JIMMA UNIVERSITY
JIMMA INSTITUTE OF TECHNOLOGY SCHOOL OF GRADUATE STUDIES
FACULTY OF CIVIL AND ENVIRONMENTAL ENGINEERING
CONSTRUCTION ENGINEERING AND MANAGEMENT CHAIR

ASSESSMENT ON PERFORMANCE OF WATER SUPPLY CONSTRUCTION PROJECTS IN JIMMA ZONE

A Research Thesis submitted to the School of Graduate Studies, Jimma University, Jimma Institute of Technology, Faculty of Civil and Environmental Engineering in Partial Fulfillment of the Requirements for the Degree Master of Science in Construction Engineering and Management

By

Lelisa Anbessa Dinka

October, 2021

Jimma, Ethiopia

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Advisor: Dr. Getachew Kebede (PhD)

Co-advisor: Engr. Ahmed Nuredin

October, 2021

Jimma, Ethiopia

DECLARATION

I declare that this research entitled **"**Assessment on the performance of water supply construction projects in Jimma Zone" is my original work and has not been submitted as a requirement for the award of any degree in Jimma University or elsewhere.

Lelisa Anbessa Dinka _____ _____

Name Signature Date

As research Adviser, I hereby certify that I have read and evaluated this thesis paper prepared under my guidance, by Lelisa Anbessa Dinka entitled" ASSESSMENT ON PERFORMANCE OF WATER SUPPLY CONSTRUCTION PROJECTS IN JIMMA ZONE'' and recommend and would be accepted as a fulfilling requirement for the Degree Master of Science in Construction Engineering and Management.

Advisor: Dr. Getachew Kebede (PhD) _____ _____

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ABSTRACT

The Ethiopian government has been struggling to meet the demand of the population in terms of potable water supply by implementing various water supply construction projects for the last consecutive periods. However; the construction sector in Ethiopia including the Urban Water Supply and Sanitation construction projects have a serious problem with the construction management and administration as well as limitation of budget, time and resources in general. Some of the main recurrent problems are a failure to complete the projects on schedule and budget due to several factors. Thus, this study aimed to assess the performance of water supply construction projects in Jimma zone. To achieve this objective descriptive survey was used as a research design and purposive sampling as sampling technique and both Qualitative and quantitative data were used. Primary and secondary data source was used. The research used five levels Likert scale type questionnaire for the primary data and document reviews for the secondary data. Seven recent completed projects and 54 respondents involved in this research. The primary data gathered through the questionnaire were analyzed using the Relative importance index and statistical package for social science (SPSS-26.1) and the results were presented using tables and charts. By deep review of different literature, associated with a title, identifying factors affecting performance of water supply construction projects was done; finally, a total of 50 factors affecting water supply construction project performance were, identified. The identified factors were organized and summarized in question incorporate respondent to rate on the factors. From the research finding the major influential factors affecting performance of water supply construction project were; Inflation (materials price fluctuation); Poor contract and project management; insufficient scheduling of a project by a contractor, high cost of machineries, bureaucracy in bidding method, progress payment delay, financial difficulties of the contractor, poor supervision on the site, low speed decision making process and high transportation cost. In addition the average rate of cost overrun was 1.216% to 23.955% of the original cost and that of schedule overrun was 40% to 100% of the original duration. In conclusion, poor cost and time management were the significant factors for the performance problem of water supply construction projects in Jimma zone.

Keywords: *cost performance, time performance, cost overrun, time overrun*

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ACWP	Actual cost of Work performed
ATWP	Actual Time Work Performed
AEC	Architectural, Engineering and Construction
BCWP	Budgeted Cost of Work Performed
BPM	Building project Management
CPI	Cost Performance Index
CV	Cost Variance
ECI	Early Contractor Involvement
ESI	Early Supplier Involvement
EVA	Earned Value Analysis
IT	Information Technology
KPI	Key Performance Indicator
PAR	Performance Appraisal and Reporting
PM	Project Management
PPI	Project Performance Indicator
PPMS	Project Performance Management System
SPI	Schedule Performance Index
STWP	Scheduled Time Work Performed
SV	Schedule Variance
RII	Relative Importance Index
UK	United Kingdom
UNDP	United Nations Development Program
UWSSP	Urban Water Supply and Sanitation Program

CHAPTER ONE
INTRODUCTION

1.1 Background of the study

Access to safe drinking water and sustainable is a global concern, especially as a millennium development Goal, and in recent years, it has been increasingly addressed as one of the basic human rights of nations (UNDP, 2020). Even though clean water is a necessity for all humans, more than 748 million people around the world have no access to clean drinking water. This problem is particularly critical in rural areas and small communities, where water collection may require hours of physical effort, water sources may be contaminated, or must be purchased at rates too expensive to allow for proper health and hygiene.

According to Water.org survey 33 million Ethiopian people's lack access to an improved water source and 89 million lack access to improved sanitation. Of those who lack access to improved sanitation, a staggering 23 million practice open defecation.

To overcome this problem the Ethiopian government has been struggling to meet the demand of the population in terms of potable water supply by implementing various water supply construction projects for the last consecutive periods. However; the construction sector in Ethiopia including the Urban Water Supply and Sanitation construction projects (UWSSP) have a serious problem with the construction management and administration as well as limitation of budget, time and resources in general. Some of the main recurrent problems are a failure to complete the projects on schedule and budget due to several factors.

According to Ayalew et al, (2016) indicated that the amount of construction project schedule slippage in Ethiopia generally ranges between 61-80% and that of planned costs and other variables such as risk, quality, resources utilization, and safety deviates in the range 21-40% from predetermined requirements or anticipated at the beginning of the project.

To improve water supply construction project performance, it is imperative to establish a proper cost and time management strategy. Indeed, a comprehensive assessment of cost and time drivers form the foundation for developing realistic project cost and time management practices and strategies. Therefore, it is necessary to conduct comprehensive and systematic examination of the impacts of cost and time influencing factors on the project. This process includes identifying, categorizing, and assessing multiple influencing factors related to construction project costs and

time. Several studies have been conducted to identify and suggest categories for the influencing factors of project cost and time.(Ali, 2018)

According to Rahman et al., (2012) keeping construction projects within estimated costs and schedules requires sound strategies, best practices, and careful judgment. To the dislike of owners, contractors and consultants, however, many projects experience, extensive delays and thereby exceed initial time and cost estimates. This problem is more evident in the traditional or the adversarial type of contracts in which the contract is awarded to the lowest bidder, which is the strategy in the majority of public projects in developing countries.

Time and cost is undoubtedly the most important concern in any business endeavor, not least in the construction industry. Poor time and cost performance in construction projects has become a major concern for both contractors and clients (Rahman *et al.*, 2013). In order to control time and costs, it is important to exercise foresight of the various project-related determinants and address the magnitude of their effects. Mahamid, (2016) agreed that realizing and understanding cost and time determinants will enrich the cost and time estimator's competence, hence, adequately delivering a more sustainable and reliable cost and time modelling and estimating technique.

1.2 Statement of the Problem

Construction can be considered as a dynamic industry which is constantly facing uncertainties. Besides these uncertainties, involvement of many stakeholders makes the management of cost and time difficult which consequently causes time and cost deviation. Therefore, cost and time performances are considered one of the most critical issues during the execution of construction projects (Tadewos and Patel, 2018).

The findings of the study conducted by Rahman *et al.*, (2012) revealed that 92% in construction projects in Malaysia were facing time overrun and only 8% of project could achieve completion within contract duration and 89% of respondents agreed that their projects were facing the problem of cost overrun with average overrun at 5-10% of the contract price. According to Shehu *et al.*, (2014) 42.3% of construction projects' time and cost performance is between 5-10% of the time scheduled and budgeted cost in Malaysia. Kumar, et al., (2019) studied assessment of project performance in terms of time, cost and quality in Nepal and identified that the range of time overrun varies from 13% to 207% and that of cost overrun varies from 6% to 15%

In Ethiopia as Ayalew et al, (2016) indicated the amount of construction project schedule slippage generally ranges between 61-80% and that planned costs and other variables such as risk, quality, resource utilization, and safety deviates in the range 21-40% from predetermined requirements or

anticipated at the beginning of the project. Lijalem, (2019) studied factors affecting schedule and cost overrun on water supply and sewerage construction in Addis Ababa city and found that the average rate of schedule overrun is between 7.69% and 280.33% of the original duration, and the average rate of cost overrun is between 0.72% and 8.11% of the original contract value. Wondwossen, (2013) studied factors affecting time performance of construction projects and identified that the average schedule overrun is between 39% and 90% of original duration.

Despite Jimma Zone administration has been struggling to meet the demand of the population in terms of potable water supply by implementing various water supply construction projects for the last consecutive periods; the construction sector has a serious problem with the construction management and administration as well as limitation of budget, time and resources in general. Some of the main recurrent problems are a failure to complete the projects on schedule and budget due to several factors.

However, almost the majority of the previous studies were limited to performance of road and building constructions in Jimma Zone level as well as within Ethiopia so that the lack of adequate researches or no empirical evidence that prove the time and cost performance of water supply construction projects especially in Jimma Zone context has been a major motivation to carry out this study.

1.3. Research Questions

1. What are the factors affecting performance of water supply construction projects in Jimma Zone?

2. How is the cost performance of water supply construction projects in Jimma zone?

3. How is the time performance of water supply construction projects in Jimma zone?

1.4. Objectives of the Study

1.4.1. General Objective

The general objective of this study is to assess the performance of water supply construction projects in Jimma Zone.

1.4.2. Specific Objectives

1) To determine the major influencing factor of water supply construction project performance in Jimma Zone.

2) To determine the cost performance of water supply construction projects in Jimma Zone.

3) To determine the time performance of water supply construction projects in Jimma Zone.

1.5 Scope and limitation of the study

The study was limited both in scope and depth. The study area was limited to Jimma zone and the research study was also limited to construction of urban water supply projects in Jimma Zone. The research was limited to, project time and cost performance only since most construction in our country give more focus to cost and time schedule.

1.6. Significance of the Study

Since the poor performance of construction project is major and chronic problem, which is high impact on the development of construction industry. The major and first solution to overcome this problem was identified and analyses the major factors leading the construction project in poor performance. On the behalf of solution, the major significance of this research is attempt to identify and analysis the major factors affecting performance of water supply construction project and to measure the existing cost and time performance in Jimma zone, and finally provide recommendation, how to improve the cost and time performance in water supply construction project. Based on this the research finding will enable/ give information for those stakeholders which is participating in the construction industry, to overcome the problem of poor performance of cost and time performance in the future project.

1.7 Thesis Organization

The research was, organized into five main chapters, which summarized below

Chapter one: Introduction to the study, a statement of the problem , a research question to be answered, objective of the research, scope of research, the significance of the study, limitation of the study and thesis organization

Chapter Two: Literature review

Chapter three: Research Methodology comprise, the major research approach used, research population and sampling method, sampling, data collection method both primary and secondary data, data analysis method.

Chapter Four: Data analysis and discussion, Include data processing, presentation and discussion

Chapter Five: Conclusion and recommendation:

- ✓In this chapter conclusion of research from the result obtained from the data analysis
- ✓Finally, recommendation

CHAPTER TWO

LITERATURE REVIEW

2.1 Definitions and concepts.

The Oxford Advanced Learner's Dictionary describes the criterion as "a standard or principle by which something is judged, or with the help of which a decision is made" while a factor is explained as "a fact or situation which influences the result of something".

Performance means carrying out a task, the progress of which can be measured and compared using a set of state requirements. Therefore, performance factor is a fact or situation which influences a progress of work which can be measured and compared using a set of the stated requirements.

Performance can be considered as an evaluation of how well individuals, groups of individuals or organizations have done in pursuit of a specific objective (Bitamba, 2020). These objectives vary significantly, but from an industry or organizational perspective, they generally revolve around satisfying the key stakeholders such as customers, employees, shareholders, the various suppliers, government and society as a whole. Fidic *et al.*, (2017) described performance as relating to such factors as increasing profitability, improved service delivery or obtaining the best results in important areas of organizational activities. In construction, because of the numerous participants who contribute towards the achievement of project objectives, performance has been defined in one sense as a participant's (client, consultant or contractor) contribution to the execution of the task required to complete the project.

