National College of Ireland

Evaluation of Risk Management Practices in the Tendering Process within the Construction Industry in Mozambique

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Abstract

Risk management is one of the nine areas of project management introduced by the Project Management Institute (2013).

Risk management is a combination of techniques to identify, analyse, evaluate, respond and control risks. Thus, the knowledge of risk management techniques enable companies to achieve their goals, improve success rates and enjoy financial savings by managing risk more efficiently. Moreover, risk management is described as being associated with construction project success in terms of three major aspects such as project cost, time and quality.

For this aim, this study aims to understand how risks are managed in the tendering process in the construction industry in Mozambique.

10 senior managers from seven construction companies operating in Mozambique were interviewed, and 47 respondents who directly work in Commercial/Tender Departments in Construction Companies participated in the online survey.

The companies selected have in their portfolios a wide variety of projects such as buildings, roads, bridges, railways, tunnels, water supply, sewers, telecommunications and electrical infrastructures, and so on.

The findings show that risk management practices applied by the construction firms in the tendering process in Mozambique, slightly differ from the risk management theories studied in this research paper. Some of these companies follow their own practices and stabilised routines. Others affirmed that they never considered risk costs while tendering for a project, even though some scholars believe that risks are one of the most significant expenses of a construction project.

Keywords: Construction, tendering process, risk, risk management.

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CHAPTER 1: Introduction

This chapter presents an introduction of the research topic, provides a preliminary brief on risks in construction tendering process in Mozambique, presents the background and statement of the research problem, defines the research questions and indicates the limitations of the study.

1.1. Background and Statement of the Research Problem

The construction industry is one of the most critical industrial domains of any country, characterised by high complexity and a substantial shift in the nature of the projects (Patel *et al.,* 2013).

This industry is in permanent exposure to various types of projects such as infrastructures, roads, railways, bridges, tunnels, buildings and dams from a new form of construction, demolitions or rehabilitation, across public and private contracts (Akinbile et al., 2018).

The industry also takes active participation in several infrastructural development projects of essential nature, including electricity, water supply, and communication. This showcased that the industry is involved deeply in forming substantial parts of a city and so a country (Håkansson and Ingemansson, 2013).

However, the growing complexity of the industry has made the industry a high risk-prone sector, and therefore, needed effective practices for managing risks. The rising risks in the industry raise the demand for applying effective risk management knowledge (Håkansson and Ingemansson, 2013). The notion of risk is defined broadly in the business decision theory, explaining it as the concept to defined the probability or probabilities distribution of the uncertain future events (Wolke, 2017). In the success of a single project, as well as for an entire company, risk management is a highly important notion. In order to accomplish the project and attain the companies' goals, there is a

vital need to structure an effective process of risk management (Osipova and Eriksson, 2011; Elkington and Smallman, 2002).

In light of the claims, Mhetre et al. (2016) examines risk management as a crucial tool to cope up with the risk in construction and helps in overcoming project failures. (Smith, 2017) has produced elaborated views describing risk management as a crucial tool focusing on identifying the sources of uncertainty and risks, assesses their impact, and assist in developing appropriate responses. In the construction context, risk management is acknowledged as a systematic and comprehensive approach to identify, examine, and respond over risks to attain the objectives of the project (Project Management Institute, 2013). Mhetre et al. (2016) also claim that risk management is the crucial element determining the failure and success of construction projects.

In attaining the project objectives, in the essence of cost, quality, time, safety, and environmental sustainability, risk management in construction projects is acknowledged as a highly important management process.

Smith et al. (2014) address that risk exposure in the construction companies reaches its peak during the process of tendering, which demands effective management of the probability of occurrence and impacts on the performed tasks during the process.

Despite the considerable importance of the tender price for a construction company, researchers have not been given enough attention to this matter (Petruseva et al., 2016).

Herein, the understanding of the fundamentals of profits, value, risks, and pricing is highly essential so that tenders, bids, and proposals resulted in new profitable businesses for shareholders, investors, and owners (Smith, 2017).

According to Nhabinde et al. (2015), Mozambique is the Sub-Saharan country with the strongest growth perspective regarding the Construction Sector across Africa.

Recently, the construction sector in Mozambique has been growing in many categories such as the construction of ports, railways, highways, hotels, shopping spaces, apartment buildings, office buildings, electricity systems, water supply and wastewater

disposal systems (Maugeri et al., 2015). Such investments have already provided a significant transformation in the country (Maugeri et al., 2015).

