COMPETITIVENESS OF LOCAL CONTRACTORS TO UNDERTAKE WASTEWATER TREATMENT CONSTRUCTION PROJECTS AROUND ADDIS ABABA

BY

ESROM BERHANU

A Thesis Submitted to Addis collage department of COTM as a Partial Fulfillment for the Degree of Master of Science in Construction Technology and Management

ADDIS ABABA

DECEMBER, 2021

Addis Collage

School of Graduate studies

Department of Construction Technology and Management

Competitiveness of Local Contractors to Undertake Wastewater Treatment Construction Projects Around Addis Ababa

Addis Ababa, Ethiopia

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

By: ESROM BERHANU

Endorsed by:

1.	Advisor	Signature	Date
	_____	_____	_____
2.	Chairperson	Signature	Date
	_____	_____	_____
3.	Internal Examiner	Signature	Date
	_____	_____	_____
4.	External Examiner	Signature	Date
	_____	_____	_____
5.	School Dean	Signature	Date
	_____	_____	_____

Declaration

I hereby declare that this thesis entitled **"Competitiveness of Local Contractors to Undertake Wastewater Treatment Construction around Addis Ababa"** was prepared by me, with the guidance of my advisor. The work contained herein is my own except where explicitly stated otherwise in the text, and that this work has not been submitted, in whole or in part, for any other degree or professional qualification.

Author: **Signature, Date:**

Certificate

This is to certify that the thesis prepared by **Mr. Esrom Berhanu Ayalew** entitled **"Competitiveness of Local Contractors to Undertake Wastewater Treatment Projects around Addis Ababa"** and submitted as a partial fulfillment for the Degree of Master of Science complies with the regulations of the College and meets the accepted standards with respect to originality, content and quality.

Abstract

The intention for well understanding of local contractor's competitiveness in the construction industry has an enormous role in advancing the construction industry. Several attempts have been made in relation to this issue in the context of Ethiopia although little attention has given to local construction firms' competitiveness in the countries construction industry especially in the wastewater treatment construction spectrum. The study mainly aimed at investigating the level of competitiveness of local contractors to undertake wastewater construction projects which are implemented by Addis Ababa Water & Sewage Authority around Addis Ababa, identifying the basic challenges regarding with competitiveness and proposing critical success factors in order enhance and restore competitiveness of the local contractors. This thesis research conducts qualitative research methods and uses primarily a case study by conducting in-depth document review and structured interview from Addis Ababa archive department and different local contractors and consulting firms as an instrument for data collection. Also, this research adopts purposive sampling method for selecting raw data's, firms, personnel's and any participants who involved in the research according to their experience and exposure with the subject matter. Results obtained from the structured interview are considered as primarily data source and exhaustive information obtained from detail document review are considered as secondary data source, Thematic analysis and ground theory critical analysis methods are implemented as data analysis and interpretation method for this specific research. The finding of the study shows that the local contractors which involved in wastewater treatment construction projects implemented by Addis Ababa Water & Sewage Authority are found not well competitive to undertake wastewater treatment projects around A.A. Exaggerated & unrealistic technical requirement demanded by the employers, lack of experience in the sector, shortage of skilled manpower for the technology and low financial potential of the local contractors are the major challenges which leads the local contractors for poor competitiveness. Hence, the responsible stake holder must highly consider the recommendations from this thesis research in order to enhance and empower the local contractor's competitiveness performance to undertake wastewater treatment construction projects on national level.

Key word - Wastewater treatment, Competitiveness, local contractors.

Acknowledgements

Above all, my special thanks go to the Almighty GOD, who will in His endless mercy give me the grace, strength, health, endurance and foresight to undertake this study.

It would never have been able to finish my thesis without the guidance of my advisor, Dr. Denamo Addissie, from Addis Ababa University, for his assistance, invaluable comments, patience, and support throughout this study.

I would like to thank my beloved families for their love, moral support, and encouragement to keep going, no matter how the circumstances and despite my use of their time. I dedicate my thesis to them hoping that they will find happiness and success in their lives.

Finally, I would like to thank all staffs of governmental organizations and private companies who have participated in providing data and valuable information's for this study.

Table of Content

List of Tables **Page No**

List of Figures **Page No**

Acronyms

AAWSA – Addis Ababa Water and sanitation Authority

ACRP - Airport Cooperative Research Program

ADEED - Alaska Department of Education and Early Development

CI - Competitiveness Indicators

CM - Construction manager

EM - Electro mechanical

GC - General contractor

GFCF - Gross Fixed Capital Formation

KCC - Key Competitive Criteria

KCI - Key competitiveness indicators

KCF - Key Competitive Factor

LC - Local Contractors

LCC - Local Construction Companies

NPDES - National Pollutant Discharge Elimination System

STP - Sewage Treatment Plant

USAID - United States Agency for International Development

UWSSP - Urban Water Supply and Sanitation Project

WRRF - Water Resource Recovery Facility

WSP - Water and Sanitation Program

WWTP - Wastewater treatment plant

CHAPTER ONE

INTRODUCTION

1.1 Back ground of the study

Construction industry is one of the most booming industries throughout the world. The industry majorly concerned with construction of real estate, apartment buildings, different size of commercial buildings and infrastructures etc. This industry can be categorized into three basic categories namely: -

- Construction involving heavy civil engineering construction of large projects such as dam, bridge, road, industry projects.
- Construction works that involve building of real estate such as residential or commercial real estate & assets.
- Construction projects involving specialty trades Construction works that involve building up of specialized items namely, electric and Electro mechanical related works (Trade, 2010).

Wastewater treatment construction project is one of the construction industries parcels which categorized in heavy civil engineering construction projects and the project mainly intended in collecting wastewater from industrial factories, residential buildings & commercial buildings etc., treating the wastewater and finally reusing it. Hence wastewater treatment is a process used to remove contaminants from wastewater and convert it into an effluent that can be returned to the water cycle. Once returned to the water cycle, the effluent creates an acceptable impact on the environment or is reused for various purposes (called water reclamation) and the treatment process takes place in a wastewater treatment plant.

There are several kinds of wastewater which are treated at the appropriate type of wastewater treatment plant. For domestic wastewater (also called municipal wastewater or sewage), the treatment plant is called a sewage treatment plant. For industrial wastewater, treatment either takes place in a separate industrial wastewater treatment plant, or in a sewage treatment plant (usually after some form of pre-treatment). Further types of wastewater treatment plants include agricultural wastewater treatment plants and leachate treatment plants.

Processes commonly used include phase separation (such as sedimentation), biological and chemical processes (such as oxidation) or polishing. The main by-product from wastewater treatment plants is a type of sludge which is usually treated in the same or another wastewater treatment plant. Biogas can be another by-product if anaerobic treatment processes are used. Some wastewater may be highly treated and reused as reclaimed water. The main purpose of wastewater treatment is for the treated wastewater to be able to be disposed or reused safely. However, before it is treated, the options for disposal or reuse must be considered so the correct treatment process is used on the wastewater (2021, Wikipedia).

Management of municipal solid & liquid waste is a global problem and is faced by all developing countries. The rapid pace of increase in population, economic growth, urbanization and industrialization is coupled with accelerated solid & liquid waste generation. Like the country Ethiopia and in most of the developing countries wastes are either scattered in urban centers or disposed of unplanned in low lying areas or open dumps. The main problem observed regarding with waste management systems in these countries are lack of infrastructure for collection, transportation, treatment and disposal of solid & liquid wastes, improper solid waste management planning, insufficient financial resources, technical expertise and public attitude consequently several environmental and health related problems are increasing. Though, there are many negative issues related to waste management, it also provides many opportunities that not only mitigates its negative impact but also helps in meeting the demand for energy and employment generation as well as in soil health improvement (Corprorate sanitation , 2015).

Waste management system is one of the major areas that a country must develop. Wastewater treatment and management will take the lion share of the city sanitation problem. Managing and proper treatment of liquid waste in the city will enhance and modernize the sanitation system. As a developing country the construction industry is also developing and experienced local construction firms will involve in construction of wastewater treatment project so that it is two birds in one stone which is encouraging and empowering the local contractors to highly involve and undertake wastewater treatment projects results in the development of the construction industry and at the same time upgrading the city sanitation system. Knowing the level of local contractor’s competitiveness stand to construct and deliver wastewater treatment plant projects is critical regarding with this study.

Addis Ababa Water and Sanitation Authority (AAWSA) is a governmental organization which is responsible for the implementation of proper sanitation system in the capital city of Ethiopia, Addis Ababa. The organization is also responsible in administration of all wastewater construction projects located in and around the city. Hence the researcher emphasis on ascertaining the local contractor's competitiveness stand which involved under this organization during procurement and construction phase hence most of the existed wastewater treatment construction projects are accompanied by foreign construction companies.

It is important to understanding organization's competitiveness for the success of a business and for successful accomplishment of the project. Several studies have been extensively conducted on competitiveness by many researchers PorterM (1980 & 1995) & Tan (2008).With increasing higher users' requirements, environmental awareness and limited resources on one side and high competition for construction business marketplace on the other side, contractors have to be capable of continuously improving their performance (Enshassi A, Mohamed S & Abushaban, 2009).

Many literatures have covered the subject of contractor's competitiveness but most of them are focusing on tender price with less attention to evaluating a contractor's performance attributes and level of capability to take projects. Particularly those literatures emphasize on competitiveness of LC other than wastewater treatment construction projects but this study basically emphasize on local contractors' competitiveness to undertake specifically on wastewater treatment construction projects and search for the critical success factors in order to mitigate the anticipated challenges and enhance their competitiveness in national context.

1.2 Statement of the Problem

Wastewater treatment construction projects considered as the most complex and capital-intensive construction projects. It is known that the sector demands a potential and capable contractor for satisfactory implementation and completion of the projects. Accordingly, the majority of the projects were given to foreign construction companies hence the main statement of problem is most of the wastewater treatment construction projects are given to foreign construction companies, is this due to the country lacks competitive local contractors to undertake those wastewater treatment construction projects or what?

Moreover wastewater treatment construction technology is new to the country and tentatively upgradeable so the researcher has huge doubt that by this contractor selection trend & system the country will be vulnerable for potential impacts like loss of foreign currency, inadequate experience gaining of LC, poor development of expertise skilled personnel's specifically for wastewater treatment construction industry and local contractors loosing appetite to involve in construction of further wastewater treatment projects.

1.3 Research questions

The basic questions that being answered by this research are;

1) What is the level of competitiveness of the local contractors to undertake waste water treatment projects in & around Addis Ababa?
2) What are the challenges facing the local contractors regarding with competitiveness to undertake wastewater treatment construction projects?
3) What are the critical success factors that would enable local contractors and enhance their competitiveness to undertake wastewater treatment construction projects?

1.4 Objectives of the study

1.4.1 General objective of the study

The Investigation of the competitiveness of local contractors to undertake wastewater treatment construction projects around Addis Ababa is the General objective for the study.

1.4.2 Specific objectives of the study

The specific objectives of this research are

- To investigate the local contractor's competitiveness level to undertake wastewater treatment projects in & around Addis Ababa.
- To identify the significant challenges that local contractors face in becoming competitive to undertake wastewater treatment construction projects.

- To identify of the critical success factors that would enable local contractors and enhance their competitiveness to undertake wastewater treatment construction projects.

1.5 Limitation of the study

Finding previous researches which have been studied in relation to local contractor's competitiveness' to undertake wastewater treatment construction projects in the context of Ethiopia for the purpose of acquiring in-depth information with the matter, limitation on finding of exhaustive & inclusive information and the present Covid-19 pandemic to conduct interviews and team discussion whenever necessary were the limitation that the researcher experienced throughout this study.

1.6 Significance of the study

This research provides significant importance to stake holders which involves in the sector through delivering a copy of this research to local construction firms engaged in wastewater treatment construction project so that they will be able to know & evaluate their status of competitiveness, potential challenges and success factors for involving in wastewater construction and also the research output would provide information to raise awareness of stakeholders about the challenges which retard the competitiveness of the local contractors which involve in wastewater treatment construction project and work in spirit of collaboration and cooperation for a capacity building and achievement.

1.7 Organization of the Thesis Paper

This thesis paper organized and classifies in five main chapters which are chapter one - introduction, chapter two - Literature review, chapter three - Research methodology, chapter four Data analysis, result & discussion and chapter five - conclusion and recommendation. Hence in this section the researcher shows the research process and link between each chapter.

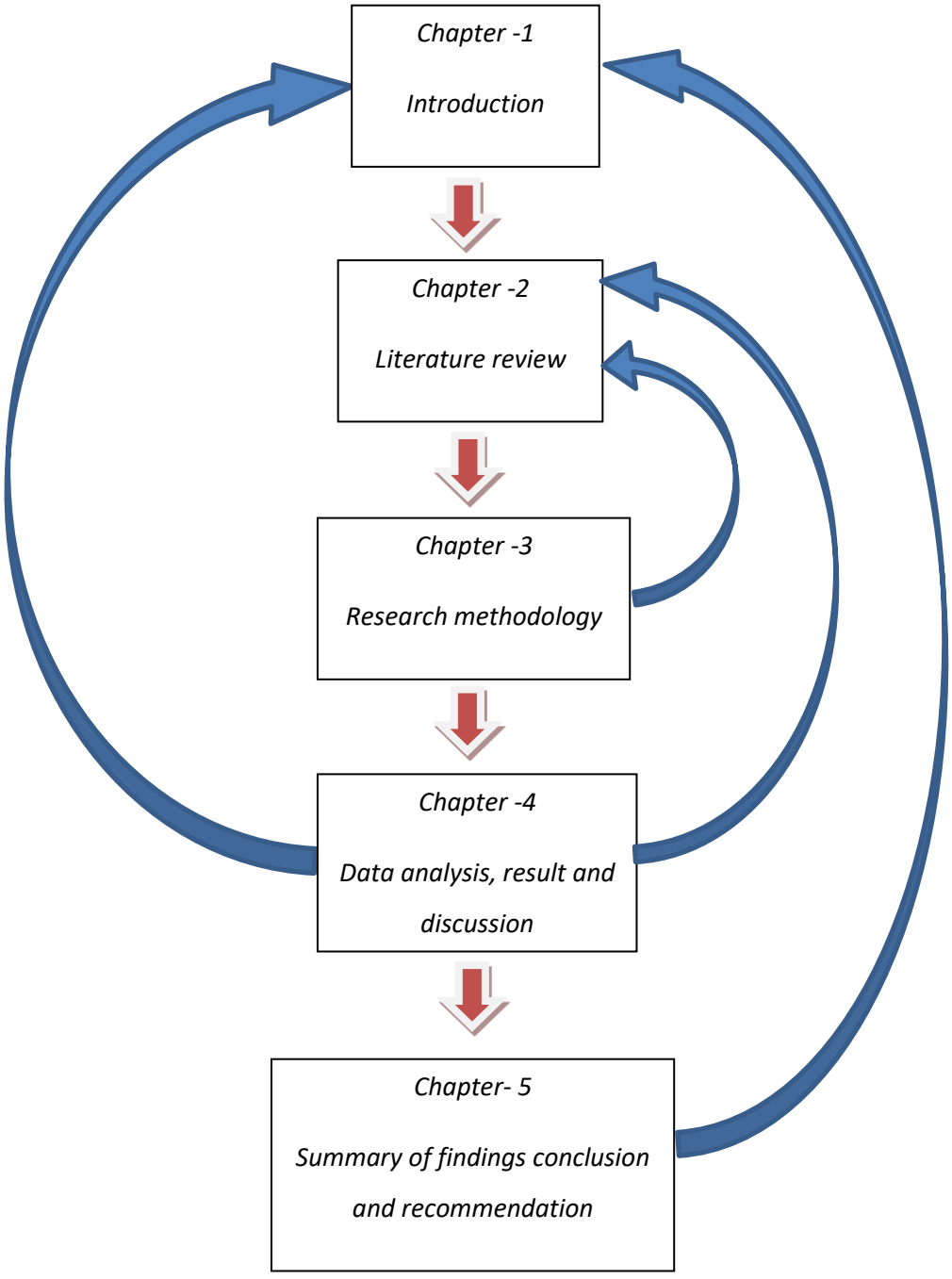

Figure 1 - Flow chart for thesis paper organization

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The literature review leads to the development of a theoretical framework of the thesis and further application in the construction industry. The level of growth and performance of Local contractors are still very low and it affects their competitiveness in the construction industry. The local contractors are still experiencing constraints that have continued to limit their growth. If this problem persists for a long time, the industry may subjects to failure to have in place a sustainable civil works contracting capacity to construct and maintain civil infrastructure and yet continue relying on foreign companies (Samson J, Henery A,Dan. T, 2010).

2.2 Over view of Ethiopian construction industry

The construction industry is a sector of the economy that transforms various resources into constructed physical economic and social infrastructure necessary for socio-economic development. It embraces the process by which the said physical infrastructure are planned, designed, procured, constructed or produced, altered, repaired, maintained, and demolished. The constructed infrastructures include:

- Buildings
- Transportation systems and facilities which are airports, harbors, highways, subways, bridges, railroads, transit systems, pipelines and transmission and power lines.
- Structures for fluid containment, control and distribution such as water treatment and distribution, sewage collection and treatment distribution systems, sedimentation lagoons, dams, and irrigation and canal systems. Underground structures, such as tunnels and mines.