The characteristics of the construction industry are such that a project is often a major business endeavor representing a major investment by the client, however the most research published in the construction management literature on performance in the construction context mainly focus attention on the contractor's role (Durdyev *et al.*, 2017). This implies that ultimately it is the project performance that determines overall business performance. These characteristics make project performance critical.

Because the client is the principal stakeholder in the construction process, good performance has been defined typically in terms of the delivery of projects on time, to specification and within budget, providing good service and achieving reasonable lifecycle costs. More recently, the requirements of the other stakeholders such as employees and society have come into focus with the need to promote sustainable construction and corporate social responsibility, and this is

reflected in a more comprehensive set of industries. Key Performance Indicators (KPIs) of project performance covering such issues as environmental protection and respect for people (Issn 2010).

According to Amusan, et al, (2017), performance indicators specify the measurable evidence necessary to prove that a planned effort has achieved the desired result. In other words, when indicators can be measured with some degree of precision and without ambiguity they are called measures. However, when it is not possible to obtain a precise measurement they are usually referred to as performance indicators. KPIs enables a comparison between different projects and enterprises to identify the existence of particular patterns (Amusan, et al , 2017).

Nyangwara and Datche, (2015) stated that KPIs are very important in order to deliver value to stakeholders. So, companies must be sure they have the right processes and capabilities in place. The KPIs also allows to suggest which processes and capabilities must be competed and distinctive, and which merely need to be improved or maintained. The key performance indicators are identified by Fidic *et al.*, (2017) as an applicable indication of project and/or company levels. In some cases the company indicator is the average value of that company's project indicator. Amusan, et al , (2017) stated that the owner satisfaction for performance can be defined as the gap between what the owner expects and the level of performance they believe is being delivered by the contractors.

2.2 Construction Project Management

A project's success defined as meeting goals and objectives as prescribed in the project plan. A successful project means that the project has accomplished its technical performance, maintained its schedule and remained within budgetary costs (Frimpong, 2003).

According to Monyane et al, (2020) project success depends on five outcomes of project management, has to be, constructed within the expected duration of the project, within budget, with the right quality and in the right environment and needs to be, achieved safely.

A project is a collection of activities to achieve a specific objective. Project management involves planning, monitoring and control. Project management is the work methods that are used to control and manage activities in the project. Project management involves the application of knowledge, skills, tools and techniques in project activities to meet the project objectives (Karisson, 2011). All management work is, based on processes as initiating, planning, executing, controlling and closing (PMBOK Edisi 5 (2013), 2015)

2.2.1 Project cost Management

Project cost management, has a broader view of life cycle costing, and incorporates the effect of

project decision on the cost of using, maintaining and supporting the product service or the results of the project (Abraham, 2008).

Also Potts, (2008) defines Cost management is the process, which is necessary to ensure that the planned development of design and procurement of the project is such that the price for its construction provides value for money and is within the limits anticipated by the client.

According to (PMBOK Edisi 5 (2013), 2015)) definition- Project cost management is primarily concerned with the cost of the resource needed to complete project activity. Project cost management should consider the effect of project decisions on the subsequent recurring cost of using, maintaining, and supporting the product, service, or result of the project.

Further, also define Project cost management includes the process involved in planning, estimating, budgeting, financing, funding, and controlling costs so that the project is, completed within the approved budget.

Project cost management processes, which include the following (Lock, 2004).

Estimating cost-the process of developing an approximation of the monitory resource needed to complete project activity.

Determining Budget-the process of aggregating the estimated costs of individuals activities or work package to establish an authorized cost baseline.

Control costs-the process of monitoring the status of the project to update the project budget and managing changes to the cost baseline.

2.2.2 Project Time Management

In project management, time management together with cost management is the most visible area. Cited on (Chin et al, 2015). The initial objectives of time management are to control time and prepare schedules, networks and so on. Time management is the function required to maintain the appropriate allocation of time to the overall conduct of the project through the successive of its natural lifecycle, (i.e. Concept, development, execution and finishing) by means of the process of time planning, time estimating, time schedule, and schedule control (PMBOK, (2013). Project time management includes the processes required to manage the timely completion of the project. The process involved in time management is:

Plan, schedule management –the process of establishing the policies, procedures, and documentation for planning, developing, managing, executing and controlling the project schedule

Define activity-the process of identifying the specific action to be, performed to produce the project deliverables.

Sequencing activities: the process of identifying and documenting relationship between the project activities

Estimate activity resource –the process of estimating the type and quantity of material, human resource, equipment, or supplies required to perform each activity

Estimate activity durations –the process of estimating the number of work periods needed to complete individual activities with the estimated resources.

Develop schedule –the process of analyzing activity sequences, durations, resource requirements, and schedule constraints to create the project schedule model.

2.3 Project Time and Cost Performance

Earned Value Management (EVM) methodology is commonly defined as a management technique that relates resource planning and usage to schedules and to technical performance requirement. More specifically, EVM can be said to bring cost and schedule variance analysis together to provide accurate status of a project (Gasparotti *et al.*, 2017).

Schedule variation is determined by (SV) and is the difference between the planned and actual duration. A negative SV means the project is late while a positive SV means the project has been completed before scheduled time. Similarly, cost variation (CV) is measured as the difference between planned cost and actual cost. A negative CV means over budget or overspent project and a positive CV means an under budget project. Performance can be also determined using SPI (schedule performance index) and CPI (Cost performance index) (Ahsan and Gunawan, 2010).

When the three key parameters are properly recorded along the project life, PMs are able to calculate two types of performance measures. The first type of performance measures are variances which represent the difference between the current status of the project and its baseline. A negative (positive) value points out that more (less) has been spent for the executed activities than what was originally planned. The Schedule Variance (SV) is an indicator that provides PMs with a value that represents whether the project is on schedule or not. A negative (positive) value means that the project is behind (ahead of) schedule.

Another type of performance measures are indices, also calculated from the three key parameters of EVM. The indices are again used to display how well the project is performing, now relatively in comparison with the baseline. Again two types of indices can be distinguished. The first type

of index is the Cost Performance Index (CPI), which expresses the cost efficiency of the executed work. A CPI of less or more than one means that the project is currently running over or under budget. The second index is the Schedule Performance Index (SPI). The SPI shows whether the project is performed on schedule or not. An SPI of more or less than one means that the project is ahead of or behind.

It is clear that the variances and indices are interrelated. Still, it is useful to calculate both performance measures. The variances can give a snapshot of where the project is today (expressed in monetary value) while the indices are rather used to represent the evolution in the performance of the project. This is a significant importance to make forecasts about the future of the project.

2.3.1 Project Cost performance

Musarat and Ahad, (2016) defined performance measurement as a comparison between the planned and the actual performances. For example, when a deviation is detected, the construction management analyzes the reasons for it. The reasons for deviation can be schematically divided into two groups: (a) unrealistic target setting (i.e., planning) or (b) causes originating from the actual construction process. In many cases the causes for deviation originate from both sources. Musarat and Ahad, (2016) Stated that performance measurement is needed not only to control current projects but also to update the historical database. Such updates enable better planning of future projects in terms of costs, schedules, labor allocation, etc.

Gebril, (2012) stated that the measurement of project performance can no longer be restricted to the traditional criteria, which consist of time, cost and quality. There are other measurement criteria such as project management, stakeholder satisfaction, health and safety, defects, etc.

Cost performance (CV) can be computed as (Odediran, et al, 2012) (Moneke, et al, 2016):

$$CV = \frac{BCWP - ACWP}{BCWP} \text{ X } 100 \quad \text{.....Equation.2.1}$$

$$CPI = \frac{BCWP}{ACWP} \quad \text{.....Equation. 2.2}$$

Where:

BCWP = Budgeted cost of Work Performed

ACWP = Actual cost of Work performed.

CPI = cost performance index

CV = cost variance

CV (Cost variance) provides an indication of the variation of the project costs over the initial award cost of the project, where award cost is the budgeted cost of work performed and Final project cost is the Actual cost of work performed.

If the value of CV is equal to 0 it means the project is completed at cost.

If the value of CV is positive it shows the project is completed under the budgeted cost of work performed.

If the value of CV is negative it shows the project is completed over the budgeted cost of work performed.

2.3.2 Project time performance

Project time performance is measured by comparing actual with the planned project period. This performance metric provides an indication of deviation of schedule between planned Project Time (Duration) over the actual complete duration of the Project.

$$SV = \frac{STWP - ATWP}{STWP} \text{ X } 100 \quad \text{.....Equation.2.3}$$

$$TPI = \frac{STWP}{ATWP} \quad \text{.....Equation.2.4}$$

Where:

STWP = Scheduled time of work performed

ATWP = Actual time of work performed.

TPI = Time performance index

SV = Schedule Variance

If the value of the SV is equal to 0, it means the project is completed on time.

If the value of the SV is positive, it means the project is completed ahead of schedule.

If the value of the SV is negative, it means the project is completed behind of schedule.

2.4 Problem of Performance in Construction Industry

The failure of any construction project is mainly related to the problems and failure in performance. Moreover, there are many reasons and factors which attribute to such problem. Nyangwara and Datche, (2015), stated that the construction industry performance problems in developing economies can be classified in three layers: inadequacies in industry infrastructure (resources supply), clients and consultants caused problems and contractor incompetence/inadequacies.

Mahamid, (2016), identified that the performance problem is related to poor budgetary and time control. Gyadu-asiedu, (2009), remarked that performance problems arise in large construction projects due to many reasons such as: incompetent designers/contractors, poor estimation and change management, social and technological issues, site related issues and improper techniques and tools. Musarat and Ahad, (2016) stated that the main performance problem can be divided into two groups: (a) unrealistic target setting (i.e., planning) or (b) causes originating from the actual construction (in many cases the causes for deviation originate from both sources).

Nyangwara and Datche, (2015), found that the traditional performance measurement systems have problems because of the large and complex amount of information with absence of approaches to assist decision maker understand, organize and use such information to manage organizational performance. Musarat and Ahad, (2016), remarked that traditional project performance control is usually generic (e.g., cost control techniques). It relies on manual data collection, which means that it is done at low frequency (normally once a month) and quite some time after the controlled event occurred (i.e., not in real-time). Moreover, manual data collection normally gives low quality data.

Ling and Bui, (2010), remarked that architectural, engineering and construction (AEC) firms may encounter challenges managing construction project performance in China because of unfamiliarity with this new operating environment. Kim et al., (2008), stated that international construction project performance is affected by more complex and dynamic factors than domestic projects; frequently being exposed to serious external uncertainties such as political, economic, social, and cultural risks, as well as internal risks from within the project.

2.5 Challenges in Water and wastewater construction projects

While each project is unique, water and wastewater projects experience many common issues. Maimuna, (2017) stated some of the key aspects that can impact the performance of water and wastewater construction projects are:-inaccurate drawing and specification, inexperience, shortage of budget, right of way occupancy, transportation of heavy equipment, mobilization of construction tools and materials, unexpected subsurface conditions, construction sequence difficulties, coordination and communication between construction parties and change order disputes are the major challenges.

2.6 Project Management and Performance

There is a strong relation between project management and project performance. Management in the construction industry is considered as one of the most important factors affecting the

performance of works. Ali, (2018) studied a new approach to the measurement of the effect of Building Project Management (BPM) on time, cost and quality outputs using 15 `cases' derived from UK data. The evaluation undertaken demonstrates that BPM as it is presently implemented in the UK fails to perform as expected in relation to the three predominant performance evaluation criteria; time, cost and quality. Wegelius-Lehtonen, (2010), obtained a model for performance measurement which assist both firms' top management and operational managers for continuous feedback on operational activities. Hughes, et al, (2004), stated that documenting and archiving performance data could be useful for future reference, such as for settling disputes on claims, and in maintenance and repair works. Moneke,et al, (2016), remarked that quantification of the impacts of the project management processes is identified through three steps of analysis: comparison of summary statistics of design performance, proof of statistical significance of any differences and calculation of a least squares regression line of a plot of design performance measurement versus amount/application of project management as a means to quantify management influence to design phase cost performance.