With the urge of new natural resources industries such as oil and gas and mining, the construction sector has been driven by the large investments pledged to infrastructure improvements Nhabinde et al. (2015).

Therefore, according to Maugeri et al. (2015), it is expected in the coming decade an accentuated economic growth of which the construction industry represents a considerable opportunity for Mozambique.

Under this circumstance, it is time for the construction companies operating in the Mozambican field to start embracing new techniques, experience and knowledge in order to be capable of successfully dealing with larger and more complex projects which are coming soon.

Such concern urges due to the various barriers to the development of the construction sector in the country (Nhabinde et al., 2015). Firstly, there is a failure in information and coordination among private and institutional players. Secondly, the level of workforce qualified is low, and management practices are inadequate Nhabinde et al., 2015).

A study conducted by Cruz et al., (2018) also address that construction industry in Mozambique is currently affected by an outdated public system that faces challenges of poor transparency, lack of uniformity, corruption, inadequate process, conflicts of interests and lack of effective monitoring.

Within this environment, this research aims to evaluate the risk factors affecting construction projects in Mozambique; investigate how risk management practices are conducted in the tendering phase of a project in order to reduce negative impacts on the next phases; present an overview of construction tendering practices applied in Mozambique; evaluate factors that might affect the accuracy of cost estimation; and assess the benefits of using risk management tools in the tendering process.

1.2. Research Questions

The following are the research questions which were responded in this study.

- What are the features of the tendering system in Mozambique and the implications this system has for companies operating in the country?
- What are the methods used by companies in Mozambique to manage risks during the tendering process?
- What are the most common factors which increase construction risks during the tendering process in Mozambique?
- How are those risk prices calculated and incorporated in tender proposals for construction contracts?
- How can the neglection of risk management during the tendering process affect the following phases of a project?

Once the research questions are adequately addressed, the objectives of this study would be met, using appropriated research methodology, methods of data analysis and understanding.

1.3. Importance of the Study

According to Håkansson and Ingemansson (2013), construction projects can be extremely complex and loaded with uncertainty Uncertainty, and risks can cause severe consequences in construction projects.

Smith et al. (2014) state that the risk exposure in the construction companies is at its peak during the process of tendering.

In order to assess risk management in the domain of construction, various surveys have been conducted. However, only few of them have examined risk management during the tendering process and its practical application in the projects.

This study is important because it investigates how companies operating in Mozambique have been managing risks during the tendering stage of the project in order to avoid the occurrence of adverse events or to reduce its impacts on the subsequent stages of a construction project.

1.4. Overview of Structure of Research Study

Chapter 1 – Introduction

The chapter states a comprehensive view of the research context by defining the problem statement and the importance of the research. It also states clearly the research questions and gaps in the current research base.

Chapter 2 – Literature Review

In the chapter, a detailed review of pertinent studies linked to risk management, tendering process, and strategies to manage risks in construction have been made. The chapter presents a critical review of the previously published literature, centred on the research topic.

Chapter 3 – Methodology

The chapter explains the methodological approaches adopted in the study to investigate the research problem. It elaborates on the research philosophy, design, methods, and approach adopted for the study, along with stating the methods used to collect data. The technique of analysing data, ethical considerations, and limitations of the research is detailed out in the chapter.

Chapter 4 – Analysis and Findings Discussion

The chapter aims at interpreting the crucial information collected from the respondents by outlining the research study results comprehensively.

Chapter 5 – Discussion

In the chapter, a detailed discussion of the prominent findings from the collected data in support of literary evidence is made, considering the research objectives.

Chapter 6 – Conclusion and Recommendations

The chapter states the key findings from the overall analysis and in-depth study of the research problem. Apart from this, recommendations for future research are also made in the chapter.

CHAPTER 2: Literature Review

In order to collect important information and knowledge about the theoretical framework of this research, two main parts are covered in the Literature Review Chapter such as Part I: Tendering Process and Part II: Risk Management.

Part I presents an overview description of tendering practices and procedures within the construction industry, more specifically in Mozambique, whereas Part II provides information about how the risk management process is designed.

PART I: Tendering Process within the Construction Industry

The tendering process is one of the most important activities in the Construction Activity (Kusumarukmi and Wahyu Adi, 2019).

