

# **Sustainability Assessment of Traditional Tendering: 'Comparative Approach'**



**Final Year Project (2018-19)**

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## **CERTIFICATION**

This is to certify that thesis entitled  
Sustainability Assessment of Traditional Tendering:  
'Comparative Approach'

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**For Bachelors in Civil Engineering**

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## **DEDICATION**

We would like to dedicate our work to our parents. It is because of them; we have come this far in life. They have always been there for us and they are the ones due to which we have fulfilled our dreams of becoming an engineer.

## **ACKNOWLEDGMENT**

We thank The Almighty Allah for giving us the strength and belief in ourselves for the undertaking of this final year project. We also take the opportunity to express our gratitude and respect to our parents, without whose prayers and wishes we would never have been able to come this far in our project.

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# Table of Contents

<b>CERTIFICATION.....</b>	<b>2</b>
<b>DEDICATION.....</b>	<b>3</b>
<b>ACKNOWLEDGMENT .....</b>	<b>4</b>
<b>LIST OF FIGURES .....</b>	<b>7</b>
<b>ABSTRACT.....</b>	<b>9</b>
<i>Chapter 1.....</i>	<b>10</b>
<b>INTRODUCTION.....</b>	<b>10</b>
1.1    Background .....	10
1.2    Problem statement .....	10
1.3    Objectives.....	11
1.4    Research Significance.....	11
<i>Chapter 2 .....</i>	<b>11</b>
<b>LITERATURE REVIEW .....</b>	<b>12</b>
2.1    Sustainability.....	12
2.1.1    What is Sustainability?.....	12
2.1.2    Social Sustainability.....	13
2.1.2.1    Equity .....	13
2.1.2.2    Diversity .....	13
2.1.2.3    Interconnectedness .....	14
2.1.2.4    Quality of Life .....	14
2.1.3    Economic Sustainability .....	14
2.1.4    Environmental Sustainability .....	15
2.1.5    Life Cycle Assessment .....	15
2.1.5    Cost-Benefit Analysis: .....	16
2.2    Defining Tendering.....	16
2.2.1    The components of tendering costs .....	17
2.2.2    Tendering Process.....	17
2.2.3    Invitation to Tender .....	18
2.2.4    Pre-qualification.....	18
2.2.5    Submission of Bid.....	19
2.2.6    Qualification.....	19
2.2.7    Types of Tendering.....	20

2.2.8	Open tendering .....	20
2.2.9	Selective Tendering .....	20
2.2.10	Negotiated Tendering .....	21
2.2.11	Serial and Continuity Tendering:.....	21
2.2.12	Single Stage and Two Stage Tendering .....	21
2.2.13	Problems in Tendering .....	22
2.2.14	Barriers to understanding tendering cost:.....	23
2.2.15	Difficulty in determining resources used in tendering: .....	23
2.2.16	Resistance to implement: .....	23
2.2.17	Greed and Corruption:.....	24
2.2.18	Factors Effecting the Resources:.....	24
2.3	Automation .....	26
2.3.1	E-TENDERING .....	26
<i>Chapter 3</i> .....		<b>29</b>
<b>RESEARCH METHODOLOGY</b> .....		<b>29</b>
3.1	Introduction .....	29
3.2	Literature review.....	32
3.3	Data collection .....	32
3.3.1	Questionnaire design .....	32
3.3.2	Final questionnaire .....	33
3.3.3	Data analysis and result .....	33
<i>Chapter 4</i> .....		<b>34</b>
<b>DATA ANALYSIS AND RESULTS</b> .....		<b>34</b>
4.1	Introduction .....	34
4.2	Presentation of results.....	34
<b>4.3 STATISTICAL ANALYSIS</b> .....		<b>40</b>
4.3.1	Reliability of the sample.....	40
4.4	Analysis of the results .....	41
4.4.1	Human resource and Material .....	41
4.4.2	Printing, copying and posting tender documents.....	42
4.4.3	Speed of tendering process .....	43
4.4.4	Overhead costs .....	43
4.4.5	Advertisement and documentation.....	44

4.4.6	Value for money.....	45
4.4.7	Complexity .....	45
4.4.8	Quality of tender .....	46
4.4.9	Lead-time .....	47
4.4.10	Environment.....	47
4.4.11	Flexibility .....	48
<b>4.5</b>	<b>CASE STUDY .....</b>	<b>49</b>
4.5.1	Introduction .....	49
4.5.2	Background of firm .....	49
4.5.3	Case study .....	50
<i>Chapter 5 .....</i>		<b>54</b>
<b>CONCLUSIONS .....</b>		<b>54</b>
4.5.1	General.....	54
<b>4.5.2</b>	<b>CONCLUSIONS .....</b>	<b>54</b>
<b>4.5.3</b>	<b>Recommendations .....</b>	<b>56</b>
<i>Chapter 6 .....</i>		<b>56</b>
<b>REFERENCES.....</b>		<b>57</b>
<b>APPENDICES.....</b>		<b>62</b>
<b>6.1</b>	<b>Questionnaire .....</b>	<b>62</b>

## LIST OF FIGURES

Figure 2.1	Sustainability map.....	8
Figure 2.3.2	E-tendering system.....	28
Figure 3	Methodology Flow Chart.....	31
Figure 5.1	Qualification of Respondents.....	37
Figure 5.2	Professional Experience.....	38
Figure 5.3	Field Of Work.....	38
Figure 5.4	Job Title.....	39

Figure 5.5 Human Resource and Material.....	41
Figure 5.6 Printing, Copying and Posting tender documents .....	42
Figure 5.7 Speed of tendering process.....	43
Figure 5.8 Overhead Costs.....	43
Figure 5.9 Advertisement and Documentation.....	44
Figure 5.10 Value for money.....	45
Figure 5.11 Complexity.....	45
Figure 5.12 Quality.....	46
Figure 5.13 Lead Time.....	47
Figure 5.14 Environmental.....	47
Figure 5.15 Flexibility.....	48



## **ABSTRACT**

Tendering has significant and long lasting economic, social and environmental impacts, and is an important dimension of construction sustainability. Since the traditional tendering procedures cause adversarial relationships and many other problems in all stages of the procurement process, this is a vital improvement area that can prove to be beneficial and contribute substantially to project success

This project aims to identify the problems in the traditional tendering process and adopts a comparative approach in which it is compared to the modern methods of tendering i.e E-tendering. The sustainability analysis is carried out for both methods.

The project involves the identification of the factors that have an impact on the sustainability of the tendering process. The sustainability of each process is assessed through a cost benefit analysis and also by questionnaire survey that gives results from field.

E-tendering provides an economically viable, socially acceptable and environment friendly tendering system which will reduce paper work, cut down the lead time and produce better quality tenders.

## **INTRODUCTION**

### **1.1 Background**

Since the construction projects and their outcomes heavily affect our modern society, the importance of a well-functioning construction industry is beyond doubt. And in many countries construction industry has, however, attracted criticism for inefficiencies like cost and time overruns, low productivity, inadequate customer satisfaction and poor quality (Eriksson and Westerberg 2011). The root causes of the inefficiencies are more or less related to the current practices that are being followed in the Construction industry. According to (Dubois and Gadde 2002) Researchers and society at large, therefore called for a change in the attitudes, behavior and procedures in order to increase the chances for project success and improved end products.

Since the traditional tendering procedures cause adversarial relationships and many other problems in all stages of the procurement process, this is a vital improvement area that can prove to be beneficial and contribute substantially to project success(Erik Eriksson and Laan 2007). This study suggests that there is a need to tailor the traditional tendering process. However public sector is considered reluctant to change and no specific previous research has been conducted to identify and quantify the losses encountered due to the traditional practices. The essence that is missing is the realization by the Government itself that the old system could not deal adequately with the emerging demands on the system in terms of transaction numbers expanding value of procurement budgets, scale and technical complexity of procurement activities. Therefore, the sustainability assessment of the tendering process is vital and there is a need to understand the problems related to the traditional practices in tendering.

### **1.2 Problem statement**

Traditional procurement/tendering process prevails in the construction industry of Pakistan but with recent technological advancements, this traditional process is rapidly becoming outdated;

with the introduction of new technologies such as e-procurement and e-tendering. However, a considerable proportion of the industry remains uncertain about embracing new technologies. This reluctance is mainly due to the lack of sustainability analysis of traditional tendering and new methods like e-tendering. There is a need to study the wastage of resources (time, cost etc) associated with the traditional tendering process, to get a clear idea about the losses encountered due to these manual processes. A data-based comparison can help motivate a change from traditional to a modern approach in tendering of projects in the construction industry.

### **1.3 Objectives**

With this notion in mind, this research is based on the sustainability of the traditional tendering process used for public procurement. The case would be backed by data of the identified factors that affect the sustainability of the tendering process (Henceforth “the Factors”).

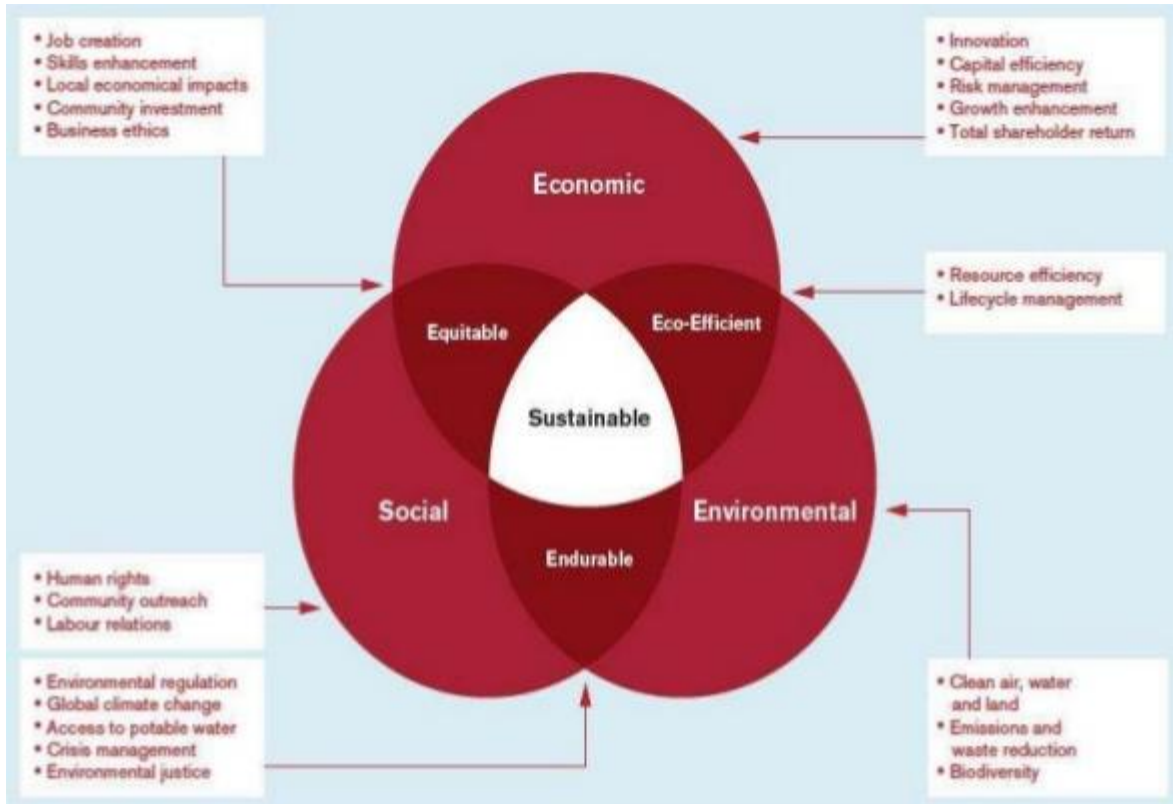
- 1) To identify the factors that are intuitive, widely expected, have a strong linear relationship with the sustainability of the process.
- 2) Identify problematic components in the traditional tendering process and link the factors that are included in these processes.
- 3) Comparing the impact of the factors in traditional tendering process and e-tendering.