The industry comprises of organizations and persons who include companies, firms and individuals working as consultants, main contractors and sub-contractors, material and component producers, plant and equipment suppliers, builders and merchants. The industry has a close relationship with clients and financiers. The government is involved in the industry as purchaser (client), financier, regulator and operator (Ministry of urban development and construction, 2012)**.**

2.3 Characteristics of Ethiopian construction industry

Over the last few years there has been a dramatic change in the way construction activity is being undertaken. This is not only in the form of new technology, but also in the way that construction projects are procured and managed. A substantial part of the construction work takes place in the informal sector of industry too. About 83% of the population lives in the rural areas. The buildings and other small infrastructure facilities for this major part of the population are constructed by the informal sector.

The informal construction sector comprises of unregulated and unprotected individuals engaged in economic activities that include the supply of labor, materials and building components to the formal construction sector directly in response to needs of clients. It also includes works carried out by individuals and groups on a self-help basis without contracting. In Ethiopia the sector has registered a remarkable growth, over the last 11 years there has been increased investment on the development and expansion of various infrastructure projects. Among the major development's construction of road infrastructure, real estate developments, and condominium housing projects are some of the examples.

The majority of enterprises in the construction industry in least developed countries (LDCs) are small with a few of them being in the medium category. It is said that, world-wide, small and medium enterprises (SMEs) account for 90% of all enterprises and over 99% in developing countries. They are mostly owned by indigenous people. Small and medium enterprises are a very diverse group, ranging from small establishments to medium-sized units, scattered throughout the country. Small and medium enterprises are vital for ensuring diversity and flexibility of the economy responsible for the creation of employment and growth. They are the only firms willing and able to undertake the small, scattered projects, especially in rural areas, which are among the key components of development required to satisfy the basic needs of people such as housing, health facilities, sanitation and roads for geographical mobility (Ministry of urban development and construction, 2012).

Growth of the SMEs provides also a platform for future medium and large-scale firms owned by indigenous people in the respective countries. In developed countries and countries with economies in transition, other than the least developed countries, their local construction industries have the lions share in market opportunities. However, for least developed countries,

the construction industries are dominated by Foreign Service providers to the tune of at least 65% in terms of money value of market share. For example, in the Southern Africa Development Community (SADC) region, and with the exception of South Africa, local contractors and consultants have approximately 30% market share in the region; Malawi (23%), Swaziland (35%), Tanzania (20%), South Africa (85%). In Ethiopia foreign contractors and consultants account for major proportions of the market share in road sector (about 58% in terms of value) but nearly 100% is executed by local contractors as far as building is concerned.

Since the construction industry is a fundamental economic activity which permeates most of the sectors of the economy it has a major role to play in achieving social economic development objectives of any country; local firms and professionals should be fully involved in the process. The sector has indirect impact on the growth or stagnation of the overall economy. Furthermore, the development of a strong construction industry should be supported by sectoral and macroeconomic policies geared towards stimulating growth and competitive position of the local actors. Experience has shown that development of the construction industry requires government commitment, many years of sustained effort and the right operating environment. A good economy is equally important as it creates demand for its services (Ministry of urban development and construction, 2012).

2.4 Importance of the Construction Industry

A major objective of development is economic growth. During the early developmental process economic growth seems to be generally high, and construction, along with manufacturing, tends to play an increasingly important role in the economy while agriculture's importance declines; once a relatively high level of development is achieved, however, economic growth appears to slow, and construction's role tends to stabilize or even decline slightly while the other sectors continue as before.

While construction's direct contributions to development are significant, it also stimulates a sizeable amount of economic growth through backward and forward linkages. Construction's requirements for goods and services from other industries are considerable; the development of the construction industry therefore stimulates these ancillary industries, thus encouraging further economic growth. In developing countries, the construction of physical facilities makes up more

than one half of gross domestic investment and tends to be concentrated on basic infrastructures in agriculture, mining, transportation, communication, and utilities. Infrastructural services make some contribution to GDP, but they also stimulate the development of other industries which, in turn, contribute more directly to economic growth. Once the basic infrastructure is created, more effort can be devoted to construction for manufacturing, commerce, and services and to the building of dwellings and institutional facilities. (Fred Moavenzadeh, 2007).

Construction's contributions to employment creation are naturally parallel to its contributions to output generation. A common condition of underdevelopment is unemployment and underemployment. In the past, the question of employment was generally neglected because of the apparent conflict between economic growth and employment creation. The extent to which growth and employment creation should be balanced in developing countries is a matter of importance and necessarily depends largely upon local economic, technical, social, and political conditions. The construction industry could play an important role in resolving this conflict because it is technologically flexible, implying that many of its operations can be made more or less labor-intensive depending upon conditions in the country at the time (Janet Ann, 2007).

Although construction plays a vital role in achieving balanced economic and social development, few national development plans explicitly consider construction in terms of defining targets or considering the industry's relation to other sectors of the economy. An examination of more than forty development plans for countries at various stages of economic growth in the mid-sixties revealed only a limited consideration of the role of construction. Development plans in general are while they may devote one concerned largely with the public sector (Fred Moavenzadeh, 2007).

2.5 Overview of wastewater treatment projects

It is necessary to treat human waste or excreta for many reasons, but the most important reason is to preserve health. Untreated human excrement contains a variety of pathogenic organisms, which include protozoa, bacteria, viruses and eggs of helminths that are disease-causing organisms. The presence of these in the environment transmits various types of diseases. They could be

- Water borne where pathogens are present in water supplies.

- Soil-based where the excreted organism is spread through the soil Insect-vector borne where the pathogen is spread by insects that feed or breed in water e.g. flies and mosquitoes.
- Facial-oral transmission routes by which pathogens from faces reach the mouth by either hand, clothes food etc.

Once excrements have been produced, it is necessary to decide what to do with the waste and determine the wastewater treatment option. There is a general distinction: Waste being treated on-site via various treatment options e.g. VIP latrines, water seal toilets, composting toilets etc. or by the use of water to carry the waste off-site to be treated someplace else either not too far from the compound as with septic tanks or to specialized treatment plants through sewer lines. This form of waste often is referred to as wastewater or sewerage.

The total management of wastewater can be separated into four categories which are

- Wastewater collection,
- Wastewater treatment,
- Treated wastewater disposal and
- Sludge management.

By definition, process means a series of actions or changes. Treatment facilities incorporate numerous processes which in combination achieve the desired water quality objectives. These processes involve the separation, removal and disposal of pollutants present in the wastewater. The treatment of wastewater is accomplished by four basic methods or techniques; physical, mechanical, biological and chemical. Physical methods of treatment include the use of tanks and other structures designed to contain and control the flow of wastewater to promote the removal of contaminants. Mechanical treatment techniques involve the use of machines, both simple and complex in design and operation. The action of bacteria and other micro-organisms are biological methods of treatment, which play a vital role in the removal of pollutants which cannot be effectively achieved by other means. Chemical treatment methods enhance the efficiency of other process operations and provide specialized treatment as a result of their addition at various treatment stages (Corprorate sanitation , 2015)

2.5.1 Levels of Wastewater Treatment

Wastewater treatment options may be classified into groups of processes according to the function they perform and their complexity (SOPAC, 1999) .

- *Preliminary Treatment* – includes simple processes that deal with debris and solid material. The purpose of preliminary treatment is to remove those easily separable components. This is usually performed by screening (usually by bar screens) and grit removal. Their removal is important in order to increase the effectiveness of the later treatment processes and prevent damages to the pipes, pumps and fittings.
- *Primary Treatment* – is mainly the removal of solids by settlement. Simple settlement of the solid material in sewage can reduce the polluting load by significant amounts. It can reduce BOD by up to 40%. Some examples of primary treatment is septic tanks, septic tanks with up flow filters, Inhofe tanks. Secondary Treatment – In -secondary treatment the organic material that remains in the wastewater is reduced biologically.
- *Secondary treatment*- actually involves harnessing and accelerating the natural process of waste disposal whereby bacteria convert organic matter to stable forms. Both aerobic and anaerobic processes are employed in secondary treatment. Some examples of secondary treatment are UASB, reed bed systems, trickling filters and stabilization ponds.
- *Tertiary treatment* – is the polishing process whereby treated effluent is further purified to acceptable levels for discharge. It is usually for the removal of specific pollutants e.g. nitrogen or phosphorus or specific industrial pollutants. Tertiary treatment processes are generally specialized processes. Some examples of tertiary treatment are bank's clarifiers, grass plots, etc.

The majority of secondary treatment processes are biological in their nature – i.e. they use the natural activity of the bacteria to break down polluting material. Biological treatment processes can themselves be divided into two general sub-divisions – aerobic and anaerobic processes.

- Advanced or quarterly treatment is applicable only to industrial wastes to remove specific contaminants.

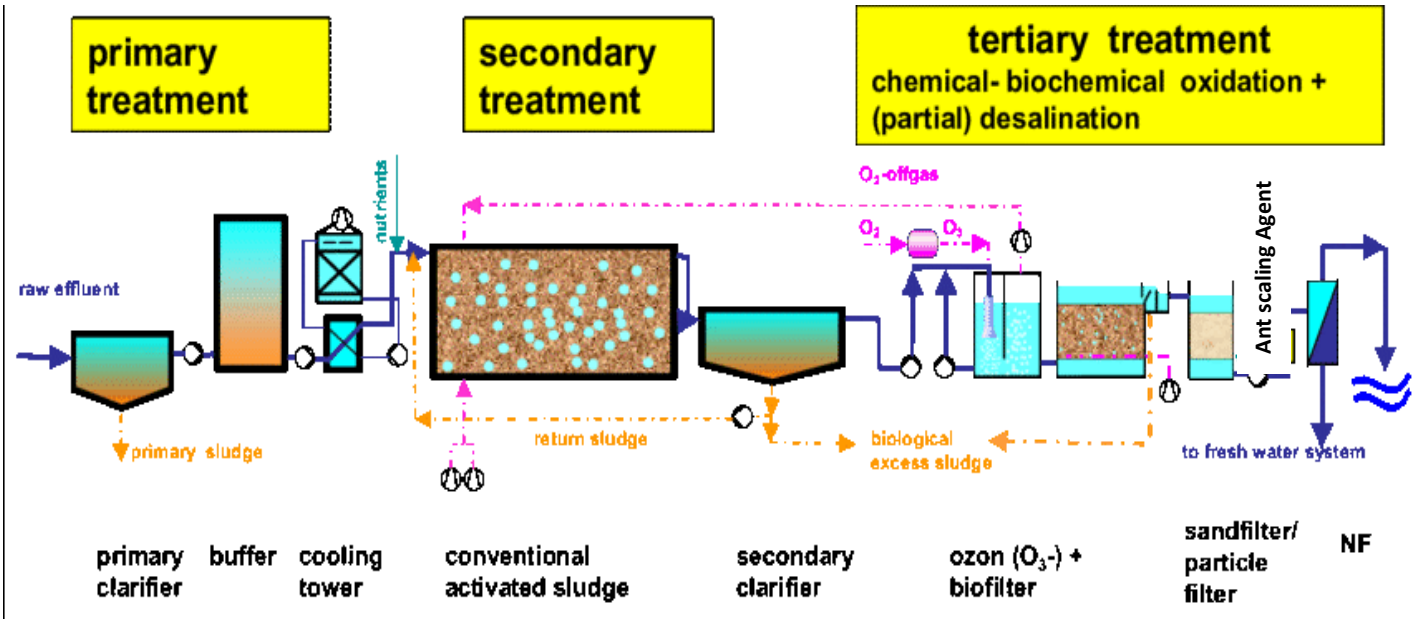

Figure 2 - Wastewater Treatment Process (SOPAC, 1999)

2.5.2 Project Delivery Methods of Waste Water Projects

This section provides a brief background on the three most common delivery methods which will be conducted on procurement of Waste water treatment construction projects, which are Design-Bid-Build (DBB), Construction manager at risk (CMAR), & Design Build (DB).

2.5.2.1 Design-Bid-Build

Being the most widely understood and accepted project delivery method across all industries, DBB is frequently referred to as the traditional project delivery method. In DBB, the owner has two separate and independent contracts, one with a designer and one with a contractor. DBB is typically a linear process, and construction only begins after detailed design has been completed and after the contractor has been awarded the bid. Since there is no contractual relationship between the designer and contractor, any design changes or adjustments that may arise during or after construction will have to be handled as change orders Shrestha, P.P & Mani (2014). DBB also does not generally allow the contractor an opportunity to provide input during the design phase, and this lack of communication may sometimes lead to project delays and cost overruns. Additionally, DBB is typically awarded based on a low-bid process and the contractor is selected based on cost rather than their qualifications.

2.5.2.2 Construction Manager at Risk

A key difference between DBB and CMAR is that CMAR firms are involved during the design-phase and are capable of providing valuable contractor input to the design. An advantage of CMAR is the pre-construction services that the CMAR firm can offer; and this includes services such as cost engineering ACRP (2009). While using CMAR similarly to DBB the owner has two separate and independent contracts, one with a designer and one with the CMAR firm. However, the difference is that with CMAR, the CMAR firm is usually contractually required to coordinate with the designer. The CMAR firm is typically handed major design responsibilities; however, the owner typically still retains the actual ownership and liability of the design, Alaska department of education & early development (2017). Moreover, the bid award process of CMAR is unlike DBB, and could be awarded based on a combination of cost and qualifications.

2.5.2.3 Design-Build

DB caters for owners who prefer to have one contract with one single-point of communication for their project. In DB, the design-builder is typically engaged early in the design phase and is responsible for both designing and constructing the project. Having the design-builder engaged early on in the design phase allows opportunities for schedule compression and project phasing Bearup and O,Donnell (2007). DB is similar to CMAR as it can also be awarded based on qualifications. On a DB project, the design-builder is responsible for the design, and design liability is transferred from the owner to the design-builder. This method is ideal for owners who are less familiar with construction project management and delivery, and are willing to give up some owner control and influence over a project.

Moreover by referring in most of contract administration experience in wastewater treatment construction projects, out of the mentioned three delivery system DB is the highly recommended and most likely adopted delivery system because the system decreases contractual and design related discrepancies and enhance timely project completion.

2.5.3 Challenges on wastewater treatment construction projects

Projects experience substantial enthusiasm and anxiety when projects enter the construction and commissioning phases rather than procurement phase. These stages are the most exciting, intensive, and nervous portions of the entire project lifecycle. The challenges which will be

discussed in this section are common challenges that were experienced in wastewater treatment construction projects and other type of construction projects.

After painstaking efforts of planning, preliminary design, final design, permitting, and construction documents preparation, the project becomes ready for bidding mostly in DBB project delivery methods then by the time venture reaches this stage, a large amount of money, man-hours, and efforts have already been invested. Also, owners, designers, engineers, government officials, regulators, and other supporting staff have made their valuable contributions at this point. Upon final review, the project gets advertised and bids are requested from contractors and at a stipulated time and location, bids are opened and the successful contractor is selected. Letter of intent and contract agreements initiate the construction process. The project now enters the challenging phase of knowns and unknowns. While each project is unique, water and wastewater projects experience many common issues. Here, an attempt is made to overview some of the key aspects that can impact the outcome of the construction work (Ambulkar, 2019).

1. **Anomalies in construction documents** – Drawings and specifications are the foundation documents for construction work. Any ambiguity in such references can create problems down the road. Designers typically rely on existing site drawings, electronic files, reports, field surveys, vendor information, and in-house expertise for creating contract drawings and specs. Resources and data are used to develop design basis, site plans, layouts, equipment sizing, infrastructure details, and system performance needs. Despite of best design efforts, discrepancies may arise and get carried over into the construction phase if references used are inaccurate, outdated, lack information, or do not reflect ground realities.

   Inexperience, omissions, errors, short budgets, and many other factors can also contribute towards these issues. Low-quality documents can create confusion, disputes, and the selection of wrong products, materials, or equipment, and eventually affect project quality. Efforts to minimize ambiguities in contract documents are hence necessary to ease construction work.

2. **Permitting delays** – Permits are key elements of water infrastructure projects. Depending upon the project scope, various types of permits may be required (like construction permit, building permit, NPDES permit, right-of-way occupancy permit, and so on). Permitting involves documents submission, regulatory authority review, and approval. This process is time-consuming and needs proper consideration in the project schedule. Delayed submittals and incomplete or wrong applications can significantly slow down the approval process and subsequent construction work. On the other hand, close communications with regulatory staff and understanding of permit requirements along with the submission of relevant forms, fees, and supporting documents can greatly expedite the process. Permits can sometimes be challenging, but timely submissions can greatly reduce worries and project delays.
3. **Bid-pricing challenges** – Finances are the most sensitive topic. Project costs are typically estimated at the planning stage and get regularly revised as more design specifics become available. Detailed drawings and specs generated for bidding provide a high degree of confidence in finalizing cost estimates. Based on the engineer's opinion of construction costs and recommendations, the client allots specific budget for the construction projects. Although provisions for money are made, actual bid prices submitted by contractors take the center stage.