Winch (2010) explains that this process is frequently used to find the most competitive price and the adequate technical proposal for the execution of a project, therefore, the tendering process plays an essential role in deciding which company will be responsible for the construction process.

2.1. Contractor's Tendering Overview

Wilson and Kusomo (2004) address that contractors must have constant contact with potential clients in order to be updated on what tenders are coming up soon. Therefore, it can be said that planning for a tender begins before the tender is published.

In addition to this, (Brook, 2016) argues that contractors should also be aware of upcoming projects by observing announcements and future plans from public bodies.

In Mozambique, the tendering documents are presented on paper or electronically, by the client or its contract manager (GIZ and ACIS, 2011). Moreover, public tenders are mostly announced at least twice in the written press, in the main newspaper that can be easily accessed by the target public (Brauch, 2012).

According to Brauch (2012), in case of international tenders, the documents must be first published in the Bulletin of the Republic of Mozambique and then on Contracting Entity webpage page and circulate in other channels.

Tender announcements must define precisely the tender object, present the contracting and funder bodies, define the amount of the provisional guarantee, indicate the venue and dates for proposals to be submitted and opened (GIZ and ACIS, 2011).

A site visit or a pre-tender meeting is usually part of the tender process (GIZ and ACIS, 2011). According to (Brook, 2016), the pre-tender meeting is an event that occurs before the submission of the proposals and aims to answer any general query and to ensure that the contractors have a clear understanding of the tender documents and the project itself. If a pre-tender meeting or construction site visit is mandatory, the announcement also must indicate the location, date and time of this event (Brauch, 2012).

Brandt and Franssen (2007) identify three sections in which tendering documents are usually split into, such as administrative, contractual and technical.

The administrative section includes all the requirements to assure contractors eligibility in terms of legal documentation (Brandt and Franssen, 2007). The contractual section includes contractual issues, whereas the technical part contains project description, general drawings, bill of quantities and technical specifications (Brandt and Franssen, 2007).

Thus, gathering all the documents needed in order to prepare a proposal for a tendering process is considered time-consuming and it involves high costs, according to Wilson and Kusomo (2004). For this reason, Wilson and Kusomo (2004) agree that it is essential for the contractor to decide whether to participate in the tender or not early.

Some scholars have identified the most important factors which influence the decision to tender or not. Since 1997 these factors have been analysed by Bajaj et al. who state that most important factors to be verified before tender are the project type (which indicates if the project suits to the company core business), contract conditions, currency, complexity of the project and available resources for its execution, tender deadline, and number of bidders.

Brook (2016) points out that, although the usual intention is to award the contract, contractors can have many different intentions when tendering on a project, for example, enhance reputation in the market and build connections with new clients or simply keep engaged with the old ones. Thus, contractors may tender on a project even if it is not attractive.

2.2. **Cost Estimation in Tendering Process**

According to Laryea (2011), cost estimation is the step in tendering process in which companies examine the tender documents such as specifications, drawings, and contract requirements and send to suppliers and subcontractors requests for prices of services and products in order to calculate the tender price. Therefore, the bidder ascertains a price on the commitment of the company and offer it to the client (Cheng, 2014).

Brandt and Franssen (2007) divide this traditional technique for estimating costs into the following activities.

The first activity involves a deep evaluation of the tender documents and a guided visit to the local where the project will be built. This is also the phase where the construction method is chosen (Brandt and Franssen, 2007).

The second activity includes the elaboration of the bill of quantities, according to the chosen construction method. In Design-bid-build method, the bill of quantities is already incorporated in the tendering documents (Brandt and Franssen, 2007).

Banaitiene and Banaitis (2012) state that the bill of quantity must be elaborated consistently, and it can only happen when the design is complete. Also, the bill of quantities ensures that all bidders will work on the same basis to calculate their tender prices.

Brandt and Franssen (2007) allocates the third stage for creating a work schedule for the execution of the project, including equipment plan and human resources plan

The estimation of direct costs such as labour, materials and subcontractors are the fourth activity (Brandt and Franssen, 2007).

The fifth task is to select the indirect costs such as equipment costs, wages of the skilled production team, insurance and guarantees. At this stage, a percentage of risk can be added to ensure that all unpredictable events are covered. Here, a profit margin is also defined in order to calculate the project selling price (Brandt and Franssen, 2007).

The sixth and last activity is to compile the outcome from the previous activities and convert it into a proposal (Brandt and Franssen, 2007).