Ugwu and Haupt, (2007), studied the project performance related to project managers and remarked that development of a Web-based construction Project Performance Monitoring System (PPMS) can assist project managers in exercising construction project performance indicators and can help senior project management practitioners, etc., in monitoring and assessing project performance. Al-Najjar, (2008), stated that while project management is only one of the many criteria upon which project performance is contingent, it is also arguably the most significant as people formulating the processes and systems who deliver the projects. Ugwu and Haupt, (2007), stated that an adequate understanding and knowledge of performance are desirable for achieving managerial goals such as improvement of institutional transformations, and efficient decision making in design, specification and construction, at various projects-level interfaces, using appropriate decision-support tools.

2.7 Water supply construction Projects and Performance

The success of projects depends mainly on the success of the performance. Many previous researches had studied the performance of construction projects. Bari *et al.*, (2012), remarked that one of the principal reasons for the construction industry's poor performance has been attributed to the inappropriateness of the chosen procurement system. Benjamin and Njenga, (2014), remarked three important structures underlying the dynamic of a project performance, which are: rework cycle, feedback effects loops on productivity and work quality and effects between work phases. Hughes, et al, (2004), identified the main performance criteria of construction projects as

financial stability, progress of work, standard of quality, health and safety, resources, relationship with clients, relationship with consultants, management capabilities, claim and contractual disputes, relationship with subcontractors, reputation and amount of subcontracting. Matin, (2016), stated that construction time is increasingly important because it often serves as a crucial benchmarking for assessing the performance of a project and the efficiency of the project organization.

According to Hughes, et al (2008), identified project performance categories such as people, cost, time, quality, safety and health, environment, client satisfaction, and communication. It was obtained by Musarat and Ahad, (2016), that a control system is an important element to identify factors affecting construction project effort. For each of the project goals, one or more Project Performance Indicators (PPI) are needed. Shahid *et al.*, (2015), obtained that human factors played an important role in determining the performance of a project. Ugwu and Haupt, (2007) remarked that both early contractor involvement (ECI) and early supplier involvement (ESI) would minimize constructability-related performance problems including costs associated with delays, claims, wastages and rework, etc. Ling and Bui, (2010), obtained that the most important of practices relating to scope management are controlling the quality of the contract document, excellence of reaction to the perceived variations and extent of changes to the contract.

2.8 Information Technology and Water supply construction Projects Performance

Information technology, technique is very important in the entire world. Information technology (IT) opens new visions in the businesses and industries performance of the world. The construction industry is considered as one of the industries using IT technique such as software management systems, database and communications. For many years, many processes, functions, operations were done difficulty because of absence of IT field. In addition, most of the work was done manually, which lead to more cost, time and poor performance. Furthermore, IT usage in the construction industry leads to many changes, innovations and developments in many aspects which lead finally to good and strong performance. There are many benefits and relations of using IT in the construction projects such as: greater use of IT correlates with better project performance, owners and contractors realize meaningful benefits, IT affects schedule compression beneficially, and overall project cost savings which lead to a successful performance of the project (Pekericli, et al, 2003).

Editor *et al.*, (2020), remarked that information Technology (IT) is now routinely used in the construction industry as a tool to reduce some of the problems generated by fragmentation. The

use of IT improves coordination and collaboration between firms participating in a construction project, leading to better communication practices and so good performance. Its benefits include an increase in the quality of documents and the speed of the work, better financial control and communications, and simpler and faster access to common data as well as a decrease in documentation errors.

Hughes, et al, (2009), proposed contractor Performance Appraisal and Reporting (PAR) system for reviewing contractor performance at an organizational level. Advancements in World Wide Web techniques provide enhanced capacities to collect, compile and disseminate performance-related information to various construction stakeholders in a timely and cost-effective manner. Nitithamyong, et al, (2007), stated that the rapid advances of web-based project management and collaboration technology offers new opportunities to improve existing construction project performance. Musarat and Ahad, (2016) obtained framework software to measure project performance based on project performance measurement system (PPMS). The system contains four stages which are data entry, database, reporting and action. This system has eight categories to measure performance, which are people, cost, time, quality, safety and health, environment, client satisfaction, and communication. Goh et al, (2011), remarked that information technology management leads to performance improvement in the construction industries.

2.9 Factors Affecting Performance of Managers

Nguyen, et al (2008), recommended the need for focused effort by economy, managers and construction industry associations to provide the infrastructure needed for efficient project management and performance. Enshassi, et al, (2009), stated that the knowledge that would influence potential performance enables project managers to pay special attention to control performance more effectively. Enshassi, et al, (2009), remarked that effective communication and fast information transfer between managers and participants help to accelerate the building construction process and performance. Odediran, et al, (2012), studied the impact of the use of a project management based organizational structure, project manager training, frequency of design meetings, and frequency of design reports on design phase cost performance. The process of a design team meeting frequency and the process of written reporting of design phase progress were found to be statistically significant in reducing design phase costs.

Musarat and Ahad, (2016), stated that data are collected and used for construction managers as a basis to evaluate the Project Performance Indicators (PPI) actual value to compare it with the planned value and forecast its future value based on past performance. Ali, (2018), identified the

importance of the working environment variables in the performance of a project manager in the private and public sectors, according to three main groups which are job condition, project characteristic and organizational related categories. The result revealed that working hours, physical condition of the project site, complexity of project, material and supplies, project size, duration of the project and time availability were viewed differently in terms of importance by the contractors and consultant groups. Team relationship was ranked as the most important variable affecting the performance of a project manager. It is obtained that project managers' experiences do not have much effect on how they perceive their working environment.

2.10 Factors Affecting Cost and Time Performance

Studies in various countries appear to have contributed significantly to the body of knowledge relating to time performance in construction projects over the past three decades, while Shahid et al., (2015), noted that project's cost performance has been studied since 1960s. Such studies range from theoretical work based on research experience to one side of structured research work to the other.

According to Nguyen, et al, (2008) stated that a number of unexpected problems and changes from the original design arise during the construction phase, leading to problems in cost and time performance. It is found that poor site management, unforeseen ground conditions and low speed of decision making involving all project teams are the three most significant factors causing delays and problems of time performance in local building works. Al-Najjar, (2008), stated that cost and time performance has been identified as general problems in the construction industry worldwide. Enshassi, et al, (2009), remarked that project complexity, client type, experience of team and communication are highly correlated with the time performance; while project complexity, client characteristics and contractor characteristics are highly correlated with the cost performance. Enshassi, et al, (2009), obtained that project schedule and budget performance are controlled by the dynamic feedback process. These processes include the rework cycle, feedback loops, creating changes in productivity and quality, and effects between work phases.

Musarat and Ahad, (2016), stated that the process of a design team meeting frequency and the process of written reporting of design phase progress were found to be statistically significant in reducing design phase costs. Otherwise, the use of project management training and a project management based organizational structure were found to be processes that do not create a statistically significant in reducing design phase costs.

According to Musarat and Ahad, (2016), factors affecting cost performance are: the competence of the project manager's; support of top management; coordinating and leadership skills of the project manager's; monitoring and feedback from the participants; decision making; coordination among project participants; owners' competence; social condition, economical condition and climatic condition. Coordination among the various participants of the project was the most considerable of all the factors having utmost influence on cost performance of projects.

Daniel Muianga, et al, (2014), proposed specific technology and management strategies to increase speed of construction and so to upgrade the construction time performance. It is remarked that effective communication, fast information transfer between project participants, the better selection and training of managers, and detailed construction programs with advanced available software can help to accelerate the performance. Zidane et al., (2015): stated that managing speed in engineering, procurement and construction projects is a key factor in the competition between innovative firms. It turns out that customers may consider time as a resource and, in this case, will encourage the contractor to improve time performance.

According to Amusan, et al , (2017) identified 15 factors that affect construction time and cost performance. These are: - poor planning and scheduling, delay in payment approval for extra work and variations, work suspension by client/owner, lack of funds to finance the project to completion, financial difficulties faced by contractors, change/errors in design specifications and drawing, presence of unskilled labour force/ shortage of labour, slow decision making process, agreement to non-feasible project duration, delay in handle site to the contractor, improper handling and monitoring of project progress, unavailable/failure of equipment as when needed, omissions in contract documents, bad weather conditions on site, material damages during transport and in storage.

Aziz, (2013) identified fifty two (52) factors affecting cost performance of the waste water construction project in his study and identified the major factors as: lowest bidding procurement method, Additional work, bureaucracy in bidding method, wrong method of cost estimation, inflation, poor contract management, funding problems, mode of financing and payment for completed work, fluctuation in the cost of materials and unexpected ground condition.

The study done by Tebeje, et al, (2015) to identify the top five factors that causes cost overrun in construction projects are ,poor planning, fluctuation of price of materials, poor productivity, inflationary pressure and project financing.

2.10.1 Factors affecting cost performance

Completion of construction project with intended budget is, frequently seen as major criteria of project success by clients, contractors, and consultants and related stakeholders (Tebeje Zewdu, 2015). The construction industry is currently facing a serious cost mismanagement problem that results in a huge cost overrun.

The problem of poor cost management and overrun in project cost is serious issue in both developed and developing countries (Rahman *et al.*, 2013). Cost overrun is situation where by a project incurs expenses in excess of its expected costs outlined in the budget for the project (Reuben & Olusegun, 2014). As cited on Memon, et al, (2012) cost overrun considered as the difference between actual cost of project and its cost limit, occurs when the resultant cost target of project exceed its cost limits where cost limit of a project refers to the maximum expenditures that the client is prepared to incur on a completed building project.

Mukuka et al, (2014) study identified a number of important factors, which cause projects 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 schedule delay also extension of project, additional cost, budget shortfall, adversarial relationship between participants of the project, delayed payments to contractors, poor quality workmanship and dissatisfaction by project owners and consequently by end user as the major effect of cost overruns.

Gomez, (2012) Suggested list of critical success factors that influence cost performance in construction projects in the UK. The factor identified are, Project manager competency, constructor's competence, client commitment to getting the job done, good relationship between project parties ,accuracy of plans and initial information ,adequate specifications, early involvement of the contractor, accurate selection of form of contract, client's involvement and feedback, availability of funding, initial identification of all the risks, and architect's competency. Also other research conducted by Oluwole, et al, (2012) on Main cause of cost overrun in the UK construction project as. The identified cause are, design changes, risk and uncertainty associated with projects, inaccurate evaluation of project's time, nonperformance of subcontractor and nominated suppliers, complexity of works, conflict between project parties, discrepancies in contract documentation, contract and specification interpretation, Inflation of prices, financing and payment for completed works, lack of proper training and experience of project management. In addition 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 ,unstable and government police .

Research, which conducted in India by Shanmugapriya and Subramanian, (2017) identified the factors that affect cost –overrun, by labeling them in eight groups. Financial groups, construction parties, construction items group, environmental group, and political group, materials group, labor and equipment group, and owners‟ responsibility group. Material market rate, contract modification, high level of quality requirement, project location, depends on the fresher has to bear the whole responsibility. and rework of bad quality performance, often changing sub-contractor's 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 sub-contractors skill, unclear specification, owners delay in freeing the contractor financial payment, and incomplete drawing Equipment shortage, poor productivity of material and labor, poor scheduling of labor and material for work, and poor documentation and no detailed written procedure.

Other research that is conducted by Daniel, (2017) on factors influencing cost overrun on water and sanitation construction project in Addis Abeba identified five most causes: underestimating time requirements, contractual claim(extension of time), inadequate supply of raw materials and equipment by contractor, poor project control (cost, schedule and time) and lowest bidding procurement.

2.10.2 Factors affecting Time performance

Factors affecting time performance are factors that lead to construction projects not being finish (completed), according to planned schedule. According to Memon, et al, (2012) Time overrun can be defined as late completion of works as compared to the planned schedule or contract schedule, occurs when the progress of contract falls behind its schedule program.