### **1.4 Research Significance**

The findings of this research can be a benchmark or reference material for future studies into finding the appropriate solutions to these problems. It will be easier to compare the sustainability of the different tendering techniques based on the factors that are identified in this research. There appears to be little research on the cost of tendering and people are more interested in the impacts of different procurement techniques however little importance is given to tendering. This research will be one of its kind and can help the government sector in choosing the type of tendering.

# LITERATURE REVIEW

## 2.1 Sustainability



**Figure 2.1** (Shriberg 2004)

### 2.1.1 What is Sustainability?

In 1987, the **United Nations** Brundtland Commission **defined sustainability** as “*meeting the needs of the present without compromising the ability of future generations to meet their own needs.*” (“The Principles of Sustainability | Taylor & Francis Group” n.d.) Since then sustainability has emerged as a universal methodology for evaluating whether human options which will yield social and environmental vitality.

Sustainability encourages the framing of decisions in terms of years and decades rather than on the next quarter's earnings report and to consider more factors than simply the profit or loss involved.

It presumes that resources are finite, and should be used conservatively and wisely with a view to long-term priorities and consequences of the ways in which resources are used.

The concept of sustainability is composed of three pillars: social, economic and environmental sustainability. It is based on system theory and stipulates that the society, economy and environment are interconnected parts of a larger system.

Social sustainability promotes social development, seeking cohesion between communities and cultures to achieve satisfactory levels in quality of life, health and education. Economic sustainability focuses on equal economic growth that generates wealth for all without harming the environment. Environmental sustainability is concerned with assuming that nature and the environment is an exhaustible resource and so, it is necessary to protect it and use it rationally.

### **2.1.2 Social Sustainability**

Social Sustainability is an integral part of the idea of sustainability. According to the Western Australia Council of Social Services (WACOSS), *"Social sustainability occurs when the formal and informal processes; systems; structures; and relationships actively support the capacity of current and future generations to create healthy and livable communities. Socially sustainable communities are equitable, diverse, connected and democratic and provide a good quality of life."* (Barr 2002)

The core principles of Social Sustainability (Barr 2002) are as follows:

#### **2.1.2.1 Equity**

The community provides equitable opportunities and outcomes for all its members, particularly the poorest and most vulnerable members of the community.

#### **2.1.2.2 Diversity**

The community promotes and encourages diversity.

### **2.1.2.3 Interconnectedness**

The community provides processes, systems and structures that promote connectedness within and outside the community at the formal, informal and institutional levels.

### **2.1.2.4 Quality of Life**

The community ensures that basic needs are met and fosters a good quality of life for all members at the individual, group and community level.

Democracy and Governance. The community provides democratic processes and open and accountable governance structures.

These principles aim to identify the goals of socially sustainable communities and to this end are visionary statements that describe what makes a community healthy and livable, considering both the present and the future.

The concept also encompasses many things such as human rights, environmental law, and public involvement & participation. Failing to put emphasis on the social part of decision or action can result in the slow collapse of the spheres of sustainability.

### **2.1.3 Economic Sustainability**

The general definition of economic sustainability is the ability of an economy to consistently support the required level of economic development without compromising future needs. It implies that we must use, safeguard and sustain resources to create long-lasting sustainable values by means of optimization. (Shriberg 2004)

The core of economic sustainability lies in the concept of moderation in consumption of resources, material and energy. This concept can help control over-production, excessive waste, over-consumption of natural resources etc.

A sustainable economy will be better poised to eradicate poverty, illiteracy, epidemics and improve infrastructure. Unsustainable economies can result in disasters like climate change, epidemic, famine and even war.

In a Sustainable Economic System not only financial capital but also human, natural and social capital are given due weightage. (Basiago 1995)

Without economic sustainability, the social and environmental parts of sustainability cannot be successfully implemented.

#### **2.1.4 Environmental Sustainability**

There is extensive literature on Environmental Sustainability and it has been defined in many different ways. The definition that is most consistent and precise is " as meeting the resource and services needs of current and future generations without compromising the health of the ecosystems that provide them". (Morelli 2011)

Healthy ecosystems provide vital goods and services to humans and other organisms. The environment consists of the Atmosphere, Fresh Water and Oceans and Land. It is important to understand, no matter how vast, all three are natural recourses that are finite and will deplete or disintegrate if not managed responsibly, long-term. The provision of clean air, clean water, and clean and productive land is foundational not only to a responsible socioeconomic system but to life itself, thus, of the three pillars, Environmental Sustainability hold the most weightage.

#### **2.1.5 Life Cycle Assessment**

Life cycle assessment is also called "cradle to grave" analysis. As the name suggests, it is used for determining the environmental impact of anything from its raw form to the disposal of it. A lot of techniques have been developed previously for the Environmental Performance Evaluation (EPE) like Environmental Indicator System (EPI), Environmental Management Accounting (EMA), Eco-labeling, and the Life Cycle Assessment (LCA) (Standardization 2006) which is the most accurate and complete. The technique caters for the impact of extraction of material, material processing, manufacture of product, distribution, usage of product, maintenance and recycle or disposal which are the processes if a product's life. The environmental aspects such as air, water, soil-emissions, raw material consumption and land use should be included in the Life Cycle Analysis. Aggregation of impacts is carried out so data can be transformed in informative form so it could help in decision making. LCA is related to sustainable materials which require less energy for their production than traditional materials. (Asdrubali 2009).

For better results, it is suggested to follow the steps of LCA.(Buyle, Braet et al. 2013) The first step is identifying the scope, defining objections and problem statement, getting a functional unit and defining boundary limits. Processing the input data points of the whole life cycle is the second step. The main step is the third step which consists of the quantification of the environmental impacts in the inventory analysis.

### **2.1.5 Cost-Benefit Analysis:**

Cost-Benefit Analysis is a technique used for decision making in selection one of the two alternatives in terms of benefit and cost preserve in selecting the better one. It works by quantifying and incorporating the strengths and weaknesses of multiple parameters. It is also used for comparing qualitative aspects in terms of cost so each parameter can be compared in the same unit. The process for cost-benefit analysis includes defining objectives, listing alternatives, determining all the stakeholders that may be effect the alternatives, selecting measuring unit, prediction of cost and benefit outcomes in a fixed time frame, conversion of all the costs and benefits in a common currency, performing sensitive analysis and finally, making decisions on the basis of calculation. The best part of this technique is to include intangibles as the parameters for comparison which cannot be done by any other technique. Cost-Benefit analysis in construction sector is very useful as a lot of tangible, intangible, complex and huge in number parameters are involved. (Yuan, Shen et al. 2011)

## **2.2 Defining Tendering**

Tendering is an old technique to procure anything that can be useful. For the better understanding of this research we must define tendering. Tendering is defined as:

*'The production and submission of a tender price for carrying out certain stated building works based on a study of the contract documents' (Brett 2012).*

Brett defined tendering in building 2014 as:

*'The process of preparing and submitting for acceptance a conforming offer to carry out work for a price, thus converting the estimate to a bid'.*

According to (Taylor-Roe 1995), tendering process has some main following uses:



1. Selection of a contractor for a construction project.
2. A market search for rates and quality because of the long-term project relationship.
3. To regulate free and open competition.

Similarly, construction tendering is a process to invite the contractors for submitting their bids for a given construction work. Generally, tendering is a long process because of the complexity of the construction works. Tendering can be on an interface between client and contractor, client and contractor or contractor and sub-contractor (Hoxley 2000). Construction works induces a longer relationship with the client and the contractor so tendering is quite complicated. Moreover, technical and financial evaluation is done on the bids submitted by the contractors and then, a contractor is selected for the work. It is not necessary that a bid with lowest price wins the tender but following things are also taken into account which further fall in the 'negotiation' type of tender. Accountability, obtaining best fit contractor and obtaining best price are other factors which will affect the contractor selection other than bids.

### **2.2.1 The components of tendering costs**

Tendering is a process that takes place to provide a transparent selection process that is based on objective criteria. It is most important in organisations that are exposed to a degree of public scrutiny from stakeholders. These stakeholders could be the general public in the case of government departments, or shareholders in the case of businesses. Indeed, there are benefits to the tendering process, but there are also costs. More to the point, if these costs are not managed effectively then they can be quite significant and not provide proportionate returns.

Tendering costs occur during three phases of any tendering process. These are:

- Preparation of tender documents by purchaser
- Preparation of response to tender by prospective suppliers
- Assessment of submitted tenders and selection of supplier

### **2.2.2 Tendering Process**

Generally tendering process consists of different parts. The process of tendering as a general overview is a common practice of tendering around the globe. Contractors can be invited for tender notice of variety of contracts like demolition, maintenance, construction project, parts of a project, etc. Following are the main steps involved in the process of general tendering.

### **2.2.3 Invitation to Tender**

At the very start an invitation to tender is processed. Client gives out the details of the work what is to be done. Work consists of quality and quantity of the work. With the invitation for bid, client also releases a pre-qualification criterion for the contractors that can apply. The main reason of pre-qualification is to shorten the list of contractors that have the capability of doing the work depending upon the scope of the work. This helps in lessen the time wasted. An invitation to tender includes a letter of invitation to tender, the form of tender document, pre-construction information or site waste management, the form of contract being offered, a tender pricing document, a drawing schedule, some basic design drawings and specifications of the drawings.

### **2.2.4 Pre-qualification**

Pre-qualification is basically a criteria set for the contractors to shorten the list of contractors for competition for the project which puts the client at a position in which any of the contractors selected will be capable of execution of the project (Finch 2011). This stage must include: (Smith, Merna et al. 2009)

**Financial Assessment:** The current financial status of the contractor is essential for assessment to make sure that contractor can carry out the amount of work in terms of money. This also includes the check of previous disputes of contractor, if he contractor has defaulted in any project or if the contractor is black listed.

**Technical Assessment:** This assessment refers to the resources available for the construction work is available with the contractor. This includes the number of engineers, number of machinery that the contractor owns and other specified resources.

**Satisfaction Assessment:** To check if contractor can keep up with the schedule of the timeline of project with respect to previous experience and the quality of the work can be maintained or not.

**Other Assessment:** Other assessment includes the attitude of contractor to claims, risks, communication, environmental factors and safety.

### **2.2.5 Submission of Bid**

In reply to an invitation to tender, contractors who are pre-qualified submit price and technical forms for the scope of the work. Some documents are submitted with the tender fee. These documents reflect the price and the quality of work which the contractor is willing to offer. The documents are not very much detailed but they mention the most important parts. Most commonly, submission of bid include: (Uher and Davenport 2009)

- Notice to tenders.
- Form of tender.
- General conditions of the project.
- Specifications.
- Drawings.
- Bill of Quantities.