The six stages scheme is illustrated in Figure 2.1.

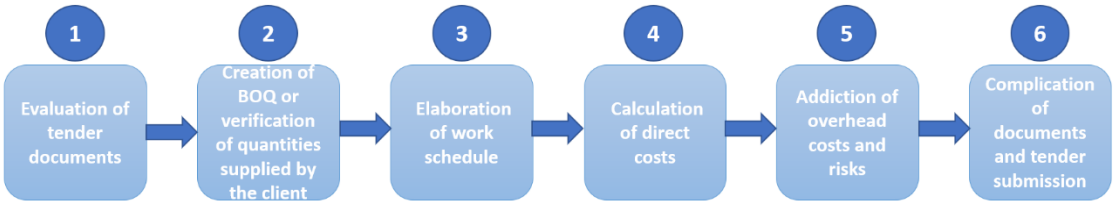

Figure 2.1 - Sequence of activities for estimating costs

Source: Author, 2020 (Based on Brandt and Franssen, 2007)

One of the ways to obtain direct costs is to obtain quotations from suppliers for materials and subcontractors for specialised works. On the other hand, another technique of cost estimating is based on experience gained from previous similar projects (Gilson and Vanreyk, 2016).

In this context, the contractor estimator plays a vital role in the success of the organisation (Tower and Baccarini, 2012). The responsibility of the estimator is forecasting economic costs for construction in a clear and consistent manner (Brook, 2016). However, the estimator has substantial knowledge of the prices prevailing in the marketplace. Therefore, management responsibility is to add the amount of basic overheads, to assess the risks and to convert estimates into a tender (Brook, 2016).

2.3. **Tender Pricing**

Tehin (2009) states that tender pricing is an activity which consists of distributing money among the items of a reviewed bill of quantities. Such values should cover the costs of materials, equipment, labour, profits and overheads.

Differently, Smith (2017) defines price as the charge for completing an element of work. Therefore, price is the cost plus allowances for general overheads, insurances, taxes, finance and profit.

According to Omran and Boon Hooi (2018), tendering price is divided into three groups, such as direct costs, indirect costs and, risks and profits.

The direct costs category includes the costs of materials, labour, and subcontractors. On the other hand, in the indirect costs are included all the costs which do not affect the project directly such as resources for project management and maintenance of the site yard such as equipment, engineers and other qualified technicians, insurance, bank guarantee, and others (Omran, and Boon Hooi, 2018). (Tower and Baccarini, 2012) indicates that cost for contingencies and uncertainties of the project are included in the risks' category.

Once the cost estimate has finished, the company CEO or shareholders decide the profit or the mark-up to be applied (Smith, 2017).

According to Brook (2016), companies often add a risk percentage in the mark-up. Contrarily, Laryea and Hughes (2011) state that one factor that increases risks is the disregard of risk costs in contractors proposals to avoid becoming not competitive.

Therefore, the mark-up depends not only on what clients are willing to pay but also on the competitive market environment (Laryea and Hughes, 2011). Thus, the tender price must be low enough for a successful competitive proposal and high enough to enable the firm to manage eventual risks and make profits (Kim et al., 2005).

The owners can choose one of the following mechanisms of payment: fixed price/lump-sum contract and unit price contract, which are the most known approaches to pricing in tenders (Knutson et al., 2008).

2.3.1. Fixed Price Bidding

Fixed price is one of the most known payment methods applied in the Construction Sector. In this method, the price is unchangeable and based on the contractor's estimation of the total cost based on the total amount of work (Öztaş and Ökmen, 2004).

The most popular fixed-price contract is the **lump sum**, where the contract price is estimated at the tendering phase and remains fixed during the whole execution phase of the project (Knutson et al., 2008). It is commonly used for projects with a properly defined scope so that works can be completely measured in advance (Gruneberg and Francis, 2019).

Öztaş and Ökmen (2004) explain that the client or funder pays the defined tender price according to the technical specifications, drawings, contract provisions, regardless of unexpected work quantities and costs that may incur during the construction period. For this reason, Smith (2017) addresses that the tender price must involve all reasonable sources of the cost related to the project.

On the other hand, Knutson et al. (2008) point out that knowing since the beginning of the contract what is the exact total amount that will be earned, the contractor can manage its budget in a more precise way.