Research that was conducted in Saudi Arabia by Assaf and Al-Hejji, (2006) on time performance of different types of construction projects , to determine the cause of delay in construction project ,seventy –three cause of delay where identified and grouped in nine group by the researcher.

Project Related Cause: Original contract duration is too short, legal disputes b/n various parts, inadequate definition of substantial completion, Ineffective delay penalties, Types of construction contract, Types of project binding and award (lowest bidder)

Owner Related Cause :Delay in progress payments 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 shop drawings and sample materials ,Poor communication and coordination by owners and other parties. In addition, Slowness in decision-making process by owner, Conflict between joint-ownership of the project, Unavailability of incentives for contractor for finishing ahead of schedule, Suspension of work by owner.

Contractor Related factor :Difficulties in financing project by contractor, Conflicts in subcontractors schedule in execution of project, Rework due to errors during construction ,Conflict b/n 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 project by contractor. In addition Improper construction methods implemented by contractor, Delays in sub –contractors work, Inadequate contractor's work, Frequent change of sub-contractors because of inefficient work, Poor qualification of contractor's 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 consultant, Poor communication /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 discrepancies in design documents, Delays in producing design documents, Unclear and inadequate details in drawing ,Complexity of 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 specifications 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 in market.
Equipment related cause: Equipment breakdowns, Shortage of equipment, Low level of equipment –operators' skill, Low productivity and engineer, inadequate experience of consultant efficiency of equipment, Lack of high –technology mechanical equipment.

Labors related cause: Shortage of labors, unqualified workforce, Nationality of labors, Low productivity level of labors, and Personal conflicts among labors.

External Factor: Effect of subsurface conditions, Delay in obtaining permits from municipality, Hot weather effect on construction activity, Rain effect on construction activities, Unavailability of utilities in site, Effect of social and cultural factors, Traffic control and restriction at jobs site. Additionally, Accident during construction, Differing site condition, Change in government regulations and laws, Delay in providing service from utilities, Delay in performing final inspection and certification by third parties.

Other research that is conducted by Alemayehu, (2020) on causes and effects of delay on 15 towns' water supply and sanitation projects in Ethiopia, identified six most causes of delay: material import delay, ineffective planning and scheduling, poor site management and supervision, delay in progress payment, slow decision making and inaccurate investigation.

2.11 Key performance indicators in construction projects.

Project performance can be measured and evaluated using a large number of performance indicators that could be related to various dimensions (groups) such as time, cost, quality, client satisfaction, client changes, business performance, health and safety (Fidic et al., 2017)

According to Bitamba et al, (2020) project performance can be measured and evaluated using a large number of performance indicator groups such as design, time, cost, quality, productivity, client/owner, health and safety, project management, contractor, consultant, labour, equipment and material, scheduling and contract.

Mahamid, (2016) also studied project performance using Cost, people, management, design and documentation, material and equipment and environmental as project performance measurement.

Babu, (2015) used ten groups of factors to measure and evaluate project performance: cost, time, productivity, quality, people, client satisfaction, regular and community satisfaction, health and safety, innovation and learning, environmental

Table 2. 1: Summary of Key Performance Indicators in Construction Projects

S/N	Author	Key Performance Indicators
1	Ali, et al (2010)	Cost, time, quality, clients' satisfaction, health and safety, functionality
2	Takim and Akintoye (2008)	Cost, time, client satisfaction, safety, profitability and productivity.
3	Enshassi , et al (2009)	Cost, time, quality, client satisfaction, health and safety, productivity, community satisfaction, people, innovation and learning, environmental

4	Lawal, et al (2015)	Project characteristics, labour and material, contracts, project procedures, external environment, consultants, contractors
5	Bitamba, et al (2020)	Design, cost, time, quality, productivity, client, health and safety, project management, contractor, consultant, labour, equipment and material, scheduling and contract.
6	Shahid *et al.*, (2015)	Cost, time, productivity, client satisfaction, quality, innovation and learning
7	Mosaku et al., (2016)	Cost, time, quality, customer satisfaction, safety, labour productivity
8	Mahamid, (2016)	Cost, people, management, design and documentation, material and equipment, environmental
9	(Nyangwara and Datche, 2015)	Cost, time, quality, productivity, client satisfaction, people factors, environmental factors
10	Babu, (2015)	Cost, time, productivity, quality, people, client satisfaction, regular and community satisfaction, health and safety, innovation and learning, environmental.

2.12 Research Gap

Lijalem (2019) studied factors affecting schedule and cost overrun on water supply and sewerage construction project in Addis Abeba; Alemayehu, (2020) did studied on causes and effects of delay on 15 towns water supply construction in Ethiopia. Gashawu, (2019) studied the project monitoring and evaluation of water work construction project in Amhara region. From these studies that have been done on cost overruns and schedule delay on water and sewerage construction projects, there is a need for future studies to focus on the following areas: The factors that affect water supply construction projects performance. It is also recommended to develop performance measurement framework and modeling system in order to measure performance of construction organizations and projects. In this study key performance indicators used to measure water supply construction project performance in Jimma zone are Cost and time performance.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Research Area

The study was conducted in Oromia regional state, Jimma Zone. The study area is located in the Jimma area of Oromia National Regional State. Jimma is located at about 346 Km in the South West of Addis Ababa. Based on the 2007 Census conducted by the CSA, this Zone has a total population of 2,486,155, an increase of 26.76% over the 1994 census, of whom 1,250,527 are men and 1,235,628 women; with an area of 15,568.58 square kilometers, Jimma has a population density of 159.69. While 281,184 or 11.31% are urban inhabitants, a further 2,204,971 are rural. A total of 521,506 households was counted in this Zone, which results in an average of 4.77 persons to a household, and 500,374 housing units.

Temperatures in Jimma are in a comfortable range, with the daily mean staying between 20 °C and 25 °C year-round and average annual rainfall of 1,766 mm.

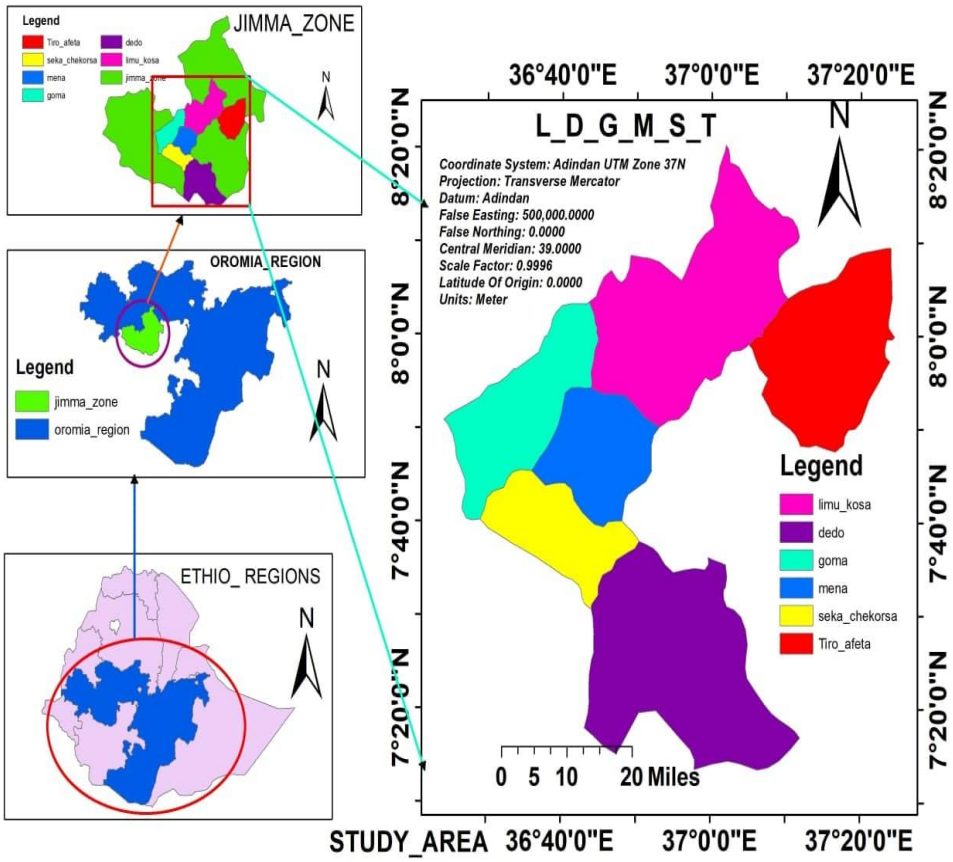

Figure 3. 1 Study Area

3.2 Research Design

This study was used descriptive research design because descriptive studies are often designed to collect data that describe characteristics of objects (such as persons, organizations, products, or brands), events, or situations. The study used survey strategy. The survey strategy is very popular because it allows the researcher to collect quantitative and qualitative data on many types of research questions. This study used mixed approach. Because mixed methods research focuses on collecting, analyzing, and mixing both quantitative and qualitative data in a single study or series of studies.

3.3 Study Variables

The study variables used in this research are dependent and independent variables. The dependent variable was performance of water supply construction project and the independent variables were cost and time performance.

3.4 Population and sampling method

The target population refers to the specific group relevant to a particular study. Population is a group of individuals or objects that have the same form of characteristics. The population used in this research was Jimma zone water supply construction projects.

The objective of sampling is to provide a practical means of enabling the data collection and processing components of research to be carried out while ensuring that the sample provides a good representation of population Taherdoost, (2018) indicated that the sample should be free from bias. Otherwise, the type of selected sample will greatly affect the reliability of subsequent generalization.

Determination of the Sample Size-The target groups in this study were Jimma zone water supply construction projects.

Sampling Technique-. The purposive sampling technique was used. The questionnaires were distributed to contractors at their offices and sites, for consultants in their project office and for the owners the questionnaires were distributed in the offices.

3.5 Source of data

To achieve the intended objective and to answer the research questions of the study, different sources of data were used. As a primary data, questionnaire and site observation sources were used. To collect secondary data literatures, archival documents were used.

3.6 Research Measurement

To indicate the center of the effect of each of the factors on factors affecting performance, the survey respondents asked to take an appropriating rating on the scale against each identified factors that reflected their opinion on the important level.

Using Likert -type Scale the respondent was, asked to various degrees of opinion, and attitude a response to each item of the factors affecting performance in terms five degrees. The numbers assigned to the agreement or degree of influence (1, 2, 3, 4, and 5) do not indicate that the interval scales are equal, nor do they indicate absolute quantities. They are merely numerical labels. Based on this scale, see table 3.1:

Table 3. 1 Rating scale for impact level factors on project performance

Impact level	Very high	High	Average	Low	Very low
Scale	5	4	3	2	1

3.7 Data collection and procedure

The study relied on both primary and secondary sources of data. This study was used a questioner, and observed for a data collection method. The primary data was collected from respondents by Likert scale type questionnaire. The secondary sources of data were obtained from literatures, archival documents.

3.8 Data presentation and analysis.

The data presentation staged by tables and charts. The relative importance index method (RII) was used to determine and rank the factors affecting performance in water supply construction projects.

The relative importance index was computed as (Iyer and Jha, 2005); (Ugwu and Haupt, 2007): using equation 3.1

$$RII = \frac{\sum W}{AXN'} \quad \text{.....Equation.3.1}$$

Where:

RII is the relative importance index,

W is the weight given to each factor by the respondents and ranges from 1 to 5

A = the highest weight = 5

N = the total number of respondents. The RII values have a range of 0 to 1 (0 not inclusive); the higher the RII is the more important factor indicators affecting the performance of construction projects.

Measures of Relationship

The Spearman (rho) rank correlation coefficient was, used for measuring the relationship in ranking among the parties of respondents scoring for various factors. In this research, correlation was found between clients versus consultant, Consultant versus contractor, client versus contractor respondent, on the ranking given to the factors affecting performance of water supply construction. To achieve this, the result obtained through the method of Relative importance Index used.

The Spearman (rho) rank correlation coefficient for any two groups of ranking is, given by the following formula: (Mukaka, 2012).

Spearman's coefficient of correlation (or rho) $=1-[6 \sum di^2/ n (n^2-1)]$……Equation.3.2

Where: Rho: Spearman's rank correlation coefficient;

Di: the difference in ranking between each pair of factors; and

n= number of pairs observations.