   Fingers are crossed as bids are requested and opened, hoping that the selected contractor bid price will be close to or within budgetary estimates. If the bid prices exceed expected costs, the owner might need to make provisions for additional funds, reduce the project scope, or even delay construction. While such situations are unfortunate and undesirable, several factors can contribute to skew project costs. These may include inaccurate estimates, inflation, bidding competition, economic conditions, project delays, and others.

4. **Handling of shop drawing submittals** – Once the construction project gets in full swing, the contractor starts working on shop drawing submittal. The shop drawing submittal process provides engineers and architects an opportunity to review and ensure that correct products are getting installed. The process involves submittal, review, revision, and approval. This step impacts project costs, quality control, and the construction progress. However, incomplete submissions, frequent revisions, and re-submittals can significantly slow down the shop drawing review process.

It can consequently affect equipment fabrication, procurement, and shipment to the site. If not handled properly, shop drawing submittals can create a bottleneck in construction work. Realizing the sensitivity of the construction schedule, the contractor needs to provide sufficient lead time for the submittals review process.

5. **Traffic management and mobilization needs** – Traffic management is another big issue, especially when the project is located in congested areas, urban surroundings, or locations with high traffic zones. Transportation of heavy equipment, construction tools, materials, establishment of the site office, and other activities require proper access to the project site. These requirements become more intensive for larger projects involving bigger structures, buildings, and higher excavation needs compared to smaller projects. Coordination with local transportation department, allocation of sufficient manpower, and ensuring public safety becomes crucial. Selecting correct traffic patterns can avoid blockage, traffic jams, accidents, and casualties. Traffic management during construction activities is indeed a challenging task.
6. **Unexpected subsurface conditions** – Excavation is an integral part of the infrastructure projects. Be it for pipelines, underground tanks, vaults, or other components, contractors most often need to perform excavation activities at the site. Projects involving deeper and wider excavation take up a significant portion of project time and costs. Boring logs, rock cores, foundation investigation reports, topographical maps, and other subsurface data provide an idea about the underground conditions and expected excavation needs. However, detection of unaccounted rock, structures, or anomalies below the grade can suddenly change project dynamics. It may lead to construction delays, increased costs, and other difficulties. Every now and then, we see such unexpected subsurface conditions becoming a major issue and adding to project complexities.
7. **Construction sequence difficulties** – Sequence of construction is typically conceptualized and visualized during the design phase, although modifications might be required during actual construction phase. The majority of water/wastewater projects involve upgrades or additions within existing premises, structures, tanks, or buildings. In such cases, maintaining existing systems' smooth operations and compliance while continuing with construction work becomes a tricky task. Well-seasoned professionals are required to develop an effective

construction sequence to achieve proper transition between current and newer systems. This issue is less complex if the project is located at an entirely new site. When the sequence is not well-defined, system operations and compliance issues may arise. A lot of coordination is required between the contractor, operators, and engineers to execute the construction sequence effectively during the project span.

8. **Commissioning complexities** – Commissioning is one of the last pieces in the puzzle. It is a crucial step where the new system gets operational. Commissioning is comparatively simpler when the project involves pipes, valves, or other simpler modifications. However, the process gets more complicated and time-consuming where pump stations, biological processes, chemical treatments; sludge processes, building installation, electrical modifications, and other major upgrades are involved. Commissioning involves substantial efforts but during the start-up, special attention is needed toward system automation, instrumentation, and controls aspects. Hassle-free transition can be a satisfying experience as the project nears completion.
9. **Coordination and communication issues** – The construction process is intense and involves a lot of coordination and communication between the contractor, sub-contractor, client, engineer, surveyors, regulators, and other members involved with the project. Project schedules, daily progress, milestones, and challenges get discussed among the teams on a regular basis. However, lack of communication, miscommunication, ignorance, assumptions, and other actions can create conflicts, disagreements, and an unpleasant atmosphere. This can adversely affect project goals. To meet project needs and keep everyone on the same page at every stage, effective communication and coordination is a must.
10. **Change order disputes** – Projects do not always go perfectly as planned. Due to unknowns or unexpected situations in the field, oftentimes work gets added or deleted from agreed contract. Common reasons may include omissions in contract documents, design changes, site conditions, substitutions, and others. In such cases, change orders are typically issued to acknowledge project scope changes and are agreed upon by the contractor, client, and other responsible entities. Verbal confirmation, written agreements, or waivers become a part of this process.

    These contract alterations are also associated with project pricing and schedule changes. If the parties do not agree to the changes, major disputes may arise that can significantly affect

project execution. Arguments among the contractor, sub-contractor, client, or other entities become unavoidable. A large number of change orders can make the project murkier and vulnerable to issues and conflicts. Keeping change orders to a minimum is the key.

Obviously, the list of top 10 challenges will vary from project to project. Also, different engineers and managers can have varied opinions and points of view on what matters the most in respective projects. However, the above narration can provide a glimpse of what can be expected in general during the wastewater construction projects. Overall, the satisfactory completion of the project is in everyone's interest. Handing over a well-laid and well-executed system to the client not only adds to company's credibility, but also provides an opportunity to develop a long-term relationship and obtain new projects on an ongoing basis (Ambulkar, 2019).

2.6 Contractors role in WWTP construction industry

In most construction projects out of all parties involves in the project there are three main parties involved: the owner or client, the management team, and the contractor. The contractor plans and coordinates construction activities, and must complete the project within the established time, quality and budget. Contractors are responsible for the entire construction process, and must determine the best methods to finish the project as specified.

2.6.1 General Responsibilities of Contractor

In general terms, a contractor is responsible for planning, leading, executing, supervising and inspecting a construction project. The responsibility extends from the beginning to the end of the project, regardless of its scope. Contractors accomplish their duties by planning activities, supervising workers, and ensuring the project follows local codes and laws. A contractor may hire subcontractors for specialized areas, such as electrical, mechanical installations and Heating, Ventilation, and Air Conditioning (HVAC) systems.

2.6.2 Specific Roles and Duties of a Contractor

As mentioned before, a contractor has multiple responsibilities, which may vary depending on the contract. There are many roles a contractor can assume during different stages of a project, and this section covers the most common ones.

- Project Planning

Every project has a master schedule that describes all activities, along with their time distribution and planned budget. This schedule has a completion date that contractors must meet, and hefty penalties normally apply for missing the deadline. A late completion can only be justified if the project was delayed by external factors beyond the contractor's control, such as extreme weather and/or force majeure. The first duty of a contractor is creating project plan to deliver it on time. Some responsibilities include:

- Planning all crucial project development and implementation details.
- Determining the material and equipment requirements, and planning their procurement.
- Predicting possible changes and creating risk mitigation strategies.
- Meeting any legal and regulatory issues.
- Establishing effective communication among all project participants.

The contractor must establish a budget for the construction project, and follow it as closely as possible. The budget is a useful tool to track project costs, since contractors can detect waste by comparing their actual expenses with the planned budget.

- Project Management

The contractor needs to complete the project on time, and this involves many construction management activities:

- Ensuring funds are available to keep the project moving.
- Purchasing materials with enough anticipation for them to reach the site when needed.
- Purchasing or renting the construction equipment required for the project.
- Interviewing and hiring subcontractors to complete specialized work.
- Creating progress reports to justify intermediate payments.

Contractors are also responsible for their personnel, making sure their staff has the right size and technical skills. Contractors also manage payroll for their own employees, and subcontractor payments.

- Project Tracking

Project tracking is fundamental to complete the work according to contract specifications and schedules. In addition to tracking progress, contractors must prevent disruption. This involves several complementary activities:

- Quality control
- Using cost-effective construction methods
- Ensuring a constant supply of materials, and scheduling purchases well in advance
- Construction site safety

During the construction process, the contractor is responsible for tracking progress and managing any necessary changes. Of course, contractors must always have the project scope, time and budget in mind when making decisions.

- Legal and Regulatory Issues

Contractors have a handful of responsibilities in terms of legal and regulatory issues. They must acquire all the necessary permits and licenses before starting the project, while covering any fees and taxes that apply. Also, the entire construction process must follow local legislation and codes. Being unaware of legal requirements is not a valid excuse in construction projects, which means that contractors must have updated knowledge. With the right construction permits and contractor licenses, the project can progress without disruption.

- Health and Safety Issues

The contractor must guarantee health and safety in the construction site, by implementing adequate procedures and raising awareness among workers. The contractor is also responsible for the proper operation of equipment and preventing any accidents from misuse. The contractor deals with any emergencies and unforeseen issues at the project site, and must report them to the client's supervision staff. Generally, contractors have many roles during the different stages of construction, and each role comes with different responsibilities. Contractors should be capable of managing uncertainty and taking decisions on a daily basis. The track record of a contractor is

also very important, since those with ample experience can respond better to common issues in projects (Tobias, 2021).

2.7 Competitiveness

Competitiveness is the demonstrated ability to design, produce and commercialize an offer that fully, uniquely and continuously fulfills the needs of targeted market segments, while connecting with and drawing resources from the business environment, and achieving a sustainable return on the resources employed. The importance of competitiveness in driving firm survival, growth and trade make it a key element in economic development (Bubeker, 2018).

2.7.1 The levels of competitiveness

The basic levels of competitiveness that any business firms have to consider includes;

- Firm capabilities - This level assesses whether firms are managed according to best practices, need resources, and whether they have competencies to manage those resources.
- Business ecosystem - This level assesses whether the local business ecosystem, which is made up of business support institutions, supplies enterprises with the resources or competences they need to be competitive.
- National environment - This level assesses the macro-economic and regulatory environment enterprises operate under. The national environment is primarily set by government. (Bubeker, 2018)

The basic pillars of competitiveness:

Pillars are different components or categories, each measuring a different aspect of competitiveness. Accordingly pillar 1 is compete i.e. measuring the static ability to meet market expectations, pillar 2 is connect i.e. arrange communications with other actors in the market, getting info on what is happening in the market and what is required and pillar 3 is change i.e. using this information to anticipate market trends, and adapt to them, dynamically changing with the market.

Figure 3 – Competitiveness pillars (World economic forum (WEF), 2009)

These competiveness pillars are not only specific to the construction industry but they will also be compatible for other trade businesses. Each pillar is further subdivided into competitiveness themes that are the subject of the analysis in the publications i.e. quantity and Cost requirements, time requirements, quality requirements, connecting to buyers, connecting to suppliers, connecting to institutions, financial requirements, skills requirements and innovation and intellectual property requirements.

2.7.2 Competitiveness Strategy

Competitiveness strategy is the third of the five phases of the project cycle. A competitiveness strategy is a plan for moving the industry toward sustained growth. Industry competitiveness, as opposed to firm competitiveness, is systemic, the result of complex and dynamic interactions between national-level social and economic factors. An industry's competitiveness depends on the ability of firms and other actors in the chain to anticipate and meet buyer demands, take advantage of end-market opportunities, and respond to or influence changes in market demand. An industry can enhance its ability to compete by improving product differentiation, operations or branding.

Though firm-level interventions may improve the competitiveness of individual enterprises in the short term, if industry-wide constraints such as a difficult policy and legal business environment or a lack of supporting markets are not addressed, impact is likely to be limited and of short duration. A firm has a competitive advantage when it delivers products or services at a

lower cost or higher quality than that of its competitors, or when it has unique characteristics that cannot easily be replicated elsewhere (such as off-season vegetables or Blue Mountain coffee). How a firm is organized and how it uses its resources and capabilities to create unique, better or lower cost products or services determines its ability to develop a competitive advantage, become an industry leader and create excellent value for its customers and higher profits for itself. A competitiveness strategy provides a roadmap for moving an industry toward higher, sustained rates of growth; it is not just a plan for helping individual firms become more profitable. However, implementing a competitiveness strategy could require working first with a limited number of firms that are willing to invest in order to create a demonstration effect for other firms (PorterM, 1980 & 1995).

2.7.3 Competitiveness nature in construction industry

Efficient management and competitiveness capacity are key factors for the success of construction companies. In recent decades, applying technology to production processes has brought construction companies to a higher standard, reducing production time, increasing efficiency, and decreasing costs of production, Chinowsky (2001). While most are still behind in competition, a few have managed to incorporate digital techniques in their operations. Construction processes have adapted slowly to the technological advancements and few progresses has been recorded. Globalization as well offers a platform for construction companies to be established, to innovate and to grow on the international market.

It is a common notion that through globalization, companies are able to exploit distant markets and own assets. For instance, a company situated in Japan can employ its resources internationally by letting the American Banking Network commit themselves to projects worldwide, Abraham (2000). Hence, companies with better resources management have advantage to compete in the global market and gain extra benefits. Globalization enhances the level of competitiveness, challenging participants to equip themselves better in terms of innovative advantages to be able to stand the fierce market. For example, contractors in certain countries such as China could have cheap labor and superior management skills, Barney (2001).

This could lead them to exploit opportunities on the global market and become more competent than other construction companies in rest of the world (e.g. Europe, America, and Australia).

Similarly, Japanese contractors are experiencing stiff competition from their counterparts, such as Korea, England, and China, all of which have massive capital deposits, sophisticated technology, and technical expertise. To survive in such an environment, it is important to increase the competitiveness ability by re-thinking and re-evaluating competitiveness. One theory that measures competitiveness in the construction industry is Porter's Competitive Theory, which studies how companies position themselves strategically for competition. Porter has developed systems to examine strategies for competitiveness that companies adopt and their connection to competitiveness abilities and advantages.

The model includes forces that inform competition in industries, three generic competitive strategies, the diamond model, and the value chain, World Economic Forum (2009). A concrete analysis of competitiveness requires an examination of both the internal and external factors in an integrated model. Yet, Porter's model lacks the internal mechanisms to convert the impact of undesirable external elements into internal capabilities. Figure 3 shows the different factors included in porter's model. The model studied the factors such as threat to new entrants and substitute products or service in addition to bargaining power of suppliers and buyers and how they could affect the rivalry among competitors.

Figure 4 – **Forces Driving Industry Competition** (PorterM, 1980 & 1995)

2.8 Key competitiveness indicators (KCIs) for local contractors

Competitiveness Indicators (CI)-These are indicators that show aspects on which contractors have competitiveness. Other proposed competitiveness indicators under five groups: contractor's organization, financial considerations, management resource, past experience, and past performance. Hatush and Skitmor (2001) suggest a set of alternative criteria classified into five categories for assessing contractor competitiveness: financial soundness, technical ability, management capability, health and safety, and reputation.

Table -1, Key Competitiveness Indicators (KCIs) for construction industries around Hong Kong, China (Yong tao,Tan and Li-yin Shen, 2007).

Label	Description
Section I: Indicators Measuring Corporate Image	
KCI-1	Organization's credibility
KCI-2	Recognized grade of the company
KCI-3	Project quality / safety / environment performance
KCI-4	Banking credibility rating
KCI-5	Business specialism
KCI-6	Professional qualifications of project manager
Section II: Indicators Measuring Technical Ability	
KCI-7	Capacity of construction equipment and plant
KCI-8	Capability of technical and professional staff
KCI-9	Conversant with the local practice
KCI-10	Proportion of advanced construction equipment and plant

KCI-11	Standing of technology advancement within the industry
Section III: Indicators Measuring Financing Ability	
KCI-12	Payment to subcontractors / suppliers on time
KCI-13	Credibility grade certified by relevant financial bodies
KCI-14	Organization's financial status
KCI-15	Capability of loan repayment
KCI-16	On the tender list for governmental works

KCI-17	Relationship with public / private sector
KCI-18	Relationship with architects / consultants
KCI-19	Relationship with subcontractors and suppliers
KCI-20	Ability to forecast the changes of market conditions
Section V: Indicators Measuring Management Skills	
KCI-21	Effectiveness of site progress management
KCI-22	Effectiveness of co-ordination with subcontractors
KCI-23	Effectiveness of contract administration system
KCI-24	Effectiveness of site safety management
KCI-25	Effectiveness of financial management
KCI-26	Knowledge about the local construction law
KCI-27	Availability and effectiveness of quality management system
KCI-28	Availability and effectiveness of risk management system
KCI-29	Number of major accidents over past 3 year

Section VI: Indicators Measuring Human Resources Strength	
KCI-31	Appropriateness of organizational and personnel structure
KCI-32	Career prospect within organization
KCI-33	Ratio of technical and professional staff in the organization
KCI-34	Availability and effectiveness of resources and programs for training
KCI-35	Retention of core staff
KCI-36	Effectiveness of group-working and problem solving

Table – 2, Key Competitiveness Factors & Criteria (KCIs) for construction industries around Korea (Huang etal, 2010).

Pillar	Key Competitive Factor (KCF)	Key Competitive Criteria (KCC)
	1.1 Human and Knowledge	1.1.1 Employee productivity
		1.1.2 Number of full-time employees
		1.1.3 Number of staff bachelor's degrees
		1.1.4 Number of employees with more than five years of experience
		1.1.5 Organization's knowledge resources & quality of staff
		1.1.6 Organization's effective use of people & knowledge resources
	1.2 Finance and profit	1.2.1 Profit Ratio: Net profit margin = Net income / total sales
		1.2.2 Activity Ratio: total assets turnover = sales / total assets
		1.2.3 Leverage ratio: Debt to total assets = Total debt / Total assets
		1.2.4 Liquidity Ratio: Quick ratio = Current Assets less inventories / Current liabilities

1.Organization Performance	1.3 Other Company resources	1.3.1 Equipment availability (%)
		1.3.2 Effective use of organization's other resources
		1.3.3 Number of years in business
		1.3.4 Value of projects completed in the past three years ($)
		1.3.5 Organization Culture
	1.4 Bidding	1.4.1 Success rate (%) of bidding over past three years
		1.4.2 Effectiveness of organization's bidding strategy
		1.4.3 Sum of contract over past three years ($)
		1.4.4 Experience for bidding & availability of resources and professional for bidding
	1.5 Competitive strategy	1.5.1 Strategy implantation
		1.5.2 Matching strategy to an organization's situation
		1.5.3 Strategic awareness & clear vision mission and goals
	1.6 Organization structure	1.6.1 Suitability of company structure
		1.6.2 Business efficiency
		1.6.3 Leaders' personality and capability
		1.6.4 Use of international aspect (ISO)
		1.6.5 Organization communications
2. Project	2.1 Time	2.1.1 Schedule Performance index (SPI)
		2.1.2 Effectiveness of time management
		2.1.3 Construction delays
	2.2 Cost	2.2.1 Cost performance index CPI
		2.2.2 Effectiveness of cost management
		2.3.1 Defects (at the time of handover)

Performance	2.3 Quality	2.3.2 Total quality accidents per year ($)
		2.3.3 Effectiveness of quality management
	2.4 Other project management issues	2.4.1 Health and safety reportable accidents
		2.4.2 Health and safety lost time accidents
		2.4.3 Risk management
		2.4.4 Site management
		2.4.5 Contract management
		2.4.6 Dispute resolving skills
		2.4.7 Management claims
		2.4.8 Logistic and supply chain management
		2.4.9 Environment management
3. Environment & Client	3.1 Client Satisfaction	3.1.1 Client's satisfaction with (the value for money on delivered Products)
		3.1.2 Client's satisfaction with (the value for money on delivered services
		3.1.3 Client's satisfaction with specified criteria
	3.2 Company Social and industry condition	3.2.1 Social conditions
		3.2.2 Construction industry conditions
	3.3 Client and Supplier environment	3.3.1 Client environment
		3.3.2 Organization's client and supplier awareness
		3.3.3 Supplier environment
		3.4.1 Relationship with client or owners

	3.4 Relationship	3.4.2 Relationship with government departments & with public
		3.4.3 Relationship with subcontractors or suppliers & with designers and consultants
4. Innovation & Development	4.1 Technology ability	4.1.1 IT application
		4.1.2 Technological innovation ability & technical application
		4.1.3 Investment in technological Innovation
		4.1.4 Ratio of technological contribution
	4.2 Strategy to develop	4.2.1 Strategy implementation
		4.2.2 Strategic awareness & clear vision, mission and goals
	4.3 Human resources development & learning	4.3.1 Employee salary
		4.3.2 human resources development strategy
		4.3.3 Effectiveness of employee enhancements, training and education
		4.3.4 Money investments per one employee (for enhancements training and education) per year
		4.3.5 Labor attractiveness, work conditions, wage level, employee motivation and job satisfaction
	4.4 Research and development ability	4.4.1 Ratio of R&D contribution per total revenue
		4.4.2 Investment on R&D
		4.4.3 Effectiveness of research and development ability
	4.5 Adjust oneself ability	4.5.1 Creative ability & flexible ability of organization
		4.5.2 Business coverage differentiation ability (per year)

		4.5.3 Feedback evaluation ability
	4.6 Marketing	4.6.1 New orders received %
		4.6.2 Business coverage type of projects
		4.6.3 Business coverage type pf regions
		4.6.4 Company experience in the market
		4.6.5 Market research, planning and publicity
		4.6.6 Marketing information

Hence for these Thesis project and as per our country construction context the researcher found KPI adopted from construction industries around China will be compatible.

2.9 Wastewater treatment construction history in Addis Ababa

According to municipal review Addis Ababa generates an estimated annual volume of 49Mm^3 total wastewater from which about 4Mm^3 is industrial wastewater. Addis Ababa has two secondary sewage treatment plants and a centralized sewerage system /Sewer line

- Kality treatment plant, runs under its designed capacity of 7,600 m3/day
- Kotebe Sludge treatment capacity- of 85,000 m3/year
- Less than 10 % is connected to the Sewer line

The treatment capacity expansion plans the wastewater treatment fraction will increase from 30% by 2008 to 53% by 2020 if funding for the project can be secured. According to 2012 World Bank appraisal report Ethiopia was developing its Plan for Accelerated and Sustained Development to End Poverty (PASDEP), covering 2005-2010 E.C. PASDEP prioritized accelerated growth by tackling complex, interlinked poverty traps through a multi-faceted approach, including a focus on addressing low levels of infrastructure, such as water supply and sanitation.

Before the project, basic service provision coverage levels were below Government targets. In 2005, it was estimated that 89% of urban residents had access to improved water supply (though only 36% had access to on-plot piped water) and 24% had access to improved sanitation. In

addition to limited service coverage, the sector was also challenged due to:

1) Low financing for expansion of service and improvements;

2) Capacity constraints linked to the push for decentralization; and

3) Historically low stakeholder participation. Further, high levels of non-revenue water resulted in low quantities of water supplied per capita per day (e.g., in secondary cities over 30 percent non-revenue water (NRW) resulted in approximately 20 L per capita per day being delivered).

The original four secondary cities Gondar, Hawassa, Jimma, and Mekelle were chosen by the project imitators in consultation with federal and regional governmental bureaus, as they each have a population greater than 200,000 and could also demonstrate that their investment plan and tariff structure would allow for a financially viable utility. In these four cities, on average, 75 percent of households had access to networked water supply (mostly through shared household connections) for about 12 hours per day, providing on average 20L per capita per day.

In Addis Ababa, where water supply and sanitation are the responsibility of the Addis Ababa Water and Sewerage Authority (AAWSA), in the fifteen years before the project began, the city's population doubled from two to four million, and in parallel the administrative boundaries expanded resulting in expansion from 220 to 540 square kilometers. During those same fifteen years, minimal investments were made in capital works. As a result, service delivery did not keep pace with population growth, and at the start of the project, only about 55 percent of the service area was supplied by the water supply network. Additionally, only 4.8 percent of billed water ended up at a wastewater treatment plant.

The project was framed around three components. The first focused on Addis Ababa, including: improvements and expansion of water supply production/distribution and sewage collection/treatment, improvements in operational efficiency, and improved governance for AAWSA. The second supported four targeted secondary cities – Gondar, Hawassa, Jimma, and Mekelle – in improving/expanding water supply production and distribution, constructing new sewer networks and wastewater treatment plants, improving operational efficiency of each utility, and improving governance of the utilities. The third component included support for

project management, monitoring and evaluation, and capacity building linked to the project.

Outputs: These activities were expected to result in the following outputs: increased water volumes supplied to households, extension and rehabilitation of the water supply network to service areas (aiming to service 90 percent of households with 24-hour service), extension of the Addis Ababa sewerage network to new service areas, reduction in NRW (by 10 percent) and related improved operational efficiency (to cover 80 percent of costs through tariffs), increased autonomy of water boards and utilities, outsourced roles to private sector providers, new public sanitation facilities in low-income areas, and improved systems and enhanced capacity for sustaining and monitoring implementation of the project.

1. *Outcomes*: In the project cities, the outputs were intended to lead to increased access to sustainable water supply and sanitation services.
2. *Long-term outcomes*: As described in both the 2006 ICAS and the Government's PASDEP, improvements in access to sustainable water supply and sanitation services will ultimately support larger government priorities linked to tackling poverty and promoting pro-poor growth. By increasing access and improving sustainability of service delivery, the beneficiaries should see health improvements, which should in turn increase labor productivity.

2.10 Over view of Addis Ababa water and sanitation Authority (AAWSA)

It was since 1893 E.C (1900 G.C.) that piped water service was started in Addis Ababa. In the beginning the provision of potable water was delegated to the then Ministry of Works. And following the defeat of Fascist Italian invaders in 1934, this responsibility was transferred to the newly re-established Municipal Office. In order to cater for the increasingly growing demand for water and waste water disposal services there did arise a need for the establishment of an autonomous body that would primarily focus on the provision of the services. Accordingly, Addis Ababa Water and Sewerage Service Authority were set up as per proclamation No. 68/1963, in 1963 E.C. (1971G.C.). And in 1987 E.C. (1995 G.C.) additional powers were invested on the authority, while being reestablished with a slightly different name, i.e., Addis Ababa Water and Sewerage Authority (AAWSA). (AAWSA, June/28/2017).

Addis Ababa Water and Sewage Authority (AAWSA) is the water service provider of Ethiopia's capital city Addis Ababa. AAWSA was established officially in 1971 with a twofold mission: provision of potable water to the city and sewerage system for the sanitary disposal of sewage. The sewerage authority proclamation of March 16, 1972 and the previous instruments outlined the full scope of AAWSA's operations and powers, giving the authority the power to borrow, among other things. The authority is organized as an autonomous public authority having its own separate judicial personality. It is fully owned by the regional government of Addis Ababa.

The 2007 census estimates that about 2.7 million people live in Addis Ababa. More recent 2016 estimates put the total number of inhabitants at 3.4 million. These people are currently being supplied with drinking water through about 375,000 connections (AAWSA, June/28/2017).

Projects - Basically AAWSA involve in Water supply and waste water treatment construction projects and below trial have been made to list some of the projects from many.

A) Water supply projects

- Legedadi Dam and Treatment Plant
    - Established in 1970 GC (1963EC).
    - Has a capacity of holding 47 million cubic meters of raw water.
    - Underwent expansion works in 1985 GC (1977 EC) and 2015 GC (2007 EC).
    - Current water yield is 195,000 cubic meters per day.
- Ground water sources
    - Over 100 deep and shallow wells have been dug since 1995 GC (1987 EC) and are operational.
    - 413,000 cubic meters out of the city's total daily water production of 608,000 cubic meters is obtained from ground water sources, which amounts to 67.9% of the total.
- Dire Dam
    - Completed in 1998 GC (1991 EC)
    - It is an earth-fill dam with a capacity of holding over 19 million cubic meters of raw water

- water yield is 195,000 cubic meters per day

- Geferssa Dam and Treatment Plant

- Completed 1940 GC (1948 EC)
- Underwent a rehabilitation project in 2008 GC, which increased its raw water holding capacity to 9.5 million cubic meters
- Current water yield is 30,000 cubic meters per day

B) Wastewater treatment projects

- Chefe waste water treatment project
- Pakage Lot 1 &2 waste water treatment project
- Koyefetche Lot -1,2 & waste water treatment project (AAWSA, June/28/2017)

2.11 Research Gap

A research gap is a question or a problem that has not been answered by any of the existing studies or research within the particular study. Sometimes, a research gap exists when there is a concept or new idea that hasn't been studied at all. Sometimes there exist research gaps if all the existing research is outdated and in need of new/updated research or perhaps a specific population has not been well studied. These are just a few examples, but any research gap that the researcher finds is an area where more studies and more research need to be conducted (Bernard,Lewis & sheppard, 2002 & 2006).

Many studies have been carried out on identifying Key Competitiveness Indicators in construction industry. For instance, Shen (2006) investigated the Contractor Key Competitiveness Indicators. In the other domain of Contractor Selection for Design/Build Projects, Tan (2008) which focused on developing a model for contractor prequalification and bid evaluation in design/build projects. The researcher made attempts to go over various literatures including the above, nevertheless, studies are not done to understand local context of the industry. And yet studies by many local researchers focus mainly on performances of contractors in terms of quality, cost, and project schedule.

For example, a study made by Abubeker J.H (2015) focuses road construction project performance in relation to schedule, low quality work and cost overrun. Other researchers have also observed that time and cost overruns are common in the construction industry worldwide.

These studies do not give any attention on identification and analysis firms Key Competitiveness Indicators.

A comparative analysis of the competitiveness of construction firms: on federal highway project implementation Bubeker (2018) is also reviewed hence this study also emphasizes basically on competitiveness of construction firms in road sector. Generally, the researcher couldn't find any researches which related to competitiveness of local contractor in waste water treatment projects around Ethiopia especially in the case of AAWSA. Furthermore articles, reports & journals with the subject matter could not be found.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

Research methodology is a way to systematically solve the research problem. It may be understood as a science of studying how research is done scientifically. In it we study the various steps that are generally adopted by a researcher in studying his research problem along with the logic behind them. It is necessary for the researcher to know not only the research methods/techniques but also the methodology. Researchers not only need to know how to develop certain indices or tests, how to calculate the mean, the mode, the median or the standard deviation or chi-square, how to apply particular research techniques, but they also need to know which of these methods or techniques, are relevant and which are not, and what would they mean and indicate and why.

Researchers also need to understand the assumptions underlying various techniques and they need to know the criteria by which they can decide that certain techniques and procedures will be applicable to certain problems and others will not. All this means that it is necessary for the researcher to design his methodology for his problem as the same may differ from problem to problem, Mimansha Patel (2019). Research methodology simply refers to the practical "how" of any given piece of research. More specifically, it's about how a researcher systematically designs a study to ensure valid and reliable results that address the research aims and objectives.

For example, how did the researcher go about deciding:

- What data to collect (and what data to ignore)?
- Who to collect it from (in research, this is called "sampling design")?
- How to collect it (this is called "data collection methods")?
- How to analyses it (this is called "data analysis methods")?

3.2 Research Design

After the research problem having been formulated in clear cut terms, the researcher is expected to prepare a research design, i.e., the researcher has to state the conceptual structure within which research would be conducted. The preparation of such a design facilitates research to be as efficient as possible yielding maximal information, Mimansha Patel (2019). This thesis research seeks to verify the competitiveness of local construction firms that have been engaged in the

execution of wastewater treatment projects under the employer of Addis Ababa water and sewerage authority. The researcher emphasis conducting case study on projects that are being governed and procured under provision of Addis Ababa water and sewerage authority.

3.3 Research methods

Researches methods are broadly classified as Qualitative, Quantitative and mixed so all methods have distinctive properties and data collection methods (Witwatersrand, 2021).

Qualitative methods - is a method that collects data using conversational methods, usually open-ended questions and. The responses collected are essentially non-numerical. This method helps a researcher understand what participants think and why they think in a particular way. Types of qualitative methods include one-to-one interview, focus groups, ethnographic studies, text analysis and case study.

Quantitative methods- methods deal with numbers and measurable forms. It uses a systematic way of investigating events or data. It answers questions to justify relationships with measurable variables to explain, predict, or control a phenomenon. Types of quantitative methods include Survey research, Descriptive research and Correlation research.

Mixed-method methodology attempts to combine the best of both qualitative and quantitative methodologies to integrate perspectives and create a rich picture, Witwatersrand (2021). Accordingly, for this thesis project the researcher conducts qualitative research method.

3.4 Data collection method

The case study method is a very popular form of qualitative analysis and involves a careful and complete observation of a social unit, be that unit a person, a family, an institution, a cultural group or even the entire community, company or organization. It is a method of study in depth rather than breadth. The case study places more emphasis on the full analysis of a limited number of events or conditions and their interrelations. The case study deals with the processes that take place and their interrelationship. Thus, case study is essentially an intensive investigation of the particular unit under consideration. The object of the case study method is to

locate the factors that account for the behavior-patterns of the given unit as an integrated totality. (Wisdom jobs, 2020).

Hence this thesis projects conducts;

- A case study on Addis Ababa Water and Sanitation Authority (AAWSA) which targets the evaluation of performance and competitiveness of local contractors which is under contract with AAWSA and/or participated in the bid.
- An assessment of local construction firms to evaluate their stands to participate in wastewater treatment projects (eligibility assessment) by conducting structured interview with the local contractors and experienced consulting firms.
- Detail document review and structured interview with the employer bureau AAWSA and consulting firms for the past completed waste water projects and evaluate the contractor's performance.

3.5 Source of data

Data collection techniques are basically two sources of data collection techniques. Primary and Secondary data collection techniques, Primary data collection uses surveys, experiments or direct observations. Secondary data collection may be conducted by collecting information from a diverse source of documents or electronically stored information, census and market studies are examples of a common sources of secondary data. This is also referred to as "data mining" (Kumar, 2013).

Primary Data - means original data that has been collected especially for the purpose in mind. It means someone collected the data from the original source first hand. Data collected this way is called primary data. Primary data has not been published yet and is more reliable, authentic and objective. Primary data has not been changed or altered by human beings; therefore, its validity is greater than secondary data (Kumar, 2013).

Some of the advantages of primary data include,

- The data interpretation is better.
- Targeted Issues will be addressed and efficient spending of Information will be held.
- Decency of Data will be attained.
- Will addresses Specific Research Issues.
- Greater Control & Proprietary Issues will be settled.

Some of the disadvantages of primary research

- Will incur high cost.
- The process is time Consuming
- Inaccurate Feed-backs
- More number of resources is required

Secondary data - is the data that has been already collected by and readily available from other sources. When we use Statistical Method with Primary Data from another purpose for our purpose we refer to it as Secondary Data. It means that one purpose Primary Data is another purposes Secondary Data. So that secondary data is data that is being reused. Such data are more quickly obtainable than the primary data. These secondary data may be obtained from many sources, including literature, industry surveys, compilations from computerized data bases and information systems, and computerized or mathematical models of environmental processes (Kumar, 2013).

Some of the Advantages of secondary data

- It is inexpensive.
- Easily accessible and Immediately available
- Will provide essential background and help to clarify or refine research problem
- Essential for literature review
- Secondary data sources will provide research method alternatives.
- Will also alert the researcher to any potential difficulties.

Some of the disadvantages of secondary data

- Takes time to define problem, sampling frame, method and analysis.
- Not as readily accessible
- Provides incomplete Information

Generally, Primary research entails the use of immediate data in determining the survival of the market. The popular ways to collect primary data consist of surveys, interviews and focus groups, which show that direct relationship between potential customers and the companies. Also, secondary research is a means to reprocess and reuse collected information as an indication for betterments of the service or product.

Both primary and secondary data source are used for this particular research. The primary data is data's in which collected through semi-structured interview conducted with local construction

firms, consulting firms and the employer AAWSA top and operational management teams. An exhaustive literature, detail document survey is reviewed on the subject area and considered to be secondary source of data.

3.6 Data source selection

Purposive sampling is adopted for this research for selecting samples and collecting data. These research uses major sources of data from data's retrieved through in-depth document review from the employer AAWSA archive dep't and from structured interview with the employer, consulting and local construction firms. The interview informants are selected by their experience and having close exposure with the subject matter. Purposive sampling is an informant selection tool widely used in case study but the use of the method is not adequately explained in most studies. The purposive sampling technique, also called judgment sampling, is the deliberate choice of an informant due to the qualities the informant possesses. It is a nonrandom technique that does not need underlying theories or a set number of informants. Simply put, the researcher decides what needs to be known and sets out to find people who can and are willing to provide the information by virtue of knowledge or experience (Bernard,Lewis & sheppard, 2002 & 2006).

The researcher has taken the past 7 years as the research period because many of mega wastewater treatment projects were procured during this period. The researcher has fixed number of samples i.e. 11 interviewee participants incorporated form the employer, consulting and local contractors' firms and selects 2 consulting firms & 3 local contractors' firms for gathering compiled information's. The researcher could not able to find many experienced consulting and local construction firms which specialized in construction of wastewater treatment project in national level.

3.7 Critical analysis of the study

Data analysis depends upon the nature of research that the researcher is undertaking. Types of data analysis vary depending upon whether the research is qualitative or quantitative in nature. In qualitative research there are six basic types of data analysis which are;

1) **Qualitative content analysis** - is possibly the most common and straightforward qualitative data analysis method. At the simplest level, content analysis is used to evaluate

patterns within a piece of content (for example, words, phrases or images) or across multiple pieces of content or sources of communication.

2) **Narrative analysis** - is all about listening to people telling stories and analyzing what that means. Since stories serve a functional purpose of helping us make sense of the world, we can gain insights into the ways that people deal with and make sense of reality by analyzing their stories and the ways they're told.
3) **Discourse analysis** - is all about analyzing language within its social context. In other words, analyzing language such as a conversation, a speech, etc. within the culture and society it takes place in.
4) **Thematic analysis** - looks at patterns of meaning in a data set of interviews or focus group transcripts. Thematic analysis takes bodies of data (which are often quite large) and groups them according to similarities. These themes help us make sense of the content and derive meaning from it.
5) **Grounded theory (GT)** - is powerful qualitative analysis method where the intention is to create a new theory (or theories) using the data at hand, through a series of facts and revisions.
6) **Interpretive phenomenological analysis (IPA)** - is designed to help you understand the personal experiences of a subject (for example, a person or group of people) concerning a major life event, an experience or a situation (Ranir Singh (Dr), 2012).

Accordingly, Thematic analysis which is about identifying themes and patterns of the specific study and Grounded theory (GT) which is about starting from scratch with a specific question and using the data alone to build a theory in response to that question are implemented as data analysis methods for these studies.

3.8 Validity and Reliability

Validity

Validity in qualitative research means "appropriateness" of the tools, processes, and data. Whether the research question is valid for the desired outcome, the choice of methodology is appropriate for answering the research question, the design is valid for the methodology, the sampling and data analysis is appropriate, and finally the results and conclusions are valid for the sample and context, J.Family (July,2015). Choice of methodology must enable detection of

findings/phenomena in the appropriate context for it to be valid, with due regard to culturally and contextually variable. For sampling, procedures and methods must be appropriate for the research paradigm and be distinctive between systematic, purposeful or theoretical (adaptive) sampling where the systematic sampling has no prior theory, purposeful sampling often has a certain aim or framework and theoretical sampling is molded by the ongoing process of data collection and theory in evolution. For data extraction and analysis, several methods were adopted to enhance validity, including 1st tier triangulation (of researchers) and 2nd tier triangulation (of resources and theories).

Reliability

In qualitative research with diverse paradigms, such definition of reliability is challenging and epistemologically counter-intuitive. Hence, the essence of reliability for qualitative research lies with consistency. A margin of variability for results is tolerated in qualitative research provided the methodology and epistemological logistics consistently yield data that are ontologically similar but may differ in richness and ambience within similar dimensions (J Familiy , July,2015).

In general, to ensure the quality of research and make it credible for the scientific community, the researcher gave due care to both validity and reliability issues of the data, the research process in general as well as the research output. The researcher used different source of data form literature, interview, site observation and document review to triangulate the data. The need for triangulation arises from the ethical need to confirm the validity of the processes involved. Triangulation increases the reliability of the data and the process of gathering it.

3.9 Ethical consideration

Ethical Considerations can be specified as one of the most important parts of the research. According to Bryman & Bell (2007), the researcher believes that the below listed major points will be highly considered for successful implementation and conclusion of these researches:

1. Research participants (Interviews) should not be subjected to harm in any ways whatsoever.
2. Respect for the dignity of research participants should be prioritized.
3. Full consent should be obtained from the participants prior to the study.

4. The protection of the privacy of research participants has to be ensured.
5. Adequate level of confidentiality of the research data should be ensured.
6. Anonymity of individuals and organizations participating in the research has to be ensured.
7. Any deception or exaggeration about the aims and objectives of the research must be avoided.
8. Any type of communication in relation to the research should be done with honesty and transparency.
9. Any type of misleading information, as well as representation of primary data findings in a biased way must be avoided. (Dudovskiy, 2018)

In order to address efficient ethical considerations, the researcher adopts basic principles like:

1. Voluntary participation of respondents in the research is important. Moreover, participants have rights to withdraw from the study at any stage if they wish to do so.
2. Respondents should participate on the basis of informed consent. The principle of informed consent involves researchers providing sufficient information and assurances about taking part to allow individuals to understand the implications of participation and to reach a fully informed, considered and freely given decision about whether or not to do so, without the exercise of any pressure or coercion.
3. The use of offensive, discriminatory, or other unacceptable language needs to be avoided in the formulation of Questionnaire/Interview/Focus group questions.
4. Privacy and anonymity or respondents are of a paramount importance.
5. Acknowledgement of works of other authors used in any part of the dissertation with the use of Harvard/APA/Vancouver referencing system according to the Dissertation Handbook.

In general, the study will be conducted with highest level of ethical considerations throughout the research. Prior to the study and data collection participants are informed about the purpose of the study. Data collection is carried out after securing the respondent's full consent for voluntary participation. Respondents are also informed that data collected for the study in this regard would never be used for any purpose other than for academic purpose.

CHAPTER FOUR

DATA ANALYSIS AND INTERPRETATION

4.1 Introduction

The chapter presents the result of the survey analysis and organizing into six main sections. The first section presents introduction; the second section discusses about the level of local contractors competitiveness to undertake wastewater treatment projects by incorporating the result obtained through in-depth document review & structured interviews and also the general demography of the research participants; the third section discusses about the current status of the procured projects; the fourth section discusses about challenges that faces local contractors regarding with competitiveness; the fifth section presents the critical success factor that would enable for enhancement of local contractors competitiveness to undertake wastewater treatment projects and finally the sixth section presents about the general information obtained through document survey & summery of data analysis chapter.

4.2 Local contractor's competitiveness level to undertake wastewater treatment project around A.A

It is recalled that the researcher targets mainly to assess whether the local contractors are competitive enough to undertake waste water treatment projects, accordingly the researcher take the past 7 years as a research period under the case of Addis Ababa water and sanitation authority. In order to investigate the local contractor's competitiveness level, the researcher conducts in-depth document review from the employer archive department in order to analyze the performance of the local contractors in wastewater treatment project bids which were launched for the past 7 years by the employer and the structured interviewees with purposely selected stake holders is discussed in this section in detail as follows.

4.2.1 Project Bid Information for WWTP projects procured in the past 7 years

The Procured wastewater treatment construction projects for the past seven years by the employer Addis Ababa Water and sanitation Development & Rehabilitation Project office (AAWSA) and the general bid information of the projects are discussed in summery tabulated form as follow

Table - 3, Project Bid Information for WWTP projects procured in the past 7 years

Item No	Description	List of Procured WWTP construction project for the past seven years				
		Koye Fetche WWTP Lot-1	**Koye Fetche WWTP Lot-2**	**Koye Fetche WWTP Lot-3**	**Chefe Phase -2 WWTP**	**Package WWTP Lot 1 & 2**
1	***Name of the contract***	Addis Ababa Decentralized Waste Water management system pilot project For Koye Fetche Condominium site Lot-1 WWTP1 (ICB)	Addis Ababa Decentralized Waste Water management system pilot project For Koye Fetche Condominium site Lot-2 WWTP2 (ICB)	Addis Ababa Decentralized Waste Water management system pilot project For Koye Fetche Condominium site Lot-3 WWTP3 (ICB)	Construction of Chefe Wastewater treatment plant (phase 2) and Operation and maintenance of Chefe Wastewater treatment plant.	Package wastewater treatment plant and civil work construction for Lot-1 (Kilinto, Mekenisa, Kara Kore 1, Degenet and Bole Bulbula Condominiums) and Lot-2 (Tuludimitu, Bole Arabsa and Genet Menafesha Condominiums) (ICB).
2	***Name of Project***	Construction of Waste Water Treatment Plant Koye Fetche condominium LOT-1	Construction of Waste Water Treatment Plant Koye Fetche condominium LOT-2	Addis Ababa Decentralized Waste Water management system pilot project For Koye Fetche Condominium site Lot-3 WWTP3 (ICB)	Construction of Chefe Wastewater treatment plant - phase 2	Package Wastewater treatment plant project for condominiums.
3	***Employer***	AAWSA (Water and sanitation Development& Rehabilitation Project office)	AAWSA (Water and sanitation Development& Rehabilitation Project office)	AAWSA (Water and sanitation Development& Rehabilitation Project office)	AAWSA (Water and sanitation Development& Rehabilitation Project office)	AAWSA (Water and sanitation Development& Rehabilitation Project office)
4	***Project duration***	365 days	365 days	365 days	560 days	150 days
5	***Bid round***	Re-Bid	1st round	1st round	1st round	1st round

6	***Project scope***	Construction of civil works & Supply and installation of all related electro mechanical equipment of the three Decentralized Waste water treatment plants for Koye Fetche Condominium sites (Lot-1 WWTP1. A.S. Extended aeration)	Construction of civil works & Supply and installation of all related electro mechanical equipment of the three Decentralized Waste water treatment plants for Koye Fetche Condominium sites (Lot-2 WWTP2. A.S. Extended aeration)	Construction of civil works and Supply and installation of all related electro mechanical equipment of the three Decentralized Wastewater treatment plants for Koye Fetche Condominium sites (Lot-3 WWTP3. Conventional Activated Sludge (CAS)	Construction of Chefe Wastewater treatment plant (phase 2) civil works Supply and installation of all related electro mechanical equipment	Construction of civil works & Supply and installation of all related electro mechanical equipment of the Lot-1 (Kilinto, Mekenisa, Kara Kore-1, Degenet and Bole Bulbula Condominiums) and Lot-2 (Tuludimitu, Bole Arabsa and Genet Menafesha Condominiums).
7	***Location***	Addis Ababa / Koye Fetche condominium sites	Addis Ababa / Koye Fetche condominium sites	Addis Ababa / Koye Fetche condominium sites	Addis Ababa / Gelan residential area	Addis Ababa / Different condominiums sites
8	***Currency***	Birr & other foreign currency that the bidder states	Birr & other foreign currency that the bidder states	Birr & other foreign currency that the bidder states	Birr & other foreign currency that the bidder states	Birr & other foreign currency that the bidder states

4.2.2 Technical qualification/Evaluation criteria for WWTP projects procured in the past seven years

The Technical qualification/Evaluation criteria for the Procured wastewater treatment construction projects on the past seven years by the employer Addis Ababa Water and sanitation Development & Rehabilitation Project office (AAWSA) are discussed in summery tabulated form as follow

Table - 4, Technical qualification/Evaluation criteria for WWTP projects procured in the past seven years

Item No	Description	*List of Procured WWTP construction project for the past seven years*				
		Koye Fetche WWTP Lot-1	**Koye Fetche WWTP Lot-2**	**Koye Fetche WWTP Lot-3**	**Package WWTP Lot 1 & 2**	**Chefe Phase -2 WWTP**
1	***Eligibility***	- *Nationality* – In accordance with ITB 4.2 (any Ethiopian & international construction companies and suppliers) - *Conflict of interest* – No conflict of interest. Laws, official regulation or by an act of compliance with UN Security Council resolution - *Contractors Grade* – Grade GC/WC 1 or equivalent for international and competitive bidder (In terms of JV the leading contractor must meet the requirements).	- *Nationality* – In accordance with ITB 4.2 (any Ethiopian & international construction companies and suppliers. - *Conflict of interest* – No conflict of interest. Laws, official regulation or by an act of compliance with UN Security Council resolution - *Bank Ineligibility* – Not having declared ineligible by the bank. - *Eligibility based on United Nations resolution or borrower's country law* – Not having been excluded as a result of the borrower's country laws or official regulation or by an act of compliance with UN Security Council resolution.	- *Nationality* – In accordance with ITB 4.2 (any Ethiopian & international construction companies and suppliers. - *Conflict of interest* – No conflict of interest. Laws, official regulation or by an act of compliance with UN Security Council resolution - *Bank Ineligibility* – Not having declared ineligible by the bank. - *Eligibility based on United Nations resolution or borrower's country law* – Not having been excluded as a result of the borrower's country laws or official regulation or by an act of	- *Nationality* – In accordance with ITB 4.2 (any Ethiopian & international construction companies and suppliers. - *Conflict of interest* – No conflict of interest. Laws, official regulation or by an act of compliance with UN Security Council resolution *Bank Ineligibility*	- *Bidder requirement* - Renewed Grade license of GC1 or WC1 or equivalent international contractors Grade and above for the current year. *Nationality* - All contractors and suppliers from eligible countries including Ethiopia are allowed. *Conflict of Interest* – No-conflict of interest is allowed. *United Nation resolution or the law of federal Democratic Republic of Ethiopia and City*

			- *Contractors Grade* – Grade GC/WC 1 or equivalent for international and competitive bidder (In terms of JV the leading contractor must meet the requirements).	compliance with UN Security Council resolution. *Contractors Grade* – Grade GC/WC 1 or equivalent for international and competitive bidder (In terms of JV the leading contractor must meet the requirements). - *Renewed Grade License & Renewed of license from bureau of trade* – renewed license from bureau of trade and industry for the current year or equivalent for international bidders.		*Government of Addis Ababa*– Not having been declared ineligible by the office of Government of Federal Democratic Republic of Ethiopia and Official regulations against commercial relation with the bidder's country, or by an act of compliance with UN Security
2	***Historical Contract Non-performance***	- Non-performance of a contract did not occur within the last 2 years prior to the dead line for application submission based on all information fully settled disputes or litigation. - *Failure to sign contract* – Not being under execution of a bid securing declaration for 2	- Non-performance of a contract did not occur within the last 2 years prior to the dead line for application submission based on all information fully settled disputes or litigation. - *Failure to sign contract* – Not being under execution of a bid securing declaration for 2 years. - *Pending litigation* – All pending	- Non-performance of a contract did not occur within the last 2 years prior to the dead line for application submission based on all information fully settled disputes or litigation. - *Failure to sign contract* – Not being under execution of a bid securing declaration for 2	- Non-performance of a contract did not occur within the last 5 years prior to the dead line for application submission, based on all information on fully settled disputes or litigations. - *Pending Litigation* – All	- Non- performance of a contract did not occur as a result of contractor default since January 1st 2013. - *Suspension based on Execution of Bid securing Declarations by the employer or withdrawal of the bid*

		years. - *Pending litigation* – All pending litigation shall in total not represent more than 25% of the applicant net worth and shall be treated as resolved against the applicant.	litigation shall in total not represent more than 25% of the applicant net worth and shall be treated as resolved against the applicant.	years. - *Pending litigation* – All pending litigation shall in total not represent more than 25% of the applicant net worth and shall be treated as resolved against the applicant.	pending Litigation shall in total not presenting more than 50% of the bidder's net worth and shall be treated as resolved against the bidder.	*within bid validity* – Not under suspension based on execution of a bid securing declaration is allowed. - *Pending Litigation History* – No consistent history of court/arbitral award decisions against the bidder since January 1st 2013.
3	***Financial situation***	- *Historical financial performance* – Submission of audited balance sheets or if not required by the law of the applicant's country, other financial statements acceptable to the employer for the last 3 years. - Liquidity ratio shall be greater than or equals to one for the current year). - *Average Annual Construction Turn over* –Minimum average annual construction turnover of US$ 20 million calculated	- *Historical financial performance* – Submission of audited balance sheets or if not required by the law of the applicant's country, other financial statements acceptable to the employer for the last 5 years. - *Average Annual Construction Turn over* – Minimum average annual construction turnover of US$ 10 million calculated as total certified payment received for contracts in progress or completed within the last 5years, (For JV terms - Greater than or	- *Historical Financial Performances* – Submission of audited balance sheet or if not required by the law of the applicant's country, other financial statements acceptable to the employer for the last 3 years. - *Average Annual Construction Turnover* – minimum average annual construction turn over US$ 20 million calculated as total certified payments received for contracts in progress or completed within	*Historical Financial performance* – Submission of audited balance sheets or if not required by the law of the bidder's country, other financial statements acceptable to the employer, for the last 3 years to demonstrate the current soundness of the bidder's financial position and its prospective long-term profitability. - *Average annual turnover* – Minimum average annual	*Financial performance* –The Bidder shall demonstrate that it has access to, or has available, liquid assets, unencumbered real assets, line of credit and other financial means sufficient to meet the construction cash flow estimated as US$ 1,250,000 for the subject contracts net of the bidder other commitments.

		as total certified payment received for contracts in progress or completed within the last 3 years, (For JV terms - Greater than or equals to 50% of the requirement must meet by the leading contractor and not less than or equal to 50% by the joint partner - *Financial Resources* – The Bidder must demonstrate access to or availability of financial resources or line of credit to meet a cash flow of US$ 4 Million.	equals to 60% of the requirement must meet by the leading contractor and not less than or equal to 40% by the joint partner). - *Financial Resources* – The Bidder must demonstrate access to or availability of financial resources or line of credit to meet a cash flow of US$ 2 Million.	the last 5 years, (For JV terms greater than or equals to 51% of the requirement must meet by leading contractor and not less than or equal to 49% by the joint partner). - *Financial Resources* – The bidder must demonstrate accesses to or availability of financial resources such as liquid assets, unencumbered real assets, line of credit and other financial means other than any contractual advance payments to meet a cash flow of US$ 4 million, (must meet requirement by the leading contractor).	turnover of US$ 5 million for Lot-1 and & million for Lot-2, calculated as total certified payments received for contracts in progress or completed within last 5 years. - *Financial Resources* – The bidder must demonstrate accesses to line of credit from recognized banks to cash flow requirements of US$ 3,500,000 for Lot-1 and 5,000,000 for Lot-2.	- The bidder shall also demonstrate to the satisfaction of the employer, that it has adequate Source of finance to meet the cash flow requirement on works currently in progress and for future contracts commitments. - *Average Annual Construction Turnover* – Minimum average annual construction turnover of US$ 15 million, calculated as total certified payments received for contracts in progress and/or completed within the last 5 years, divided by 5 years, (The lead contractor or JV partner must meet 70% of the requirement).
4	***Work***	- *General Construction Experience* –work experience	- *General Construction Experience* – work experience	- *General Construction Experience* – Experience	- Experience under contracts in the role of supply of	- In study and design of sanitation facilities (at

	Experience	under construction contracts in the role of contractor sub-contractor or management contractor for at least the last three years prior to the application submission dead line, (For JV terms - Greater than or equals to 50% of the requirement must meet by the leading contractor and not less than or equal to 50% by the joint partner). - *Specific Construction Experience in water supply and sewerage projects* – Participation as contractor, management contractor or subcontractor in at least 1 work within the last 3 years, each with a value of at least equivalent to planned contract, that have been successfully and substantially completed and that are similar to the proposed works. The similarity shall be based on the physical size complexity,	under construction contracts in the role of contractor sub-contractor or management contractor for at least the last 5 years prior to the application submission dead line and the with activity in at least nine months in each year. - *Specific Construction Experience in water supply and sewerage projects* – Participation as contractor, management contractor or subcontractor in at least 2 works within the last 5 years, each with a value of at least equivalent to planned contract, that have been successfully and substantially completed and that are similar to the proposed works. The similarity shall be based on the physical size complexity, methods/technology, (For JV terms –partners and leading contractor must meet the requirement). - For the above or other contracts	under construction contracts in the role of contractor, subcontractor, or management contractor for at least 5 years prior to the application submission deadline, (Greater than or equal to 60% of the requirement must meet by the leading contractor and not less than or equal to 40% by joint partner). - *Specific Construction Experience* – Participation as contractor, management contractor or sub-contractor, in at least 2 within the last 5 years, each with a value of at least of at least 100% of planned contract, that have been successfully and substantially completed and that are similar to the proposed works. The similarity shall be based on the physical size, complexity, methods/technology or other characteristics as describes in	similar equipment for at least the last 5 years prior to the application submission dead line and with activity in at least 9 months in each year. - Participation as contractor within the last 5 years each with a value of at least US$ 8 million for Lot-1 and 10 million for Lot-2, that have been successfully and substantially completed and that are similar to the proposed plant and installation service. The similarity shall be based on the physical size, complexity, - methods/technology -influent and effluent quality or other characteristics as described under employer's requirement - Designed, supplied and installed 6 packages for at least 5 years = 50%	least 1 project). - Experience in construction supervision and contract administration work (at least 1 project). - Experience in training and manual preparation on sanitation works (at least 1 project).

		methods/technology, (For JV terms – at least 1 partner must meet the requirement).	executed during the period stipulated in 4.2 above minimum construction experience in the following key activities like supply of at least 150 km of pipes in 6 months, pipe trench excavation, laying and concrete related civil works for at least 150 km in 1.5 years, Intake and weir, Pumping station, water treatment plant, storage reservoir and elevated water tank works (For JV terms – above 70% of one of partners must meet the requirement).	scope of the works. For the above or other contracts executed during the period, a minimum construction experience either of the following key activities supply of sewer pipes, pipe line trench excavation and laying and concrete related civil works, intake and weir, pumping stations, water treatment plant, storage reservoir& elevated water tanks (Greater than or equal to 50% of the requirement must meet by the leading contractor and not less than or equal to 50% by joint partner).	- Supplied 4 packages at least 5 years = 40% - Supplied 3 packages for at least 5 years = 35% - *Suppliers experience on east African countries* – Participation as contractors within the last 5 years, each with a value of at least US$15 million for Lot-1 and 20 million for Lot-2 that have been successfully and substantially completed and that are similar to the proposed plant and installation services.	
5	*Personnel requirement*	Please Refer Annex-1	Please Refer Annex-1	Please Refer Annex-1	Please Refer Annex-1	
6	*Equipment requirement*	Please Refer Annex-1	Please Refer Annex-1	Please Refer Annex-1	The bidder must demonstrate that it will have access to the key Contactors equipment after contract awards.	

7	***Sub-Contractors***	***Only for Package WWTP Lot 1 & 2 project*** - Eligibility must meet the requirements. - Certificate of Business registrations – Renewed license. - Category – GC/BC 5 and above. - Pending litigation – No pending litigation. - Experience under similar complexity and size of the project 5 projects and above for the last 3 years.
8	***Adequacy of the required documentation***	***Only for Chefe Phase -2 WWTP project*** - Firms comment and suggestion on TOR. - conducting and reporting site visit, knowledge. - Preparing Methodology for the implementation of the assignment, design review and subsequent outcomes. - submitting methodology for construction supervision and contract administration. - submitting methodology for environmental and social mitigation measures proposal during implementation. - submitting work plan, staffing and reporting

4.2.3 Assessment of list of local contractors which participates in the bids and their performance up on the Technical evaluation

In this section, the assessment and analysis of list of local contractors participated in the bids and their performance up on the technical evaluation along with winning price will be discussed in tabulated format as follows.

Table – 5, General Bid Evaluation Analysis of contractors which participates in the bids

Item No	Projects	List of Bidders who buys the Bid	List of Bidders who Participates the Bid	Bidders passes Technical evaluation	Basic Disqualification factors of the bidders	Winner of the bid
1	**Koye Fetche condominium Waste Water Treatment Plant LOT-1**	46 - Local contractors	6- Foreign contractors	4- Foreign contractors	- The 1st Foreign Contractor has No affidavit compliance regarding with manufacturing authorization, warranty & catalog for EM equipment's. - The 2nd Foreign Contractor scored 65% which is less than the required 75% in Equipment criteria and the 3rd Foreign Contractor has also No affidavit compliance regarding with manufacturing authorization, warranty & catalog for EM equipment's. - The 3rd Foreign Contractor	104,149,211.3 ETB & 6,780,200.3 EURO

		10 - Foreign contractors			Bidders with a record of pending litigation.	
2	**Koye Fetche condominium Waste Water Treatment Plant LOT-2**		3 - Foreign contractors	3 - Foreign contractors	No rejected Foreign contractors	136,502,448.5 ETB & 10,353,952.9 EURO
3	**Koye Fetche condominium Waste Water Treatment Plant LOT-3**		2 - local contractors & 1 - Foreign contractor	1- Foreign contractor	- One Local Contractor do not pass the preliminary evaluation criteria (the bid needs GC/WC-1 but the Local Contractor registered in BC-1. - The other Local Contractor did not meet the minimum required average annual construction turn over & financial resources and minimum equipment requirement.	183,036,969.4 ETB & 9,204,723.1 EURO
4	**Package Wastewater treatment plant and civil work**	19 – Local contractors 7 – Foreign	4 - Foreign	4 - Foreign	No disqualified Foreign Contractors all 4 foreign contractors were passed to financial evaluation	Lot-1,100,223,152.9 ETB & 5,971,663.2 EURO,125,016.3USD and Lot-

	construction (Lot 1 & 2)	contractors				2,93,306,763.9 ETB,14,890,921.02 EURO
5	**Chefe Wastewater Treatment Plant – Phase 2**	42 – Local contractors 3 – Foreign contractors	11- Local contractors & 2 - Foreign contractors	1 – Local contractor 2 – Foreign contractors	- Some of the JV Local Contractors did not submitting Bid submission sheet. - Some of the JV Local Contractors were not having Renewed Grade license. - Some of the JV Local Contractors were even not having Grade license. - The Local Contractors personnel did not meet the minimum requirement and did not meet specific experience.	109,868,284.9 ETB & 4,921,623.4 USD

4.2.4 General demography of the research participants

4.2.4.1 General demography of the Interviewee participants

The Interview respondents are purposely selected from the employer Addis Ababa Water and sanitation Authority (AAWSA) project office engineering and procurement departments, consulting firms and local contractors' firms. The detail profile of the respondents and participants are briefly listed in detail. The researcher purposely selected the participants as per their experience, management roll and their direct exposure with the subject matter.

Table – 6, Profile of Interviewee Respondents

Item No	Name	Gender	Firm Category	Department	Qualification	Year of experience	Position held
1	Interviewee 1	F	Employer	Procurement	MSC in COTM	12	Procurement Dept manager
2	Interviewee 2	M	Employer	Procurement	BSC in Civil Engineering	18	Procurement Engineer
3	Interviewee 3	F	Employer	Engineering	BSC in Hydraulic Engineering	13	Civil engineer
4	Interviewee 4	M	Employer	Engineering	BSC in Civil Engineering	15	Civil engineer
5	Interviewee 5	M	Employer	Engineering	MSc in Civil Engineering	10	Engineering Dept Team leader
6	Interviewee 6	M	Contractor	Water Con.	MSc in Hydraulics	25	Water works department manager
7	Interviewee 7	M	Contractor	Contract Admin	MSc in Geotechnical Engineering	21	Contract administration department head
8	Interviewee 8	M	Contractor	Engineering	MSc in EM Engineering	16	Deputy manger
9	Interviewee 9	M	Consultant	Supervision	MSc in Civil Engineering	14	Project coordinator
10	Interviewee 10	M	Consultant	Supervision	MSc in Civil Engineering	12	Resident engineer
11	Interviewee 11	M	Consultant	Supervision	BSC in Civil Engineering	15	Resident engineer

4.2.4.2 General demography of the Local contractors and consulting firms

The local contractors and consulting firms for the intended interview were selected purposely by their exposure and experience in wastewater treatment construction projects. However, the researcher could not able to find experienced consulting firm related with WWTP construction projects as many as possible.

Table – 7, Profile of Consulting and local construction firms

Item No	Description	Grade	General Experience in construction	Specific Experience in WWTP in years	Number and Status of project they held
1	Consulting Firm - 1	1	14 yrs	8 yrs	- 3 completed and on operation - 2 terminated - 2 on progress
2	Consulting Firm - 2	1	8 yrs	5 yrs	- 2 completed and on operation - 1suspended - 1 on progress
3	Local contractors Firm - 1	1	15 yrs	15 yrs	As JV with foreign contractors - 2 completed and on operation - 1 suspended - 1 terminated
4	Local contractors Firm - 2	1	18 yrs	10 yrs	- As lead contractors (4 completed and on operation) - As JV with foreign contractors (1 completed &2 on progress) - As JV with local contractors (2 on progress)
5	Local contractors Firm - 3	1	20 yrs	8 yrs	- As lead contractors (10 completed and on operation - As JV with foreign contractors (2 suspended and 6 on progress) - As JV with local contractors (10 completed)

4.2.5 Discussion on questions and answers conducted with the employer office

From the employer bureau the researcher emphasizes in two main departments i.e. procurement and engineering so that it will make it easier to demonstrate the information obtained from personnel's and get generalized information about the procured wastewater treatment projects from different perspectives. The researcher tries as much as possible to raise questions that are related with the subject matter directly in consultation of supporting officials to employer management teams and their subsequent replies is discussed in detail as follows.

Table – 8, List of Questions raised and concluded Answers from Employer office

Item No	Raised Questions	Concluded responses
1	How your bureau develops and/or adopt technical qualification criteria for Waste water treatment plant projects WWTP projects	A committee will be assigned every new budget year to prepare an updates technical specification to WWTP projects and then will presented to management teams for approval.
2	Is the least bidder being always the bureau preference during procurement If yes why?	- Yes, most of the time the procumbent process will conduct in 2-way evaluation Technically responsive (Preliminary & detail) and Financial Least bidder
3	Do you think our countries local contractors are well competitive?	Not as it is expected (Not at all!)

4	From your experience what are the major areas to be improved technically by the local contractors in order to increase their (Local contractors) competitiveness?	- They must participate in huge WWTP project as joint venture and/or as a sub-contractor under mega foreign contractors so that to acquire experience. - Experience related to new WWTP technologies innovations - Having latest and modern machineries and equipment's - Availability of skilled human resource who were involving the treatment project construction
5	Why the bureau always implements ICB (International competitive bid) instead of NCB (national competitive bid)	Almost the entire project is funded by World Bank, Hence, conducting ICB is the world's banks procurement invitation regulation we are obliged to conduct it.
6	In your opinion how to empower and enhance local contractors 'competitiveness in order to undertake wastewater treatment projects - From your bureau (AAWSA) perspectives - From local contractors' perspectives - From Governments perspectives	***From the employer perspective*** - Make available adequate WWWTP projects by approving budget. - Create fair and equals opportunity for local contractors. - Prepare & Adopt technical evaluation criteria which will be compatible with local contractors without compromising the technology. ***From the Contractors perspective*** - Built reliability (Focus on quality) ***From the Governments perspective*** Giving different incentives to local contractors

4.2.6 Discussion on questions and answers conducted with consulting firms

In this section the researcher tries as much as possible to raise questions that are related with the subject matter directly in consultation of supporting officials to consulting firms' personnel's and their subsequent replies is discussed in detail as follows.

Table – 9, List of Questions raised and concluded Answers from consulting firms

Item No	Raised Questions	Concluded responses
1	What are the factors to be considered regarding with Local contractors' competitiveness?	- Skilled personnel arrangement - The firms equipped with the latest equipment and machineries - Annual financial turnover - Firm annual and consecutive years financial profit - Experience (General and Specific) - Firms finical liquidity and liability status - Having Feasible strategic plan Expertise follow up system and tracking mechanism for project on different stages (Startup, construction, completion & operation)
2	Do you think our countries Local contractors (LC) are competitive to undertake Wastewater treatment projects (WWTP)?	Not at all

3	If your answer is YES for the above question what is the LC competitiveness level (Low, moderate or High?).	Low
4	If LC is not well competitive, in your expertise what are the major factors for not being well competitive?	For not having and fulfilling the points raised question No-1
5	What will be the consultant's firm's roll for enhancing LC competitiveness to undertake WWTP projects?	- Involve in procurement phase in order to set reliable specification and accommodation which will be compatible for the local contractors - Give technical advice to the employer in technical evaluation criteria which gives upper hand to local contractors - Conducting expertise follow up and tracking mechanism during construction phase and aware the Local contactor and the employer for early notification and correction - Approval of MAS (Material approval sheet) on time for catalyzing the project - Approval and follow up project schedule - Approval of any payments which will be requested by the contractor - Give timely and technical response of any contractual and operational request and clarification by the contractor - Helping and suggesting the Local contractor related to new technology and innovation exposures and any other technical matters
6	What will be the Government specially the employer (AAWSA) roll for enhancing the	- Creating a plat form for experience sharing with international contractors engaged on WWTP projects

	LC competitiveness to undertake WWTP projects?	- Fairness and Equity to all bidders during Bid Evaluation & Awarding - Avoid fraud and corruptions up on evaluation - Adopting bid criteria which highly conserved the local contractors
7	Are there any other stake holders in the construction industry which will have a roll in enhancing the LC competitiveness to undertake WWTP projects and what will be their fundamental roll?	Funder organization must release the fund and payment within the anticipated time
8	What is the LC performance on the projects mentioned in question No 1?	Very poor
9	What must the LC do in order to increase and upgrade their competitiveness to undertake WWTP projects?	Fulfilling the points raised question No-1
10	Generally, is there any opinion, suggestion and comment other than the above raised questions related to Local contractors' competitiveness to undertake WWTP projects.	The Government must give great attention to the construction industry especially for waste water treatment projects because they have huge impact in the countries growth and enhancement of living standard.

4.2.7 Discussion on questions and answers conducted with Local construction firms

In this section the researcher tries as much as possible to raise questions that are related with the subject matter directly in consultation of supporting officials to local construction firms' personnel's and their subsequent replies is discussed in detail as follows.

Table – 10, List of Questions raised and concluded Answers from local construction firms

Item No	Raised Questions	Concluded responses
1	What is your firm's performance on the above-mentioned projects?	Not satisfactory
2	What are the contractual, operational & technical challenges that your firm face on the above listed projects regarding with	
	Procurement phase	- Choosing incorrect project delivery system and poor feasibility study both technical and economical. - Floating the bid with poor consistency and incompleteness (incomplete design and specification), discrepancy between bid documents. - Unrealistic technical requirement to participate on the bid, - Shorter projects durations which results by not clearly identifying on the implementation process.
	In construction phase	Issues listed above on procurement phase manifest themselves on this stage. - Due to missing specification a lot of variation works are issued for the contractors. - Due to incomplete drawings the contractor received many rework and suspension of

		works. - It is obvious WWTP have civil work and electro mechanical works the integration design of this two major part of the project is main problem during the construction phase - There is no materials, expertise and designer of EM work in local market due to this the contractor forced to work with experienced foreign sub-contractor or designer. - Client unwilling to release the contractor's payment on time - Shorter projects durations which results by not clearly identifying on the implementation process. - Lack of accurate and detailed design, lack of skilled man power and required fund. - Missed items, shipment delays and damages, LC opening problems, Custom clearance problems.
	Completion and operation phase	- Most of the time contractors will complete the civil work successfully but unable to complete the electromechanical work by integrating with the civil work - There is no independent specialized contractor or experts to conduct test and commissioning of the completed project. - The client unwillingness to pay for the contractor for operational period. - Lack of skilled manpower to hand over the projects, client willingness to avail required skilled manpower and receive the project to resume operation. - Availability of required spare parts and consumables which will be continuously imported from foreign suppliers
3	What are the core points to be considered in your firm regarding with	- Having Management Manual - Having Personnel Administration Manual

	competitiveness?	- Having updated Job Description - Having latest and modernized Required Machinery to be owned - Having professionals who are capable of in designing and in operation WWTP Projects - Having Updated Program (Updated Master Schedule) - Having updated strategic plan and project management protocols
4	Do you think your firm is competitive to undertake Wastewater treatment projects (WWTP)?	Yes, but our firm should fulfill the above factors for its competitiveness
5	If your answer is YES for the above question what is your firm's competitiveness level (Low, moderate or High?)	Moderate
6	If your firm is not well competitive, what do you think the factors are?	- Limited experience on only WWTP projects - Lack of Project Management Manual - Lack of Personnel Administration Manual - Lack of Job Description - Lack of Required Machinery to be owned - Limited professionals who are capable of designing WWTP Projects - Lack of Contractor's Updated Program (Updated Master Schedule) - Lack of strategic plan
7	What is your firm plan to increase and upgrade your competitiveness to undertake WWTP projects?	- Try to gain& share experience from foreign contractors by working jointly - Prepare and implement smart, efficient and accurate Strategic Plan - Preparation & application of Project Management Manual

		- Preparation & application of Personnel Administration Manual - Preparation & application of Job Description - Owning of Required Machinery - Availing professionals who are capable of designing and implementation of WWTP Projects - Preparation & application of Contractor's Updated Program (Updated Master Schedule) in all its contracted WWTP - Prepare and apply Strategic Plan - Trying to get all products and all required resource to assemble the required components of WWTP locally
8	What will be the consultant's firm's roll for enhancing your firm's competitiveness to undertake WWTP projects? (If the consulting firm has a value regarding with the matter).	- Requesting and control the application Contractor's Updated Program (Updated Master Schedule) - Approving the designs timely - Considering the Contractor as a responsible stakeholder - Preparing a very generic specification which does not incline to a specific brand and technology and give room to the industry experts to propose the type of WWTP to be delivered.
9	What will be the Government specially the employer (AAWSA) roll for enhancing your firm's competitiveness to undertake WWTP projects?	- Arranging project visit to the specialized sub-contractor and supplier foreign country for Experience sharing (creating a plat form for experience sharing) - Fairness and Equity to all bidders during Bid Evaluation & Awarding - Avoid fraud and corruptions - The Government is becoming more reliant on its service providers as implementers, both for the delivery of services and for the creation of new or improved processes to support

		service delivery. - Good contract management instruments should be applied as it eases the efficient absorption of funds. The stages before contract placement are critical in shortening the time to the commencement of absorption, and then the implementation phase is where absorption takes place. - Effect payments timely - Undertake stakeholders' consultation regularly - Making the procurement activities very transparent as well as encouraging local contractors to get an advantage while competing in the market/bids. Or creating mechanisms that help local contractors associate themselves with foreign to get technology transfer. - The employer must adopt technical qualification criteria which highly considered the local contractors financial, physical and operational stand. - The employer must have rule and regulation that limits the interference of foreign contractors or which will declare to work as JV with local contractors to increase the local contractors experience and competitiveness - The employer should be giving local preference for local contractors by considering that if the project awarded for the local contractor the client or the country save their foreign currency expense
10	Are there any other stake holders in the construction industry which will have a roll in enhancing your firm's competitiveness to undertake WWTP projects and what will be their	- Country's custom office to reduce the tax for importing EM equipment and materials. - University and technical and vocational colleges to graduate students by EM works for WWTP Projects - NGOs, World Bank and any other funder to propose and approve budget for WWTP

	fundamental roll?	projects which will improve our countries living standard and guarantees healthy & productive nations.
11	As an LC firm did you have a strategic plan to increase and upgrade your firm's competitiveness to undertake WWTP projects? If you have please mention core points.	Yes, but highly recommended to revise it tentatively

4.3 Current status and contractual summery of the procured projects

The current status of the wastewater treatment projects which were described and discussed in the sub section 4.2 will be summarized in tabulated form as follows.

Table – 11, Current status of the procured projects

Description	***Koye Fetche Lot-1***	***Koye Fetche Lot-2***	***Koye Fetche Lot-3***	***Package Lot 1 & 2***	***Chefe Waste Treatment project***
Employer	AAWSA	AAWSA	AAWSA	AAWSA	AAWSA
Consultant	SWS consult (Local)	SWS consult (Local)	SWS consult (Local)	Hywas Engineering (Local)	Seureca consult (Local)
Contractor	Contractor A (Foreign)	Contractor A, (Foreign)	Contractor B, (Foreign)	Lot-1, Contractor A, (Local)& Lot-2, (Foreign), Contractor C	Contractor D, (Foreign)
Project duration	365 days	365 days	365 days	330 days	540 days
Contract signing date	Aug/16/2019	Aug/16/2019	Aug/20/2015	Sep/11/2015	Jul/26/2017
Commencement date	Dec/31/2019	Dec/31/2019	Sep/15/2015	Mar/22/2015	Sep/20/2018

Contract amount	119,771,592.9 ETB & 6,780,200.25 EURO	136,502,448.5 ETB & 10,353,952.9 EURO	183,036,969.4 ETB & 9,204,723.1 EURO	Lot-1,100,223,152.9 ETB & 5,971,663.2 EURO,125,016.3 USD and Lot-2,93,306,763.9 ETB,14,890,921.02 Euro	133,576,411.78 ETB & 4,885,152.9 USD
To date project progress	73.4%	51%	99%	100%	100%
Time elapsed	-	-	-	-	-
Actual project status	In Termination process	In Termination process	In Progress	On operation	On operation
If Terminated or Suspended, main reason for suspension and/or Termination	A) LC opening problem B) Poor performance of the contractor	A) LC opening problem B) Poor performance of the contractor	-	-	-
Major contractual and other problem experienced	The civil works must constructs integrated with the EM works so delaying in opening of LC for the EM items delays the civil work and even suspend it temporally.	The civil works must constructs integrated with the EM works so delaying in opening of LC for the EM items delays the civil work and even suspend it temporally.	A) Sewage problem for commissioning& testing B) Covid -19 pandemic suspension	- Delay in LC opening - lack of local contractor's experience for the new technology	Covid -19 pandemic suspension
Main contractors' performance					- The weakness of contractor is delay on providing and submitting technical document for

	Poor performance specially following project work schedule	Poor performance specially following project work schedule	Poor performance specially following project work schedule	- Poor time management - Even if the technology were new the local contractors were egger to attain quality.	the consultant for approval & changing of project manager repeatedly - The contractor's strength is having well experienced employees
Problems experienced with other stakeholders other than contractors	The Employer – delay in opening of LC	The Employer – delay in opening of LC	The Employer – delay in opening of LC	The Employer – delay in opening of LC	Employers fails to open LC on time without delay and providing enough waste water for test and commissioning of the treatment plant

4.4 Challenges of Local contractors to undertake wastewater treatment projects around A.A

A) *Procurement phase*

- Choosing incorrect project delivery system and poor feasibility study both technical and economical.
- Floating the bid with poor consistency and incompleteness (incomplete design and specification), discrepancy between bid documents.
- Unrealistic technical requirement to participate on the bid,
- Shorter projects durations which results by not clearly identifying on the implementation process.

B) *In construction phase*

Issues listed above on procurement phase manifest themselves on this stage.

- Due to missing specification a lot of variation works are issued for the contractors.
- Due to incomplete drawings the contractor received many rework and suspension of works.
- It is obvious WWTP have civil work and electro mechanical works the integration design of this two major part of the project is main problem during the construction phase
- There is no materials, expertise and designer of EM work in local market due to this the contractor forced to work with experienced foreign sub-contractor or designer.
- Client unwilling to release the contractor's payment on time
- Shorter projects durations which results by not clearly identifying on the implementation process.
- Lack of accurate and detailed design, lack of skilled man power and required fund.
- Missed items, shipment delays and damages, LC opening problems, Custom clearance problems.

C) *Completion and operation phase*

- Most of the time contractors will complete the civil work successfully but unable to complete the electromechanical work by integrating with the civil work
- There is no independent specialized contractor or experts to conduct test and commissioning of the completed project.

- The client unwillingness to pay for the contractor for operational period.
- Lack of skilled manpower to hand over the projects, client willingness to avail required skilled manpower and receive the project to resume operation.
- Availability of required spare parts and consumables which will be continuously imported from foreign suppliers

4.5 Critical success factors that enable local contractors to enhance their competitiveness

The critical success factors that must highly considered in order to enhance the local construction firm's competitiveness to undertake wastewater treatment construction projects are,

- The local contractors must participate in huge WWTP project as joint venture and/or as a sub-contractor under mega foreign contractors so that to acquire experience.
- Experience related to new WWTP technologies innovations
- Having latest and modern machineries and equipment's
- Availing skilled human resource who were involving the treatment project construction
- The employer AAWSA has to make available adequate WWWTP projects by approving budget and also has to create a plat form for experience sharing with international contractors engaged on WWTP projects
- The employer AAWSA has to create fair and equal opportunity for local contractors.
- The employer AAWSA has to Prepare & Adopt technical evaluation criteria which will be compatible with local contractors without compromising the technology and if the project awarded for the local contractor the client or the country save their foreign currency
- The employer has to making the procurement activities very transparent as well as encouraging local contractors to get an advantage while competing in the market/bids. Or creating mechanisms that help local contractors associate themselves with foreign to get technology transfer.
- The key points that LC firms must consider regarding with competitiveness are
  - Having latest and modernized Required Machinery to be owned.
  - Having professionals who are capable of in designing, construction and in operation WWTP Projects.
  - Having updated strategic plan and project management protocols.
  - Prepare and implement smart, efficient and accurate Strategic Plan

- Preparation & application of Project Management Manual
- Preparation & application of Personnel Administration Manual
- Boost up annual financial turnover
- Attaining Firms annual and consecutive years financial profit
- Expertise follow up system and tracking mechanism for project on different stages (Startup, construction, completion & operation)

4.6 Generalized information obtained from data collection instruments

- The WWTP projects launched by the employer AAWSA for the past 7 years are 5 WWTP projects.
- For the launched 5 projects the employer has been arranged total budget of 927,086,830.9 ETB, 47,201,460.52 Euro and 5,046,639.7 USD generally close to 4 Billion ETB.
- For the launched 5 projects cumulatively 46 local contractors buy the bid, on average 11 local contractors participates in the bids and only 1 contractor passes the technical evaluation.
- The basic failures focus area of the local contractor upon the technical evaluation session were
  - No affidavit compliance regarding with manufacturing authorization, warranty & catalog for EM equipment's.
  - Not fulfilling Equipment and personal criteria.
  - Not fulfilling preliminary evaluation criteria regarding with contractor's firm grade
  - Not meeting the minimum required average annual construction turn over & financial resources and minimum equipment requirement.
  - Some of the JV partners did not submit Bid submission sheet.
  - Rejection of bidders with a record of pending litigation.
  - Not having Renewed Grade license.
  - The LC personnel did not meet the minimum requirement and did not meets specific experience.

Generally, the above listed critically analyzed collected information's enables the researcher to conclude on the subject matter however the researcher is unable to compare the interpreted research results with other studies because the researchers could not find any studies with the related topic and concerning the same objectives.

The researcher confirms validity and reliability on both instruments through;

In document review – the researcher collects the data for in-depth document review from Addis Ababa water and sewerage authority (AAWSA) archive department so almost all of the collected and interpreted raw data's and reporters are verified by auditing and consulting bureaus so the researcher finds the information & data collected in the topic is valid and reliable.

In the interview session – the researcher conduct interview with different entities i.e. with the employer AAWSA, consulting firm and local contractor firms by raising questions with almost linear content & concept. However, while concluding the answers the researcher uses triangulation in order to validate the responses i.e. for one specific question the researcher picks answer that has been answered in the same ways by individuals (management personnel's) from the mentioned firms and by further counter checking the replies with information retrieved from document reviewing session.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion of the study

The researcher finally reaches on conclusion after going through detail document review and conduction of structured interviewees.

The researcher at this point has collected and analyzed enough information regarding with the research objective and ready to conclude hence it is good to remind the research questions in order help the reader to correlate with the research objectives

The basic research questions were

1) What is the level of competitiveness of the local contractors to undertake waste water treatment projects in & around Addis Ababa?
2) What are the challenges facing the local contractors regarding with competitiveness?
3) What are the critical success factors that would enable local contractors and enhance their competitiveness to undertake wastewater treatment construction projects?

And the conclude answers for those research questions are;

1) By reviewing WWTP construction projects which were procured by AAWSA for the past 7 years, out of 5 procured projects only 1 local contractor manage to pass the preliminary technical evaluation in only 1 project but later fails to pass the finial technical evaluation criteria but in contrary there were 5 foreign contractors which were technically responsive in all 5 procured projects and majority of them manages even to win the bids. Hence, finalizing the review on the general procurement process and results the researcher concludes that the local contractor's competitiveness level to undertake wastewater treatment projects is LOW.
2) The basic challenges facing local contractors' competitiveness are
    - Availability of skilled man power/personnel which specialized on WWTP projects
    - Shortage of cash flow to purchase machineries and equipment's which will be compatible for the technology
    - Lack of expertise knowledge to derivate feasible firm's strategic plan

- Lack of experience on WWTP projects and technologies
- Difficulty and shortage to obtain letter of credit (LC) and foreign currency problems if almost all of the EM equipment's are to be purchased and imported from abroad
- Scarcity of EM equipment's local supplier
- Shortage on production of Chemicals and other spare parts for operation on the completed projects (on operation and maintenance phase)
- Choosing incorrect project delivery system and poor feasibility study both technical and economical (on procurement phase).
- Floating the bid with poor consistency and incompleteness (incomplete design and specification), discrepancy between bid documents (on procurement phase).
- Unrealistic technical requirement to participate on the bid (on procurement phase).,
- Shorter projects durations which results by not clearly identifying on the implementation process (on procurement phase).
- Fraud and improper relation between the employer and contractor/supplier (on procurement phase).

3) The critical success factors that would enable local contractors and enhance their competitiveness to undertake wastewater treatment construction projects are discussed under recommendation sub section.

5.2 Recommendations

In The recommendation sub topic, the researcher tries to give technical recommendation for the conclusion and results obtained on the above chapter. The recommendation sub topic is further classified in to recommendations that the researcher provides to major stake holders which involves in the industry.

5.2.1 Recommendation for Employers

In order to enhance the local contactors competitiveness to undertake wastewater treatment projects (WWTP's) the employer must consider & implement the following key points;

- The employer has to create fair and equal opportunity for local contractors by Preparing & Adopting technical evaluation criteria which will be compatible with the local contractors without compromising the quality & technology.

- The employer has to entertain DBB project delivery system to minimize communication barrier and contractual discrepancies
- Creating a plat form for the Local Contractors so that they can share experience with international (foreign) contractors engaged on WWTP projects.
- The employer has to set a mandatory technical requirement that any eligible foreign contractors must integrate with eligible local contractors as a JV or as a subcontractor in order to participate in the bid ant that will help in empowering the local contractors.

5.2.2 Recommendation for Consultant Firms

In order to enhance the local contactors competitiveness to undertake wastewater treatment projects (WWTPs) the consultant's firm must consider & implement the following key points;

- The consulting firms must integrate with the employer and involve in the procurement phase in order to set compatible technical and financial specification which will be convenient for the local contractors without compromising the general scope of the project.

5.2.3 Recommendation for Local Contractor Firms

In order to enhance the local contactors competitiveness to undertake wastewater treatment projects (WWTP's) the Local contactors (LC's) must consider & Implement the following key points;

- The local contractors have to manage participating in huge WWTP project as joint venture and/or as a sub-contractor with mega foreign contractors so that to acquire experience before participating as leading contractor on WWTP projects.
- The local contractors have to acquire latest and modern machineries and equipment's which will be compatible for new technologies.
- The local contractors have to make available of skilled human resource that are specialized in the wastewater treatment construction projects.

- The local contractors have to manage to establish feasible and implementable strategic plan to increase their level of competitiveness to undertake wastewater treatment construction projects.
- Finally, the local contractors' firms are recommended to form a committee or a team specifically to conduct expertise follow up and tracking mechanism on procurement phase to avoid being rejected by minor & manageable problems.

5.2.4 Recommendation for future studies

The researcher has made a trial mainly to investigate whether our countries local contractors are competitive enough to undertake wastewater treatment construction project and to forward technical suggestion & recommendation for empowering the local contractors by giving tips to increase and upgrade their competitiveness scale. Despite of the limitation regarding with data collection the researcher eagerly tries to compile all relevant information to support the subject matter. However, the responsible parties must overlook the research findings and play their roll to support the countries developing construction industry through enhancing and empowering the local contractors.

More over the researcher highly recommends to the future studies and future researchers to explore more about the competitiveness of local contractors in not only to undertake wastewater treatment construction projects but also to other spectrum of the construction industries because empowering the local contractors is empowering the countries construction industry. However, the researcher will advise the future researchers to emphasis on the sanitation sector because sanitation is vital for a countries development as well as the development of the industry, since identifying and proposing further feed backs which will be observed as a problem and as a constraint on the sector will add value to take further correction and remedial measurements.

"END"

References

- Patton 1999,Forum, Oncology Nursing. (2014, september 05). *Methods & Meanings*. Retrieved April 28, 2021, from https://scholar.google.com/scholar=Patton+(1999)&hl=en&as_sdt=0&as_vis=1&oi=scholart
- Wisdom jobs. (2020). *Reaserch methodology tetorial*. Retrieved March 15, 2021, from Case Study Method in Research Methodology - Research Methodology: https://www.wisdomjobs.com/e-university/research-methodology-tutorial-355/case-study-method-11496.html
- 2021, Wikipedia. (n.d.).
- AAWSA. (June/28/2017). Retrieved Jun 11, 2021, from https://aawsa.gov.et/2017/06/?lang=en
- Abraham, G. (2000). Identification of critical success factor for construction. Georgia: Georgia institute of technology.
- Abubeker J.H. (2015). Factors Affecting time and cost overrun in road construction projects. Addis Ababa: Journal of business and administrative studies (JBAS).
- ACRP. (2009). *A guidebook for selecting airport capital project delivery methods.* Washington,DC: Airport Cooperative Research Program.
- Alliance, E. (2020). *Construction and opportunities in Ethiopia.* USA: Experts Alliance.
- Ambulkar, A. (2019). *Guidance for professional development in drinking water and waste water industry.* United kingdom: International Water Association.
- Barney, J. (2001). Reasurce based theories of competitve advantage. *a ten year retrospective on the resource based view, 27(6)*, 643-650.
- Bearup and O'Donnell. (2007). Alternative delivery methods, a primer. North America. Chicago, IL.
- Bernard,Lewis & sheppard. (2002 & 2006). *Ethnobotany Research & Applications*. Retrieved March 02-05, 2021, from www.ethnobotanyjournal.org/vol5/i1547-3465-05-147.pdf
- Bryman,A & Bell,E. (2007). *Business reaserch methods.* UK: Oxford universty press.
- Bubeker, A. (2018). A COMPARATIVE ANALYSIS OF THE COMPETITIVENESS OF CONSTRUCTION . Addis Ababa: AAU Institutional Repository.
- Chinowsky. (2001). Strategic managemnt in engineering orginization. In *Strategic managemnt* (pp. 60-68).

- Corprorate sanitation . (2015). Introdution to wastewater treatment. *sanitaion for city of guelph*, 3.
- Derek Jansen (MBA) and Kerryn Warren (Phd). (2020). *Gradcoach*. Retrieved June 11, 2021, from https://gradcoach.com/what-is-research-methodology/
- development, A. d. (2017). *Project delivery method handbook.* Juneau, AK: State of Alaska Department of Education and Early.
- Dudovskiy, J. (2018). *The ultimate guide to writing a disseration in Business studies* (1st edition ed.). USA: E-book.
- Edutorial, T. (2017, October 29). Retrieved May 08, 2021, from https://www.constructiontuts.com/
- Enshassi A, Mohamed S & Abushaban. (2009). Journal of Civil engineering and managment. *Factors affecting performance of Construction projects located in the Gaza Strip*, PP 269-280.
- Fred Moavenzadeh. (2007). The construction industries in development countries. USA, massachusetts : spiring.
- Hailemeskel, T. (2013). Management control of projects in construction industry. *For partial fullfillment of the requirement of MBA*. New Delhi, maiden Gari: Indra Gandhi National open universty.
- Hatush and Skitmor. (2001). Addressing the contarctor selection problem using an evidential reasoning approch. *Enginnering,construction and Architectural managemnt V-83*, PP 198-210.
- Huang et al. (2010). Competitiveness Factor. Korea.
- J Familiy . (July,2015). Validity,reliability and Generalizability in Qualitive research. *Journal of medicine and primary care,* V-4 (P-3).
- J Familiy Med Prim Care. (July,2015). Validity,reliability and Generalizability in Qualitive research. *Journal of medicine and primary care*, V-4 (P-3).
- Janet Ann. (2007). Construction industry. *Technology adaptation programme*. USA, masssachusetts instrtute of technology: spirings.
- Kaplan R.S and Norton D.P. (1996). Using the balanced scorecard as a startegic managemnt system. (harvard Bus), 75-85.
- Kumar, M. (2013). *slideshare*. Retrieved June 12, 2021, from https://www.slideshare.net/manukumarkm/source-of-data-in-research
- Mimansha Patel & Nitin Patel. (2019). Exploring Research Methodology. *International Journal of reaserch & reviw (IJRR)*, 3-3.

- Ministry of urban development and construction. (2012). Construction industry policy.
- Ofori Kuragu, J.k baiden and badu K.E. (2016). Key performance indicattor for project sucess in Ghanaian contractors. *International journal of construction Engineering and managemnt*, PP 1-10.
- PorterM. (1980 & 1995). Compititive strategy. *Techniques for analyzing industries and competitors*. New york: Free press.
- Ranir Singh (Dr). (2012). Data Analysis. Delhi, National law univercity delhi, India.
- Samson J, Henery A,Dan. T. (2010). An analysis of the comititivness of local construction contractors in Uganda. *Second international conference on advance in engineering and techonology*, PP 346-353.
- Sasse. (1998). *Cromaglass Wastewater Treartment Systems.* Enviro-Thechnolg Inc.
- Shen, L.-Y. (2006). Contractor Key Competitiveness Indicators. *Journal of construction Engineering and managemnt, 132*(4).
- Shrestha,P.P and Mani. (2014). Impact of Design cost on project performance of design-bid-build road projects. *Journal of managemnt in engineering, 30(3)*(10.1061).
- SOPAC. (1999). Small scale wastewater treatmenet project. *Sopac Tecxhinical report 288, 1*, 5-8.
- Tan. (2008). Contractors comititiveness and compititive startegy. *A thesis sbmitted in partial fullfillment of the requirements for degree of docutor of philosophy*. Hong Kong: the polytechnic universty department of building and real estate.
- Technofunc. (2012, June 21). *technofunc.* Retrieved May 08, 2021, from https://www.technofunc.com/
- Tobias, M. (2021, February 6). Roles and responcibilites of contarctor. *Newyork Engineers*, p. 5.
- Trade, I. (2010, June 29). *Economy watch*. Retrieved from Economic watch: https://www.economywatch.com/international-trade/benefit.html
- Veitch, C. (2018, January 30). *African Business Information.* Retrieved May 08, 2021
- Witwatersrand, U. o. (2021). *Research support*. Retrieved Mar 8, 2021 11:59 AM, from Research support guide for faculty and students.: https://libguides.wits.ac.za/reaserach-support
- Wong, C. (2000). Lowest price or value?
- World Bank. (2017). *PROJECT APPRAISAL DOCUMENT.* Addis Ababa: World bank (PAD2108).

- World economic forum (WEF). (2009). *Global Competttiveness report.* Geneva: World economic forum.
- Yong-tao Tan and Li-yin Shen. (2007). *Contarctors key compitive indicators.* Hong kong: Servaying built enviroment.

Annex

Annex-1

1.1 Koye Fetche condominium wastewater Treatment Plant LOT-1

1.1.1 Project density and location detail

Waste Water Treatment plant	Population	Coordinate	Treatment Technology
WWTP1	68,090	479762,984447	Extended Aeration Activated Sludge (EAAS) System

1.1.2 Personal requirement detail

Item No	Position	General work experience in years in construction	Specific experience in years in Water supply and sewerage projects)
1	Waste water treatment plant engineer and lead	10	5
2	Structural engineer	8	4
3	Electrical engineer	7	4
4	Mechanical engineer	7	4
5	Civil Engineer	6	4
6	Project/Contract manager	10	4
7	Concrete Superintendent	7	3
8	Formwork Superintendent	7	3
9	Earthwork Superintendent	7	3

10	Process Mechanical Superintendent	7	3
11	Electrical Superintendent	7	3

N.B – Bidders who score greater than or equal to 75% of the requirement shall be considered as responsive.

1.1.3 Equipment and machinery requirement detail (owned, lease or rental with supportive evidence)

Item No	Equipment Type and characteristics	Minimum Requirement
1	Excavator with hydraulic jack hammer and bucket size of 1- 2 m^3 capacity	1
2	Track type tractor (dozer) – 200 Kw	1
3	Dump trucks - dual axel	3
4	Rock breaking/drilling equipment	1
5	Concrete mixer – 500 L capacity	3
6	Crane – 10 ton	1
7	Truck – ordinary (3t)	1
8	Truck crane	1
9	4WD pick up	2
10	Wheel loader/backhoe (1 m^3)	1
11	Lifting device/hoist cranes (Min 3000 Kg)	1
12	Compressor with tools, hose & jack	1
13	Hand vibratory rollers (500 kg)	2

14	Plate compactors	3
15	Vibration pokers	2
16	Diesel Generator on trolley (500Kva)	1
17	Engine Driven pump (250 m3/h)	1

N.B – Bidders who score greater than or equal to 75% of the requirement shall be considered as responsive.

1.2 Koye Fetche condominium wastewater Treatment Plant LOT-2

1.2.1 Project density and location detail

Waste Water Treatment plant	**Population**	**Coordinate**	**Treatment Technology**
WWTP2	68,090	479856,984724	Extended Aeration Activated Sludge (EAAS) System

1.2.2 Personal requirement detail

Item No	**Position**	**General work experience in years in construction**	**Specific experience in years in Water supply and sewerage projects)**
1	Waste water treatment plant engineer and lead	15	12
2	Structural engineer	10	8
3	Electrical engineer	10	8
4	Mechanical engineer	10	8
5	Civil Engineer	15	8
6	Project/Contract manager	10	8

7	Concrete Superintendent	10	8
8	Formwork Superintendent	10	8
9	Earthwork Superintendent	10	8
10	Process Mechanical Superintendent	10	8
11	Electrical Superintendent	10	8

N.B – Bidders who score greater than or equal to 75% of the requirement shall be considered as responsive.

1.2.3 Equipment and machinery requirement detail (owned, lease or rental with supportive evidence)

Item No	Equipment Type and characteristics	Minimum Requirement
1	Excavator with hydraulic jack hammer and bucket size of 1- 2 m^3 capacity	1
2	Track type tractor (dozer) – 200 Kw	1
3	Dump trucks - dual axel	3
4	Rock breaking/drilling equipment	1
5	Concrete mixer – 500 L capacity	3
6	Crane – 10 ton	1
7	Truck – ordinary (3t)	1
8	Truck crane	1
9	4WD pick up	2
10	Wheel loader/backhoe (1 m^3)	1
11	Lifting device/hoist cranes (Min 3000 Kg)	1

12	Compressor with tools, hose & jack	1
13	Hand vibratory rollers (500 kg)	2
14	Plate compactors	3
15	Vibration pokers	2
16	Diesel Generator on trolley (500 Kva)	1
17	Engine Driven pump (250 m3/h)	1

N.B – Bidders who score greater than or equal to 75% of the requirement shall be considered as responsive.

1.3 Koye Fetche condominium wastewater Treatment Plant LOT-3

1.3.1 Project density and location detail

Waste Water Treatment plant	**Population**	**Coordinate**	**Treatment Technology**
WWTP3	90,480	481500,981880	Conventional Activated Sludge (CAS) System

1.3.2 Personal requirement detail

Item No	**Position**	**General work experience in years in construction**	**Specific experience in years in Water supply and sewerage projects)**
1	Waste water treatment plant engineer and lead	15	5
2	Structural engineer	10	4
3	Electrical engineer	10	4
4	Mechanical engineer	10	4

5	Civil Engineer	10	4
6	Project/Contract manager	10	4
7	Concrete Superintendent	8	3
8	Formwork Superintendent	8	3
9	Earthwork Superintendent	8	3
10	Process Mechanical Superintendent	8	3
11	Electrical Superintendent	8	3

N.B – Bidders who score greater than or equal to 75% of the requirement shall be considered as responsive.

1.3.3 Equipment and machinery requirement detail (owned, lease or rental with supportive evidence)

Item No	Equipment Type and characteristics	Minimum Requirement
1	Excavator with hydraulic jack hammer and bucket size of 1- 2 m^3 capacity	1
2	Track type tractor (dozer) – 200 Kw	1
3	Dump trucks - dual axel	3
4	Rock breaking/drilling equipment	1
5	Concrete mixer - 500 L capacity	3
6	Crane – 10 ton	1
7	Truck – ordinary (3t)	1
8	Truck crane	1
9	4WD pick up	2

10	Wheel loader/backhoe (1 m^3)	1
11	Lifting device/hoist cranes (Min 3000 Kg)	1
12	Compressor with tools, hose & jack	1
13	Hand vibratory rollers (500 kg)	2
14	Plate compactors	3
15	Vibration pokers	2
16	Diesel Generator on trolley (500Kva)	1
17	Engine Driven pump (250 m3/h)	1

N.B – Bidders who score greater than or equal to 75% of the requirement shall be considered as responsive.

1.4 Package wastewater treatment plant and civil work construction (Lot 1 & 2)

1.4.1 Personal requirement detail

Item No	Position	General work experience in years in construction	Specific experience in years in Water supply and sewerage projects)
1	Wastewater treatment plant specialist	10	5
2	Structural engineer	10	5
3	Electrical engineer	10	5
4	Mechanical engineer	10	5
5	Civil Engineer	10	5
6	Project manager	12	8

N.B – Bidders (leading contractor) must meet the requirements.

1.5 Chefe wastewater Treatment Plant – Phase 2

1.5.1 Personal requirement detail

Item No	Position	General work experience in years in construction	Remark
1	Sanitary specialist	Msc-12, Bsc-14	At least 1 Project experience in sewerage facilities and wastewater mgmt. work
2	Quantity surveyor	Msc-4, Bsc-6	At least 1 Project experience in sewerage facilities and wastewater mgmt. work
3	Site Engineer	Msc-4, Bsc-6	At least 1 Project experience in sewerage facilities and wastewater mgmt. work
4	Contract Management Specialist, mechanical Eng.	Msc-8, Bsc-10	At least 1 Project experience in sewerage facilities and wastewater mgmt. work
5	Resident/Sanitary Engineer	Msc-8, Bsc-10	At least 1 Project experience in sewerage facilities and wastewater mgmt. work
6	Project manager	Msc-10, Bsc-12	At least 1 Project experience in sewerage facilities and wastewater mgmt. work
7	Surveyor	Msc-6, Bsc-8	At least 1 Project experience in sewerage facilities and wastewater mgmt. work
8	Civil Engineer/structural Engineer	Msc-4, Bsc-6	At least 1 Project experience in sewerage facilities and wastewater mgmt. work