Therefore, Smith (2017) claims that fixed-price payment method provides a more beneficial outcome for both clients and contractors.

2.3.2. Unit Price Contract

Following this method, quantities are listed according to the project components which are valued per unit by the contractor. In order to determine the total amount for the total quantities, a unit price is added of each work in the bill of quantities during the bidding process (Gruneberg and Francis, 2019).

The difference between this method and the lump sum method is that the client pays the contractor invoices based on the quantity of work executed (Smith, 2017). Thus, the final cost of the project remains unknown to both the client and contractor until the construction phase is complete, explains (Smith, 2017).

According to Gruneberg and Francis (2019), uncertainty and risk are bears by the customer after payment of the estimated final price. The contractor profit is limited to the standard prices, which are settled in agreement with the customer. Therefore, the contractor has no incentive to manage the costs effectively (Smith, 2017).

2.4. **Procurement Methods**

The sequence of the tendering process depends on the procurement method (Osipova and Eriksson, 2011).

In order to purchase products and services for investing in new infrastructure, clients follow a formal process which is known as procurement (Sullivan, et al., 2017). Apart from this, for significant procurement decisions, the contractor selection process is

demanding and time-consuming (Wilson and Kusomo, 2004). As per this process, it is assumed that clients get competitive proposals, tenders and bids from suppliers and provide them with possible solutions which help contractors to accept business challenges (Smith, 2017).

According to Potts (2010), the procurement method selected has a direct correlation with the risk level in a construction project. This illustration can be seen in Figure 2.2.

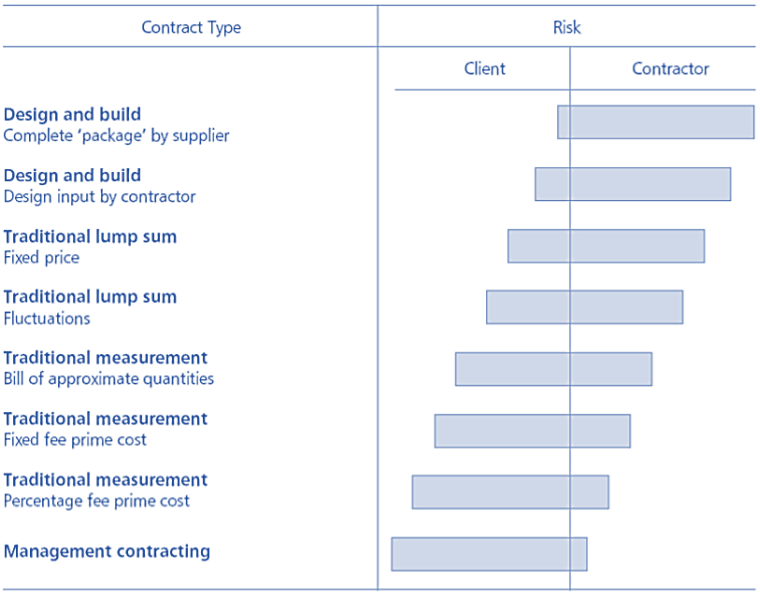

Figure 2.2 – Balance risks through procurement methods and contracts

Source: Clamp et al. (2007)

A description of the most applicable procurement methods in Mozambique is included in the subchapters 2.4.1.

2.4.1. Organisational Methods of Procurement

Design-build, design-bid-build and management contracting are the three major types of procurement organisational methods used in the Mozambique Construction Sector, according to (GIZ and ACIS, 2011).

2.4.1.1. Design-build method

In design-build procurement method, the project design is also part of the contractor responsibilities (Sullivan, et al., 2017). For this reason, the period for tendering is normally more extensive in this type of contract.

The design part can be executed either by the company's internal design team, if available, or by creating a joint venture with an external company of designers, as most of the contractors do not have such division within their firms in Mozambique (Ruas et al., 2007).

The contractor can also opt to combine the drawings provided by each subcontractor who will be in charge of the design and project execution according to their specialisation such as Civil Works, Mechanical Works, Electrical Works, Hydraulic Works, and other parts of a construction project (Hughes et al., 2015).

The level of design details varies according to the characteristics of the project and the client requirements (Potts, 2010). For the tendering phase, only the price and generic drawings are included in the proposal to give the client a general idea of what the contractor is proposing (Hughes et al., 2015).