The value of the Spearman (rho) rank correlation coefficient varies between -1 and +1. For the case of this research, (1) perfectly positively correlated, [1, 0.3] positively correlated, [-0.3, 0.3] no correlation, [-1, -0.3] negatively correlated, (-1) - perfectly negatively correlated

Statistical package for social sciences (SPSS) and Microsoft excel, analytical tool used for data analysis.

3.9 Data Reliability

The reliability test was conducted using Cronbach's alpha coefficient of internal consistency and reliability test was used. As a result, the survey presents fifty (50) factors generated for factors affecting water supply construction performance on the basis of recent related research works on factors affecting water supply construction projects.

Cronbach's alpha is computed using equation 3.4

$$\alpha = \frac{K}{K-1}\left[1 - \frac{\sum S^2 y}{S^2 x}\right] \quad \text{.....Equation.3.3}$$

Where:-

- α = Cronbach's coefficient
- K= Number of items
- $\sum S^2y$ = sum of item variance
- S^2x = Variance of total score

Interpretation

Table 3. 2 Interpreting ALPHA for Likert scale question

Cronbach's alpha	Internal consistency
0.9 and above	Excellent
0.8 – 0.89	Good
0.7 – 0.79	Acceptable
0.6 – 0.69	Questionable
0.5 – 0.59	Poor
Below 0.5	Not acceptable

Source: (Taber, 2018)

The results as presented in table 3.3 shows a coefficient of 0.89, implying that the data are reliable and internally consistent and therefore accepted as depicted in table 3.3

Table 3. 3 Summary of Cronbach's alpha calculation.

Variables	Description	Values	Internal consistency
K	Number of items	50	Good
$\sum S^2y$	Sum of the item variance	68	
S^2x	Variance of total score	539	
A	Cronbach's alpha	0.89	

Table 3.3 Cronbach's alpha computation based on field survey data, 2021

Research sequence framework

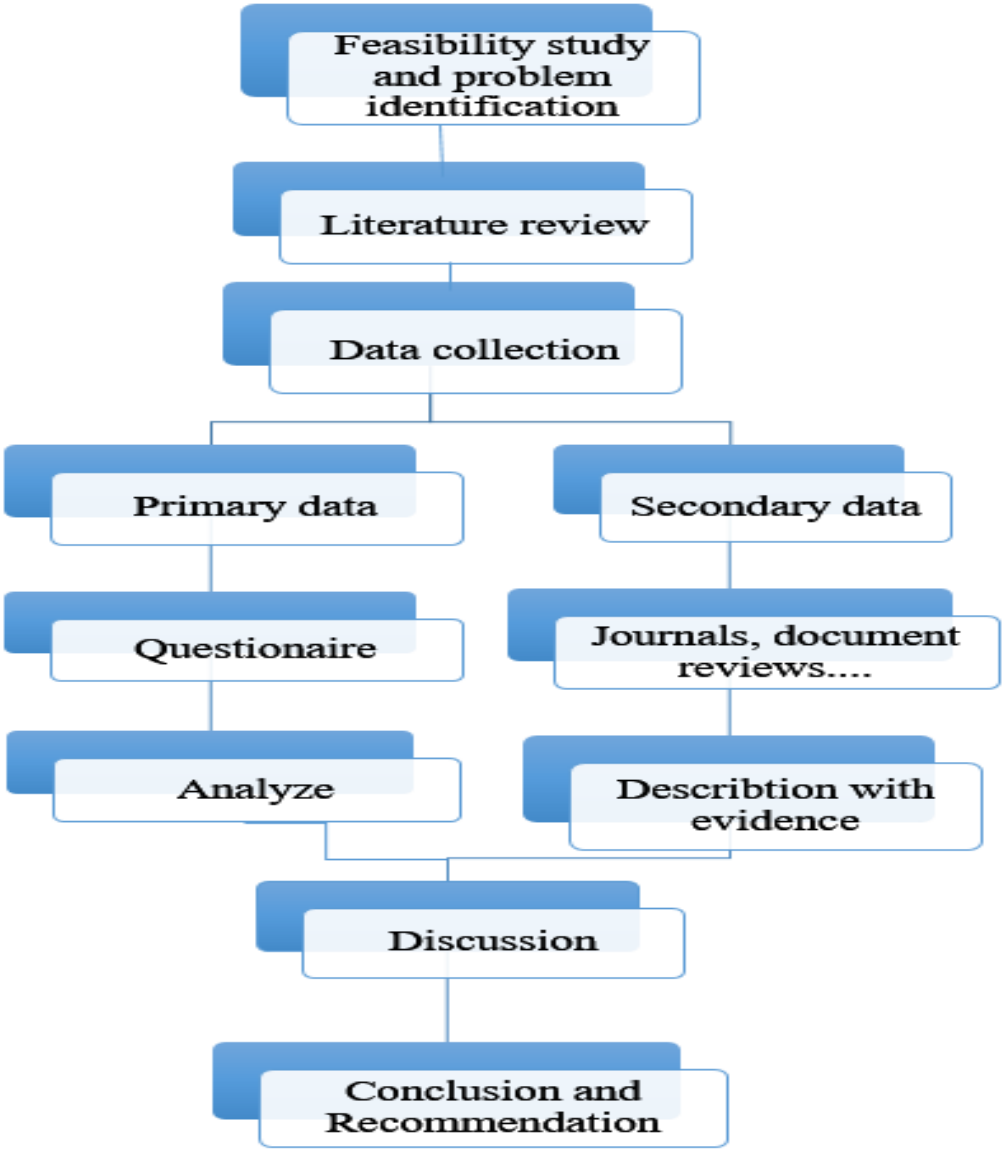

Figure 3. 2 Research Sequence

CHAPTER FOUR
RESULT AND DISCUSSION

The findings in this chapter portray based on the research objectives and research questions as stated in the introduction part. In analyzing the data on the assessment of the factors affecting performance on water supply construction projects in Jimma Zone, both the primary and secondary data gotten were linked for better understanding and analyzing the research outputs.

4.1. Questionnaire Response Rate

The study targeted a sample of 62 respondents from the client, contractors and consultant's offices and out of which 54 filled out and returned the questionnaires giving a response rate of 87.09%.

Table 4. 1 Summary of Questionnaire distribution and response rate

Organization type	Total Questionnaire Distributed	Total Questionnaire Returned	Response rate (%age)
Client/Owner	27	25	92.59
Consultant	17	14	82.35
Contractor	18	15	83.33
Total	62	54	87.096

4.2 Analysis of factors affecting performance of water supply construction projects

The relative importance index was used to rank the factors affecting performance of water supply construction projects in Jimma Zone. The RII value was calculated for each group of the respondents, including the clients, consultants and contractors.

Table 4.2displays the factors affecting performance of water supply construction projects with their RII value which were ranked by the groups of respondents.

Table 4. 2 Factors affecting performance of water supply construction with their RII

	Factors	Client	Consultant	Contractor	Average	
		RII	RII	RII	RII	Rank
1	Bureaucracy in bidding method	0.72	0.843	0.640	0.734	5
2	Inflation (materials price fluctuation)	0.936	0.729	0.853	0.839	1
3	Economical condition of the zone	0.632	0.614	0.613	0.620	20
4	High cost of machineries	0.792	0.843	0.773	0.802	3

5	Changes in the laws provided by the government	0.504	0.557	0.400	0.487	47
6	Financial difficulties of contractor	0.76	0.629	0.667	0.685	7
7	Progress payment delay	0.632	0.857	0.600	0.696	6
8	Sudden order change by owner during construction	0.52	0.543	0.507	0.523	40
9	Overhead percentage of project	0.504	0.443	0.440	0.462	49
10	Regular project budget update	0.496	0.686	0.520	0.567	31
11	Poor estimation of original costs	0.632	0.743	0.627	0.667	12
12	Poor contract and project management	0.696	0.943	0.787	0.808	2
13	Insufficient scheduling of project by contractor	0.688	0.857	0.733	0.759	4
14	Delay in delivering the site to contractor	0.64	0.686	0.653	0.660	14
15	Sub-contractor change (cause insufficient work)	0.496	0.657	0.387	0.513	43
16	Low-speed decision making process	0.584	0.871	0.587	0.681	9
17	Not having enough experience by consultant on water supply construction	0.6	0.543	0.427	0.523	40
18	Delay in accepting and performing the changes in the scope of the project by consultant	0.6	0.700	0.547	0.616	21
19	Delay in delivering the imported materials	0.656	0.657	0.627	0.647	16
20	Poor supervision on the site	0.648	0.700	0.707	0.685	8
21	Delay in producing and completing the design documents	0.6	0.800	0.587	0.662	13
22	Lack of proper mechanical equipment/machinery	0.608	0.700	0.600	0.636	18
23	Inadequate contractor work/ Low bid	0.592	0.643	0.653	0.629	19
24	Interest rate changes (on the loans from banks)	0.48	0.429	0.547	0.485	48
25	Having complexity in the documents	0.6	0.629	0.587	0.605	23
26	High transportation costs	0.672	0.700	0.640	0.671	10
27	Late action in inspection and testing by consultant	0.608	0.586	0.520	0.571	29
28	Delay in gaining the needed permissions from municipality	0.56	0.557	0.467	0.528	38
29	Delay in reviewing and accepting the design documents	0.616	0.557	0.533	0.569	30
30	Lack of skilled people in using the equipment (borehole construction)	0.592	0.514	0.533	0.547	36
31	Insufficient coordination among the parties	0.576	0.586	0.627	0.596	24
32	Shortage of materials	0.632	0.700	0.600	0.644	17
33	Shortage of technical and qualified personnel on the site	0.616	0.643	0.573	0.611	22
34	Taxes on the construction utility and equipment	0.568	0.457	0.653	0.559	33

	(Electricity, water, telephone etc.)					
35	High cost of the qualified personnel	0.608	0.543	0.547	0.566	32
36	Effect of subsurface condition/ ground problems	0.568	0.443	0.547	0.519	42
37	Unexpected geological condition/ natural disaster	0.496	0.443	0.573	0.504	45
38	Topography	0.624	0.457	0.573	0.551	35
39	Inadequate contractor experience	0.648	0.686	0.613	0.649	15
40	Low level of experience in design team	0.704	0.600	0.707	0.670	11
41	Effect of hot/cold weather on the construction and the materials	0.52	0.486	0.520	0.509	44
42	High number of public holidays	0.456	0.429	0.400	0.428	50
43	Accessibility of site	0.592	0.571	0.560	0.574	28
44	Preparation and approval of drawing	0.616	0.614	0.533	0.588	26
45	Quality assurance/control	0.584	0.571	0.613	0.590	25
46	Major disputes and negotiations.	0.544	0.557	0.507	0.536	37
47	Wastage of materials on the site	0.528	0.529	0.520	0.526	39
48	Equipment choice and quality control of materials	0.592	0.571	0.573	0.579	27
49	Project materials monopoly by some Suppliers	0.528	0.571	0.560	0.553	34
50	Non-conforming and inappropriate use of material	0.488	0.557	0.453	0.499	46

Source: Field survey Data, 2021

Client's view

According to the survey data factors affecting performance of water supply construction projects in Jimma zone according to the clients view were analyzed individually as on table 4.2. Table 4.3 shows the general factors affecting water supply construction projects and their RII and rank of factors.

Table 4. 3 Factors affecting performance of water supply construction, according to clients view.

	Factors	RII	Rank
1	Bureaucracy in bidding method	0.72	4
2	Inflation (materials price fluctuation)	0.936	1
3	Economical condition of the zone	0.632	13
4	High cost of machineries	0.792	2
5	Changes in the laws provided by the government	0.504	43

6	Financial difficulties of contractor	0.76	3
7	Progress payment delay	0.632	13
8	Sudden order change by owner during construction	0.52	41
9	Overhead percentage of project	0.504	43
10	Regular project budget update	0.496	45
11	Poor estimation of original costs	0.632	13
12	Poor contract and project management	0.696	6
13	Insufficient scheduling of project by contractor	0.688	7
14	Delay in delivering the site to contractor	0.64	12
15	Sub-contractor change (cause insufficient work)	0.496	45
16	Low-speed decision making process	0.584	32
17	Not having enough experience by consultant on water supply construction	0.6	24
18	Delay in accepting and performing the changes in the scope of the project by consultant	0.6	24
19	Delay in delivering the imported materials	0.656	9
20	Poor supervision on the site	0.648	10
21	Delay in producing and completing the design documents	0.6	24
22	Lack of proper mechanical equipment/machinery	0.608	21
23	Inadequate contractor work/ Low bid	0.592	28
24	Interest rate changes (on the loans from banks)	0.48	49
25	Having complexity in the documents	0.6	24
26	High transportation costs	0.672	8
27	Late action in inspection and testing by consultant	0.608	21
28	Delay in gaining the needed permissions from municipality	0.56	37
29	Delay in reviewing and accepting the design documents	0.616	18
30	Lack of skilled people in using the equipment (borehole construction)	0.592	28
31	Insufficient coordination among the parties	0.576	34
32	Shortage of materials	0.632	13
33	Shortage of technical and qualified personnel on the site	0.616	18
34	Taxes on the construction utility and equipment (Electricity, water, telephone etc.)	0.568	35
35	High cost of the qualified personnel	0.608	21
36	Effect of subsurface condition/ ground problems	0.568	35

37	Unexpected geological condition/ natural disaster	0.496	45
38	Topography	0.624	17
39	Inadequate contractor experience	0.648	10
40	Low level of experience in design team	0.704	5
41	Effect of hot/cold weather on the construction and the materials	0.52	41
42	High number of public holidays	0.456	50
43	Accessibility of site	0.592	28
44	Preparation and approval of drawing	0.616	18
45	Quality assurance/control	0.584	32
46	Major disputes and negotiations.	0.544	38
47	Wastage of materials on the site	0.528	39
48	Equipment choice and quality control of materials	0.592	28
49	Project materials monopoly by some Suppliers	0.528	39
50	Non-conforming and inappropriate use of material	0.488	48

From Table:4.3 according to client's view the major significant factors affecting performance of water supply construction ranked in first position from total of 50 factors was, inflation (materials price fluctuation) (RII =0.936), High cost of machineries was the second significant factors affecting performance of water supply construction with (RII= 0.792), the third position was financial difficulties of the contractor with (RII=0.76), the fourth position was bureaucracy in bidding method with (RII=0.72). Moreover, the fifth position according to client view low level of experience in design team with (RII=0.704), was the significant factors affecting performance of water supply construction. And poor contract and project management, insufficient scheduling of project by contractor, high transportation cost, delay in delivering the imported materials, and Poor site supervision are ranked from six to ten respectively.

In general, in client view the major significant factors affecting performance of water supply construction presented in Figure: 4.1

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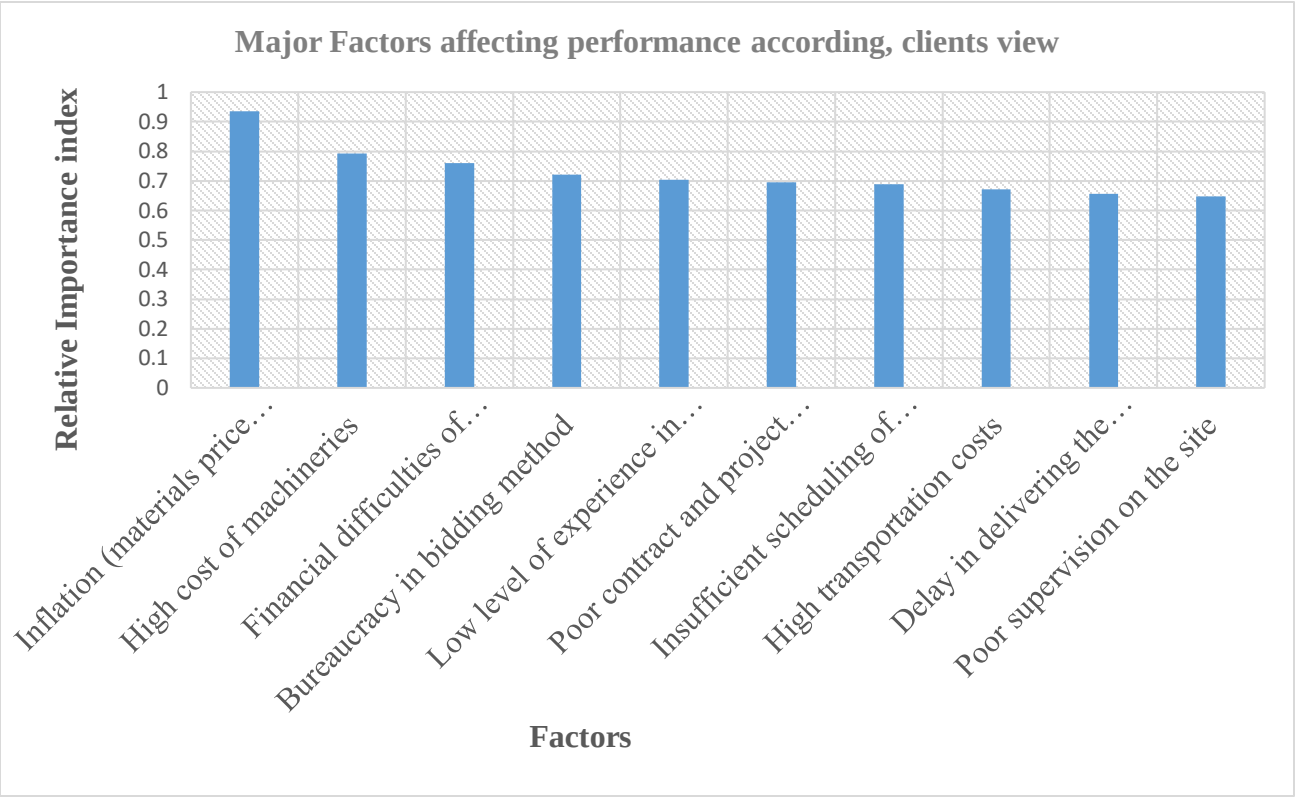

Figure 4. 1 The major Factors Affecting Performance of water supply construction, according to client's view

Consultant's view

According to a Consultant's view the value of RII and rank of factors affecting performance of water supply construction project presented in table 4.4

Table 4. 4 Factors affecting performance of water supply construction according to Consultants view.

	Factors	RII	Rank
1	Bureaucracy in bidding method	0.843	5
2	Inflation (materials price fluctuation)	0.729	9
3	Economical condition of the zone	0.614	24
4	High cost of machineries	0.843	5
5	Changes in the laws provided by the government	0.557	33
6	Financial difficulties of contractor	0.629	22
7	Progress payment delay	0.857	3
8	Sudden order change by owner during construction	0.543	38
9	Overhead percentage of project	0.443	46

10	Regular project budget update	0.686	15
11	Poor estimation of original costs	0.743	8
12	Poor contract and project management	0.943	1
13	Insufficient scheduling of project by contractor	0.857	3
14	Delay in delivering the site to contractor	0.686	15
15	Sub-contractor change (cause insufficient work)	0.657	18
16	Low-speed decision making process	0.871	2
17	Not having enough experience by consultant on water supply construction	0.543	38
18	Delay in accepting and performing the changes in the scope of the project by consultant	0.700	10
19	Delay in delivering the imported materials	0.657	18
20	Poor supervision on the site	0.700	10
21	Delay in producing and completing the design documents	0.800	7
22	Lack of proper mechanical equipment/machinery	0.700	10
23	Inadequate contractor work/ Low bid	0.643	20
24	Interest rate changes (on the loans from banks)	0.429	49
25	Having complexity in the documents	0.629	22
26	High transportation costs	0.700	10
27	Late action in inspection and testing by consultant	0.586	27
28	Delay in gaining the needed permissions from municipality	0.557	33
29	Delay in reviewing and accepting the design documents	0.557	33
30	Lack of skilled people in using the equipment (borehole construction)	0.514	42
31	Insufficient coordination among the parties	0.586	27
32	Shortage of materials	0.700	10
33	Shortage of technical and qualified personnel on the site	0.643	20
34	Taxes on the construction utility and equipment (Electricity, water, telephone etc.)	0.457	44
35	High cost of the qualified personnel	0.543	38
36	Effect of subsurface condition/ ground problems	0.443	46
37	Unexpected geological condition/ natural disaster	0.443	46
38	Topography	0.457	44
39	Inadequate contractor experience	0.686	15
40	Low level of experience in design team	0.600	26

41	Effect of hot/cold weather on the construction and the materials	0.486	43
42	High number of public holidays	0.429	49
43	Accessibility of site	0.571	29
44	Preparation and approval of drawing	0.614	24
45	Quality assurance/control	0.571	29
46	Major disputes and negotiations.	0.557	33
47	Wastage of materials on the site	0.529	41
48	Equipment choice and quality control of materials	0.571	29
49	Project materials monopoly by some suppliers	0.571	29
50	Non-conforming and inappropriate use of material	0.557	33

According to Consultants view poor contract and project management is the most significant factors affecting performance of water supply construction and ranked in the first position with RII equal to 0.943. Low speed decision making process has been considered as the second factor affecting performance of water supply construction with RII=0.871, Insufficient scheduling of project by contractor, has been considered as the third most important factors affecting performance of water supply construction RII= 0.857, Progress payment delay ranked as the fourth factors affecting performance of water supply construction with RII=0.857, High cost of machineries ranked in the fifth position affecting cost performance with RII=0.843, Bureaucracy in bidding method, delay in producing and completing the design documents, poor estimation of original cost, inflation (materials price fluctuation) and lack of proper mechanical equipment /machineries are ranked from six to ten respectively.

In general, the major significant factors affecting performance of water supply construction projects under consultants view was presented in Figure: 4.2

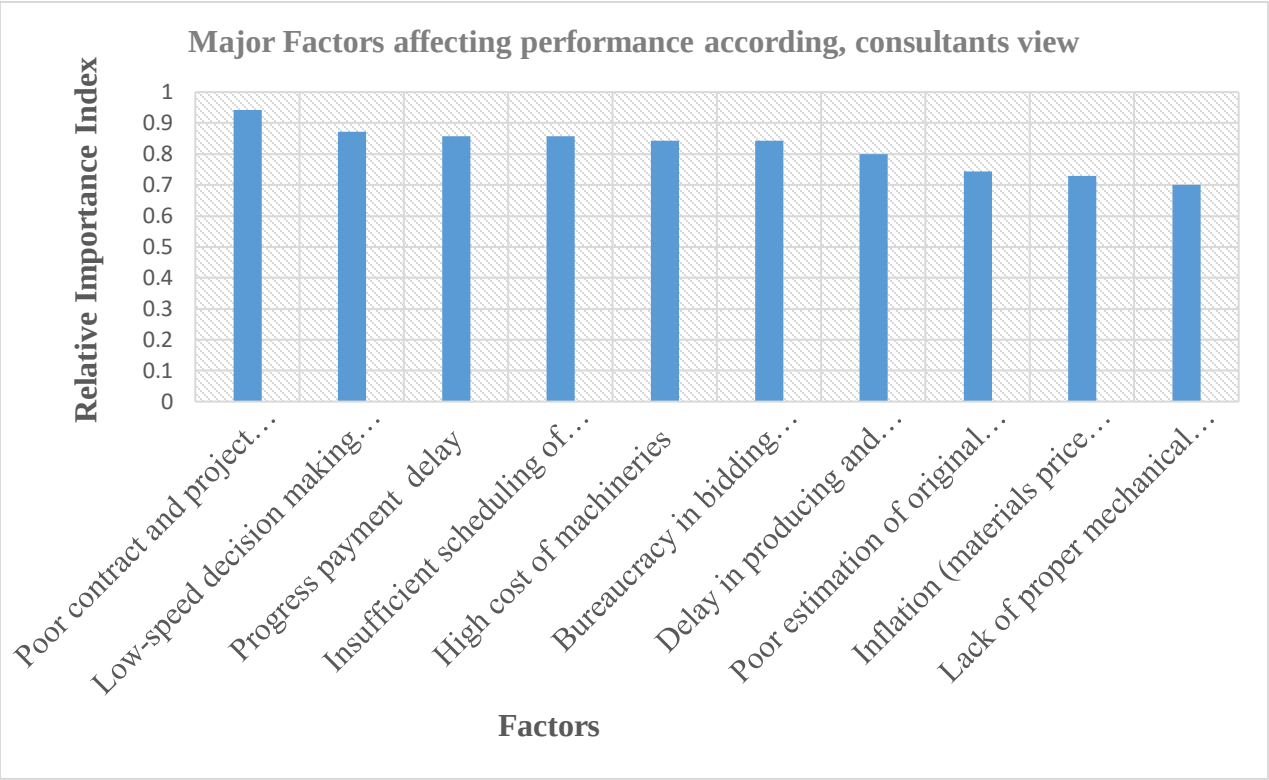

Figure 4. 2 The major Factors Affecting Performance of water supply construction, according to Consultants view.

Contractor's view

According to Contractors view the value of RII and rank of factors affecting performance of water supply construction project presented in table 4.7

Table 4. 5 Factors affecting performance of water supply construction, according to Contractors view.

	Factors	RII	Rank
1	Bureaucracy in bidding method	0.640	11
2	Inflation (materials price fluctuation)	0.853	1
3	Economical condition of the zone	0.613	16
4	High cost of machineries	0.773	3
5	Changes in the laws provided by the government	0.400	48
6	Financial difficulties of contractor	0.667	7
7	Progress payment delay	0.600	19
8	Sudden order change by owner during construction	0.507	42
9	Overhead percentage of project	0.440	46
10	Regular project budget update	0.520	38
11	Poor estimation of original costs	0.627	13

12	Poor contract and project management	0.787	2
13	Insufficient scheduling of project by contractor	0.733	4
14	Delay in delivering the site to contractor	0.653	8
15	Sub-contractor change (cause insufficient work)	0.387	50
16	Low-speed decision making process	0.587	22
17	Not having enough experience by consultant on water supply construction	0.427	47
18	Delay in accepting and performing the changes in the scope of the project by consultant	0.547	31
19	Delay in delivering the imported materials	0.627	13
20	Poor supervision on the site	0.707	5
21	Delay in producing and completing the design documents	0.587	22
22	Lack of proper mechanical equipment/machinery	0.600	19
23	Inadequate contractor work/ Low bid	0.653	8
24	Interest rate changes (on the loans from banks)	0.547	31
25	Having complexity in the documents	0.587	22
26	High transportation costs	0.640	11
27	Late action in inspection and testing by consultant	0.520	38
28	Delay in gaining the needed permissions from municipality	0.467	44
29	Delay in reviewing and accepting the design documents	0.533	35
30	Lack of skilled people in using the equipment (borehole construction)	0.533	35
31	Insufficient coordination among the parties	0.627	13
32	Shortage of materials	0.600	19
33	Shortage of technical and qualified personnel on the site	0.573	25
34	Taxes on the construction utility and equipment (Electricity, water, telephone etc.)	0.653	8
35	High cost of the qualified personnel	0.547	31
36	Effect of subsurface condition/ ground problems	0.547	31
37	Unexpected geological condition/ natural disaster	0.573	25
38	Topography	0.573	25
39	Inadequate contractor experience	0.613	16
40	Low level of experience in design team	0.707	5
41	Effect of hot/cold weather on the construction and the materials	0.520	38
42	High number of public holidays	0.400	48

43	Accessibility of site	0.560	29
44	Preparation and approval of drawing	0.533	35
45	Quality assurance/control	0.613	16
46	Major disputes and negotiations.	0.507	42
47	Wastage of materials on the site	0.520	38
48	Equipment choice and quality control of materials	0.573	25
49	Project materials monopoly by some suppliers	0.560	29
50	Non-conforming and inappropriate use of material	0.453	45

According to Contractors view Inflation (materials price fluctuation) is the most significant factors affecting performance of water supply construction and ranked in the first position with RII equal to 0.853, Poor contract and project management has been considered as the second factor affecting performance of water supply construction with RII=0.787, High cost of machineries, has been considered as the third most important factors affecting performance of water supply construction RII= 0.773, insufficient scheduling of project by contractor ranked as the fourth factors affecting performance of water supply construction with RII=0.733, Poor supervision on the site ranked in the fifth position affecting cost performance with RII=0.707, Low level of experience in design team, financial difficulties of the contractor, inadequate contractor/low bid, taxes on the construction utilities and equipment and delay in delivering the site to the contractor are ranked from six to ten respectively.

In general the major factors affecting performance of water supply construction projects was presented in Figure 4.3

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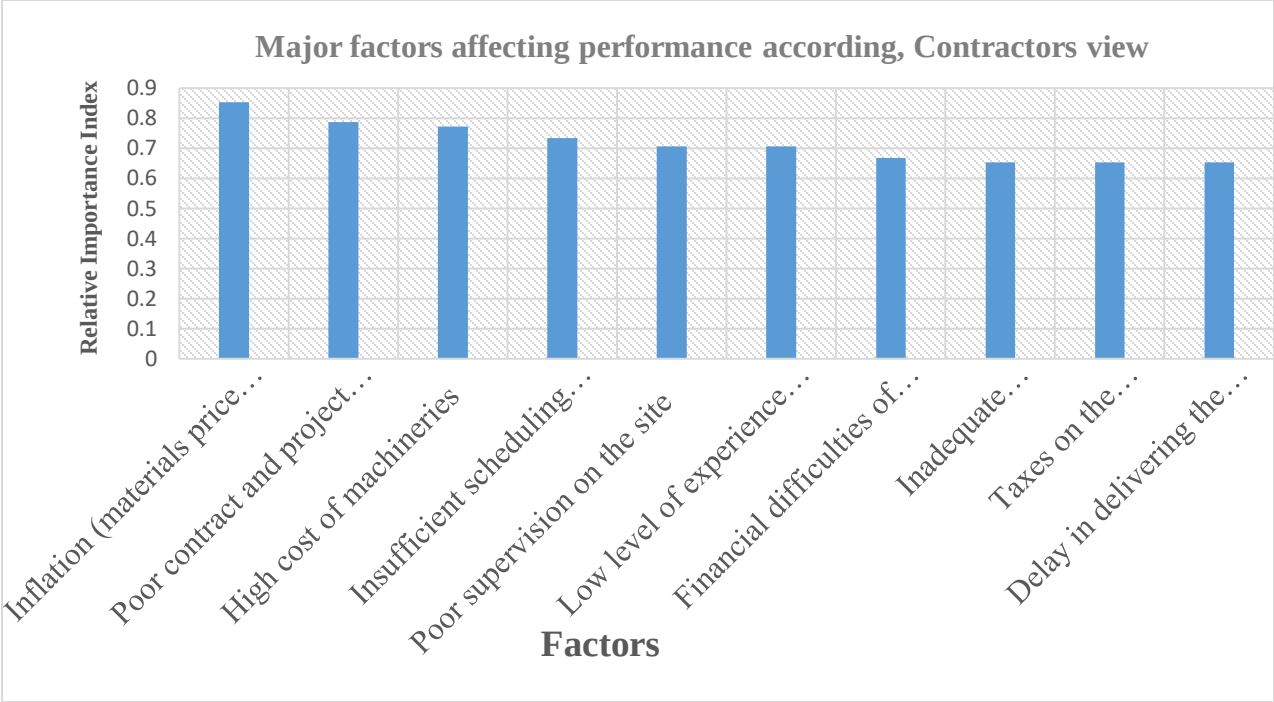

Figure 4. 3 The major Factors Affecting Performance of water supply construction, according to Contractors view

Summary of Factors Affecting Performance of water supply construction projects.

The general summery and discussion of the major influencing factors affecting performance of water supply construction are: Inflation (materials price fluctuation) with (RII=0.839), Poor contract and project management with (RII=0.808), High cost of machineries with (RII=0.802), Insufficient scheduling of project by contractor with (RII=0.759) Bureaucracy in bidding method with (RII=0.734),Progress payment delay with (RII=0.696), Financial difficulties of contractor with (RII=0.685), Poor supervision on the site with (RII=0.685), Low speed decision making process with (RII=0.681) and High transportation cost.

Thus, the most influential factors affecting performance of water supply construction projects are; Inflation (materials price fluctuation) with (RII=0.839, R=1), Poor contract and project management with (RII=0.808, R=2), High cost of machineries with (RII=0.802, R=3) and Insufficient scheduling of project by the contractor with (RII=0.759, R=4).

This result partially, agrees with Mirzai Matin, (2016), Emmanuel et al,(2015), Alemayehu, (2020) who also pointed out the significant factors for water construction performance projects. However, the findings were not in agreement with the study Nyangwara and Datche, (2015) of who showed that the most influential factors affecting construction performance as; the average delay in claim approval and payment approval owner to the contractor, availability of resources

as planned through project and duration, leadership skill for a project manager/owner and availability of personal with high experience and qualification and Babu (2015), (Enshassi, et al, 2009) who found the most influential factors affecting construction performance as: escalation of materials prices, availability of resources as planned through project duration, average delay and availability of personal with high experience.

Table 4. 6 Summary of factors affecting water supply construction projects.

Rank	Clients view	Consultants view	Contractors view	Overall
1	***Inflation (materials price fluctuation)***	***Poor contract and project management***	***Inflation (materials price fluctuation)***	***Inflation (materials price fluctuation)***
2	***High cost of machineries***	Low-speed decision making process	***Poor contract and project management***	***Poor contract and project management***
3	Financial difficulties of contractor	Progress payment delay	***High cost of machineries***	***High cost of machineries***
4	Bureaucracy in bidding method	***Insufficient scheduling of project by contractor***	***Insufficient scheduling of project by contractor***	***Insufficient scheduling of project by contractor***
5	Low level of experience in design team	***High cost of machineries***	Poor supervision on the site	Bureaucracy in bidding method
6	***Poor contract and project management***	Bureaucracy in bidding method	Low level of experience in design team	Progress payment delay
7	***Insufficient scheduling of project by contractor***	Delay in producing and completing the design documents	Financial difficulties of the contractor	Financial difficulties of contractor
8	High transportation costs	Poor estimation of original costs	Inadequate contractor/low bid	Poor supervision on the site
9	Delay in delivering the imported materials	***Inflation (materials price fluctuation)***	Taxes on the construction utilities and equipment	Low-speed decision making process
10	Poor supervision on the site	Lack of proper mechanical equipment/machinery	Delay in delivering the site to the contractor	High transportation costs

Relationship Measurement on factors affecting Performance of water supply construction.

Spearman correlation coefficient was determined to determine the association/correlation exist between "client and consultant, client and contractor, consultant and contractor" respondents ranking of factors affecting Performance, the result of correlation coefficient is attached in **Appendices 2**. The coefficient of correlation between the parties was (rho=0.76, 0.66, 0.6) which shows there is a positive correlation, implies all the parties have the same opinion on ranking of the factors.

4.3 Assessment of project time and Cost performance

This study addresses performance of water supply construction projects in Jimma zone in terms of time and cost parameters. To assess time performance of project, scheduled duration and actual duration of project were used. There are also two common elements to evaluate cost performance of project. These are budgeted cost and actual cost of project and each project cost and time deviation were calculated. Performance can be measured by both variance and performance index. Performance index indicate whether the project is under or over the budgeted cost and time but it doesn't shows the extent of deviation. In most cases it is used to check whether the project is ahead or behind the schedule at some point in a time. But cost or time variance shows the magnitude of variation between the budgeted and actual cost and duration of project in terms of birr and days. Therefore, in this research time and cost variance was used to analyze the performance of water supply construction projects in Jimma zone. Data about Project duration and cost was collected from contract documents, schedule and performance related tables, monthly and annual reports.

For the assessments of time and cost performance 7 recent completed water supply construction project was identified when the data was collected.

4.3.1. Assessment of project cost performance

According to equation 2.1 and 2.2 Cost Variance (CV) was calculated. Value of CV zero means the project is completed on budget, value of CV positive means the project is completed under budget and value of CV negative shows the project is completed over budget.

As the result shows on table 4.6 six (85.714%) of the selected projects were completed with more than planned budget and the remaining one (14.286%) was completed under budget.

Table 4. 7 Summary of cost performance of some projects.

Project name	Contract amount	Actual completed cost	Rate of cost overrun (%)
Benja Town Water Supply	13,443,153.46	14,929,047	-11.053
Boga Kamisa Water Supply	10,205,607.14	10,092,531.94	1.108
Garihu Water Supply	10,100,901.43	10,351,403.87	-2.480
Ilke Water Supply	7,115,749.83	7,515,749.83	-5.621
Kore Water Supply	1,896,587.88	1,996,996.88	-5.294
Lillu Water Supply	457,971.38	567,676.83	-23.955
Lalisa Water Supply	1,776,851.12	1,798,456	-1.216

Source: Jimma Zone water resource and energy bureau (July, 2021)

4.3.2 Assessment of project time performance

According to equation 2.3 and 2.4 schedule variance (SV) was calculated. Value of SV 0 means the project is completed on time, value of SV positive means the project completed a head of schedule and SV negative means the project completed behind of schedule.

As the result shows on table 4.7 all (100%) of the selected projects were completed with more than planned time.

Table 4. 8 Summary of time performance of some projects.

Project name	Contract time (months)	Actual completed time(months)	Rate of time overrun
Benja Town Water Supply	12	24	-100.00
Boga Kamisa Water Supply	12	24	-100.00
Garihu Water Supply	12	18	-50.00
Ilke Water Supply	8	12	-50.00
Kore Water Supply	6	10	-66.67
Lillu Water Supply	6	9	-50.00
Lalisa Water Supply	5	7	-40.00

Source: Jimma Zone water resource and energy bureau (July, 2021)

Summary of project time and cost performance

According to table 4.6 and 4.7 almost all of the above projects have consumed more than the planned cost and time. The average rate of cost overrun is between 1.216% and 23.955% of the original duration and the rate of schedule overrun is between 40% to100 percent. The cost overrun in those projects was due to material price fluctuation, insufficient scheduling, design error, site

condition, etc. From the analysis the highest rate of cost overrun was 23.955% of the original cost for Lillu water supply and it was due to design case. The designer of the project was mistakenly omitted any necessary structures and the design was revised. The second was Benja town water supply with an 11.053 % rate of cost overrun which was caused due to site conditions. From this finding design error is a significant factor in construction projects that may cause huge amount of cost overrun.

The time overruns in those projects were due to site conditions, low speed decision making process, financial difficulties of contractor, progress payment delay, etc. From table 4.7 Benja and Boga Kamisa water supply had the highest rate of time overrun 100% of its original duration due to site conditions and insufficient scheduling of the project by the contractor respectively. As the researcher reviewed above, Project efficiency is measured by its actual performance compared with what was planned in terms of time, cost and quality requirements (the golden triangles). If any project failed to meet its planned requirement in terms of time, cost and quality that project will be assumed as inefficient. The selected construction projects are completed beyond their plan in terms of cost and time; we can argue that almost all those projects are inefficient in terms of cost and time. As the result indicates on the table 4.7 and 4.8 water supply construction projects in the Jimma zone are highly affected by time delay than cost overrun.

CHAPTER FIVE
CONLUSION AND RECOMMENDATION

5.1. CONCLUSION

According to the research findings, the major factors affecting water supply construction projects performance in Jimma zone as perceived by the three parties (client, consultants, and contractors) are inflation (materials price fluctuation), poor contract and project management, insufficient scheduling of project by contractor, high cost of machineries, bureaucracy in bidding method, progress payment delay, financial difficulties of contractor, poor supervision on the site, low speed decision making process, and high transportation cost.

In addition the survey result indicated that almost all of the water supply construction projects in the Jimma zone encounter cost overruns to varying degrees. The rate of cost overrun is between 1.216% and 23.955% of the original cost and it was due to material price fluctuation, insufficient scheduling, design error, site condition and etc. Design error was the major factor that caused a huge amount of cost overrun.

The survey result also indicated that the majority of the water supply construction projects in the Jimma zone experienced extraordinary schedule delays. The rate of schedule overrun is between 40% and 100% of the original duration and it was due to different factors. Further, the main conclusion was that schedule slippage and cost overruns are almost common problems in all kinds of construction projects in developing countries due to the low level of project management practice, skills, knowledge, competencies, technology and also due to various determinant factors.

5.2. RECOMMENDATION

Based on the findings of the study, the following recommendations are made to the following responsible parties:

- Inflation has a serious impact on employment, when the inflation rate is high companies may reduce the number of their workers and thus the quality of their works. Inflation is the main cause of material and equipment costs rises. To decrease inflation (materials price fluctuation): use domestic materials, unnecessary delays in project implementation should be avoided, proper planning and scheduling should be adopted, purchasing the bulk of materials before starting construction activities, the government should intervene to control the market fluctuations.

- Poor contract and project management is the main cause that affects project performance in construction projects. The contract and project managers should oversee a project's contract from their initial pre-award phase through to completion and ensures that the project's budget and resources are in alignment with its overall objectives. Tracking contracts as they progress and identifying and managing any issues as they come up is an important project management process.
- Insufficient scheduling of a project by the contractor may occur when contractors do not fully understand the plans, specifications, scope work and client expectation. The contractors should understand the plans, scope work, read specification deeply and know client expectation.
- The selection of the appropriate type and size of construction equipment often affects the required amount of time and effort and thus the job-site productivity of a project. It is therefore important for site managers and construction planners to be familiar with the characteristics of the major types of equipment most commonly used in construction.
- Choosing the bidding winner in water supply construction project is not as easy as other construction projects due to the size issue. Most very large sized projects are given to big contractors and consultants. However, the bidding methods are limited because of the financial and inflation status and trust issues arise. It is better to neglect Lowest and highest bidders and the bidding winner can be chosen from the remaining bidders.
- Progress payment delay may cause problems since an inability of the owner to make payments will result to contractors being less motivated to complete their task with the best quality and at the exact time. Monthly payments due to economic problems have an impact on most of the projects as contractors usually do not risk their assets to provide further finance in a given month (when needed) and that reduces the overall speed of the process. The length of the contract may be extended in such cases, but no compensation should be given.
- Financial difficulties of contractor: Contractors' poor management causes them financial problems which force them to work non-constructional on the side to compensate. To alleviate this problem proper care and higher attention, should be taken during the procurement or the selection of a contractor, through deep investigation and evaluation of contractor financial status using contractor, current or previous year financial statement (like the Balance sheet statement and Income

statement etc.) and financial analysis ratio. And also during construction contractor should manage financial resources and plan cash flow by utilizing progress payment.

- Site management and supervision: administrative and technical staff should be assigned as soon as the project is awarded to make arrangements to achieve completion within specified time with the required quality, and estimated cost.
- Furthermore, it is also recommended that frequent site coordination meetings and harmonized communication between the three project players (contractor, consultant, and client) should be arranged at appropriate intervals in order to solve all kinds of project related problems on time including minimizing unnecessary bureaucracy, which leads to schedule and cost overruns.

5.3 Recommendation for Future Studies

This research was concentrated on identifying the factors affecting performance, cost and time performance of water supply construction project in Jimma zone. For the future study,

- Impact of poor cost and time performance on water supply construction project.
- A mitigating method to improve cost and time performance in water supply construction.
- Impact of poor infrastructure development of water supply construction

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Appendices 1

QUESTIONNAIRE

QUESTIONNAIRE SURVEY ON PERFORMANCE OF WATER SUPPLY CONSTRUCTION PROJECT IN JIMMA ZONE.

Introduction

This questionnaire is prepared to obtain information from key informants with structured questions. The information is required for the academic research entitled "**Assessment on performance of Water supply Construction Project in Jimma Zone**", which is being conducted as partial fulfillment of MSc in Construction Engineering and Management. The main objective of this research is to assess the performance of water supply construction project. The questionnaire consists of two sections. Section 1 general information and Section 2 contains factors affecting performance of Water supply construction projects. Your response, in this regard, is highly valuable and contributory to the outcome of the research. All feedback will be kept strictly confidential, and utilized for this academic research only.

Thank you

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Instructions: This research is conducted for academic purposes, so please try to fill it carefully and truthfully. For each of the questions, please tick [□] in the provided box the most suitable answer using the given scale. Please also answer all the questions to enhance the objectivity of the research.

SECTION 1: GENERAL ORGANIZATION INFORMATION

1. Name of organization: ----------

2. Respondent organization/company type:

Owner □ Contractor □ Consultant □

3. Respondents designation:

Head of organization □ Project Manager □ Site Engineer □ Office Engineer □

Site Supervisor □ Other_____

4. Relevant working experience (Years): □ <1Yr □ 1-4Yrs □ 5-8Yrs □ 9-12Yrs □ >12Yrs

SECTION 2: FACTORS AFFECTING PERFORMANCE OF WATER SUPPLY CONSTRUCTION PROJECT IN JIMMA ZONE.

Please indicate the significance of each factor by ticking (□) the appropriate boxes. Add any remarks relating to each factor on the last column e.g. as to the reasons, the critical factors or the solutions.

Very high (5) High (4) Average (3) Low (2) Very low (1)

	Factors	**5**	**4**	**3**	**2**	**1**	**Remark**
1	Bureaucracy in bidding method						
2	Inflation (materials price fluctuation)						
3	Economical condition of the zone						
4	High cost of machineries						
5	Changes in the laws provided by the government						
6	Financial difficulties of contractor						
7	Progress payment delay						
8	Sudden order change by owner during construction						

		5	4	3	2	1	Remark
9	Overhead percentage of project						
10	Regular project budget update						
11	Poor estimation of original costs						
12	Poor contract and project management						
13	Insufficient scheduling of project by contractor						
14	Delay in delivering the site to contractor						
15	Sub-contractor change (cause insufficient work)						
16	Low-speed decision making process						
17	Not having enough experience by consultant on water supply construction						
18	Delay in accepting and performing the changes in the scope of the project by consultant						
19	Delay in delivering the imported materials						
20	Poor supervision on the site						
21	Delay in producing and completing the design documents						
22	Lack of proper mechanical equipment/machinery						
23	Inadequate contractor work/ Low bid						
24	Interest rate changes (on the loans from banks)						
25	Having complexity in the documents						
26	High transportation costs						
27	Late action in inspection and testing by consultant						
28	Delay in gaining the needed permissions from municipality						
29	Delay in reviewing and accepting the design documents						
30	Lack of skilled people in using the equipment (borehole construction)						
31	Insufficient coordination among the parties						
32	Shortage of materials						
33	Shortage of technical and qualified personnel on the site						
34	Taxes on the construction utility and equipment (Electricity, water, telephone etc.)						
35	High cost of the qualified personnel						

		5	4	3	2	1	Remark
36	Effect of subsurface condition/ ground problems						
37	Unexpected geological condition/ natural disaster						
38	Topography						
39	Inadequate contractor experience						
40	Low level of experience in design team						
41	Effect of hot/cold weather on the construction and the materials						
42	High number of public holidays						
43	Accessibility of site						
44	Preparation and approval of drawing						
45	Quality assurance/control						
46	Major disputes and negotiations.						
47	Wastage of materials on the site						
48	Equipment choice and quality control of materials						
49	Project materials monopoly by some suppliers						
50	Non-conforming and inappropriate use of material						

Appendices 2

Spearman's rho Correlation Coefficients

1 Factors affecting performance of water supply construction projects

Correlations

		Client	Consultant	Contractor
Client	Pearson Correlation	1	.76**	.66**
	Sig. (2-tailed)		.000	.000
Consultant	Pearson Correlation	.76**	1	.6**
	Sig. (2-tailed)	.000		.000
Contractor	Pearson Correlation	.66**	.6**	1
	Sig. (2-tailed)	.000	.000	

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

b. List wise N=50