BIM execution plan may also be submitted with the bid if client has asked to use building information modeling. Alternative bid is also submitted by enhancing the scope of the project at a better value of money which are called variant bids. Client take a look at these types of bids separately so that he can know what the contractors have to offer him. Notice to tender is responsible to make sure that the all the contractors who are submitting the bid are evaluated under the same criteria (Tang, Lu et al. 2003). For specifications it is suggested that at this stage these should be clear, project specific, appropriate, constructive, up-to-date and clear (Brook 2016).

### **2.2.6 Qualification**

A lot of methods are available for the technical and financial evaluation of the bids received by the client. Clients is interested in meeting his requirements at a lower price possible as a criteria for evaluation (Seeley 1997). A separate consultancy firm is also hired at the start of the tendering process which is also responsible for the evaluation of the contractor's firm and contractor's bid. The variety of methods for the evaluation makes it very difficult to pick a method and evaluate because none of them is wrong and none of them is perfect in each aspect. Some types of evaluation techniques are lowest price bid, most economically advantageous tender, mean value and exclusions of the extremes. Low priced bids are not usually the best bids because they are not usually practical. There are matrixes for the factors which give a score to financial and technical scores. These factors are given a score for each bid and final score for technical and financial specifications are finalized. Then, these scores are added in a fix decided

percentage with cumulative decision of client and consultant and final score is attained. The bid with the highest score gets the tender. The tender awarded contractor is then called for further discussions. These discussions include more specifications of the project and negotiations are also carried out for the project.

### **2.2.7 Types of Tendering**

After the general discussion of the tendering process, it is necessary to study different types of tendering as different types of tendering have different factors that affect the time and cost analysis. These factors should be taken into account for successful quantification of the cost and time wastage in the common tender practices. It is more efficient if factors are categorized as the types of tendering. Types of tendering forms on the basis of the difference in the general process of tendering. Different types of tendering are as follows:

#### **2.2.8 Open tendering**

Open tendering is open to every contractor. Any contractor who is interested in the project can tender in it. In this type of tendering, a lot of unknown organizations can submit their bid for the tender that can be a high risk for the client (Smith, Merna et al. 2009). This technique is usually adopted for the public projects because it provides with the transparency of the project and a wide list of contractors to bid on the tender. But implementation of this tender type has resulted in the decline of the project (Uher and Davenport 2009). Open tendering provides an opportunity for the new contractors to bid for the purpose of growth and diversifying in different types of works that will direct to fulfilling their objectives (Kwakye 1994). Main Drawback of the open tendering is that a lot of bids are to be evaluated technically and financially which waste a lot of money in terms of human resource and consulting services and a lot of time is consumed to get the right contractor (Tang, Lu et al. 2003). Open tendering has been discouraged since 1940's and suggested to alternate it with selective tendering (Griffith, Knight et al. 2003).

#### **2.2.9 Selective Tendering**

(Building 2014) defines selective tendering as follows:

*'A method of selecting tenderers and obtaining tenders whereby a limited number of contractors are invited to tender. The tender list is made up of contractors who are considered suitable and able to carry out the work. This suitability is usually determined by pre – selection procedures.*

A few contractors are invited to bid on the tender. These contractors are already known that they can carry out the work. This reduces the hustle of the client and the risks are reduced. But the competition is low due to which the price of the project can be increased. The main drawback of the selective tendering is that cover pricing can be induced which can reduce the amount of serious bidders (Ofori 1990).

### **2.2.10 Negotiated Tendering**

Negotiation tendering refers to contacting a single contractor for a specific project and negotiating price for the specifications. Usually, the criteria of selecting a single contractor is due to the reputation of the contractor. The final agreement for the first project generates a relationship between the contractor and the client which continues for projects in the future. Due to this relationship, if the client is satisfied by the work of contractor, client would be more inclined to work with the same contractor on the negotiation basis (Hughes, Champion et al. 2015). Some advantages and disadvantages of negotiation are: (Kwakye 1994)

- Early and complete involvement of the contractor.
- Negligible cost of evaluation.
- Less time taken for mobilization and contractual documents.
- Expertise of the contractor can be exploited to maximum extent.
- Approach is not totally accountable.
- Initial price and final price of the project may differ.

### **2.2.11 Serial and Continuity Tendering:**

Serial tendering is used when client has a number of projects and he wants to hire a single contractor so that the projects can be serialized with respect to time and better rates can be originated by a single contractor. These projects are sequential contracted. Usually, the projects are of similar nature so the estimation of projects become easier. Continuity tendering is similar to serial tendering but includes one ensuing project. Subject to satisfactory performance, the second project is negotiated with the contractor on the basis of the prices in the first contract (Mudd 1984).

### **2.2.12 Single Stage and Two Stage Tendering**

The most commonly used methods of tendering around the globe are single stage and two stage tendering around the globe (Finch 2011). In single stage tendering, only one step is included in shortlisting of contractors for the submission of bid and competing for the tender. Shortlisting can be done on the basis of

pre-qualification or after open tendering. Disadvantage of the single stage tendering is that some of the capable are left unattended in the short listing but it has benefits which other tendering types does not have (Kwakye 1994):

- A positive competition among the bidders is generated.
- Cover pricing is minimized to a greater extend.
- The evaluation of bids is less hectic and performance is better.

Two stage tendering involves two steps:

1. Competitive selection of the contractor on the basis of a fixed price of the project.
2. Negotiations of contract details and price with the contractor who is selected in the first stage.

The advantages of two stage tendering are (Rawlinson 2006):

- Early awarding of the tender that does not waste a lot of time.
- It combines the power of competition and negotiation.
- Eliminating the risk of conflicts.
- Contractor contributes to the design.
- Giving contractor a lead to mobilize, plan and schedule.

### **2.2.13 Problems in Tendering**

The cost of tendering is considered to be very excessive but a little empirical evidence is available to demonstrate this and innovative steps should be taken to reduce the cost spent and time taken for tendering (Hughes, Hillebrandt et al. 2001). According to (Dalrymple, Boxer et al. 2006), a cost is spent majorly in three different areas of tendering process which are following:

- Preparation of tender documents.
- Preparation of response to tender.
- Assessment and selection.

Quantification of the resources wasted are to be estimated based on the available data so that other techniques can be adopted and general awareness can be spread about the wastage of the conventional tendering process.

#### **2.2.14 Barriers to understanding tendering cost:**

In the construction industry, it is an assumption that the cost of tendering is very high and it has to be reduced because of the lack of understanding of cost of tendering. Due to this the cost reduction was only possible by introducing the prequalification criteria for tenders. But this prequalification was as unclear as the cost of tendering. This vague understanding did not give importance to the benefits which can be obtained from an organized prequalification technique.

A survey of tendering documentation carried out worldwide showed that organizations did not think that cost of tendering is significant and they were not aware of the money they were expending on tendering. Moreover, no arrangements were made for understanding of this cost. The importance of the cost of tender can be felt by following quote:

*"If contractors are winning typically one tender if four, then we're paying four times the cost of tendering for each contract. The industry needs to find a better way to avoid wasting this money." <http://www.constructingexcellence.org.uk>*

For better understanding we divide the barriers in following sub-categories.

#### **2.2.15 Difficulty in determining resources used in tendering:**

Cost of tendering can only be understood if the data is accurate and if it can be presented in a meaningful way. However, a lot of times the resources used are not directly contributing to the cost of tender but still they have significant contribution to the cost of tendering. Furthermore, the understanding complexes due to the manipulation of the data for personal gains.

#### **2.2.16 Resistance to implement:**

A lot of organizations started keeping record of the data of cost of tender but most of them failed to act on it. Government has repeatedly added clauses in law for tracking the cost of tendering because it effects both the operations team and also the tenderers. Many companies also changed

their policy in the favor of determining the cost of tendering but they did not implement it because it cost them more human resource. Companies were thinking only on a shorter time scale but not the big picture of tendering process. Still, when representatives of the companies are asked for the data, they are confident about the quantity and the impact of resources used but in fact, no accurate data is available.

### **2.2.17 Greed and Corruption:**

People misuse the power of their organizational positive and the reward system of the environment. The greed is often satisfied in different forms of corruption for personal gains. Sometimes cold-blooded ethical decisions have to be made for the betterment of the society. There exist four logical reasons that a person gives himself for the doing of some unethical act. First is that they pretend that they are deciding in the ethical limits, second is that they think of personal gain is not bad, third is to think that it would be safe by him and no one would ever find out and lastly fourth one is that the decision adds up for the achievement of objectives. Corruption in construction sector is common due to the complexity of the process. Giles Commission (1992) stated the solution to the cost of tendering in the terms of corruption aspects:

*"Each company submitting a tender added a certain amount that (in the event of winning the tender) was understood to be distributed among the other tenderers (those who did not win the contract)."*

### **2.2.18 Factors Effecting the Resources:**

First, we need to identify the resources which are possibly wasted extensively during the process of tendering. With the qualitative analysis, it is proven that the two major resources in a tendering process are money and time.

Sometimes the process of prequalification of contactors is also carried out by the procuring agency in order to shortlist contractors as an inceptoption of the bidding process. This method is extensive enough to entail time and cost expense. The procuring agency forms a set of prequalification documents that include the criteria for a contractor to be qualified to partake in the subsequent bidding process.



The procuring agency shall provide a set of pre-qualification documents to any supplier or contractor, on request and subject to payment of price, if any. The procuring agency uses time and resources into formation of such documents and their required circulation in the relevant audience. Furthermore, time and cost is spent in acquisition of the prequalification documents by the contractors which can be easily avoided if an electronic system for acquisition of said documents is implemented. It is notable that a contractor firm for civil works has to submit bids for several documents in a short span of time and the time requirement for this process can be very crucial in making a decision for both the contractor and the procuring agency.

A procuring agency, at any stage of the procurement proceedings, if feel any discrepancy in the capacities of the contractors, may require the contractors to provide information concerning their professional, technical, financial, legal or managerial competence whether already pre-qualified or not. A qualification may only be decided after putting down the reasons for it in writing and they shall form part of the records of that procurement proceeding. This causes further delays as well as expenditure on resending required data. After the complete analysis of the documents submitted by the contractors, the procuring agency may send out in writing the reason or reasons for either qualification or disqualification to all the contending contractors. This causes further delays due to time spent in printing, sending, and then receiving of the aforementioned written documents which can again be avoided if an electronic system were used to communicate the necessary documents.

Furthermore, it is worth noting that during the above mentioned procedure several interviews and meetings may also take place between the relevant parties to ensure the elimination of doubt and ambiguity. This also entails expenditure of resources on conduction of said meetings.

The code of estimating practices (Building 2014) seems to contain the clearest explanation on tender review meetings. However, this account is based on experiential rather than systematic knowledge. There are several variables associated with tender review meetings, including time of occurrence in the tender process, participants, issues discussed in relation to the tender submission, documents examined, length of meeting, and the extent of working hours, which all have implications for the efficiency of the tendering process, its output, and costs.

## **2.3 Automation**

Looking at the above explained factors, there is a need to think about other ways of tendering. There are different options available other than conventional tendering. For example: e-tendering. A qualitative analysis can be done on the comparison of conventional tendering and e-tendering so that clients know how to eliminate wastage of resources.