Hughes et al. (2015) state that, usually, tender documents predetermine some parts of the design, which must be followed by contractors in order to draw the remaining parts. In a later stage, the contractor performs the whole construction design that will be used for the execution of the project

Some advantages of Design-build procurement method are that the construction stage can start before the design stage is totally concluded and as the construction phase proceeds, the contractor can easily make adjustments on its own project in order to meet time, budget and the quality standards required (Sullivan, et al., 2017).

For the client, the advantage of using this type of contract is that he has less responsibility by establishing one unique agreement with the contractor for both project design and project execution (Potts, 2010). Thus, the client is allowed to communicate and deal with only one party what facilitates the speed of project delivery.

On the other hand, Ling et al. (2004) address that this type of contract can be more expensive for the client, as the contractor responsibility is broader. Consequently, he is likely to charge higher prices to overcome risks of faults in design and construction.

2.4.1.2. Design-bid-build method

In Design-bid-build procurement method, construction design is under the client's responsibility; therefore, the tendering process only involves the construction phase (Hughes et al., 2015).

According to (Osipova and Eriksson, 2011) the essential difference from this method to the Design-build method is the involvement of a general contractor.

Only one contract agreement is stabilised between the client and the general contractor who is responsible for the construction activity as a whole and the coordination of specialised subcontractors often hired to perform parts of the construction work. Over the years, this has been the most used method of procurement (Sullivan, et al., 2017).

Hughes et al. (2015) argue that the decision to choose the Design-bid-build method depends on the stage of development of the design of the project before the tender is published. In complement to this theory, Potts (2010) affirms that Design-bid-build contracts allow clients to have an estimation value of the project before they decide to proceed to the tendering process.

Because there is more work to do before the tendering process, Potts (2010) points out time-consuming as being one of the main disadvantages of this method for the client. On the other hand, Osipova and Eriksson (2011) address that the client can benefit from lower construction costs as contractors apply lower profit margins and there are fewer risks for contractors as they only focus on construction.

In summary, the differences between DBB and DB methods are represented in Figure 2.3.

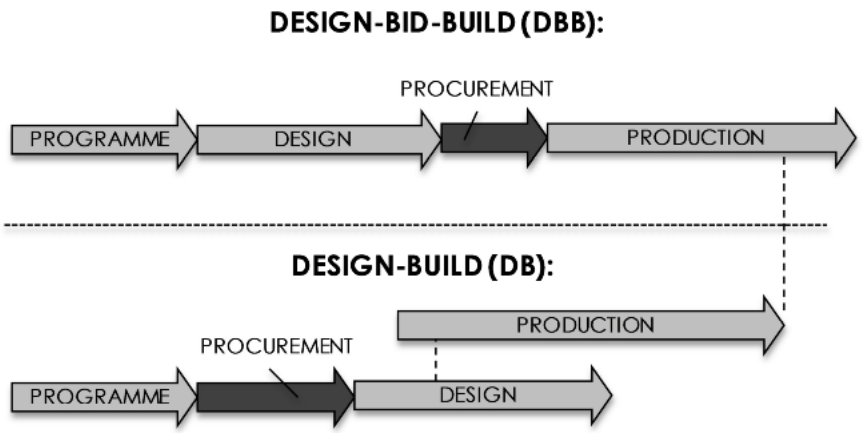

Figure 2.3 - Scheme of procurement DBB and DB methods

Source: Osipova (2008)

2.4.1.3. Management Contracting

Less used than the other forms, management contracting is a model of construction procurement where it is the client's responsibility to employ subcontractors to execute different parts of project works. In this case, the role of the main contractor is just to manage the subcontractors on the Client's behalf (Hughes et al., 2015).

The contractual relationship between the different parties can be seen in Figure 2.4.

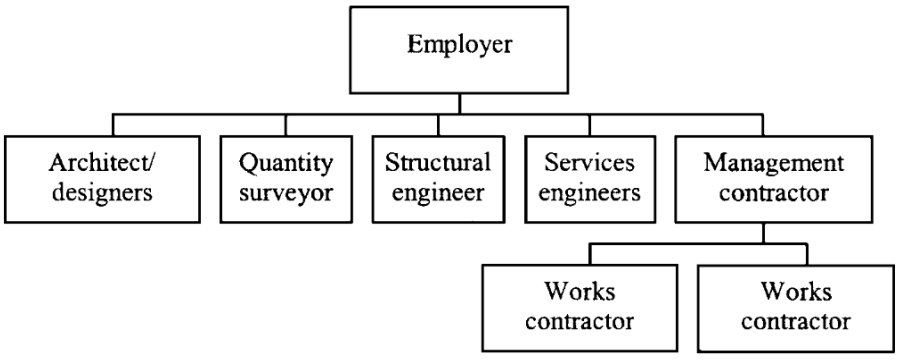

Figure 2.4 – Contractual relationships in management contracting method

Source: Hughes et al. (2015)

2.5. **Public Procurement**

The construction industry is broadly categorised into the private and public sectors in Mozambique. A large array of legislative has been passed to provide background and legal construction context. It involves the 2005 Procurement Regulation, laws concerning building codes, licensing, and individuals involved in private and public works (GIZ and ACIS, 2008).

Major part of the clients in the construction industry are Public bodies (Eriksson, 2008).

UFSA (Unidade Funcional de Supervisão das Aquisições), the Unit for the Supervision of Acquisitions is the public body responsible for oversight of the Procurement Regulation in Mozambique (GIZ and ACIS, 2011).

The process of tendering is largely influenced by the several aspects of these regulations. For example, it assists in regulating the tender documents regarding the content and the qualifications on which it must be disproved. Large projects of construction must announce to the public effectively (Cerveira and Castro, 2019). In order to regulate the award and service of the public contract or good contracts, the Regulation on the Award of Public Contracts (RPC) is considered as the key legislation, approved by Decree 5/2006 that laid down the rules to award the contracts in Mozambique. Regulation on the Award of Public Contracts (RPC) also has applicability in awarding contracts of public lease, concession granting, and consultation of service contracts GoM (2016).

Since 26th August 1995, Mozambique is remained a World Trade Organization member but not remained a signatory of the Agreement on Government Procurement (GPA), which aims at fostering open mutual market of procurement among the involved parties. Nonetheless, the legal framework of Portuguese produces a substantial impact on the RPC, along with other distinct legislation on the award of the public contract. Due to this reason, the RPC evident adhered to a similar framework with the EU (Cerveira and Castro, 2019).

2.5.1. Ethics Principles and the Right of Appeal

Two major principles govern procurement regulation, namely, transparency and equal treatment (GIZ and ACIS, 2011). Herein, transparency emphasises on providing the accurate and same information to all the parties, whereas, equal treatment demands the involvement of all parties to access the information equally at a point of time.

Both these principles can be demonstrated during the tendering process, in case of having ambiguity in the documents and a comprehensive answer is available to all competitors via the public client (GIZ and ACIS, 2011).

Apart from these principles, the Regulation is also applied in Mozambique, such as anti-corruption legislation and laws overriding state employee's behaviour (Brauch, 2012).

2.6. **Evaluation and Decision Criteria**

In Mozambique, the most used criteria to evaluate and decide which contractor will award a project to execute are the lowest-price criterion and the conjugated criterion (Brauch, 2012).

According to Hughes et al. (2015), the public works contracts and supply of products and services are customary determined on lowest-price criterion. However, duo to the complexity of certain projects, the conjugated criterion can be used on the basis of the price and technical evaluation (Brauch, 2012).

2.6.1. Lowest-Price Criterion

This decision criterion provides the guarantee of quality and qualifications of the tenderer, which is essential to attain public interest as per the tender documents. While evaluating prices, the conditions about payment can be taken into account, as far as the

criterion of the contract is objectively stated and remain available in advance, in the documents of tender (Brauch, 2012).

2.6.2. Conjugated Criterion

Following this criterion, evaluation is made on the basis of the conjugation of financial and technical proposals that are weighed in the documents of tender (Hughes et al., 2015).

The factors of the technical evaluation are associated with construction methods, materials specifications, delivery deadline, operational costs, payment schedule, qualification of the technical team, equipment availability and efficiency, cost of transportation and insurance, warranty conditions, health and safety certification and environmental benefits (Brauch, 2012).

PART II: Risk Management

Risk is any uncertain circumstance or event, with a positive or negative impact, which occurs during any project stage (Keshk et al., 2018)

High uncertainty and risk are created by the complexity and dynamism of projects within the construction industry (Mhetre et al., 2016).

Risk can be generated from various sources and be defined as the effect of threats and uncertainty from corporate business or project failures at any stage (Bowers, 2016).

To this theory, