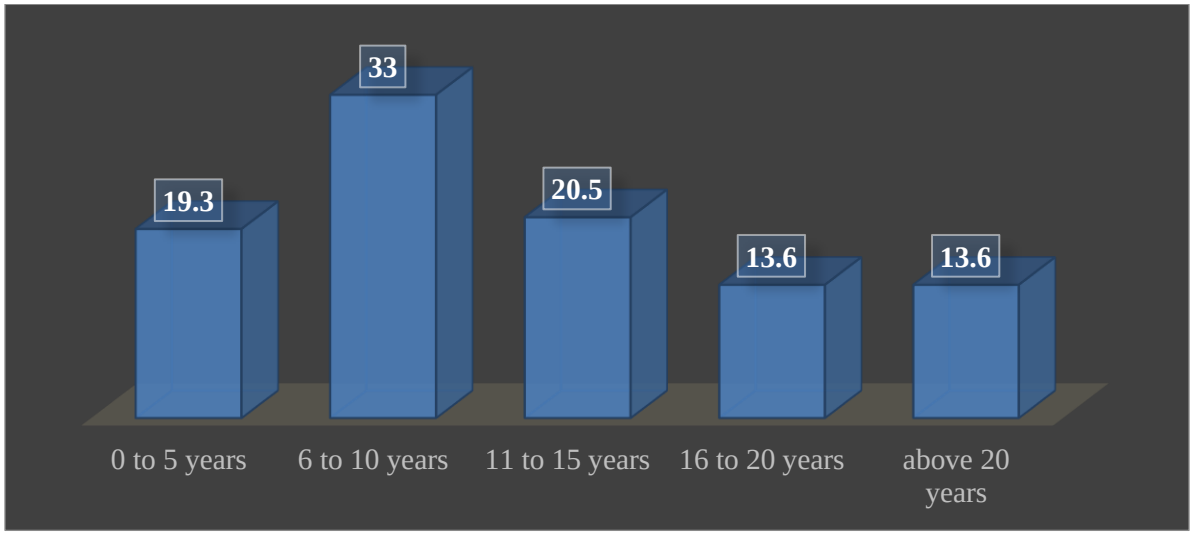

Figure 4.3 Respondents Years of Work Experience

Figure no 4.3 presents the distribution of work experience among survey respondents. The data is divided into different categories based on the number of years of work experience, and it

percentage for each category. The respondents with 0 to 5 years of work experience, which accounts for 19.3% of the total respondents. The respondents with 6 to 10 years of work experience, representing 33% of the total respondents. The respondents with 11 to 15 years of work experience, accounting for 20.5% of the total respondents. The respondents with 16 to 20 years of work experience, making up 13.6% of the total respondents. The respondents with more than 20 years of work experience, which also represents 13.6% of the total respondents. The cumulative percentage is now 100%.

In summary, the total number of respondents is 88. The majority of respondents (33%) have 6 to 10 years of work experience, followed by those with 11 to 15 years of experience with20.5%. The least represented group is the one with 16 to 20 years and above 20 years of experience, both with 13.6% of respondents.

Number of Town WSS projects executed by the respondents

The question "Number of Towns' Water Supply and Sanitation projects executed in your organization" is asking the respondent to provide information about the total number of water supply and sanitation projects that their organization has successfully completed in different towns. This question aims to gather data on the respondent's organization's experience and capacity in implementing such projects. The respondent should provide a numerical value representing the total number of projects executed in different towns (refer fig 4.4).

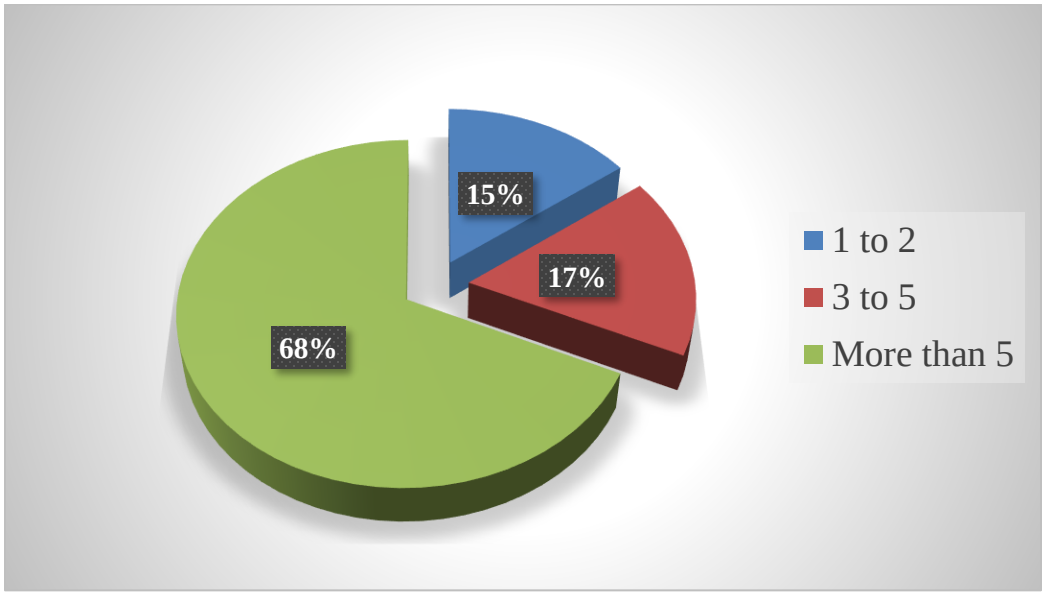

Figure 4.4 Number of Towns' WSS Projects Executed by Respondents

Figure 4.4 above presents the distribution of the number of water supply and sanitation projects executed by different organizations. It shows the range of projects completed (1-2, 3-5, and more than 5), 15% of the total organizations completed 1 to 2 projects. 17% of the total organizations completed 3 to 5 projects. 32% of organizations have completed up to 5 projects. 60 organizations. 68% of the total organizations have completed more than 5 projects.

The total number of respondents surveyed is 88. This figure indicates that the majority of the organizations (68%) have completed more than 5 water supply and sanitation projects, while a smaller percentage have completed between 1-2 projects (15%) and 3-5 projects (17%).

4.2 Evaluation of Overall Towns' WSS Project Construction Success

The assessment focused solely on the construction stage of the Towns' Water Supply and Sanitation (WSS) projects in Southern Ethiopia. Here are some potential elements that might be examined: project schedule management, Budget Management, Quality Control and assurance, and scope managements.

Performance of Towns' WSS projects in the schedule time period

The performance of Towns' Water Supply and Sanitation (WSS) projects within the scheduled time period refers to how well the projects were executed in relation to the predefined timeline. This refers to whether the projects were completed within the set schedule. Were there any delays? Projects are often broken down into stages or milestones. Did the project reach these milestones on time? Was time used effectively to ensure tasks were completed in a timely manner or not? Assessing these factors can provide a comprehensive understanding of how well the towns' WSS projects performed within the scheduled time period.

Table 4.2 Project Performance Evaluation within the Scheduled Time Period

Scale	Frequency	Percent	Cumulative Percent
Very low Performance	14	15.9	15.9
Low Performance	36	40.9	56.8
Moderate Performance	29	33	89.8
Good Performance	9	10.2	100
Very good performance	0	0	
Total	88	100	

Source: Own Survey (2023)

Table 4.2 represents a frequency distribution of the performance of towns' Water Supply and Sanitation (WSS) projects within a scheduled time period. It shows the responses of 88 individuals who were asked to rate the performance of these projects.

Here's a breakdown of the table: 14 out of 88 respondents, or 15.9%, rated the performance of the WSS projects as very low. This represents the lowest rating for project performance in the group. 36 out of 88 respondents, or 40.9%, rated the performance of the WSS projects as low. This means that cumulatively, 56.8% of respondents rated the performance as either low or very low. 29 respondents, or 33% of the total, rated the performance of the WSS projects as moderate. This means that cumulatively, 89.8% of respondents rated the performance as either very low, low, or moderate.

On the other hand, 9 respondents, or 10.2% of the total, rated the performance of the WSS projects as good. This means that all respondents (100%) rated the performance as either very low, low, moderate, or good. In addition, No respondents (0%) rated the performance of the WSS projects as very good.

In summary, most respondents (56.8%) rated the performance of the town's WSS projects as low or very low, and a significant portion (33%) thought the performance was moderate. Only a small fraction (10.2%) considered the performance to be good, and none of the respondents thought the performance was very good.

Performance of Towns' WSS projects within the allocated time budget

The statement is referring to how well the water supply and sanitation project was executed in the towns within its stipulated budget. It addresses the efficiency and effectiveness of the project's management in terms of financial resources.

In a broader context, this involves considering whether the project was able to achieve its objectives without exceeding the budget. For example, if the project was able to supply clean water and improve sanitation in the towns as planned, and did so within or even under the allocated budget, the performance would be considered high. Alternatively, if the project faced cost overruns or was unable to meet its goals despite using all the budgeted funds, the performance might be rated as low.

Table 4.3 Project Performance Evaluation within the Allocated Budget

Scale	Frequency	Percent	Cumulative Percent
Very low Performance	6	6.8	6.8
Low Performance	24	27.3	34.1
Moderate Performance	34	38.6	72.7
Good Performance	23	26.1	98.9
Very Good Performance	1	1.1	100
Total	88	100	

Source: Own Survey (2023)

Table 4.3 presents the data on the performance of the towns' water supply and sanitation project within the allocated budgeted cost, rated on a five-point scale from Very low Performance to Very Good Performance. It includes the frequency and percentage of each response, and the cumulative percentage.

Very low Performance was selected by 6 respondents, which represents 6.8% of the total responses. This is also the starting point of the cumulative percentage. Low Performance was selected by 24 respondents, constituting 27.3% of the total responses. Adding this to the previous cumulative percentage, 34.1% of respondents rated the project's performance as low or very low.

On the other hand, Moderate Performance was selected by 34 respondents, making up the largest portion at 38.6%. When added to the cumulative total, 72.7% of respondents rated the performance as moderate or below. Good Performance was chosen by 23 respondents, which is 26.1% of the total. When added to the cumulative total, 98.9% of respondents selected good performance or below.

Lastly, Very Good Performance was selected by only 1 respondent, representing 1.1% of all respondents. This brings the cumulative total to 100%.

In summary, the majority of respondents (72.7%) rated the performance of the towns' water supply and sanitation project as moderate or below within the allocated budgeted cost. Very few respondents (1.1%) rated the performance as very good.

Performance of Towns' WSS project as per the desired quality

This statement is referring to how well the Water Supply and Sanitation (WSS) projects in various towns are performing according to the quality expected or desired. It suggests an evaluation or assessment is being made, possibly based on certain quality standards or benchmarks.

Table 4.4 Project Performance Evaluation as per the Desired Quality

Scale	Frequency	Percent	Cumulative Percent
Very low Performance	1	1.1	1.1
Low Performance	9	10.2	11.4
Moderate Performance	35	39.8	51.1
Good Performance	33	37.5	88.6
Very Good Performance	10	11.4	100
Total	88	100	

Source: Own Survey (2023)

Table 4.4 reports the results of an evaluation of the performance of the towns' water supply and sanitation projects, relative to the desired quality.

Out of the 88 responses: 1 respondent, representing 1.1% of the total, rated the performance as Very low. This is also the cumulative percent up to this point. 9 respondents, or 10.2% of the total, rated the performance as Low. Adding this to the previous cumulative percent, 11.4% of respondents rated the performance as Low or Very low. 35 respondents, or 39.8% of the total, rated the performance as Moderate. Adding this to the previous cumulative percent, 51.1% of respondents rated the performance as Moderate or lower. 33 respondents, or 37.5% of the total, rated the performance as Good. Adding this to the previous cumulative percent, 88.6% of respondents rated the performance as "Good" or lower.

On the other hand, 10 respondents, or 11.4% of the total, rated the performance as Very Good. Adding this to the previous cumulative percent, 100% of respondents rated the performance as Very Good or lower.

In summary, the majority of respondents consider the performance of the towns' water supply and sanitation projects to be at least Moderate, with a significant portion rating it as Good. However, around 11% of respondents consider the performance to be Low or Very low.

Performance of Towns' WSS projects as per mutual agreed scope (Minimal variation)

This statement means that the performance of the town's water supply and sanitation project is aligned with the scope that was mutually agreed upon, with only minimal variation. This suggests that the project is being executed effectively, adhering closely to the planned activities, objectives, and goals. The phrase "minimal variation" indicates that there are only small differences or changes from the original plan, which is generally a positive sign in project management as it shows the project is on track.

Table 4.5 Project Performance Evaluation as per Mutual Agreed Scope (Minimal Variation)

Scale	Frequency	Percent	Cumulative Percent
Very low Performance	1	1.1	1.1
Low Performance	16	18.2	19.3
Moderate Performance	28	31.8	51.1
Good Performance	38	43.2	94.3
Very Good Performance	5	5.7	100
Total	88	100	

Source: Own Survey (2023)

Table 4.5 provides an analysis of the performance of the Towns' water supply and sanitation project as per a mutually agreed scope, with minimal variation.

The performance is measured on a scale from very low to very good. The frequency column shows the number of times each level of performance was observed, and the percent column shows the proportion of the total that each level of performance represents. The cumulative percent column shows the running total of the percentage, adding each level to the sum of the previous levels.

Here's a breakdown of the performance levels: Very low performance was observed only once, representing 1.1% of all observations. This is the lowest performance level. Low performance was observed 16 times, representing 18.2% of all observations. Cumulatively, very low and low performance represent 19.3% of all observations. Moderate performance was observed 28 times, representing 31.8% of all observations. Cumulatively, very low, low, and moderate performance represent 51.1% of all observations.

On the other hand, good performance was observed the most, 38 times, representing 43.2% of all observations. Cumulatively, very low, low, moderate, and good performance represent 94.3% of all observations. Very good performance was observed 5 times, representing 5.7% of all

observations. When added to the cumulative total, it reaches 100%, meaning all observations have been accounted for.

In summary, the project's performance was generally good, with the majority (43.2%) of observations falling in the "Good Performance" category. However, there is room for improvement, as a significant portion (19.3%) of observations were rated as "low" or "very low" performance. Only a small portion (5.7%) was rated as "very good."

Overall performance of projects based on time, cost, quality and other constraints

The topic is asking for an evaluation of the performance of Towns' water supply and sanitation construction projects over the last five years. This evaluation should take into account various factors such as time, cost, quality, and other constraints.

Table 4.6 Overall Performance Evaluation within the Last Five Years

OVERALL TOWNS' WATER SUPPLY AND SANITATION CONSTRUCTION PROJECTS PERFORMANCE IN THE LAST FIVE YEARS BASED ON TIME, COST, QUALITY, AND OTHER CONSTRAINTS			
SCALE	**Frequency**	**Percent**	**Cumulative Percent**
Very low Performance	6	6.8	6.8
Low Performance	30	34.1	40.9
Moderate Performance	37	42	83
Good Performance	14	15.9	98.9
Very Good Performance	1	1.1	100
Total	88	100	

Source: Own Survey (2023)

The scale in the table 4.6 represents the performance level of the Towns' water supply and sanitation construction projects over the last five years, ranging from Very Low Performance to Very Good Performance. The frequency is the number of times a particular performance level was reported, and the percent represents the percentage of the total responses each performance level received.

From the table, it can be interpreted that: Very Low Performance was reported 6 times, which accounts for 6.8% of the total responses. Low Performance was reported 30 times, making up 34.1% of the total responses. This indicates that a significant proportion of the projects performed below average.

On the other hand, Moderate Performance was the most frequent response, reported 37 times, accounting for 42% of the total responses. This suggests that a majority of the projects had an average performance level. Good Performance was reported 14 times, making up 15.9% of the total responses. This reveals that a smaller proportion of projects were considered to perform well.

In the contrary, Very Good Performance was reported only once, representing a mere 1.1% of the total responses. This indicates that very few projects were considered to perform exceptionally well.

In conclusion, the majority of the Towns' water supply and sanitation construction projects over the past five years had a Moderate to Low performance level based on criteria such as time, cost, quality, and other constraints. Only a small number of projects achieved 'Good' or Very Good performance levels. This data could be used to identify areas for improvement in future projects.

Evaluation of overall the projects performance based on their mean score

The rule of thumb to measure the mean value in a Likert scale data is to simply add up all the values and then divide by the number of respondents.

However, keep in mind that Likert scale data is ordinal, not interval. This means that while the numbers have a rank order, the differences between the numbers don't necessarily represent equal changes in the attitude or opinion being measured.

Table 4.7 Project Performance Evaluation Based on Mean Score

Description of Project Success	N	Mean	Standard Deviation
The performance of the Towns' water supply and sanitation project within the scheduled time period.	88	2.37	0.875
The performance of the Towns' water supply and sanitation project within the allocated budgeted cost.	88	2.87	0.92
The performance of the Towns' water supply and sanitation project as per the desired quality.	88	3.48	0.871
The performance of the Towns' water supply and sanitation project as per mutually agreed scope (Minimal variation).	88	3.34	0.883
Overall Towns' water supply and sanitation construction projects performance in the last five years based on time, cost, quality, and other constraints	88	2.7	0.86

Source: Own Survey (2023)

Table 4.7 provides an analysis of the performance of the Towns' water supply and sanitation project as per different constraints with their mean score and standard deviation.

In general, a lower standard deviation indicates that the responses were closer to the mean, thus suggesting a general agreement among the respondents. On the other hand, a higher standard deviation indicates a wider spread of responses, suggesting differing opinions among respondents. Based on the provided data all the standard deviations are below one, which shows that there is agreement among respondents.

The performance of the Towns' water supply and sanitation project within the scheduled time period has a mean of 2.37, which falls within the range of 1.80-2.60, which means the performance is **Low**.

The performance of the Towns' water supply and sanitation project within the allocated budgeted cost has a mean of 2.87, which falls within the range of 2.60-3.4, which corresponds to **Moderate Performance**.

The performance of the Towns' water supply and sanitation project as per the desired quality has a mean of 3.48, which falls under the category of Good Performance which ranges from 3.40 to 4.20. This suggests that on average, the performance of the project is considered **Good Performance** by the respondents.

Besides, the performance of the Towns' water supply and sanitation project as per mutually agreed scope (Minimal variation) has a mean of 3.34, which falls within the range of 3.40-4.2. However, since it's slightly less than 3.4, it can be considered as showing **Moderate Performance**.

The overall towns' WSS projects success in the last five years based on time, cost, quality and other constraints has a mean value of 2.7 falls within the range of 2.60-3.4, which, according to the provided response options, corresponds to **Moderate Performance**.

Therefore, according to the data provided, the overall performance of the Towns' water supply and sanitation construction projects in the last five years, based on time, cost, quality, and other constraints, is considered to be between moderate and low. The variability in the performance across these parameters suggests areas of improvement, particularly in terms of project completion within the scheduled time period and budget.

4.2.1 Project Performance Evaluation Based on Open Ended Questions

Survey respondents were asked a series of open-ended questions, the following table provides an insightful overview of certain aspects pertaining to the execution of Towns' Water Supply and Sanitation projects in the last five years. The responses to which were then averaged to obtain a quantifiable measure of various factors such as project execution, adherence to schedule and budget, quality standards, and frequency of complaints. The survey used a scale to quantify responses, thus providing an opportunity to analyze trends and identify areas of success and improvement in a measured and systematic manner. The findings of this survey, discussed in detail in the following sections, offer valuable insights that can help in future project planning and execution in the construction industry.

Table 4.8 Responses to Open Ended Questions for Project Performance Evaluation

Item No	Open Ended Questions Asked to Respondents	Average score	Maximum	Minimum
1	How many Towns' Water Supply and Sanitation projects Executed in the last 5 years	5	18	1
2	How many of them were behind the schedule	4	18	0
3	How many of them were over budget	3	18	0
4	How many of them were less than the desired quality standard	1	5	0
5	How many of them were most complained about	2	9	0

Source: Own Survey (2023)

Table 4.8 contains survey responses about Towns' Water Supply and Sanitation projects performed over the past five years. The responses include the average, maximum, and minimum scores for each question. The interpretation would be as follows:

How many Towns' Water Supply and Sanitation projects Executed in the last 5 years: The average score of 5 suggests that respondents were involved in an average of 5 projects over the past 5 years. However, the range from the minimum of 1 to the maximum of 18 projects. The maximum of 18 shows there's a significant difference in the number of projects executed by respondents, this indicates that some respondents were engaged in many more projects, possibly due to varying job roles, sectors, or extent of involvement in such projects, while others may be involved in a fewer number.

How many of them were behind the schedule: An average score of 4 suggests that on average, around 4 out of the 5 projects executed by the respondents were behind schedule. However, with a minimum of 0 and a maximum of 18, again there's a broad range of experiences among respondents. Still, the extent of these scheduling issues varied greatly among respondents, with the maximum being as high as 18.

How many of them were over budget: An average score of 3 means that, on average, the respondents went over budget on 3 of their projects out of 5. Despite this, some respondents reported more extreme experiences, with up to 18 projects exceeding their budgets.

How many of them were less than the desired quality standard: The average score of 1 suggests that typically, respondents had only one project that was less than the desired quality standard. The maximum score of 5 indicates that there were respondents who had more projects falling below the desired quality standards.

The average response indicating that 2 projects were often the subject of complaints suggests some level of dissatisfaction among stakeholders. While most respondents didn't report more than 2 problematic projects, a maximum score of 9 indicates more widespread concerns among certain respondents.

Overall, the survey focused on Towns' Water Supply and Sanitation projects executed over the last 5 years. On average, respondents were involved in 5 such projects. However, the majority of these projects faced challenges. On average, 4 out of 5 projects were reported to be behind schedule, and 3 out of 5 projects exceeded their budgets. Quality was less of an issue, with only 1 out of 5 projects, on average, reported to be below the desired quality standards. Complaints were received for an average of 2 out of 5 projects.

These results suggest that while the number of projects executed is relatively high, there are significant areas for improvement, particularly in terms of project scheduling and budget management. Quality control seems to be less of a concern, but the number of complaints received indicates that there may be other issues affecting stakeholder satisfaction.

4.2.2 Case Study for Project Performance Evaluation

In this particular scenario, the researcher is utilizing a case study methodology to ascertain the overall success of certain projects. This approach involves an in-depth, multifaceted examination of a small number of sample sites to gain a comprehensive understanding of the situation.

The data for these case studies are primarily obtained from consultant reports and other sources. Consultant reports are typically comprehensive documents that provide a detailed analysis of the project, covering all aspects from planning and execution to the final outcome. They offer valuable insights into the project's performance, challenges faced, solutions applied, and the final results. These reports can be a rich source of qualitative and quantitative data, offering an in-depth understanding of the project's success.

Table 4.9 Sample Towns WSS Projects and Their Status

Item No	Name of sample Towns' WSS projects	Contract signed date	Commenc. date	Main Contract Time	Progress as of May 2023(%)	time elapsed	Delay (%)
1	Gecha	6-Jan-21	27-Jan-21	365	98	524	145.56
2	Kele	27-May-22	10-Aug-22	365	52.07	229	62.74
3	Shinshicho	30-Nov-21	25-Dec-21	365	61.83	240	65.75
4	Wacha	9-Nov-21	1-Dec-21	365	80.46	531	147.5
5	Gedeb	24-Sep-21	9-Oct-21	365	52.17	498	136.44
6	Tercha	9-Apr-21	27-May-21	365	61.59	693	189.86
7	Jinka	16-Nov-21	7-Dec-21	485	50.65	480	98.97

Source: Consultant and Client Reports

Table 4.9 represents the status of WSS projects in various towns.

Gecha: The contract was signed on January 6, 2021, and the project commenced on January 27, 2021. The project was expected to take 365 days to complete. By April 2023, the project had been in progress for 852 days, which is 145.56% of the planned duration, indicating a delay. However, the project was 98% complete.

Kele: The contract was signed on May 27, 2022, and the project began on August 10, 2022. As of April 2023, 52.07% of the project was complete. However, the project had been in progress for 296 days, which is 62.74% of the planned duration.

Shinshicho: The contract was signed on November 30, 2021, and the project started on December 25, 2021. By April 2023, 61.83% of the project was complete. However, the project had been in progress for 406 days, which is 65.75% of the planned duration.

Wacha: The contract was signed on November 9, 2021, and the project started on December 1, 2021. By April 2023, 80.46% of the project was complete. However, the project had been in progress for 531 days, which is 147.55% of the planned duration, indicating a delay.

Gedeb: The contract was signed on September 24, 2021, and the project started on October 9, 2021. By April 2023, 52.17% of the project was complete. However, the project had been in progress for 498 days, which is 136.44% of the planned duration, indicating a delay.

Tercha: The contract was signed on April 9, 2021, and the project started on December 7, 2021. By April 2023, 61.59% of the project was complete. However, the project had been in progress for 693 days, which is 189.86% of the planned duration, indicating a significant delay.

Jinka: The contract was signed on November 23, 2021, and the project started on May 27, 2021. By April 2023, 50.65% of the project was complete. However, the project had been in progress for 480 days, which is 98.97% of the planned duration, indicating a significant delay.

Many of the projects have significantly exceeded their planned durations, this suggests that while time management and scheduling may have been poorly executed. These delays can lead to increased costs, either through direct expenses or opportunity costs. They might also cause dissatisfaction among stakeholders. Hence the management of these projects needs to be improved to avoid such significant delays and to improve the overall success of the project.

From the overall result it can be concluded that construction of towns' water supply and sanitation projects have been facing significant challenges in terms of the time, cost, quality, scope and other constraints like customer satisfaction. Accordingly, it is essential to consider the challenges and limitations in the sector to make future water supply and sanitation projects successful.

4.3 Factors Affecting the Construction Success of Town WSS Projects

In a comprehensive study aimed at identifying the challenges affecting the success of water supply and sanitation projects, the researcher has identified 83 different factors. These factors have been classified into eight distinct categories, each addressing a unique aspect of the project.

To gather a wide range of perspectives, a questionnaire summarizing these 83 factors was developed. This questionnaire was systematically distributed among three key stakeholder groups involved in the projects - the clients who supervise the projects, the contractors responsible for the actual construction, and the consultants who provide expert advice throughout the projects.

Table 4.10 Category of Factors Affecting Project Success

Item No	Category of factors	No of factors
1	Design change related factors	11
2	Material related factors	12
3	Labor related factors	10
4	Machinery and equipment related factors	8
5	Finance related factors	10
6	Management related factors	13
7	Contractual related factors	11
8	External factors	8

Source: Own Survey (2023)

Based on table 4.10, it appears to be a categorization of factors related to the construction success of towns' water supply and sanitation project in Southern Ethiopia. The table consists of eight categories of factors, each with a corresponding number of factors.

Here is the breakdown of the table: Design change related factors: This category has 11 factors. Material related factors: This category has 12 factors. Labor related factors: This category has 10 factors. Machinery and equipment related factors: This category has 8 factors. Finance related factors: This category has 10 factors. Management related factors: This category has 13 factors. Contractual related factors: This category has 11 factors. External factors: This category has 8 factors.

The distribution of the questionnaire yielded 88 valid responses. These responses constituted a diverse mix of insights and opinions, providing a comprehensive overview of the various challenges and obstacles that these projects might face.

For the analysis of the collected data, the SPSS software, known for its advanced statistical capabilities, was used. This software allowed for a detailed and thorough examination of the responses, leading to a systematic understanding of the factors affecting the success of the projects.

Based on the analysis of the questionnaire responses using SPSS software, the researcher has identified the top 15 important factors that affect the construction success of towns' water supply

and sanitation (WSS) projects in the southern part of the country. These factors are categorized into different categories and ranked based on their mean values and Relative Importance Index (RII). The mean value represents the average score given to each factor by the respective entity. The RII is a normalized value ranging from 0 to 1, indicating the relative importance of each factor within the entity and overall respondents. The higher the RII, the more important the factor is considered. The rank shows the position of each factor in terms of importance within the entity and for all respondents.

Table 4.11 Top Fifteen Most Important Factors based on Mean and RII Score

Item No	Description of Factors	Category	All Response		
			Mean	RII	Rank
1	Fluctuation of construction material prices	Finance related	4.03	0.807	1
2	Delay in supply of materials from foreign countries	Material related	4.01	0.802	2
3	Shortage of foreign currency	Finance related	3.93	0.786	3
4	Overall inflation in the economy	External	3.91	0.782	4
5	Shortage of construction materials in market	Material related	3.86	0.773	5
6	Fluctuation in foreign currency exchange rate	Finance related	3.82	0.764	6
7	Financial difficulties faced by the contractor	Finance related	3.75	0.750	7
8	Late Supply of Materials	Material related	3.73	0.745	8
9	Insufficient cash flow on site	Finance related	3.66	0.732	9
10	Government support in providing foreign currency	Finance related	3.66	0.732	10
11	Client’s financial shortage	Finance related	3.56	0.711	11
12	Mobilization of equipment’s on site as per contractual agreement	Equipment related	3.52	0.705	12
13	Delayed payments to contractors	Finance related	3.47	0.69	13
14	Unrealistic contract duration	Management related	3.42	0.68	14
15	Equipment unavailability	Equipment related	3.39	0.68	15

Source: Own Survey (2023)

The above table no 4.11 shows top ranked factors based on their mean score and RII value, as we can see in the table there are two highly important factors with RII value greater than 0.8 and 13 important factors with RII value between 0.65 and 0.8.

Let’s analyze each factor in detail: Fluctuation of construction material prices (Finance related): with Mean value of 4.03 and RII (Relative Importance Index) value of 0.807 ranked (1). This factor indicates that the fluctuation of construction material prices has a high impact on the success of the projects. It suggests that the cost of materials can significantly affect the overall budget and financial feasibility of the projects.

Delay in supply of materials from foreign countries (Material related): with mean value of 4.01 and RII value of 0.802 ranked (2). This factor highlights the importance of timely supply of materials from foreign countries. Delays in material import can lead to project delays and hinder the progress of the construction projects.

Shortage of foreign currency (Finance related): with mean value of 3.93 and RII value of 0.786 ranked (3) which means the shortage of foreign currency is identified as a significant factor affecting the success of the projects. It suggests that the availability of foreign currency is crucial for procuring necessary materials and equipment from international suppliers.

Overall inflation in the economy (External): with mean value of 3.91 and RII value of 0.782 ranked (4). This factor indicates that the overall inflation rate in the economy has an impact on the construction projects. Inflation can lead to increased costs of labor, materials, and other project expenses.

Shortage of construction materials in the market (Material related): with mean value of 3.86 and RII value of 0.773 ranked (5). The shortage of construction materials in the market is considered an important factor. It suggests that the availability of necessary materials locally can affect the progress and completion of the projects.

Fluctuation in foreign currency exchange rate (Finance related): with mean value of 3.82 and RII value of 0.764 ranked (6). This factor highlights the impact of fluctuations in foreign currency exchange rates. It suggests that changes in exchange rates can affect the cost of imported materials and impact the project's financial stability.

Financial difficulties faced by the contractor (Finance related): with mean value of 3.75 and RII value of 0.750 ranked (7). The financial difficulties faced by the contractor are identified as an important factor. It indicates that the financial stability and capability of the contractor can influence the successful execution of the projects.

Late Supply of Materials (Material related): with mean value of 3.73 and RII value of 0.745 ranked (8). This factor emphasizes the importance of timely supply of materials. Delays in material delivery can lead to project delays and impact the overall progress.

Insufficient cash flow on site (Finance related): with mean value of 3.66 and RII value of 0.732 ranked (9). This factor indicates that the availability of sufficient cash flow on the construction site is crucial. Insufficient cash flow can hinder the progress of the projects and lead to delays.

Government support in providing foreign currency (Finance related): with mean value of 3.66 and RII value of 0.732 ranked (10). The availability of government support in providing foreign currency is considered important. It suggests that government policies and support can help mitigate the impact of currency shortages on the projects.

Client's financial shortage (Finance related): with mean value of 3.56 and RII value of 0.711 ranked (11). This indicates that if the client is facing a financial crunch, it can delay payments and affect the project's progress.

Mobilization of equipment's (Equipment related): with mean value of 3.52 and RII value of 0.705 ranked (12). This suggests that delays in mobilizing equipment on the construction site can disrupt the project schedule.

Delayed payments to contractors (Finance related): with mean value of 3.47 and RII value of 0.69 ranked (13). This suggests that payment delays can affect contractor's cash flow and hence the project's progress.

Unrealistic contract duration (Management Related) with mean value of 3.42 and RII value of 0.68 ranked (14). It implies that if the project timeline is unrealistic, it can lead to rushed work or delays.

Equipment unavailability (Equipment related): with mean value of 3.39 and RII value of 0.68 ranked (15). This suggests that a lack of necessary construction equipment can delay the project.

Overall, the top five factors affecting project success as per respondents insight include fluctuations in construction material prices, delays in importing materials from foreign countries, a shortage of foreign currency, overall economic inflation, and a scarcity of construction materials in the market.

4.3.1 Ranking Group Category Factors

In a comprehensive study aimed at identifying the challenges affecting the success of water supply and sanitation projects, a researcher has recognized 83 different factors. These factors have been classified into eight distinct categories, each addressing a unique aspect of the project. This research focuses on the towns located in the southern part of the country where these projects are being implemented.

Table 4.12 Ranking Category of Factors Based on Their Mean and RII Score

Item No	Categories of Factors	All Response		
		Mean	RII	Rank
1	Design change related factors	2.87	0.58	7
2	Material related factors	3.24	0.65	2
3	Labor related factors	2.82	0.56	8
4	Equipment related factors	3.23	0.65	3
5	Finance related factors	3.62	0.72	1
6	Management related factors	3.07	0.61	5
7	Contractual related factors	3.10	0.62	4
8	External factors	3.02	0.60	6

Source: Own Survey (2023)

Based on the above shown table no 4.12 provided, it appears to be a comparison of different factors categorized into eight categories: design change related factors, material related factors, labor related factors, equipment related factors, finance related factors, management related factors, contractual related factors, and external factors.

Based on the information provided, Design change related factors: The mean score for this category is 2.87, and it has a Relative Importance Index (RII) of 0.58 based on this result it is ranked 7th among the eight categories. Material related factors: The mean score for this category is 3.24, and it has an RII of 0.65 based on this result it is ranked 2nd among the eight categories. Labor related factors: The mean score for this category is 2.82, and it has an RII of 0.56 based in this result it is ranked 8th among the eight categories. Equipment related factors: The mean score for this category is 3.23, and it has an RII of 0.65 based on this result it is ranked 3rd among the eight categories. Finance related factors: The mean score for this category is 3.62, and it has an RII of 0.72 as per this result it is ranked 1st among the eight categories. Management related

factors: The mean score for this category is 3.07, and it has an RII of 0.61 with this result it is ranked 5th among the eight categories. Contractual related factors: The mean score for this category is 3.10, and it has an RII of 0.62, It is ranked 4th among the eight categories. External factors: The mean score for this category is 3.02, and it has an RII of 0.60, It is ranked 6th among the eight categories.

To summarize Finance related factors ranked first among the eight categories and followed by material related factors and equipment related factors second and third respectively.

4.3.2 Correlation Analysis among the Three Groups of Respondents

To compare the correlation between different variables among the three groups of respondents (client, contractor, and consultant), the researcher used statistical analysis techniques. These techniques help to understand the relationship and strength of association between variables within each group and compare them across the groups.

The researcher used statistical software called SPSS to run the Pearson correlation analyses among the three independent groups and determine their correlation coefficients (r). Based in the analysis conducted the result shown below in table 4.13

Table 4.13 Correlation Analysis among the Three Group of Respondents

Correlations

Which organization do you represent			Design related factors	Material related factors	Labor related factors	Equipment related factors	Finance related factors	Management related factors	contractual related factors	External related factors
Client	Design related factors	Pearson Correlation	1	.760**	.609**	.629**	.564**	.505**	.598**	.526**
		Sig. (2-tailed)		0.000	0.001	0.000	0.002	0.006	0.001	0.004
	Material related factors	Pearson Correlation	.760**	1	.671**	.658**	.610**	0.234	.484**	0.175
		Sig. (2-tailed)	0.000		0.000	0.000	0.001	0.231	0.009	0.372
	Labor related factors	Pearson Correlation	.609**	.671**	1	.668**	.546**	0.372	.612**	.556**
		Sig. (2-tailed)	0.001	0.000		0.000	0.003	0.051	0.001	0.002
	Equipment related factors	Pearson Correlation	.629**	.658**	.668**	1	.748**	.551**	.801**	.478*
		Sig. (2-tailed)	0.000	0.000	0.000		0.000	0.002	0.000	0.010
		Pearson Correlation	.564**	.610**	.546**	.748**	1	.709**	.762**	.465*

	Finance related factors	Sig. (2-tailed)	0.002	0.001	0.003	0.000		0.000	0.000	0.013
	Management related factors	Pearson Correlation	.505**	0.234	0.372	.551**	.709**	1	.699**	.535**
		Sig. (2-tailed)	0.006	0.231	0.051	0.002	0.000		0.000	0.003
	contractual related factors	Pearson Correlation	.598**	.484**	.612**	.801**	.762**	.699**	1	.660**
		Sig. (2-tailed)	0.001	0.009	0.001	0.000	0.000	0.000		0.000
	External related factors	Pearson Correlation	.526**	0.175	.556**	.478*	.465*	.535**	.660**	1
		Sig. (2-tailed)	0.004	0.372	0.002	0.010	0.013	0.003	0.000	
Contractor	Design related factors	Pearson Correlation	1	.743**	.601**	.480**	.576**	.559**	.599**	.637**
		Sig. (2-tailed)		0.000	0.000	0.007	0.001	0.001	0.000	0.000
	Material related factors	Pearson Correlation	.743**	1	.811**	.870**	.693**	.815**	.730**	.704**
		Sig. (2-tailed)	0.000		0.000	0.000	0.000	0.000	0.000	0.000
	Labor related factors	Pearson Correlation	.601**	.811**	1	.790**	.694**	.873**	.785**	.720**
		Sig. (2-tailed)	0.000	0.000		0.000	0.000	0.000	0.000	0.000
	Equipment related factors	Pearson Correlation	.480**	.870**	.790**	1	.683**	.789**	.735**	.678**
		Sig. (2-tailed)	0.007	0.000	0.000		0.000	0.000	0.000	0.000
	Finance related factors	Pearson Correlation	.576**	.693**	.694**	.683**	1	.647**	.750**	.664**
		Sig. (2-tailed)	0.001	0.000	0.000	0.000		0.000	0.000	0.000
	Management related factors	Pearson Correlation	.559**	.815**	.873**	.789**	.647**	1	.793**	.690**
		Sig. (2-tailed)	0.001	0.000	0.000	0.000	0.000		0.000	0.000
	contractual related factors	Pearson Correlation	.599**	.730**	.785**	.735**	.750**	.793**	1	.834**
		Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000		0.000
	External related factors	Pearson Correlation	.637**	.704**	.720**	.678**	.664**	.690**	.834**	1
		Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Consultant	Design related factors	Pearson Correlation	1	.652**	.548**	.496**	.418*	.633**	.499**	0.269
		Sig. (2-tailed)		0.000	0.002	0.005	0.022	0.000	0.005	0.150
	Material related factors	Pearson Correlation	.652**	1	.771**	.620**	.734**	.658**	.614**	.419*
		Sig. (2-tailed)	0.000		0.000	0.000	0.000	0.000	0.000	0.021

Labor related factors	Pearson Correlation	.548**	.771**	1	.732**	.686**	.710**	.579**	.556**
	Sig. (2-tailed)	0.002	0.000		0.000	0.000	0.000	0.001	0.001
Equipment related factors	Pearson Correlation	.496**	.620**	.732**	1	.686**	.691**	.712**	.692**
	Sig. (2-tailed)	0.005	0.000	0.000		0.000	0.000	0.000	0.000
Finance related factors	Pearson Correlation	.418*	.734**	.686**	.686**	1	.801**	.781**	.624**
	Sig. (2-tailed)	0.022	0.000	0.000	0.000		0.000	0.000	0.000
Management related factors	Pearson Correlation	.633**	.658**	.710**	.691**	.801**	1	.795**	.666**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000		0.000	0.000
contractual related factors	Pearson Correlation	.499**	.614**	.579**	.712**	.781**	.795**	1	.701**
	Sig. (2-tailed)	0.005	0.000	0.001	0.000	0.000	0.000		0.000
External related factors	Pearson Correlation	0.269	.419*	.556**	.692**	.624**	.666**	.701**	1
	Sig. (2-tailed)	0.150	0.021	0.001	0.000	0.000	0.000	0.000	

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

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

Source: Own Survey (2023)

Based on the provided table no 4.13, it appears to be a correlation matrix showing the correlation coefficients between different variables for each group of respondents (client, contractor, and consultant). The correlation coefficients range from -1 to 1, where 1 indicates a perfect positive correlation, -1 indicates a perfect negative correlation, and 0 indicates no correlation.

Here's how to interpret the table: Each row and column represents a specific variable or factor. The values in the table represent the correlation coefficients between the variables. For example, in the client group, the correlation coefficient between "Design related factors" and "Material related factors" is .760** (significant at the 0.01 level). The significance levels are indicated by asterisks (**). A correlation coefficient is considered significant if the p-value is less than the chosen level of significance (0.01 or 0.05). Positive correlation coefficients (values closer to 1) indicate a positive relationship between the variables, meaning that as one variable increases, the other tends to increase as well.

Negative correlation coefficients (values closer to -1) indicate a negative relationship between the variables, meaning that as one variable increases, the other tends to decrease. Correlation coefficients close to 0 indicate a weak or no relationship between the variables.

Overall, the table essentially illustrates the correlation between variables within each respondent group, highlighting the intensity and orientation of their relationship. The findings suggest a prevailing positive correlation within the group.

4.3.3 ANOVA Analysis to compare mean of the Three Groups

One Way ANOVA (Analysis of Variance) is used to compare the means of three or more groups to determine if there are significant differences between them. In the context of a client, contractor, and consultant, you might use one-way ANOVA to determine if there are significant differences in their mean scores between these three groups. ANOVA is a statistical test used to analyze the differences between group means and determine if those differences are statistically significant. Base on this the researcher used statistical software called SPSS to compare the mean score of the three group of respondents and eight categories of variables to check if there are significant difference among the means scores of the groups of respondents (client, contractor, and consultant) Refer table 4.14

Table 4.14 One Way ANOVA Analysis to Compare the Group Mean Score

One Way ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Design related factors	Between Groups	2.473	2	1.237	2.250	.112
	Within Groups	46.722	85	.550		
	Total	49.195	87			
Material related factors	Between Groups	.525	2	.262	.382	.684
	Within Groups	58.470	85	.688		
	Total	58.995	87			
Labor related factors	Between Groups	.854	2	.427	.791	.457
	Within Groups	45.880	85	.540		
	Total	46.735	87			
Equipment related factors	Between Groups	.921	2	.460	.560	.573
	Within Groups	69.856	85	.822		
	Total	70.777	87			
Finance related factors	Between Groups	2.091	2	1.045	1.310	.275
	Within Groups	67.812	85	.798		
	Total	69.903	87			
Management related factors	Between Groups	.718	2	.359	.462	.632
	Within Groups	66.097	85	.778		
	Total	66.815	87			
contractual related factors	Between Groups	.220	2	.110	.151	.860
	Within Groups	62.035	85	.730		
	Total	62.255	87			
External related factors	Between Groups	1.234	2	.617	.831	.439
	Within Groups	63.154	85	.743		
	Total	64.388	87			

Source: Own Survey (2023)

The above table no 4.14 is one way ANOVA (Analysis of Variance) here's how to interpret the table: Each row represents a specific factor or variable. "Between Groups" refers to the variability between the different groups or levels of the factor. "Within Groups" refers to the variability within each group. "Total" represents the total variability in the data. "Sum of Squares" (SS) represents the sum of squared deviations from the mean. "df" represents the degrees of freedom, which is the number of groups minus 1 for the "Between Groups" column and the total number of observations minus the number of groups for the "Within Groups" column. "Mean Square" (MS) is the sum of

squares divided by the degrees of freedom. "F" is the ratio of the mean square between groups to the mean square within groups. It is used to test the null hypothesis that there are no significant differences between the group means. "Sig." represents the p-value associated with the F-statistic. It indicates the probability of obtaining the observed F-value by chance alone. A p-value less than the chosen level of significance (usually 0.05) suggests that there are significant differences between the group means.

In the provided table, p-values are greater than 0.05. This suggests that there are no significant differences between the group means for each factor.

4.3.4 Major Challenges Identified from Case Study

In the process of constructing towns' Water Supply and Sanitation Projects, stakeholders often face various challenges that may hinder the successful execution of a project. To understand these challenges better, the researcher has decided to study different consultants', contractors' and clients' reports. These reports, prepared by experienced professionals in the field, provide valuable insights into the hurdles and obstacles faced by stakeholders in diverse projects. The researcher aims to identify the top ten challenges frequently faced in project execution.

The process of studying these reports would involve an in-depth analysis where the researcher would meticulously review each report, extract data pertaining to the challenges faced, and categorize them based on their frequency and impact on the project execution. The results of this research could be instrumental in understanding the common difficulties stakeholders face in project execution.

Based on the case study conducted these are the top ten challenges identified from the case study:

- Construction material price escalation
- Lack of construction materials in the national market specially cement
- Significant project delay due to LC problem to supply goods and electromechanical equipment from abroad.
- Overall inflation in the economy
- Budget constrain (Payment delay due to client finance shortage and financial difficulties by the constructor to run construction activities as per schedule)
- Mobilization of insufficient resources by the contractor

- Poor project planning and organization by the contractor
- Right of way issues
- Poor organization and financial limitation problem of the contractor
- Adverse weather conditions

4.4 Project Management Practices Effectiveness and its success

The integral role of project management in ensuring the successful execution of construction projects is underscored by the data presented. It provides a compelling snapshot of how effective project management practices significantly contribute to the accomplishment of construction projects. However, it also brings attention to the fact that project management is not the sole determinant of project success, as there are projects which, despite efficient management, did not achieve their intended outcomes. This paves the way for a deeper investigation into the numerous factors influencing the success of construction projects.

Table 4.15 Relationship between Project Management and project Construction Success

Relationship between project management success and project construction success				
Item No	Measurement level	Frequency	Percent	Cumulative Percent
1	Always successful	18	20.5	
2	Generally successful	60	68.2	20.5
3	Sometimes successful	10	11.4	88.6
	Total	88	100	100

Source: Own Survey (2023)

Table 4.15 represents the relationship between project management success and project construction success. The table shows three categories of success: Always Successful, Generally Successful, and Sometimes Successful. Always successful category: 18 respondents, representing 20.5% of the total, were always successful in both project management and project construction. Generally successful category: 60 respondents, representing 68.2% of the total projects, were generally successful.

On the other hand, sometimes successful category: 10 respondents, representing 11.4% of the total projects, were sometimes successful. The "total" row indicates that there were 88 projects surveyed, which is confirmed by the Percent, Valid Percent, and Cumulative Percent all reaching 100%.

Therefore, Project management plays a crucial role in the successful completion of construction projects. This is highlighted by the data provided, which offers valuable insights into the correlation between effective project management and the success rate of construction projects. The data suggests that a majority of successful projects owe their success, at least in part, to effective project management strategies. However, the data also indicates that there are other factors at play, given that not all projects with effective management were always successful. This introductory analysis sets the stage for a more in-depth exploration of these factors and their impact on project success.

This evaluation could provide valuable insights into which management practices are most effective, and which areas may need improvement. This could potentially lead to improvements in the planning and execution of future WSS projects, ultimately resulting in more successful outcomes.

Understanding of how project management practices can impact the overall success of these projects. By identifying 20 management practices for analysis, the researcher conducted a thorough evaluation of the different management strategies used in these projects.

In addition, the findings from this study could also contribute to the broader field of project management by providing empirical data on the effectiveness of different management practices in the specific context of WSS projects in Southern Ethiopia. This could add to the existing body of knowledge on project management in different cultural and geographical contexts.

In this case, using the SPSS software, the researcher evaluated and ranked the 20 construction project management practices based on their mean scores. The ones with the lowest mean scores are considered the least practiced and the variable with the highest mean value considered as the management practice with good practice.

Based on the assessment of the overall result 13 management practices out of 20 are in good performance. However, the reaming 7 management practice are in moderate performance level, which needs improvement for the successful accomplishment of future projects.

Based on these the lease 5 management practice with mean score of below 3.4, which need improvement are shown below.

Table 4.16 Least Five Management Practice That Need Improvement

Item No	Description of Management practice	All Response	
		Mean	Rank
1	Strict adherence to construction standards and guideline.	3.3	16
2	The project management team practice to appropriately address any external factors like weather, political issues, and economic issues and so on.	3.25	17
3	The project management practice in budget control to ensure that estimated costs are in line with actual expenditures.	3.25	18
4	Timely completion of construction activities to avoid cost overrun and delay.	3.2	19
5	The construction management practice in utilizing any specific project management tools or software during the construction stage.	3.19	20

Source: Own Survey (2023)

Table 4.16 shows the five management practices that are rated the lowest management

practice out of the 20 identified by the researcher that have mean score of below 3.4. These practices are seen as the area's most in need of improvement according to the respondents' feedback. The management practices are ranked from 16 to 20, based on their mean scores.

Strict adherence to construction standards and guideline: ranks 16th with a mean score of 3.3, indicating that the practice of adhering strictly to construction standards and guidelines could be improved.

The project management team practice to appropriately address any external factors like weather, political issues, and economic issues and so on: shares the 17th rank with the budget control practice, both with a mean score of 3.25. This implies that the practice of addressing external factors effectively could be improved.

The project management practice in budget control to ensure that estimated costs are in line with actual expenditure: has a mean score of 3.25 and ranks 18th, indicating that budget control practices could be improved to ensure that estimated costs align with actual spending.

Timely completion of construction activities to avoid cost overrun and delay: ranks 19th with a mean score of 3.2. This suggests that timely completion of tasks is a significant area that needs improvement to prevent additional costs and delays.

The construction management practice in utilizing any specific project management tools or software during the construction stage: ranks last (20th) with the lowest mean score of 3.19, this practice is the least practiced among the management practices evaluated in the construction projects. It suggests that construction projects may not be leveraging technology as effectively as they could be. Suggesting that this is the area that most needs improvement according to the respondents.

The management practice of utilizing specific project management tools or software during the construction stage is seen as the practice most in need of improvement, with the lowest rank of 20 and a mean score of 3.19. Other areas identified for improvement include timely completion of construction activities, budget control, addressing external factors appropriately, strict adherence to construction standards and guidelines, and proper allocation of resources.

Results and Discussion

Based on the respondent's insight and case study conducted for selected sites, the overall performance of the Towns' water supply and sanitation construction projects in the last five years, based on time, cost, quality, and other constraints, can be summarized as moderate and below moderate level.

Therefore, this implies that, construction of towns' water supply and sanitation projects faces significant challenges. Accordingly, it is essential to consider the challenges and resistances in the construction processes to make future water supply and sanitation projects successful.

Accordingly based on the quantitative study using first-hand information from respondents, it was able to identify 13 important factors and two highly important factors. In line with this, from a case study, the researcher identified the top ten challenges from reports of the three parties.

Triangulation is a process used in research to ensure the robustness and reliability of the findings. It involves comparing, contrasting, and combining data from different sources or methods to identify common patterns, discrepancies, or new insights.

Based on the information provided from the qualitative study using respondent's insight and the case study from different reports, and by triangulating the results to identify the top five challenges for project success. The final most important key factors mentioned in both studies are:

Fluctuations in construction material prices: The unpredictable changes in the prices of construction materials can significantly impact project budgets and timelines. Some of the construction materials price getting two-fold higher than the baseline, which is getting uncontrollable for the construction industry. Consequently, the construction material price escalation is highly impacting the project progress.

Delays in importing materials from foreign countries: Issues with importing materials, such as delays in process of letter of credit, customs clearance or logistical challenges, can cause project delays and hinder progress. Supply and installation of pipes and fittings and Electro- Mechanical equipment are crucially important part of the towns' WSS projects; however, the supply remain behind due to shortage of foreign currency and LC process.

Shortage of construction materials in the market: Limited availability of construction materials, particularly cement, can lead to delays and increased costs for projects. Especially, shortage and underground market of cement in the country vitally affect the progress and success of the civil work. Since the civil work consumes high amount of cement, this problem significantly impacts the progress of the civil work.

Overall economic inflation: Inflationary pressures can increase the costs of labor, materials, and other project-related expenses, affecting the overall project budget and feasibility. As it is obviously known that recently, the price of fuel increase highly and unexpectedly due to change in government policy and legislation on subsidizing fuel supply. This act of the government influences the fuel market and distribution of fuel throughout the country. Inflation often leads to an increase in the cost of raw materials, which directly impacts the construction industry. High inflation rates can lead to higher costs for materials such as steel, concrete, and labor which can cause construction projects to go over budget. High inflation rates can create economic uncertainty. This can lead to a slowdown in the construction sector.

Budget constraints: Financial shortages on the client's side and insufficient resources mobilized by the contractor can limit the project's ability to meet its objectives within the allocated budget.

Fluctuation in construction material price was identifies as the first most important factor by this study and it was also considered as the first most important factor causing delay in medium town water supply projects in the case of Ethiopia one wash national program (Dereje 2021). Dereje also identified client financial shortage as one of the most important factor in his sturdy, which is the fourth ranked factor in this study stated as budget constraint that affect the success of towns' WSS project in southern Ethiopia.

Supply and installation of DCI pipes, fittings and Electro-mechanical equipment are vitally important part of water supply and sanitation projects. However, Delays in importing these materials from foreign countries ranked second in this study and similarly Alemayehu (2020) also identified as the first most important factors causing delay of water supply and sanitation projects in the case of 15 towns' water supply and sanitation projects in Ethiopia.

Shortage of construction materials in the market ranked third in this study that affect the success of the projects by delaying the progress. Mathiows (2018) also identified scarcity of materials in the market as the fourth most important factors that cause delay in water supply construction projects in Ethiopia.

Therefore, by considering the findings from both studies, these challenges emerge as the most critical factors affecting project success. It is important to address these challenges proactively and develop strategies to mitigate their impact on successful project outcomes.

In survey questions that asked respondents to assess the relationship between project management success and project construction success, taken together, the responses suggest a strong belief among respondents that the success of project management has a direct and often positive influence on the success of construction projects. Majorities of respondents either always (20.5%) or generally (68.2%) have successful projects with effective project management, and just a very few reported only random success (11.4%).

The researcher evaluated and ranked 20 construction project management practices based on their mean scores. The ones with the lowest mean scores are considered the least practiced and the variable with the highest mean value considered as the management practice with good practice. Based on the assessment of the overall result 13 management practices out of 20 are in good performance. However, the reaming 7 management practice are in moderate performance level, which needs improvement for the successful accomplishment of future projects.

Furthermore, from 20 construction management practices the researcher undertake analysis to identify the least management practice in project construction. From this analysis, the five least effective management practices requiring improvement are: Rigorous adherence to construction standards and guidelines; The ability of the project management team to appropriately address external factors such as weather, political issues, and economic fluctuations; Budget control strategies in project management to ensure alignment between estimated costs and actual expenditures; Timely completion of construction activities to prevent cost overruns and delays; and use of specific project management tools or software during the construction stage by the construction management team.

4.5 Strategic Framework Solution for the most important factors

Framework Solution for the top five important factors that affect the construction success

To address these factors affecting the construction success of towns' WSS projects, a comprehensive framework should be developed. Here are some possible strategic framework solutions to avoid or minimize the impact on the successful accomplishment of towns' WSS projects in the future:

Table 4.177 Suggested Framework Solution for the Top Five Important Factors

Highly Important factor	**Process (Strategic Solutions)**	**Output (Expected Results)**
Fluctuations in Construction Material Prices	• Implement a robust procurement strategy that involves bulk buying. • Purchasing raw materials in bulk ahead of time • Long-term contracts agreement with suppliers. • Continuous market analysis to predict and manage price fluctuations. • Include clauses in contracts that allow for price adjustments	Steady supply of construction materials despite market fluctuations for successful project construction
Delays in Material Imports due to issue with LC	• Look for multiple sources of materials from various countries • Encourage the local production of these materials in partnership with international manufacturers. • Plan and procure materials well in advance to avoid or minimize delay • Consider working with import suppliers who are experienced in handling LC issues. • Seek government intervention to prioritize such projects	Minimized delays in material imports.

Shortage of Construction Materials	• Diversify the supplier base to avoid reliance on a single source. • Explore alternative materials that can be used. • Establish a contingency plan in case of shortages.	Minimized delays in construction material supply
Overall economic Inflation	• Include clauses in contracts that allow for price adjustments. • Implement strategies to use resources more efficiently and reduce waste. • Regularly negotiate with suppliers to try to keep prices down. • Regularly review and adjust budgets to reflect changes in the economic climate.	Managed economic inflation impacts on the project costs.
Budget Constraints	• Seek diverse funding sources such as grants, loans, or public-private partnerships. • Advocate for government policies that can provide financial support for such projects. • Establish sound financial management practices to ensure efficient use of resources. • Choose contractors with a strong financial background and proven track record of resource management.	Overcome financial constraints, ensuring the project's financial viability and continuity.

Framework Solution for the least management practices that shows weak performances

To provide a framework solution for the least encountered management practices in town's water supply and sanitation projects, the researcher prioritizes and address each management practice based on its rank. Here's a suggested strategic framework solution to enhance the poor management practice investigated in this study:

Table 4.18 Suggested Framework Solution for the least Five Weak Management Practice

Weak management practice that needs improvement	**Process (Strategic Solutions)**	**Output (Expected Results)**
Strict adherence to construction standards and guideline.	• Identify and document the key construction standards and guidelines relevant to water supply and sanitation projects. • Develop training programs for project teams to ensure understanding and adherence to these standards and guidelines.	Enhanced compliance with construction standards and guidelines, leading to improved project

	• Conduct regular inspections and audits to monitor compliance with the standards. • Implement a feedback system to address any non-compliance issues and continually improve adherence.	outcomes and fewer regulatory issues.
The project management practice in budget control to ensure that estimated costs are in line with actual expenditures.	• Develop a comprehensive budgeting process that includes estimating costs accurately and regularly monitoring and controlling actual expenditures. • Utilize appropriate project management software or tools to track and analyze budget performance. • Implement a system for approving and managing changes to the budget to minimize cost overruns and ensure financial stability.	Improved budget control, with estimated costs closely aligning with actual expenditures. This can help avoid financial overruns and ensure the project remains financially viable.
The project management team practice to appropriately address any external factors like weather, political issues, and economic issues and so on.	• Identify the potential external factors that can impact water supply and sanitation projects, such as weather, political issues, and economic factors. • Create contingency plans or risk mitigation strategies for each identified external factor. • Establish clear communication channels to keep stakeholders informed about any external factors and their potential impact on the project. • Regularly review and update the contingency plans based on evolving external factors.	Better preparedness for external factors, reducing the potential for delays or cost overruns due to unforeseen circumstances.
Timely completion of construction activities to avoid cost overrun and delay.	• Develop a detailed project schedule that includes milestones and critical path activities. • Monitor progress regularly and identify any potential delays or issues. • Implement effective project management techniques like resource allocation, task prioritization, and efficient communication to ensure timely completion of construction activities. • Establish a system for evaluating and addressing any bottlenecks or obstacles that may lead to delays.	Timely completion of construction activities, reducing the potential for cost overruns and delays.

The construction management practice in utilizing any specific project management tools or software during the construction stage.	• Identify and select appropriate project management tools or software that can enhance construction management processes. • Train project teams on the effective use of selected tools or software. • Implement the tools or software to streamline construction activities, improve collaboration, and ensure efficient project execution.	More efficient and effective management of the construction process, with the use of project management tools or software leading to improved communication, reduced errors, and better project outcomes.

The output ultimately results in the successful completion of the town's WSS projects despite the challenges presented. Remember that implementing this framework require strong project management skills, including risk management, financial management, and stakeholder management. Regular monitoring and evaluation should also be conducted to assess the effectiveness of the framework and make necessary adjustments.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

This section summarizes key findings, draws conclusions based on the research objective, and discusses recommendations.

5.1 Conclusions

The analysis based on respondents' feedback indicates that most Water Supply and Sanitation (WSS) projects in towns over the past five years have shown moderate to low performance. This assessment is based on various criteria including time, cost, quality, and other constraints. Based on respondents' insight of the opened ended questions, on average, respondents were involved in 5 such Town WSS projects. However, the majority of these projects faced challenges. On average, 4 out of 5 projects were reported to be behind schedule, and 3 out of 5 projects exceeded their budgets. Quality was less of an issue, with only 1 out of 5 projects, on average, reported to be below the desired quality standards. Complaints were received for an average of 2 out of 5 projects.

The case study revealed that many projects considerably surpassed their planned timelines, indicating potential issues with time management and scheduling. Such delays can escalate costs directly or indirectly and lead to stakeholder dissatisfaction.

Therefore, the overall result both from respondent's insight and case study implied that, construction of towns' water supply and sanitation projects faces significant challenges in terms of the time, cost, quality, scope and other constraints like customer satisfaction.

Based on the information provided from the qualitative study using respondent's insight and the case study from different reports, and by triangulating the results to identify the top five challenges for project success. The final most important key factors mentioned in both studies are: fluctuations in construction material prices, delays in importing materials, market shortages of construction materials, overall economic inflation, and budget constraints.

The researcher conducted an analysis to assess the effectiveness of management practices in ensuring successful construction projects, using insights from respondents. The aim was to investigate the relationship between the success of project management and the success of the construction project. The findings underscored the vital role of project management in the

successful completion of construction projects. However, the data also suggested the presence of other influential factors contributing to the overall success of the project.

In addition, the researcher identified 20 construction management practices and carryout analysis to identify the least management practice in project construction. From this analysis, the five least effective management practices requiring improvement were identified as follows:

- Rigorous adherence to construction standards and guidelines.
- The ability of the project management team to appropriately address external factors such as weather, political issues, and economic fluctuations.
- Budget control strategies in project management to ensure alignment between estimated costs and actual expenditures.
- Timely completion of construction activities to prevent cost overruns and delays.
- Use of specific project management tools or software during the construction stage by the construction management team.

Finally, the researcher has meticulously devised a strategic framework solution that addresses the five most crucial factors out of the eighty-three general elements identified, along with the least five common management practices encountered among the twenty management practices observed in the study areas. The framework solution designed by the researcher is not just a response to the challenges posed by these factors and practices, but also a proactive approach aimed at enhancing the effectiveness and efficiency of WSS projects in towns. These strategic framework solutions offer a comprehensive approach to overcoming potential obstacles and improving overall project success rates.

5.2 Recommendations

This study has critically examined the factors influencing the success of Water Supply and Sanitation (WSS) projects in southern Ethiopia, shedding light on various aspects that need improvement. The findings underscore the urgent need for strategic approaches to enhance the effectiveness and efficiency of these projects' construction stage. These recommendations aim to address the identified issues and boost the success of WSS projects, ultimately contributing to the broader goal of ensuring clean drinking water and sanitation for all.

- Fluctuations in Construction Material Prices: To mitigate the risk of price fluctuations, consider entering into long-term contracts with suppliers. These contracts can lock in prices for a certain period, thus safeguarding against sudden price increases. Also, try to predict future price trends by monitoring market conditions and incorporating price escalation clauses in contracts.
- To address the delay in importing materials such as electromechanical items and DCI pipes and fittings due to LC processes and shortage of foreign currency, several strategies could be considered. These include exploring alternative suppliers for quick switches during delays and maintaining a buffer stock based on previous consumption and lead time. Early ordering can also accommodate for potential delays. Diversifying import countries can help avoid shortages of a specific foreign currency. Financial strategies such as negotiating favorable payment terms on the LC with the bank, or using trade finance instruments like Forfaiting may also be beneficial. If necessary, lobbying for government intervention or assistance could also be a viable option. Communication with clients about potential delays and mitigation steps is crucial throughout the process.
- Implement Comprehensive Budget Control Measures: Budget overruns can significantly impact the success of a project. Establish strict budget control measures that include frequent budget reviews, regular auditing, and the development of a contingency plan. This plan should anticipate potential financial issues and outline strategies to address them.
- Market Shortages of Construction Materials: Diversify supply chain. Don't rely on a single supplier for all required construction materials. This way, if one supplier runs out of stock, it would be possible to shift to another. Also, keep a backup stock of essential materials to tackle immediate shortages.
- To lessen the impact of economic inflation on construction projects, robust financial planning is vital. This entails creating budgets that factor in inflation, incorporating escalation clauses in contracts to account for potential cost increases, and implementing strict cost control measures. It is also prudent to diversify supplier sources to reduce dependency, and explore financial tools for safeguarding against inflation. Through proactive and strategic management, it is possible to navigate successfully through inflationary challenges and ensure project success.

- Prioritize Time Management: Delays in project implementation can lead to cost overruns and stakeholder dissatisfaction. Therefore, effective time management is critical. This could involve using project management tools or software that provide real-time tracking of project timelines, allowing for quick adjustments when necessary.
- Strict Adherence to Construction Standards and Guidelines: To ensure the quality and safety of the WSS projects, it is crucial to adhere strictly to construction standards and guidelines. Regular inspections and audit processes should be implemented, and any deviations should be addressed promptly.
- Invest in Project Management Technology: Technology can play a significant role in improving project management. Encourage the use of project management tools or software that can streamline processes, improve communication, track progress, and identify potential issues at an early stage.
- Continuous Improvement of Management Practices: The construction business environment is dynamic, and so should be the management practices. Regularly review and update management practices based on project outcomes, lessons learned, and changes in the external environment. This will ensure that the practices remain effective and relevant, leading to improved project success rates.

5.3 Recommendation for Further Studies

This study possesses several limitations, the most significant being its focus solely on the factors influencing the success of urban water supply and sanitation (WSS) projects in southern towns. This geographical and urban-centric perspective leaves a gap in understanding how these factors might manifest or differ in rural areas or other regions of the country. Thus, conducting parallel studies on rural WSS projects across diverse regions would substantially contribute to a more holistic understanding of the subject.

Another overlooked aspect in this study is the potential impact of technological advancements and innovation on the success of WSS projects. As we progress into an increasingly digital era, technology and innovation are becoming pivotal in almost every field, including construction and public utilities. Hence, future research investigating their role and influence on WSS projects would be beneficial.

Lastly, this study identified construction material price fluctuation as a major factor impacting the success of town WSS projects. However, it did not explore deeper into the fundamental relationship between these two elements. A comprehensive understanding of how construction material price fluctuation directly affects WSS project outcomes would not only confirm the findings of this study but also provide actionable insights for the successful execution of future projects.

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APPENDIX

1. Survey Questionnaire

Dear Sir/Madam,

First of all, I would like to thank you for your willingness to receive and respond to this study questionnaire. This research study is designed for the purpose of the partial fulfillment of the requirement for the Degree of Master of Science in Construction Technology and Management in Addis College with research title ‘’ASSESSMENT OF FACTORS AFFECTING THE CONSTRUCTION SUCCESS OF TOWNS’ WATER SUPPLY AND SANITATION PROJECTS IN SOUTHERN ETHIOPIA’’ In general, I will assure you that the research data will only be used solely for the academic requirement and will be treated with strict confidentiality.

Your open and prompt response is highly appreciated.

Objective of the survey

The basic aim of the survey is that to gather reliable information in order to achieve the following research specific objective

5. To assess the recent overall construction success of town WSS projects in Southern Ethiopia.
6. To identify the challenges and obstacles faced in the construction of town WSS projects in Southern Ethiopia.
7. To evaluate the effectiveness of project management practices in ensuring the success of town WSS projects in Southern Ethiopia
8. To formulate a framework for improving the construction success of future town water supply projects in Southern Ethiopia.

RESEARCHER’S INFORMATION

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Part one: - Respondent's information (Please tick or fill in the blanks where necessary)

1. Which organization do you represent?

   ☐ Client ☐Contractor ☐ Consultant

2. Respondent position in the project

   ☐ Owner ☐ Supervisor ☐ Resident Engineer

   ☐ Project manager ☐ Project coordinator ☐ Site Engineer

   ☐ Office Engineer Others (Specify): -_____

3. Academic qualification

   ☐ Certificate ☐ Diploma ☐ First degree (B.Sc.)

   ☐ Second Degree (M.Sc.) ☐ PhD Others (Specify): -_____

4. Years of work experience

   ☐ 0 to 5 years ☐ 6 to 10 years ☐ 11 to 15 years

   ☐ 16 to 20 years ☐ above 20 years

5. Number of Towns' Water Supply and Sanitation project executed in your organization

   ☐ 1 to 2 ☐ 3 to 5 ☐ More than 5

Part two: - Overall construction success of town water supply and sanitation project in southern Ethiopia.

(Please tick (√) the appropriate box**: Very low Performance (1); Low Performance (2); Moderate Performance (3); Good Performance (4) and Very Good Performance (5)**

Description	Agreement Scale				
	1	2	3	4	5
1. The performance of the Towns' water supply and sanitation project within the scheduled time period.	☐	☐	☐	☐	☐
2. The performance of the Towns' water supply and sanitation project within the allocated budgeted cost.	☐	☐	☐	☐	☐
3. The performance of the Towns' water supply and sanitation project as per the desired quality.	☐	☐	☐	☐	☐
4. The performance of the Towns' water supply and sanitation project as per mutually agreed scope (Minimal variation).	☐	☐	☐	☐	☐
5. Overall Towns' water supply and sanitation construction projects performance in the last five years based on time, cost, quality, and other constraints	☐	☐	☐	☐	☐

6. How many towns water supply and sanitation projects have you executed in the last five years? _____

   - ✓ Of those projects, how many of them were behind schedule? _____
   - ✓ Of those projects, how many of them were over budget? _____
   - ✓ Of those projects, how many of them were less than the desired quality standards? _____
   - ✓ Of those projects, how many of them were the most complained about? _____

Part three: - Factors affecting the performance of town water supply and sanitation construction projects

Below are numbers of factors affecting the performance of town water supply and sanitation construction projects. From your experience, please express your opinion on the importance of the following factors as key performance indicators for the aforementioned construction projects in southern Ethiopia.

(Please tick (√) the appropriate box). **Not Significant (1), Slightly Significant (2), moderately Significant (3), Very Significant (4), Extremely Significant (5)**

The main cause of success or failure	**Degree of significance**				
	1	**2**	**3**	**4**	**5**
Design change related factors					
1. Change order	☐	☐	☐	☐	☐
2. Change in drawing	☐	☐	☐	☐	☐
3. Change in specification	☐	☐	☐	☐	☐
4. Incomplete contract document	☐	☐	☐	☐	☐
5. The decision during the development stage	☐	☐	☐	☐	☐
6. Mistakes and discrepancies in design documents	☐	☐	☐	☐	☐
7. Problem of identifying the location of buried utilities and infrastructure during design period.	☐	☐	☐	☐	☐

8. Change in subsurface condition	☐	☐	☐	☐	☐
9. Change in the scope of the project	☐	☐	☐	☐	☐
10. Risk and uncertainty associated with project	☐	☐	☐	☐	☐
11. Variation	☐	☐	☐	☐	☐
Material related factors					
1. Quality of material	☐	☐	☐	☐	☐
2. Late Supply of Materials	☐	☐	☐	☐	☐
3. Availability of local material around the project and its accessibility	☐	☐	☐	☐	☐
4. Shortage of construction materials in market	☐	☐	☐	☐	☐
5. Poor material handling on site	☐	☐	☐	☐	☐
6. Material wastage on site	☐	☐	☐	☐	☐
7. Low quality of material	☐	☐	☐	☐	☐
8. Change in material types and specifications during construction	☐	☐	☐	☐	☐
9. Delay in manufacturing special construction materials	☐	☐	☐	☐	☐
10. Poor procurement system of material	☐	☐	☐	☐	☐
11. Late procurement of construction materials	☐	☐	☐	☐	☐
12. Delay in supply of materials from foreign countries (Material Import)	☐	☐	☐	☐	☐
Labor related factors					
1. Shortage of labor	☐	☐	☐	☐	☐
2. Low productivity level of Labor	☐	☐	☐	☐	☐
3. Unqualified/inadequate experienced labor	☐	☐	☐	☐	☐
4. Deployment of enough labor on site	☐	☐	☐	☐	☐
5. Payment of daily and skilled laborer	☐	☐	☐	☐	☐
6. Absenteeism	☐	☐	☐	☐	☐
7. Low motivation and morale of labor	☐	☐	☐	☐	☐
8. Labor management system	☐	☐	☐	☐	☐
9. Labor union action	☐	☐	☐	☐	☐
10. Personal conflict among labor	☐	☐	☐	☐	☐

Equipment related factors					
1. Improper equipment	☐	☐	☐	☐	☐
2. Equipment unavailability	☐	☐	☐	☐	☐
3. Low productivity of equipment	☐	☐	☐	☐	☐
4. Equipment breakdowns	☐	☐	☐	☐	☐
5. Shortage of equipment and hiring delay	☐	☐	☐	☐	☐
6. Mobilization of equipment's on site as per contractual agreement	☐	☐	☐	☐	☐
7. Equipment management system	☐	☐	☐	☐	☐
8. Low efficiency of equipment	☐	☐	☐	☐	☐
Finance related factors					
1. Delayed payments to contractors	☐	☐	☐	☐	☐
2. Delayed payments to suppliers and subcontractors	☐	☐	☐	☐	☐
3. Client's financial shortage	☐	☐	☐	☐	☐
4. Shortage of foreign currency	☐	☐	☐	☐	☐
5. Fluctuation in foreign currency exchange rate	☐	☐	☐	☐	☐
6. Government support in providing foreign currency	☐	☐	☐	☐	☐
7. Financial difficulties faced by the contractor	☐	☐	☐	☐	☐
8. Insufficient cash flow on site	☐	☐	☐	☐	☐
9. Difficulty in accessing advance payment	☐	☐	☐	☐	☐
10. Fluctuation of construction material prices	☐	☐	☐	☐	☐
Management related factors					
1. Organizational change	☐	☐	☐	☐	☐
2. Application of Obsolete technology and innovation	☐	☐	☐	☐	☐
3. Poor site management (not responding as contractual agreement)	☐	☐	☐	☐	☐
4. Mistakes in construction	☐	☐	☐	☐	☐
5. Unrealistic contract duration	☐	☐	☐	☐	☐
6. Inaccurate cost estimation	☐	☐	☐	☐	☐
7. Not preparing the method statement	☐	☐	☐	☐	☐

8. Inappropriate organization management	☐	☐	☐	☐	☐
9. Ineffective planning and scheduling of project	☐	☐	☐	☐	☐
10. Similarity of contractors crashed schedule with master schedule	☐	☐	☐	☐	☐
11. Inadequate contractor experience	☐	☐	☐	☐	☐
12. Inadequate consultant experience	☐	☐	☐	☐	☐
13. Underestimation of the complexity of the project	☐	☐	☐	☐	☐
Contractual related factors					
1. Non-utilization of professional construction/contractual management	☐	☐	☐	☐	☐
2. Delay in delivering the site project to the contractor	☐	☐	☐	☐	☐
3. Delay in approval of documents	☐	☐	☐	☐	☐
4. Unsmooth internal and external communications	☐	☐	☐	☐	☐
5. Lack of communication between parties	☐	☐	☐	☐	☐
6. Slowness in giving instruction	☐	☐	☐	☐	☐
7. Slowness in the decision-making process	☐	☐	☐	☐	☐
8. Duration of the inspection procedure	☐	☐	☐	☐	☐
9. Company’s procedure of selecting subcontractors	☐	☐	☐	☐	☐
10. Delay in performance of subcontractors	☐	☐	☐	☐	☐
11. Problems with the contractors	☐	☐	☐	☐	☐
External factors					
1. Inclement weather condition	☐	☐	☐	☐	☐
2. Delay in obtaining permit services	☐	☐	☐	☐	☐
3. Change in government regulations and laws	☐	☐	☐	☐	☐
4. Delay in providing services from utilities (such as telephone, electricity and etc.)	☐	☐	☐	☐	☐
5. Natural disaster (flood, hurricane, earthquake and so on)	☐	☐	☐	☐	☐
6. Political instability	☐	☐	☐	☐	☐
7. Unforeseen site condition	☐	☐	☐	☐	☐
8. Overall inflation in the economy	☐	☐	☐	☐	☐

Part Four: - To evaluate the effectiveness of project management practices in ensuring the success of town WSS projects.

(Please tick (√) the appropriate box **Very low Performance (1); Low Performance (2); Moderate Performance (3); Good Performance (4) and Very Good Performance (5)**

Description	Agreement Scale				
	1	2	3	4	5
1. The project management team communication with stakeholders.	☐	☐	☐	☐	☐
2. Proper planning and design during the construction stage.	☐	☐	☐	☐	☐
3. The project management practice to prepare effective planning and scheduling for the successful accomplishment of the project.	☐	☐	☐	☐	☐
4. Strict adherence to construction standards and guideline.	☐	☐	☐	☐	☐
5. Clear division of roles and responsibilities among the project management team members during the construction stage.	☐	☐	☐	☐	☐
6. The project management practices in risk identification and mitigation.	☐	☐	☐	☐	☐
7. Timely completion of construction activities to avoid cost overrun and delay.	☐	☐	☐	☐	☐
8. The project management practices in ensuring proper allocation of resources.	☐	☐	☐	☐	☐
9. The project management quality control and assurance practice to ensure the quality standards of the project.	☐	☐	☐	☐	☐
10. The project management practice in budget control to ensure that estimated costs are in line with actual expenditures.	☐	☐	☐	☐	☐
11. The project management practices in managing changes and modification in the project scope.	☐	☐	☐	☐	☐
12. The project management practice with the decision-making process during the construction stage of the WSS project.	☐	☐	☐	☐	☐
13. The construction management practice in utilizing any specific project management tools or software during the construction stage.	☐	☐	☐	☐	☐
14. The project management team effort to demonstrate a strong ability to collaborate and coordinate among team members.	☐	☐	☐	☐	☐
15. The project management team practice to appropriately address any external factors like weather, political issues, and economic issues and so on.	☐	☐	☐	☐	☐
16. Involving local communities in the construction process to enhance their sense of ownership and commitment to the success of the project.	☐	☐	☐	☐	☐

17. Regular monitoring and evaluation during the construction period to identify and address potential issues in town WSS projects.	☐	☐	☐	☐	☐
18. Effective collaboration between government agencies, consultants, and community organizations for the successful of the projects.	☐	☐	☐	☐	☐
19. The project management practice in monitoring and controlling project progress.	☐	☐	☐	☐	☐
20. Overall, the project management practices contributed to the successful implementation and completion of the town WSS project?	☐	☐	☐	☐	☐

1. Relationship between project management success and project construction success

When project management is successful, project is:

Always successful ☐

Generally successful ☐

Sometimes successful ☐

No correlation ☐

2. Sample water supply and sanitation project under construction in the study area

Item No	Name of sample project	Client name	Contractor name	Consultant name
1	Boditi Town Water Supply and Sanitation project	SNNPR Water, Irrigation and Mines Development Bureau	Wegeret Construction PLC	TAWSSEE in association with Blue Matrix Consultancy
2	Gecha Town Water Supply and Sanitation Project	SWEPRS- Water, Mine And Energy Resource Development Bureau	Shodeb Engineering Construction in JV with ACME Engineering and Trading PLC	Ketema Consulting Engineers
3	Gedeb Town Water Supply and Sanitation project	SNNPR Water, Irrigation and Mines Development Bureau	Compound Construction PLC in JV with BELT General Business PLC	Ahadu consulting Eng. in association with TAWSSEE
4	Kele Town Water Supply and Sanitation Project	SNNPR Water, Irrigation and Mines Development Bureau	Barcon Engineering in Joint Venture with Bigeta Business Plc	Milky Consulting PLC
5	Key-Afer Town Water Supply and Sanitation Project	SNNP water, irrigation and mines development Bureau,	Wegeret Construction plc	Milky Consulting PLC
6	Sankura Multi-Village Water Supply Project	Federal Water Development Commission	GTB Engineering JV With EMU General Importer PLC	SOUTH Design & Construction Supervision Enterprise
7	Shinshicho Town water supply and Sanitation project	SNNPRS, Water, Irrigation and Mine Development Bureau	Biget Business Pvt. Ltd Company in JV with YisakAbebe G.C	PLANET Integrated Water Resources Development PLC
8	Tarcha Town Water Supply and Sanitation project	SWEPR Regional State Water, Mines and Energy Development Bureau	United Construction P.L.C	Blue Matrix Consultancy

9	Tum Town Water Supply and Sanitation project	Southwest Ethiopia Peoples Regional State Water, Mines & Energy Bureau	United Construction PLC	Ketema Consulting Engineers
10	Wacha Town Water Supply and Sanitation project	Southwest Ethiopia Peoples Regional State Water, Mines & Energy Bureau	Compound Construction PLC in JV with BELT General Business PLC	Ketema Consulting Engineers
11	Yalo-Lala Water Supply And Sanitation Project	SWEPRS- Water, Mine And Energy Resource Development Bureau	Bigeta Business PLC In JV With Tegegn Terefe GWWC	Milki Consulting PLC.
12	Zefine Town Water Supply and Sanitary Project	SNNPR Water, Irrigation and Mines Development Bureau	Tariku G/meskel GWWC in JV with Belt General Business PLC	MILKI Consulting PLC

3. Calculation of RII and rank based on its value

Item No	Description of Factors	1	2	3	4	5	N	ΣW	5N	RII	Rank
	Design change related factors	Not Significant	Slightly Significant	moderately Significant	Very Significant	Extremely Significant					
1	Change order	13	23	36	14	2	88	233	440	0.530	76
2	Change in drawing	10	32	27	14	5	88	236	440	0.536	74
3	Change in specification	16	26	25	13	8	88	235	440	0.534	75
4	Incomplete contract document	18	20	21	22	7	88	244	440	0.555	68
5	The decision during the development stage	5	21	35	19	8	88	268	440	0.609	45
6	Mistakes and discrepancies in design documents	9	24	25	19	11	88	263	440	0.598	51
7	Problem of identifying the location of buried utilities and infrastructure during design period.	10	17	28	14	19	88	279	440	0.634	35
8	Change in subsurface condition	11	23	34	16	4	88	243	440	0.552	70
9	Change in the scope of the project	13	21	26	22	6	88	251	440	0.570	66
10	Risk and uncertainty associated with project	12	21	29	18	8	88	253	440	0.575	63
11	Variation	7	16	32	22	11	88	278	440	0.632	36
1	Quality of material	11	28	14	21	14	88	263	440	0.598	51
2	Late Supply of Materials	3	11	19	29	26	88	328	440	0.745	8
3	Availability of local material around the project and its accessibility	8	15	26	20	19	88	291	440	0.661	20
4	Shortage of construction materials in market	6	10	11	24	37	88	340	440	0.773	5

5	Poor material handling on site	11	27	31	14	5	88	239	440	0.543	71
6	Material wastage on site	11	31	25	16	5	88	237	440	0.539	73
7	Low quality of material	12	29	16	19	12	88	254	440	0.577	62
8	Change in material types and specifications during construction	12	23	20	23	10	88	260	440	0.591	56
9	Delay in manufacturing special construction materials	8	20	15	27	18	88	291	440	0.661	20
10	Poor procurement system of material	6	21	25	26	10	88	277	440	0.630	37
11	Late procurement of construction materials	5	19	21	30	13	88	291	440	0.661	20
12	Delay in supply of materials from foreign countries (Material Import)	5	8	11	21	43	88	353	440	0.802	2
1	Shortage of labor	16	29	23	13	7	88	230	440	0.523	79
2	Low productivity level of Labor	8	22	34	19	5	88	255	440	0.580	61
3	Unqualified/inadequate experienced labor	7	23	31	22	5	88	259	440	0.589	59
4	Deployment of enough labor on site	7	21	31	22	7	88	265	440	0.602	48
5	Payment of daily and skilled laborer	6	24	26	23	9	88	269	440	0.611	42
6	Absenteeism	12	31	31	11	3	88	226	440	0.514	80
7	Low motivation and morale of labor	7	26	32	17	6	88	253	440	0.575	63
8	Labor management system	4	16	31	27	10	88	287	440	0.652	24
9	Labor union action	14	27	28	14	5	88	233	440	0.530	76
10	Personal conflict among labor	21	30	24	11	2	88	207	440	0.470	83
1	Improper equipment	6	26	28	14	14	88	268	440	0.609	45
2	Equipment unavailability	4	15	25	31	13	88	298	440	0.677	15

3	Low productivity of equipment	4	23	25	24	12	88	281	440	0.639	30
4	Equipment breakdowns	6	17	30	25	10	88	280	440	0.636	33
5	Shortage of equipment and hiring delay	3	12	37	25	11	88	293	440	0.666	18
6	Mobilization of equipment's on site as per contractual agreement	2	18	21	26	21	88	310	440	0.705	12
7	Equipment management system	7	22	33	19	7	88	261	440	0.593	54
8	Low efficiency of equipment	4	19	33	21	11	88	280	440	0.636	33
1	Delayed payments to contractors	5	17	18	28	20	88	305	440	0.693	13
2	Delayed payments to suppliers and subcontractors	6	17	17	34	14	88	297	440	0.675	16
3	Client's financial shortage	7	17	12	24	28	88	313	440	0.711	11
4	Shortage of foreign currency	6	5	12	31	34	88	346	440	0.786	3
5	Fluctuation in foreign currency exchange rate	3	11	18	23	33	88	336	440	0.764	6
6	Government support in providing foreign currency	4	13	19	25	27	88	322	440	0.732	9
7	Financial difficulties faced by the contractor	3	10	18	32	25	88	330	440	0.750	7
8	Insufficient cash flow on site	5	5	24	35	19	88	322	440	0.732	9
9	Difficulty in accessing advance payment	11	18	32	18	9	88	260	440	0.591	56
10	Fluctuation of construction material prices	2	8	18	17	43	88	355	440	0.807	1
1	Organizational change	12	25	33	12	6	88	239	440	0.543	71
2	Application of Obsolete technology and innovation	8	30	30	14	6	88	244	440	0.555	68
3	Poor site management	7	15	31	23	12	88	282	440	0.641	29
4	Mistakes in construction	12	28	24	15	9	88	245	440	0.557	67

5	Unrealistic contract duration	3	20	21	25	19	88	301	440	0.684	14
6	Inaccurate cost estimation	5	15	25	28	15	88	297	440	0.675	16
7	Not preparing the method statement	6	19	36	21	6	88	266	440	0.605	47
8	Inappropriate organization management	10	20	32	17	9	88	259	440	0.589	59
9	Ineffective planning and scheduling of project planning	5	13	34	22	14	88	291	440	0.661	20
10	Similarity of contractors crashed schedule with master schedule	7	21	23	22	15	88	281	440	0.639	30
11	Inadequate contractor experience	9	23	24	18	14	88	269	440	0.611	42
12	Inadequate consultant experience	7	27	23	20	11	88	265	440	0.602	48
13	Underestimation of the complexity of the project	7	20	25	25	11	88	277	440	0.630	37
1	Non-utilization of professional construction/contractual management	6	24	20	28	10	88	276	440	0.627	39
2	Delay in delivering the site project to the contractor	4	16	30	30	8	88	286	440	0.650	26
3	Delay in approval of documents	5	21	23	28	11	88	283	440	0.643	28
4	Unsmooth internal and external communications	7	22	27	23	9	88	269	440	0.611	42
5	Lack of communication between parties	11	21	27	17	12	88	262	440	0.595	53
6	Slowness in giving instruction	8	24	26	23	7	88	261	440	0.593	54
7	Slowness in the decision-making process	9	14	29	23	13	88	281	440	0.639	30
8	Duration of the inspection procedure	9	23	29	17	10	88	260	440	0.591	56

9	Company's procedure of selecting subcontractors	7	25	34	16	6	88	253	440	0.575	63
10	Delay in performance of subcontractors	6	19	34	19	10	88	272	440	0.618	40
11	Problems with the contractors	5	14	31	24	14	88	292	440	0.664	19
1	Inclement weather condition	4	14	35	27	8	88	285	440	0.648	27
2	Delay in obtaining permit services	5	23	34	18	8	88	265	440	0.602	48
3	Change in government regulations and laws	16	32	22	15	3	88	221	440	0.502	81
4	Delay in providing services from utilities (such as telephone, electricity and etc.)	13	31	24	14	6	88	233	440	0.530	76
5	Natural disaster (flood, hurricane, earthquake and so on)	28	21	16	16	7	88	217	440	0.493	82
6	Political instability	6	21	21	24	16	88	287	440	0.652	24
7	Unforeseen site condition	8	16	36	18	10	88	270	440	0.614	41
8	Overall inflation in the economy	5	10	11	24	38	88	344	440	0.782	4

4. Mean, RII and ranking of all factors

Item No	Description of Factors	Client			Contractor			Consultant			All Response			
		Mean	RII	Rank	Mean	RII	Rank	Mean	RII	Rank	Mean	Std. Dev.	RII	Rank
	Design change related factors													
1	Change order	2.64	0.53	67	2.63	0.53	80	2.67	0.53	73	2.65	0.995	0.53	76
2	Change in drawing	2.46	0.49	76	2.87	0.57	69	2.70	0.54	70	2.68	1.06	0.54	74
3	Change in specification	2.61	0.52	69	3.03	0.61	51	2.37	0.47	83	2.67	1.20	0.53	75
4	Incomplete contract document	2.39	0.48	79	3.30	0.66	31	2.60	0.52	77	2.77	1.26	0.55	68
5	The decision during the development stage	3.00	0.60	41	3.30	0.66	31	2.83	0.57	62	3.05	1.03	0.61	45
6	Mistakes and discrepancies in design documents	2.82	0.56	58	3.43	0.69	21	2.70	0.54	70	2.99	1.19	0.60	51
7	Problem of identifying the location of buried utilities and infrastructure during design period.	2.89	0.58	52	3.40	0.68	23	3.20	0.64	35	3.17	1.29	0.63	35
8	Change in subsurface condition	2.50	0.50	75	2.93	0.59	59	2.83	0.57	62	2.76	1.04	0.55	70
9	Change in the scope of the project	2.64	0.53	67	3.07	0.61	49	2.83	0.57	62	2.85	1.16	0.57	66
10	Risk and uncertainty associated with project	2.89	0.58	52	3.07	0.61	49	2.67	0.53	73	2.87	1.16	0.58	65
11	Variation	3.14	0.63	25	3.13	0.63	43	3.20	0.64	35	3.16	1.11	0.63	36
	Material related factors													

1	Quality of material	2.89	0.58	52	2.87	0.57	69	3.20	0.64	35	2.99	1.31	0.60	51
2	Late Supply of Materials	3.79	0.76	6	3.63	0.73	12	3.77	0.75	6	3.73	1.122	0.75	8
3	Availability of local material around the project and its accessibility	3.14	0.63	25	3.47	0.69	17	3.30	0.66	25	3.31	1.24	0.66	20
4	Shortage of construction materials in market	3.75	0.75	7	3.77	0.75	10	4.07	0.81	1	3.86	1.27	0.77	5
5	Poor material handling on site	2.61	0.52	69	2.77	0.55	73	2.77	0.55	66	2.72	1.06	0.54	71
6	Material wastage on site	2.54	0.51	73	2.70	0.54	77	2.83	0.57	62	2.69	1.09	0.54	73
7	Low quality of material	2.75	0.55	62	2.73	0.55	76	3.17	0.63	40	2.89	1.28	0.58	62
8	Change in material types and specifications during construction	3.00	0.60	41	2.90	0.58	65	2.97	0.59	51	2.95	1.24	0.59	56
9	Delay in manufacturing special construction materials	3.43	0.69	12	3.27	0.65	35	3.23	0.65	31	3.31	1.28	0.66	20
10	Poor procurement system of material	2.79	0.56	60	3.30	0.66	31	3.33	0.67	19	3.15	1.12	0.63	37
11	Late procurement of construction materials	3.11	0.62	30	3.47	0.69	17	3.33	0.67	19	3.31	1.14	0.66	20
12	Delay in supply of materials from foreign countries (Material Import)	3.96	0.79	3	4.00	0.80	2	4.07	0.81	1	4.01	1.23	0.80	2
	Labor related factors													
1	Shortage of labor	2.54	0.51	73	2.70	0.54	77	2.60	0.52	77	2.61	1.18	0.52	79
2	Low productivity level of Labor	2.68	0.54	66	2.93	0.59	59	3.07	0.61	47	2.90	1.03	0.58	61
3	Unqualified/inadequate experienced labor	2.71	0.54	63	2.93	0.59	59	3.17	0.63	40	2.94	1.032	0.59	59

4	Deployment of enough labor on site	2.93	0.59	48	2.93	0.59	59	3.17	0.63	40	3.01	1.07	0.60	48
5	Payment of daily and skilled laborer	2.89	0.58	52	3.20	0.64	39	3.07	0.61	47	3.06	1.11	0.61	42
6	Absenteeism	2.46	0.49	76	2.47	0.49	82	2.77	0.55	66	2.57	0.99	0.51	80
7	Low motivation and morale of labor	2.61	0.52	69	3.13	0.63	43	2.87	0.57	58	2.88	1.04	0.58	63
8	Labor management system	3.11	0.62	30	3.33	0.67	28	3.33	0.67	19	3.26	1.03	0.65	24
9	Labor union action	2.61	0.52	69	2.90	0.58	65	2.43	0.49	79	2.65	1.10	0.53	76
10	Personal conflict among labor	2.25	0.45	83	2.40	0.48	83	2.40	0.48	81	2.35	1.05	0.47	83
	Equipment related factors													
1	Improper equipment	2.93	0.59	48	3.00	0.60	53	3.20	0.64	35	3.05	1.17	0.61	45
2	Equipment unavailability	3.25	0.65	16	3.47	0.69	17	3.43	0.69	14	3.39	1.08	0.68	15
3	Low productivity of equipment	2.96	0.59	43	3.43	0.69	21	3.17	0.63	40	3.19	1.11	0.64	30
4	Equipment breakdowns	2.86	0.57	56	3.60	0.72	13	3.07	0.61	47	3.18	1.089	0.64	33
5	Shortage of equipment and hiring delay	3.21	0.64	19	3.47	0.69	17	3.30	0.66	25	3.33	0.98	0.67	18
6	Mobilization of equipment’s on site as per contractual agreement	3.46	0.69	11	3.40	0.68	23	3.70	0.74	7	3.52	1.13	0.70	12
7	Equipment management system	3.04	0.61	35	2.93	0.59	59	2.93	0.59	54	2.97	1.06	0.59	54
8	Low efficiency of equipment	2.96	0.59	43	3.37	0.67	26	3.20	0.64	35	3.18	1.06	0.64	33
	Finance related factors													
1	Delayed payments to contractors	3.21	0.64	19	3.83	0.77	8	3.33	0.67	19	3.47	1.20	0.69	13

2	Delayed payments to suppliers and subcontractors	3.18	0.64	23	3.70	0.74	11	3.23	0.65	31	3.37	1.17	0.68	16
3	Client's financial shortage	3.43	0.69	12	3.83	0.77	8	3.40	0.68	17	3.56	1.33	0.71	11
4	Shortage of foreign currency	4.11	0.82	1	3.87	0.77	7	3.83	0.77	5	3.93	1.17	0.79	3
5	Fluctuation in foreign currency exchange rate	4.07	0.81	2	3.93	0.79	5	3.47	0.69	12	3.82	1.17	0.76	6
6	Government support in providing foreign currency	3.75	0.75	7	3.90	0.78	6	3.33	0.67	19	3.66	1.19	0.73	9
7	Financial difficulties faced by the contractor	3.64	0.73	10	4.00	0.80	2	3.60	0.72	8	3.75	1.10	0.75	7
8	Insufficient cash flow on site	3.82	0.76	5	3.60	0.72	13	3.57	0.71	9	3.66	1.06	0.73	9
9	Difficulty in accessing advance payment	3.04	0.61	35	3.20	0.64	39	2.63	0.53	76	2.95	1.15	0.59	56
10	Fluctuation of construction material prices	3.96	0.79	3	4.20	0.84	1	3.93	0.79	4	4.03	1.13	0.81	1
	Management related factors													
1	Organizational change	2.39	0.48	79	2.80	0.56	72	2.93	0.59	54	2.72	1.08	0.54	71
2	Application of Obsolete technology and innovation	2.71	0.54	63	2.87	0.57	69	2.73	0.55	68	2.77	1.05	0.55	68
3	Poor site management	3.07	0.61	33	3.10	0.62	46	3.43	0.69	14	3.20	1.13	0.64	29
4	Mistakes in construction	2.79	0.56	60	2.60	0.52	81	2.97	0.59	51	2.78	1.19	0.56	67
5	Unrealistic contract duration	3.14	0.63	25	3.57	0.71	15	3.53	0.71	10	3.42	1.16	0.68	14
6	Inaccurate cost estimation	3.14	0.63	25	3.53	0.71	16	3.43	0.69	14	3.38	1.128	0.68	16
7	Not preparing the method statement	3.14	0.63	25	2.97	0.59	57	2.97	0.59	51	3.02	1.01	0.60	47

8	Inappropriate organization management	2.71	0.54	63	3.00	0.60	53	3.10	0.62	45	2.94	1.14	0.59	59
9	Ineffective planning and scheduling of project planning	3.04	0.61	35	3.33	0.67	28	3.53	0.71	10	3.31	1.09	0.66	20
10	Similarity of contractors crashed schedule with master schedule	3.29	0.66	15	3.00	0.60	53	3.30	0.66	25	3.19	1.21	0.64	30
11	Inadequate contractor experience	2.93	0.59	48	2.90	0.58	65	3.33	0.67	19	3.06	1.24	0.61	42
12	Inadequate consultant experience	3.21	0.64	19	2.93	0.59	59	2.90	0.58	57	3.01	1.17	0.60	48
13	Underestimation of the complexity of the project	3.04	0.61	35	3.10	0.62	46	3.30	0.66	25	3.15	1.15	0.63	37
	Contractual related factors													
1	Non-utilization of professional construction/contractual management	3.18	0.64	23	3.00	0.60	53	3.23	0.65	31	3.14	1.15	0.63	39
2	Delay in delivering the site project to the contractor	3.25	0.65	16	3.40	0.68	23	3.10	0.62	45	3.25	1.01	0.65	26
3	Delay in approval of documents	3.11	0.62	30	3.27	0.65	35	3.27	0.65	30	3.22	1.12	0.64	28
4	Unsmooth internal and external communications	2.96	0.59	43	3.13	0.63	43	3.07	0.61	47	3.06	1.12	0.61	42
5	Lack of communication between parties	2.96	0.59	43	3.03	0.61	51	2.93	0.59	54	2.98	1.22	0.60	53
6	Slowness in giving instruction	2.82	0.56	58	3.20	0.64	39	2.87	0.57	58	2.97	1.11	0.59	54
7	Slowness in the decision-making process	2.96	0.59	43	3.30	0.66	31	3.30	0.66	25	3.19	1.183	0.64	30
8	Duration of the inspection procedure	3.25	0.65	16	2.97	0.59	57	2.67	0.53	73	2.95	1.15	0.59	56
9	Company’s procedure of selecting subcontractors	3.04	0.61	35	2.90	0.58	65	2.70	0.54	70	2.88	1.03	0.58	63

10	Delay in performance of subcontractors	3.07	0.61	33	3.33	0.67	28	2.87	0.57	58	3.09	1.08	0.62	40
11	Problems with the contractors	3.43	0.69	12	3.17	0.63	42	3.37	0.67	18	3.32	1.10	0.66	19
	External factors													
1	Inclement weather condition	3.21	0.64	19	3.37	0.67	26	3.13	0.63	44	3.24	0.98	0.65	27
2	Delay in obtaining permit services	2.93	0.59	48	3.23	0.65	38	2.87	0.57	58	3.01	1.03	0.60	48
3	Change in government regulations and laws	2.36	0.47	81	2.77	0.55	73	2.40	0.48	81	2.51	1.08	0.50	81
4	Delay in providing services from utilities (such as telephone, electricity and etc.)	2.43	0.49	78	2.77	0.55	73	2.73	0.55	68	2.65	1.13	0.53	76
5	Natural disaster (flood, hurricane, earthquake and so on)	2.29	0.46	82	2.67	0.53	79	2.43	0.49	79	2.47	1.32	0.49	82
6	Political instability	3.04	0.61	35	3.27	0.65	35	3.47	0.69	12	3.26	1.21	0.65	24
7	Unforeseen site condition	2.86	0.57	56	3.10	0.62	46	3.23	0.65	31	3.07	1.10	0.61	41
8	Overall inflation in the economy	3.71	0.74	9	3.97	0.79	4	4.03	0.81	3	3.91	1.238	0.78	4

5. Mean, and ranking of all Management practices

Item No	Description of Management practice	Client		Contractor		Consultant		All Response		
		Mean	Rank	Mean	Rank	Mean	Rank	Mean	Std. Dev.	Rank
1	The project management team communication with stakeholders.	3.5	13	3.4	5	3.53	5	3.48	0.994	8
2	Proper planning and design during the construction stage.	3.5	13	3.17	14	3.53	5	3.4	1.088	13
3	The project management practice to prepare effective planning and scheduling	3.5	13	3.27	10	3.47	10	3.41	1.057	11
4	Strict adherence to construction standards and guideline.	3.57	10	3.13	15	3.2	19	3.3	0.912	16
5	Clear division of roles and responsibilities among the project management team	3.57	10	3.47	2	3.4	13	3.48	1.072	9
6	The project management practices in risk identification and mitigation.	3.61	9	3.4	5	3.23	18	3.41	1.057	11
7	Timely completion of construction activities to avoid cost overrun and delay.	3.36	19	3	17	3.27	16	3.2	1.288	19
8	The project management practices in ensuring proper allocation of resources.	3.5	13	3.2	11	3.27	16	3.32	1.012	15
9	The project management quality control and assurance practice to ensure the quality standards	3.64	8	3.4	5	3.53	5	3.52	0.994	5
10	The project management practice in budget control to ensure that estimated costs are in line with actual expenditures.	3.57	10	2.77	20	3.43	12	3.25	1.053	18

11	The project management practices in managing changes and modification in the project scope.	3.68	6	3	17	3.47	10	3.37	0.986	14
12	The project management practice with the decision-making process during the construction stage	3.82	1	3.2	11	3.5	9	3.5	0.994	7
13	The construction management practice in utilizing any specific project management tools or software during the construction stage.	3.32	20	3.1	16	3.17	20	3.19	1.153	20
14	The project management team effort to demonstrate a strong ability to collaborate and coordinate among team members.	3.68	6	3.5	1	3.57	4	3.58	0.991	1
15	The project management team practice to appropriately address any external factors like weather, political issues, and economic issues and so on.	3.46	17	3	17	3.3	15	3.25	0.997	17
16	Involving local communities in the construction process to enhance their sense of ownership and commitment to the success of the project.	3.71	5	3.43	3	3.4	13	3.51	1.028	6
17	Regular monitoring and evaluation during the construction period to identify and address potential issues	3.46	17	3.43	3	3.53	5	3.48	1.083	10
18	Effective collaboration between government agencies, consultants, and community organizations for the successful of the projects.	3.82	1	3.2	11	3.6	2	3.53	1.039	4

19	The project management practice in monitoring and controlling project progress.	3.75	3	3.37	8	3.6	2	3.57	1.037	3
20	Overall, the project management practices contributed to the successful implementation and completion of the town WSS project?	3.75	3	3.33	9	3.67	1	3.58	1.003	2