### **2.3.1 E-TENDERING**

#### **2.3.1.1 Definition**

“An internet-based process wherein the complete tendering process; from advertising to receiving and submitting tender-related information are done online. This enables firm to be more efficient as paper-based transactions are reduced or eliminated, facilitating for a more speedy trial of information”.(Betts et al. 2006)

#### **2.3.1.2 Introduction**

As information technology has its impact on almost all fields, it also leaves its mark in construction industry in the form of e-tendering. E-tendering is a process in which documents of procurement are electronically transferred. The technological advancement also influences the tendering process where Information and data is distributed digitally which makes communication cheaper and more efficient. If organizations want to succeed, they have to accept the change. Exploration and adaptation of advancement is a key element to remain in competition.

Construction organizations and experts are aware of the advantages and benefits of e-tendering and cooperative environments. However, once a new software or new procedures are presented in any organization, it is natural that the staff become cautious and frightened of their jobs (Lou 2006). Age and experience are also a significant factor because aged and more experienced contractors and surveyors are more critical of e-tendering than newer ones.

E-tendering is a method that swaps the standard paper tendering system within the procurement of goods and services. It additionally offers means to automatically notifying, involving, inspecting and choosing suppliers. So, the contractors have to compete electronically to get a contract. One of the key advantages of e-tendering is that it reduces of prices from production of documentation for tender, it minimizes the tender period, it is fortified technique of sending and receiving tenders and it is more systematic and progressive technique of operating. E-tenders also are moveable, economical and simple to compile (Lou and Alshawi 2009).

Though the benefits of information technology are visible but some organizations are still hesitant to adopt e-tendering. Most of them are cautious in the approach in order to get a vision of its advantages and boost the confidence of its employees before implementation. The aspects of security and legality are also a major concern.

As with increased technological complications, design and build procurement and client expectations, e-tendering has become more efficient than current process of tendering method. This method offered time saving and also reduce the cost of printing, copying and courier. It has also reduced the probabilities of miscommunication. So, e-tendering should be made more mainstream and accessible to all the associates of supply chain in construction industry. It is a way to minimize bid cost and bureaucracy and also a way forward to provide opportunities for better clarification of information.

### 2.3.2 E-tendering system

There are numerous e-tendering systems accessible to government and also the construction industry. Each system typically offers similar tools for communication together with electronic messaging to all or any parties, document management tools and audit trails. The aspects of practicality and functionality of existing e-tendering systems are alike, at the most points, they are the reflection of the legal needs of a paper tendering system

*TABLE: Steps in a typical e-tendering process*

Tendering System Component	E-tendering Basic System Function
----------------------------	-----------------------------------

Pre-qualification registration &	Pre-Qualification Registration
	Issue User Name and Password
Public invitation	Tender Advertisement
	Tenderer Views Tender Advertisement and Notice
Tender submission	Tenderer Registration to Tender for a Project
	Download Tender Document
	Addenda Distributed by Principal
	Tenderer Submits Tender
Close of Tender	Close Tender
	Principal Opens Tender
Tender Evaluation	Tender Evaluation Process
	Request for Information
Award of Tender	Award Tender/Acceptance of Tender
	Sign the Formal Agreement
Archiving	Retention of Document

(Betts et al. 2006)g

### 2.3.3 Summary

E-tendering can empower the construction industry around the globe by enabling more control on tendering and providing access to wide information about tenders (Davila, Gupta et al. 2003). Before that organizations had procurement, specialist who were allotted the work of all the activities related to tendering. This work was labor-intensive and dominated by paper which made them costly and inefficient (Oyediran and Akintola 2011). According to (Seah 2008), e-tendering reduces the paper handling and increases communication which directly effects the productivity of the tendering process and this is the main objective of e-tendering: to shift from paper manual to

fully automated electronic systems. (Henriksen, Mahnke et al. 2004) explained the uses of e-tendering which are:

- Transparency.
- Accountability.
- Ease of use.
- Speedy exchange of information.
- Intangible benefits (reducing administrative costs).
- Reduce direct procurement cost.

## *Chapter 3*

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

The aim of this chapter is to describe the detailed methodology adapted for this study in order to achieve the research purpose and objectives that are previously stated in chapter 1. It includes the study tools that were used, data collection method that was applied and the data analysis tools which were used. This research comprises of the desk study, questionnaire and a case study that was selected.

The purpose of this research is to extract the most valuable information from the relevant research papers through literature study, and to get high quality information from the field that is required for the assessment of the traditional and e-tendering. For that purpose, it is important to study recent papers and device a methodology for the research.

This study was conducted to identify the problems in traditional tendering, the factors that have an impact on the cost and sustainability of the tendering process. Which add up to the extra cost or effort that is caused by these factors. This research is the primary form of research so data that is extracted only from literature study is not enough to justify the results. For that purpose, reliable data from field was collected through questionnaire survey. The methodology is presented here in a traditional four discrete phases; The literature review, data collection, data analysis and results'

interpretation and discussion. Each phase is briefly explained. And the detailed methodology is graphically represented in figure 3.1.

## Methodology Flow Chart:

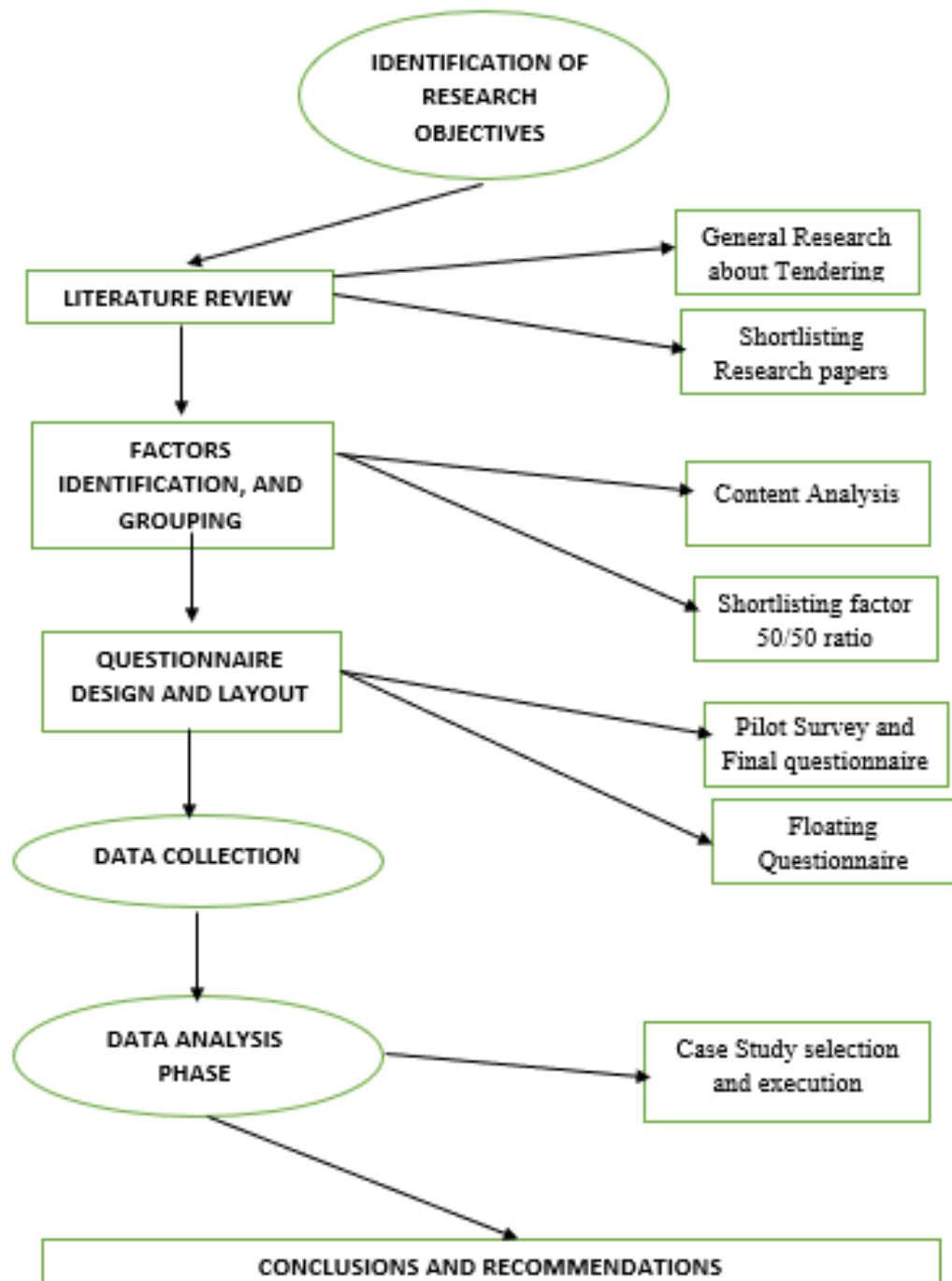


FIGURE 3.1 Research Methodology

## **3.2 Literature review**

Extensive literature has been carried out for this study related to the field of sustainability, sustainability assessment, types of sustainability in the first part. There has been a lot of research on sustainability and it was easier to find papers and articles that gave a complete idea about sustainability.

However, the major problem was finding articles about tendering specifically as there is only limited research on tendering alone. The factors that needed to be identified from literature had to be extracted by studying articles about procurement. For this purpose, we initially studied 40 papers to get a good grip about our subject. Then we shortlisted 20 most significant articles from which we could extract the factors that have an impact on the sustainability of the tendering process. As a result of literature study, suitable methodology was envisioned for the research, and 45 factors were identified. Then grouping of the factors in the different processes of tendering was done.

## **3.3 Data collection**

Further, to make sure these factors actually caused problems in the tendering process in projects a questionnaire survey from field was required. In this regard our target was to get responses from professionals in the field of tendering. The people that were targeted were from government sector. The 4 main departments that were chosen in this regard were National highway Authority (NHA), Communication & Works Department (C&W KPK), Irrigation Department (KPK) and Capital Development Authority (CDA). To get response from the public sector we shared our questionnaire with private companies too. Which include Petroleum Exploration limited (PEL) and Techno Engineering Services.

### **3.3.1 Questionnaire design**

Initially the questionnaire design was based on a simple five-point Likert scale, with the same scale which comprised of 1- strongly agree to 5- strongly disagree. After having a pilot survey from a small sample, and getting responses, necessary changes were made to the questionnaire.



After discussing and studying articles the final questionnaire was designed. This questionnaire was divided into 3 sections. The goal of the survey was explained briefly. This included a short description of the e-tendering and traditional tendering to make sure the respondents did not have any issues in understanding the process. And in the first section, demographics of respondents were asked

The second section was related to traditional tendering and the questions that were asked were based on the factors that were shortlisted for research. A total of 10 questions were asked in this section it was based on five-point Likert scale, with a different scale based on the type of question asked.

The third section dealt with e-tendering. This again had similar questions as asked in section 2. This section had a total of 9 questions that were asked about the different factors and how they impact the tendering process.

### **3.3.2 Final questionnaire**

After designing the questionnaire, an online questionnaire was developed as it is easier and more efficient to get responses online. Also compiling the results is complex through paper-based survey. This questionnaire was shared through emails and personally through meetings.

The responses from field were favorable and the feedback about the questionnaire were very positive and the professionals showed a lot of interest in this research.

### **3.3.3 Data analysis and result**

Once data was collected, it was analyzed to produce descriptive statistics. For descriptive and comparative analysis MS- Excel 2010 was used. And to check reliability Cronbach's Alpha coefficient method was adopted. This test is performed on Stata software. The data from questionnaire was analyzed based on expert judgment and relating the results with sustainability.

## **DATA ANALYSIS AND RESULTS**

### **4.1 Introduction**

This part exhibits the investigation of the information gathered through the questionnaire-based survey completed with a specific end goal to gather reliable reaction from the personnel that are involved in the tendering process, mainly from the government sector. The data collection was divided into 2 parts. The first part deals with the respondent's information. And in the second part results from the questionnaire are explained.

### **4.2 Presentation of results**

The results are presented below: -

#### **4.2.1 Factors**

The factors extracted from the literature review were 45, and further grouping of the factors on the bases of the tendering process eliminated some factors as they did not have an impact on any of the 3 processes of tendering. The following is the list of factors after grouping:

<b>TENDER PREPARATION</b>	<b>TENDERING</b>	<b>TENDER EVALUATION</b>
<ul style="list-style-type: none"> <li>• Tendering capability</li> <li>• Complexity of the project</li> <li>• Familiarity of project</li> <li>• General needs</li> <li>• Design innovation</li> <li>• Absence of information</li> <li>• Little precise understanding of the cost of tendering in terms of value</li> <li>• Quality required</li> <li>• Location of project</li> <li>• Explicit user's requirement</li> </ul>	<ul style="list-style-type: none"> <li>• Rigorous paper work</li> <li>• Printing, copying and posting tender documents</li> <li>• Advertisement and documentation</li> <li>• Habits of employees</li> <li>• Courier charges</li> <li>• Long lead-time is required for bidders to physically come to a centralized location to purchase a tender</li> <li>• Inadequate Project experience</li> <li>• Expense of tendering and uncertainty of outcomes</li> </ul>	<ul style="list-style-type: none"> <li>• Price competition / total cost</li> <li>• Arbitration and dispute</li> <li>• Success rate of the Contractor</li> <li>• Number of contractors entering into contract</li> <li>• Transparency issues (difficult to track the progress of tender)</li> <li>• Information asymmetry /miscommunication</li> <li>• Professional insurance</li> <li>• Poor information safety and Availability</li> <li>• Meetings and opening of tender in public</li> </ul>

<b>Common Factors</b>
<ul style="list-style-type: none"> <li>• Speed of process</li> <li>• Flexibility of the tendering process</li> <li>• Complexity of Process</li> <li>• Risks involved</li> <li>• Human resource and Material usage</li> <li>• Expense of tendering and uncertainty of outcomes</li> </ul>

- Productivity
- Poor work environment
- Absorbed as overheads (Dawood 1995) and each bid must incorporate the cost of failed tenders (Hillebrandt 2000)
- High paper usage and storage
- Poor information safety and Availability
- Paper documentation editing is difficult
- Personal (staff etc)
- Premises in which tendering work is carried out
- Environmental impact

FIGURE 4.1 FACTORS

Further, the factors were analyzed on Excel and rating of factors was done using their literature score. After rating the factors from most important to least important, shortlisting of factors was done to get only those factors which had a great impact on the tendering process. 50/50 ratio was used and 11 factors were shortlisted for further analysis.

These are:

- 1) Human resource and material
- 2) Printing, copying and posting tender documents
- 3) Speed of tendering process
- 4) Overhead costs
- 5) Advertisement and documentation
- 6) Value for money
- 7) Complexity
- 8) Quality
- 9) Lead-time
- 10) Environmental impact
- 11) Flexibility of tendering process

## 4.2.2 Respondent's Attributes

To determine the respondent's attributes, 5 questions were drafted in the research questionnaire. These questions were related to:

- a. Professional Experience
- b. Field of work
- c. Job title
- d. Academic qualification
- e. Understanding of the tendering process of respondents

This information would help in getting a clear image about the type of respondents that filled the questionnaire, to see if the right type of respondents are targeted in our research.

### 4.2.2.1 Qualification of Respondents

4) Please indicate your highest academic qualification.

50 responses

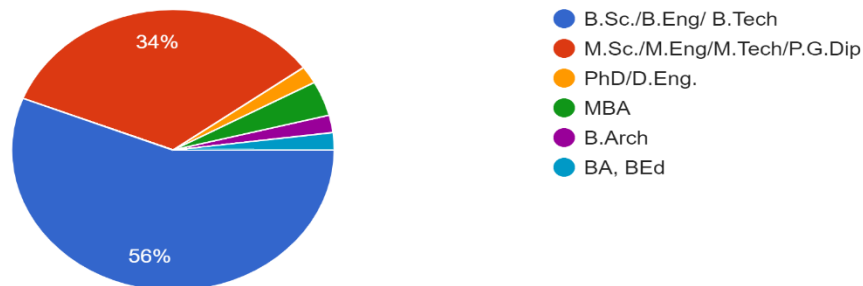


Figure 5.1: Qualification of respondents

The synopsis of the capability of the respondents is demonstrated in Figure 5.1, which shows that almost all of our respondents have at least a bachelor's degree, with 36% of the respondents having master's degree or PHD, further expanding the dependability of the outcomes.

### 4.2.2.2 Professional experience

1) Please indicate your years of professional experience.

51 responses

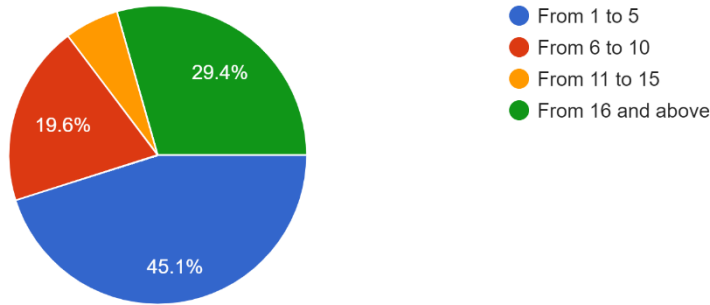


Figure 5.2: Professional experience

The respondents that were targeted are people who have a professional experience after graduation. More than 50% of which have a professional experience of 6 years or more. This further verifies that people who have field experience responded.

### 4.2.2.3 Field of work

2) Please indicate your field of work (Please select all that may apply).

47 responses

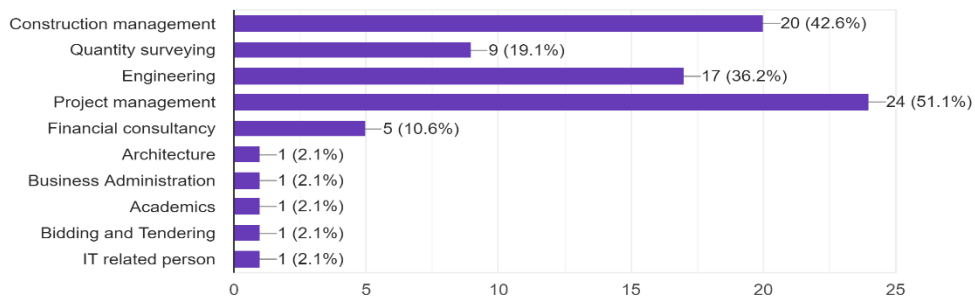


Figure 5.3: Field of work

The type of respondents targeted during the questionnaire survey were from different field of work, which included both clients and contractors from government sector. Most of which are from construction management or project management. This is in favor of getting accurate results as the scope of our research falls under these fields.

#### 4.2.2.4 Job Title

3) Please indicate your job title.

45 responses

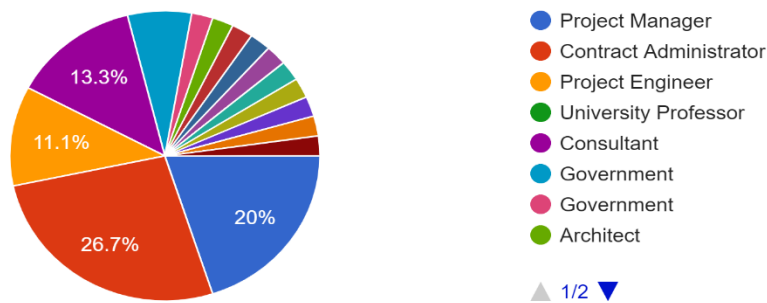


Figure 5.4: Job title

Project managers (20%), Contract Administrators (26.7%) make up the majority of the respondents.

#### 4.2.2.5 Understanding of the tendering process

5) Rate your understanding of tendering process and procurement, based on the number of tenders that you have conducted?

50 responses

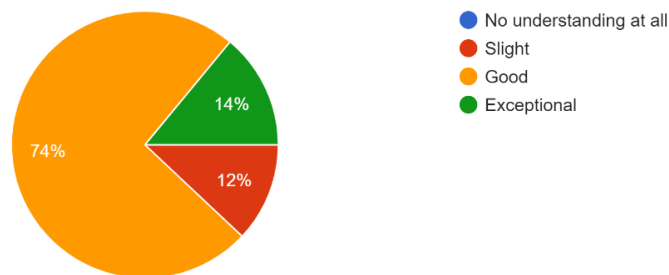


Figure 5.5: Understanding of tendering process

Along with the other details perhaps one of the most important is the understanding of the tendering process of respondents. About 88% of the respondents rated their understanding as good or exceptional which indicates that the quality of the results will be high.

## 4.3 STATISTICAL ANALYSIS

### 4.3.1 Reliability of the sample

To check the reliability of data, when questions are asked on Likert scale in the questionnaire, Cronbach's Coefficient Alpha method is most commonly used. In this test if the alpha value is higher than 0.7, it means that the data is acceptable for analysis. Further according to (LI, 2007) getting a value for alpha greater than 0.9 means that the data is excellent for analysis. For the collected data, the alpha value was calculated to be 0.8383 using Stata, as given in figure 4.3.1. Its higher value indicated that the data was consistent and reliable for further analysis.

Item	Obs	Sign	item-test correlation	item-rest correlation	average interitem covariance	alpha
highusageof~r	50	+	0.4037	0.3144	.185667	0.8350
printingco~d	50	+	0.4889	0.4133	.1829146	0.8313
whatisther~i	50	-	0.5637	0.4962	.1796542	0.8278
theoverhea~n	50	+	0.6217	0.5626	.1776078	0.8253
theadverti~n	50	+	0.6989	0.6373	.1694022	0.8200
howcomplex~n	50	-	0.4613	0.3602	.1810648	0.8344
ratetheten~a	50	-	0.5197	0.4460	.1809422	0.8296
thequality~t	50	-	0.4659	0.3725	.1818235	0.8335
whatisthei~t	50	-	0.3286	0.2196	.1895032	0.8417
howflexibl~e	50	-	0.4963	0.3991	.1785244	0.8320
lowusageof~i	50	+	0.5374	0.4415	.1758598	0.8301
v18	50	+	0.7088	0.6593	.1732525	0.8210
v19	50	+	0.5859	0.5073	.1752837	0.8266
v21	50	-	0.2267	0.1004	.1948756	0.8494
v20	49	+	0.3966	0.3141	.1868881	0.8353
whatistheq~h	50	+	0.5843	0.5240	.1802955	0.8274
lessleadti~c	50	+	0.6854	0.6303	.1733183	0.8217
whatisthei~n	50	+	0.4274	0.3636	.1884753	0.8339
howflexibl~d	50	+	0.6001	0.5132	.1721871	0.8262
Test scale					.1803976	0.8383

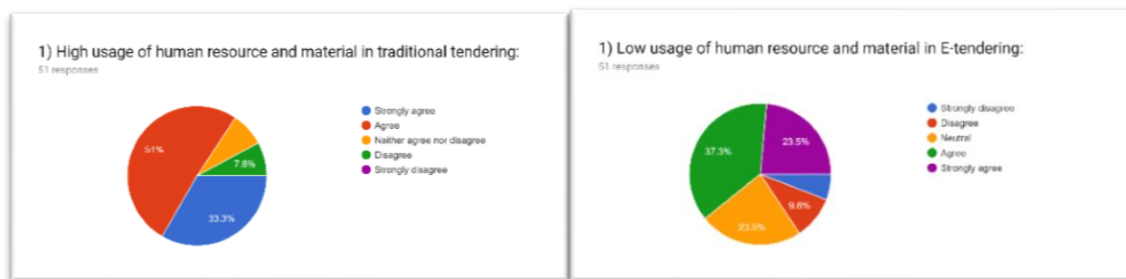


## 4.4 Analysis of the results

This segment is related to the section II and section III of the questionnaire survey. Segment II of the questionnaire was intended to research about the traditional tendering process and the impact of the factors identified through literature study. The respondents had to give responses to 11 questions that were based on the 11 factors shortlisted for our research. And segment III had questions relating the factors to e-tendering, and getting responses related to e-tendering that can be used to compare the sustainability of both traditional and e-tendering.

The analysis based on the questionnaire results are:

### 4.4.1 Human resource and Material



**Figure 5.6: Traditional tendering**

**Figure: E-tendering**

By analyzing the results of questionnaire responses, it is important to note down the trend of answers related to traditional and e-tendering. There were 51 respondents to the question asked, out of which 83.3% (42) respondents agree that there is a high usage of human resource and material. This high usage has a direct impact on the cost of tendering as extra effort is used in traditional tendering. The 7% that disagree with this are mostly those people who have rated their understanding of tendering as slight.

In comparison to this, the same question was asked for E-tendering. The responses gathered show that experts agree that Human resource and material usage is lesser in E-tendering. 60.8% agree, and 23.5% were neutral in this regard as e-tendering has not yet been fully developed in Pakistan.

The conclusion that can be extracted from this is that e-tendering uses less human resource and material, as compared to traditional tendering. This factor has an impact on economic sustainability which is regarding the efficient use of resources.

#### 4.4.2 Printing, copying and posting tender documents

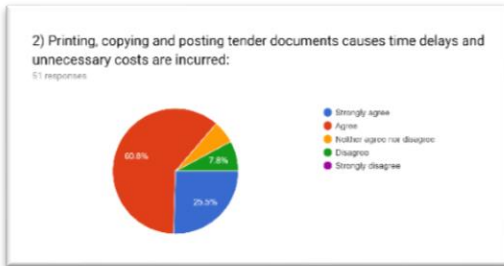


Figure 5.7: Traditional tendering

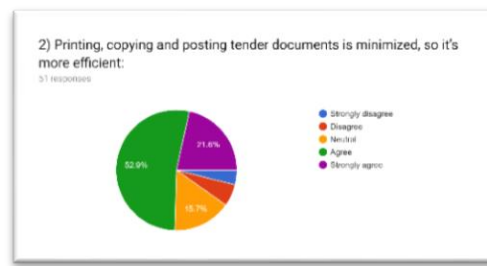


Figure: E-tendering

The use of paper in the traditional tendering and hard form of submissions and documentation is the issue that was addressed in this survey. The responses show that for Traditional tendering that 60.8% respondents agree and a further 25.5% strongly agree that printing, copying and posting tender documents causes time delays, as well as unnecessary costs. Furthermore the 25.5% people that strongly agree represent the respondents related to contract administration field which further makes a strong case that the issue identified is real and has a negative impact on the traditional tendering process.

On the other hand, a total of 39 people out of a sample of 51 agree that printing, copying and posting tender documents is minimized in E-tendering. The idea of e-tendering is to minimize the paper usage throughout the process of tendering. This makes e-tendering more environmentally sustainable as the use of ink and paper is reduced. It also reduces the costs and makes it easier to deal with, further impacting the social, environmental and economic sustainability.

### 4.4.3 Speed of tendering process

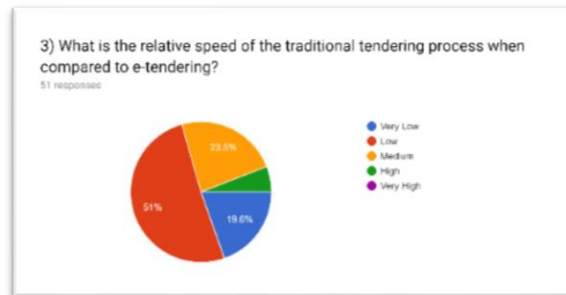


Figure 5.7

In this part the speed of both types of tendering is compared. The results suggest that E-tendering is a speedier process when compared with traditional tendering. In this when the respondent was asked to rate the speed of traditional tendering when compared to e-tendering, only 5% of people said it was high. Those 5% rated their understanding of tendering as slight so their response can be insignificant. 95% of the respondents agree that the traditional tendering process is slower when compared to e-tendering. This means that more time will be taken to carry out one tender which is addressed in our case study section.

### 4.4.4 Overhead costs

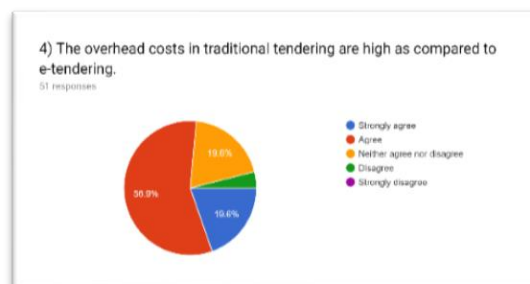


Figure 5.8

The factor considered here is crucial and generally missed out when calculating the cost of tendering. The overhead costs include any costs that are not directly affecting the cost of tendering but are consumed during the process of tendering as office overheads etc. Through survey from 51 professionals in the field of tendering, about 75% respondents agree that the overhead costs in traditional tendering are high as compared to e-tendering. All of the respondents with experience of 16 years and above agreed that overhead costs in traditional tendering are high when compared to e-tendering. This factor again has an impact on the economic sustainability of the process. Making E-tendering more economically sustainable as compared to traditional tendering.

#### 4.4.5 Advertisement and documentation

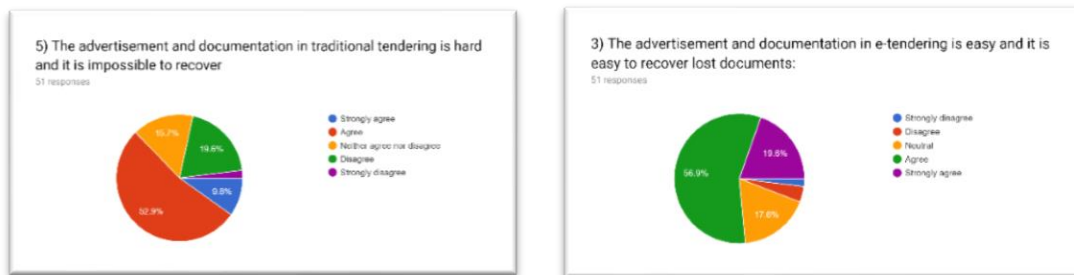


Figure 5.9 Traditional tendering

E-tendering

A total of 51 respondents responded to this part out of which 15 had an experience of 16 years and above. 10 of those respondents agreed that advertisement and documentation is difficult using the traditional method of tendering, and that it is impossible to recover the documents once lost. In total 60% people agreed to it too. And 16% people remained neutral about it and about 19% people disagreed with it. After discussing it with experts from the field it was evident that this problem has a major impact on the social sustainability of the process. As it caused difficulty in the tendering process. Once a document is lost it is not possible to recover it.

In comparison, advertisement of tender and tender documentation is easier in e-tendering and it is easy to recover the lost documents by a click of a button as everything is saved and backed up in a computer. This result was obtained from the survey in which 76.5% of the respondents agreed, 18% people stayed neutral and only a small portion disagreed for unknown reasons.

The conclusion to be drawn from this is that e-tendering makes it easier to work and reduces the chances of permanently losing the documents. In this way it can be said that e-tendering enhances the social sustainability of the process.

#### 4.4.6 Value for money

The value for money concept is used in reference to something that is well worth the money spent on it. In this part of the survey the problem was getting mixed results for traditional tendering.

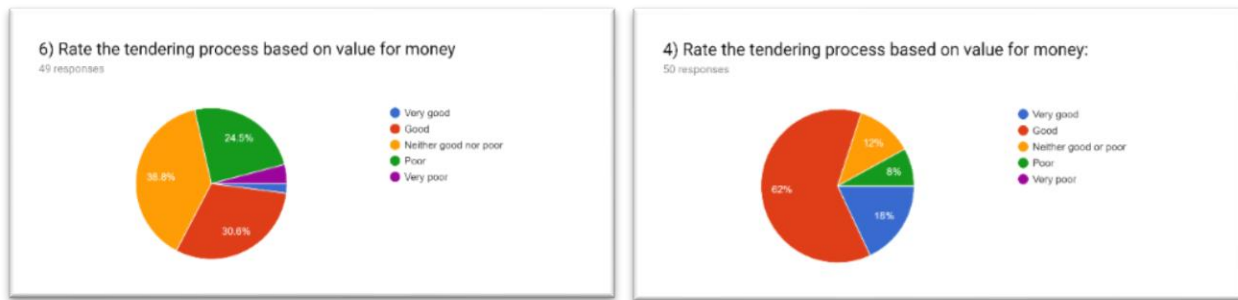


Figure 5.10 Traditional

E-tendering

When the respondents were asked to rate the traditional tendering process based on the value for money, only 30% rated it good and 28% rated it as poor and 39% people rated it as neither good nor poor. The general outcome shows that people are not really sure about the value for money of the traditional tendering process.

However, when the same respondents were asked to rate the value for money of the E-tendering process, a major change in the trend of responses was experienced. 80% professionals rated it as good or very good. While 12% rated it as neither good nor poor and only 8% people rated it as poor. This shows that e-tendering procedure might have a good value for money.

#### 4.4.7 Complexity

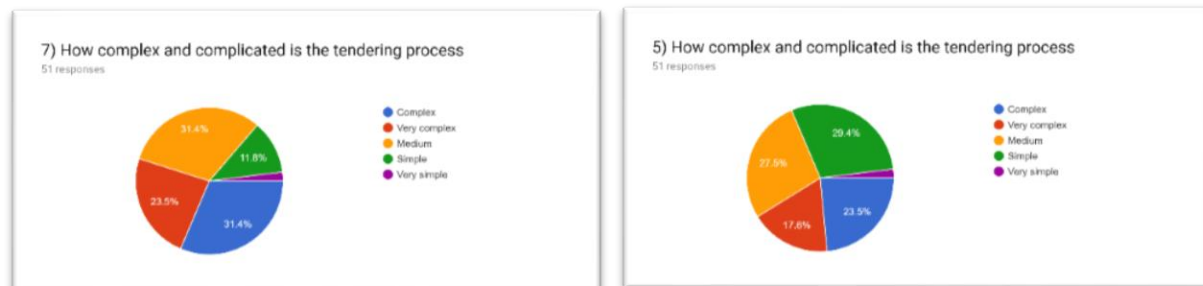


Figure 5.11 Traditional tendering

E-tendering

The results of this part of the survey were again mixed up. The complexity of the process could not be judged and nothing final can be said about the complexity of the both e-tendering and traditional tendering by this survey. But analyzing and comparing both results the respondents rated traditional tendering simpler as compared to e-tendering. Only 32% people considered traditional tendering as a complex method while in case of e-tendering 40% people rated it as complex or very complex.

So, on the bases of the survey traditional tendering is considered simpler as compared to the e-tendering method.

#### 4.4.8 Quality of tender

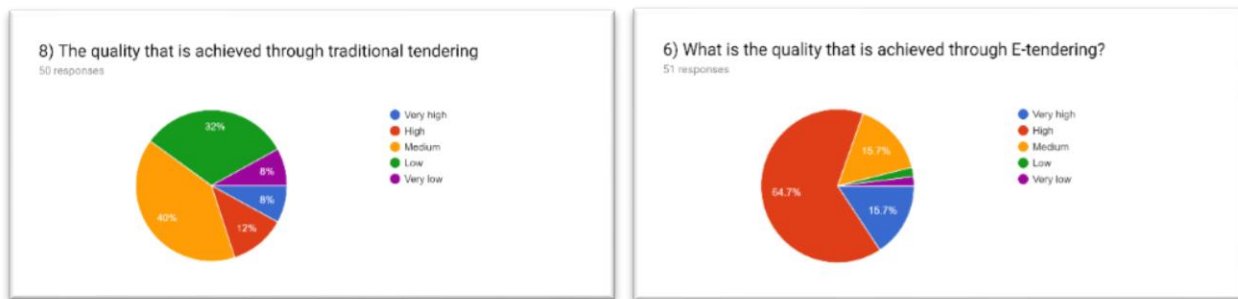


Figure 5.12 Traditional tendering

E-tendering

When asked about the quality of tender resulting from the traditional tendering a total of 40 respondents considered the quality produced as medium or low, which makes up to be 80% of the respondents. In comparison, when the same people were asked about the quality of tender produced in e-tendering, out of 50, 33 respondents rated it to be high with a further 8 respondents considering it very high. This clearly highlights that more people feel that e-tendering produces high quality tenders.

#### 4.4.9 Lead-time

The lead time is time taken from commencement to finishing of the tendering process.

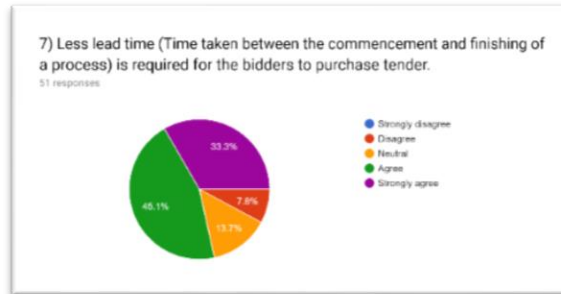


Figure 5.12 E-tendering

With regard to time saving, the results are in favor of E-tendering, with 45% respondents agreeing with the statement and further 33% strongly agreeing. As time and cost go hand in hand. It can be said based on the results that e-tendering saves time as well as cost when compared to traditional tendering. Time and cost have a great impact on the sustainability of the tendering process, mainly targeting the economic sustainability which is crucial for developing countries like Pakistan.

#### 4.4.10 Environment

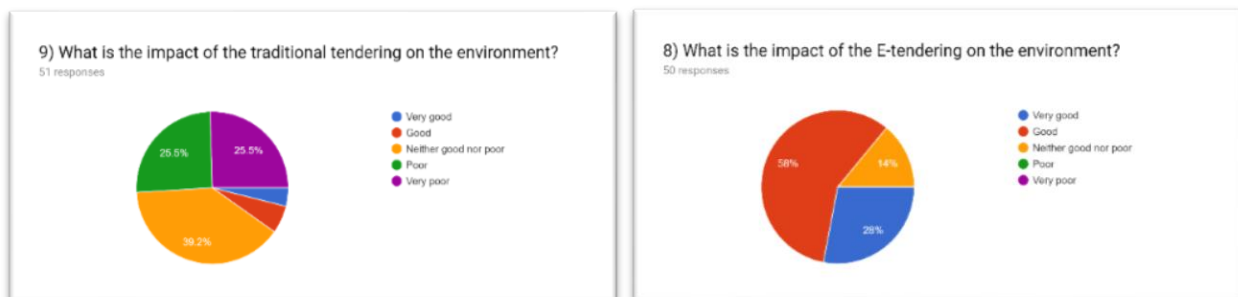


Figure 5.13 Traditional tendering

E-tendering

When asked about the environmental impact of both the processes the results were in favor of E-tendering. 51% of respondents felt that the traditional tendering process had a poor impact on the

environment, including 25.5% people who thought it had a very poor impact on the environment. This is mainly due to the use of paper and ink in traditional tender documents.

In comparison 86% respondents believed that e-tendering has a good impact on the environment, less physical waste was produced as it is conducted on a software. The paper usage is greatly reduced which means lesser trees would be cut. The 14% left chose the option that it had no good or bad impact on environment. This highlights that the e-tendering process is more environmentally friendly.

#### 4.4.11 Flexibility

Flexibility is considered the ability to cope quickly with the environmental development by adapting to new technology and taking into account market information in order to satisfy the customer's needs.

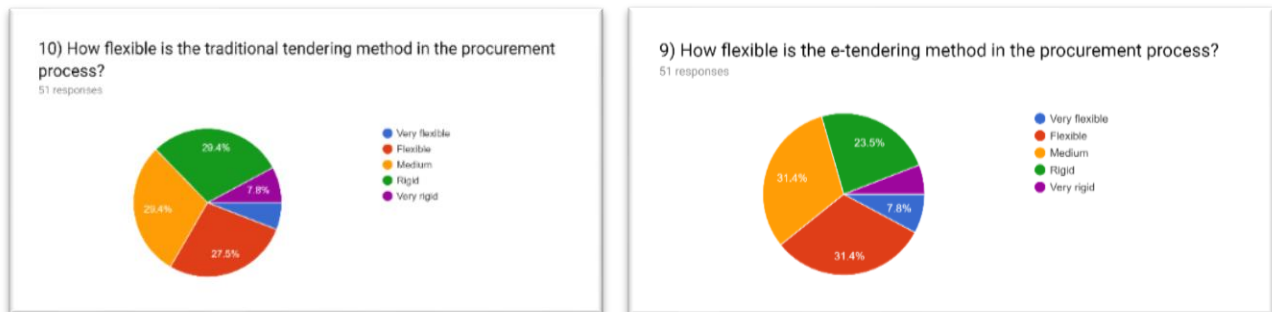


Figure 5.15 Traditional tendering

E-tendering

For traditional tendering it is hard to draw any conclusion from the survey, as the number of respondents that feel that the process is rigid and the respondents that feel it is flexible are almost same. 18 felt it is rigid and also 14 people considered it to be flexible. So, on the bases of survey, flexibility could not be judged with accuracy. However, the results in case of e-tendering were better. 40% respondents said that e-tendering process had high flexibility, so it was easier to cope with changes in specifications in e-tendering. 20% believed it was rigid, but e-tendering has not yet been fully implemented in Pakistan so variance in the results were expected.

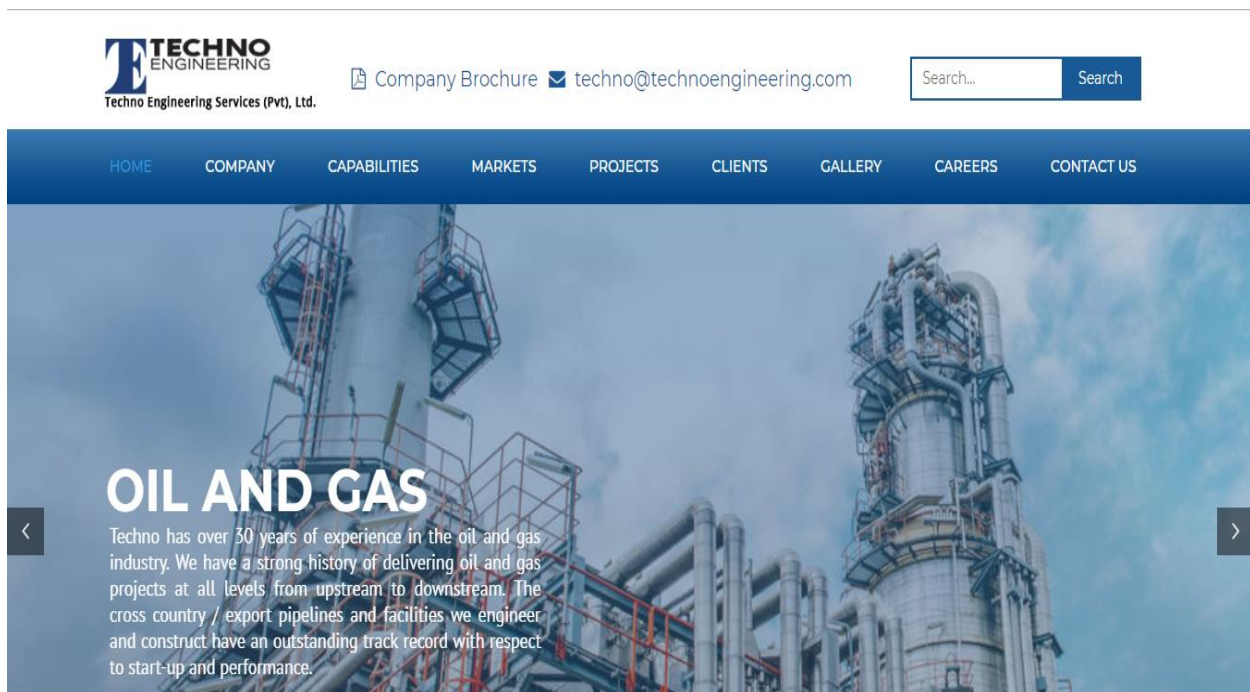


## 4.5 CASE STUDY

### 4.5.1 Introduction

Construction of 14 storage tanks Client: PSO

Contractor: Techno Engineering services



### 4.5.2 Background of firm

Techno engineering services (PVT.) ltd. is a privately-owned firm established in 1979 which began its services by serving Pakistan’s domestic oil and gas industry. Since then, TES has focused on growing and expanding its professional services not only in the oil and gas sector but also in Power, Water, Infrastructure development and API pipeline manufacturing sectors. The company has done projects not only in Pakistan but also in Qatar and Kuwait.

### 4.5.3 Case study

The case study is construction of 14 oil storage tanks at different locations within Pakistan (Faisalabad, Karachi, Mehmoodkot, TaruJabba, Juglot). The project tender was won by TECHNO ENGINEERING SERVICES.

The objective of the case study was to assess those barriers that participants experience in traditional tendering process from the time advertisement appears on newspaper to the awarding of contract and get a comparison by using e-tendering.

- The value of the project was approximately 500 million pkr.
- The tender submission period was 27 days initially but it was further increased by 10 days. Total 37 days were given.
- 17 contractors participated in this tender

The case study was taken from them after interview with one of the personnel of the firm. The meeting took place in the company's procurement office located in BLUE AREA Islamabad.

The personnel gave data that included:

Paper Usage, Time of each task, Transportation cost, Printing cost, Salaries of the personnel involved the details of which are as follows:

#### **Documents Procurement:**

1. 5 volumes (250-300 pages each volumes)
2. 5000 PKR/- documents procurement cost.
3. 4000 PKR/- shipping cost from Karachi to Islamabad

#### **Document Study:**

1. 2500 pages scanned and emailed to everyone for study.

#### **Bid Preparation:**

2000 pages typed in terms of BOQs and annexures to be attached with bid.

Total bid printing was about 25000 pages for 7 tanks for storing diesel and PMG

5000+ pages were wasted due to timely identification of addendum otherwise it would have been more than that.

**Bid submission:**

30000 PKR/- to send documents at earliest to Karachi for submission.

**Duration:**

Document procurement	3 Days
Bid documents study	6 days
Bid preparation	25 days
Bid submission	5 hours

**Salaries of personnel involved:**

Documents Procurement: Representative of Karachi office and driver 6000 PKR/-

Documents study and bid preparation: Engineers whose salary sum up to 620000 PKR/ month

Printing cost = paper, toner, service (PKR 50000 sum).

**Interview:**

- The personnel told that tender documents were purchased from the client head office which is in Karachi, A representative of the firm with letter of attorney had to go to Karachi to get the documents and bring them back safely.
- He further stated that the invitation to bid had a lot of pages and all the concerned people should have a copy of them and it is not possible to photocopy them for each person so they sent scanned copies to the concerned people in the firm, The problem with scanned documents is that they are not editable.
- He told that BOQs in hard form are not editable. They have to make Excel sheets to do the calculations.
- The personnel told that their printer went out of order before the last day of bid submission.
- Management of 28000 paper in only 14 portions was an issue.
- The paper used in preparation of bid for 1 tank is to be multiplied by 14 as there is separate bid for each tank.

- If there is mistake (typing error) on any specific page which they found later it is difficult to find the pages from the stack and correct the mistake. It has to be done manually.
- In case a paper is damaged it cannot be recovered.
- Storage of documents is a big task.
- Only authorized people are allowed in the room where the tender documents are present. Security of documents is crucial.

#### **Addressing the problems with E tendering approach:**

- In E tendering the money can be transferred through bank and invitation to bid can be downloaded, so it saves the money which is wasted otherwise in traditional tendering.
- The task of giving power of attorney to representative is not required. So, no issue related to losing power of attorney.
- No transportation cost.
- In E tendering the documents can be sent to the concerned personnel's in soft form without printing, photocopying and scanning them.
- In E tendering no storage space is required. (hard drives)
- In E tendering mistake can be corrected easily by editing it.
- No issues in documentation
- Security is not an issue as only concerned personnel have access to them.

#### **4.5.4 Conclusions:**

- The result of questionnaires showed that people in construction field agree to the fact that the shortlisted factors are affecting the efficiency of traditional tendering and from the case study and interview it was also justified.

The first factor usage of material that is paper, ink for printers almost to it and from the data of case study it was found that almost 28000 pages were used for the bid and a lot human resource is required to manage these documents and keep them secure.

REF Indian case study the work of 100 days was reduced to 40 days.

- 2<sup>nd</sup> factor that is printing, copying and documentation was also agreed upon. From case study it is clear that printing and copying was done on huge scale for which printers (printer ink) was used and it is a cumbersome task. The printer went out of order in our case study and it effected the whole process. Sending the bid document takes time and if it is late due to fault of courier or postal service, it can cause failure to submit the tender. All the efforts are of no use and the bid security is also lost if it doesn't reach on time.

- 3<sup>rd</sup> factor Speed was speed. From case study it is evident that traditional tendering is a time taking process with all the sending and receiving of documents and addendums.
- 4<sup>th</sup> factor that is effect on environment is very clear. The amount of paper used is very high. According to The Global Forest Resource Assessment conducted in 2015, 8333 sheets of paper are produced by processing one tree. In this case almost 30000 pages were used, which means that 3.5 trees were cut down to carry out 1 tender.

## **CONCLUSIONS**

### **4.5.1 General**

This section covers the conclusion and suggestions that would help with conquering the difficulties confronted by the industry in the tendering process of construction industry of Pakistan. The conclusions were drawn on the premise of the outcomes acquired through examination.

The higher up objectives of the work were accomplished by distinguishing 45 factors that had an impact on the sustainability of the tendering process, through extensive literature study. 11 of these factors were shortlisted and were further confirmed by data gathered from the field through survey. The processes that are affected by these factors were also identified by first understanding the tendering process and through interviews with the concerned people from industry. The study finished up to the best conceivable results with respect to the set targets.

The results obtained, conclusion and suggestions may be imparted to PPRA for further assessment and spread to the construction industry of Pakistan.

### **4.5.2 CONCLUSIONS**

The information was analyzed in Stata for reliability check. The consequences of reliability examination by Cronbach's Alpha test demonstrated that information got through study was reliable.

The following are conclusions drawn from our survey results and case study:

- Dramatic reduction in the timeframe of the tender period.
- Streamlined document handling, reduced paperwork, clear audit trail.
- Reduction in time and money spent on copying and posting tender documentation. Late changes can more easily be incorporated into the tender.
- Regular usage would in time lower tender production costs for all stakeholders and invariably lower overall project costs.
- Efficiency savings - cost, time.
- The e-tendering method is not yet developed in Pakistan and PPRA does not allow e-tendering and it is not legally accepted in Pakistan.
- Not all companies have the capability to carry out e-tendering.
- Resistance to change is the hardest aspect, once people are familiar then the benefits are significant.
- A large proportion of the construction industry supply chain does not have the necessary software/hardware capabilities as the main contractors, so inevitably hard copy documents are still issued by main contractors.

If procurement methods have been compared, the easiest to adopt would be traditional tendering. It is a tried and tested method of procurement. It has been used in the market for the long time and both consultant and contractor are familiar with it to face and solve the risk during the procurement state of the process.

Traditional procurement process includes many tasks to be performed on and on. These tasks could be approvals, negotiations, writing contracts. Handling all these along with invoices, bills makes the traditional processes expensive.

Paperwork is also a big hurdle for traditional tendering. More paperwork consumes more resources. Space is also required to store that paperwork. So traditional tendering put more strain on resources in the form of space and money.

### 4.5.3 Recommendations

#### a) Technical and Behavioral Training

- More emphasis should be laid on the behavioral development to ensure commitment for the e-tendering implementation.
- Workshops/Seminars, advertisements, special lectures at institutional level training sessions, etc. Showing the profits and gains of e-tendering in construction be help at regular intervals.

#### b) Research

The Institutions should increase the amount of research in this field. The main goal should be to quantify the benefits of e-tendering. And a detailed feasibility of e-tendering should be carried out.



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# APPENDICES

## 6.1 Questionnaire

Respected Sir/Madam,

This survey is being carried out as part of UG research titled “Sustainability assessment of Traditional Tendering: Qualitative approach”. The objective of this research is to show that there is a need to understand the drawbacks of Traditional tendering process, by practically examining the different factors incorporated in it, that have an impact on the sustainability of the tendering process.

Modern methods of tendering exist that have proven to be more efficient and sustainable as compared to traditional tendering in construction projects. Sustainability has three aspects, namely environmental, economic and social progress.

The main stages of Tendering process are:

- Tender preparation
- Tendering
- Tender evaluation

Each of the mentioned processes has associated factors. So, the main goal of this survey is to compare the sustainability of traditional tendering and e-tendering based on the factors identified through literature study.

The main part of this research study relies on the questionnaire survey. Your contribution is highly appreciated. Please be assured that the data will only be used for study purpose and no personal information will be disclosed at any forum/level. Please remember to click submit at the end. In case of any inquiry, please feel free to contact.

Regards,

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### **Section-A: Background information of the respondents**

1. Please indicate your years of professional experience.

- From 1 to 5
- From 6 to 10
- From 11 to 15
- From 16 to 20
- From 21 and above

2. Please indicate your field of work (Please select all that may apply).

- Building design
- Infrastructure management
- Construction management
- Quantity surveying
- Engineering
- Project management
- Financial consultancy
- Other:

3. Please indicate your job title.

- Project Director
- Project Manager
- Construction Manager
- Contract Administrator
- Assistant Manager
- Site Manager
- Project Engineer
- Architect/Designer
- University Professor
- Consultant

- Risk Manager
- Other

4. Please indicate your highest academic qualification.

- B.Tech
- B.Sc./B.Eng.
- M.Sc./M.Eng/M.Tech/P.G.Dip
- PhD/D.Eng.
- Other.

5. Rate your understanding of the Tendering process?

- No understanding at all
- Slight
- Somewhat
- Moderate
- Exceptional

### **Section-B: Traditional tendering**

Rank the factors on the basis of their contribution towards sustainability on 1 to 5 Likert scale based on your experience:

1) High usage of human resource and material in traditional tendering:

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

2) Printing, copying and posting tender documents causes time delays and unnecessary costs are incurred:

- Strongly agree
- Agree



- Neither agree nor disagree
  - Disagree
  - Strongly disagree
- 3) What is the relative speed of the traditional tendering process when compared to other types of tendering?
- Very high
  - High
  - Med
  - Low
  - Very low
- 4) The overhead costs in traditional tendering are high as compared to other methods of tendering:
- Strongly agree
  - Agree
  - Neither agree nor disagree
  - Disagree
  - Strongly disagree
- 5) The advertisement and documentation in traditional tendering is hard and it is impossible to recover lost documents:
- Strongly agree
  - Agree
  - Neither agree nor disagree
  - Disagree
  - Strongly disagree
- 6) Rate the tendering process based on value for money:
- Very good
  - Good
  - Neither good nor poor
  - Poor
  - Very poor

7) How complex and complicated is the tendering process

- Very complex
- Complex
- Med
- Simple
- Very simple

8) The quality that is achieved through traditional tendering

- Very high
- High
- Med
- Low
- Very low

9) Long lead time is required for the bidders to physically come to purchase tender.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree

10) What is the impact of the traditional tendering on the environment?

- Very good
- Good
- Neither good nor bad
- Bad
- Very bad

11) How flexible is the traditional tendering method in the procurement process?

- Very flexible
- Flexible

- Med
- Rigid
- Very rigid

### **Section–C E-tendering**

12) Low usage of human resource and material in E-tendering:

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

13) Printing, copying and posting tender documents is minimized, so it's more efficient:

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

14) What is the relative speed of the e-tendering process when compared to traditional tendering?

- Very high
- High
- Med
- Low
- Very low

15) The overhead costs in e-tendering are low as compared to traditional tendering:

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

16) The advertisement and documentation in e-tendering is easy and it is easy to recover lost documents:

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

17) Rate the tendering process based on value for money:

- Very good
- Good
- Neither good nor poor
- Poor
- Very poor

18) How complex and complicated is the tendering process

- Very complex
- Complex
- Med
- Simple
- Very simple

19) What is the quality that is achieved through E-tendering?

- Very high
- High
- Med
- Low
- Very low

20) Less lead time is required for the bidders to purchase tender.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree

21) What is the impact of the E-tendering on the environment?

- Very good
- Good
- Neither good nor bad
- Bad
- Very bad

22) How flexible is the e-tendering method in the procurement process?

- Very flexible
- Flexible
- Med
- Rigid
- Very rigid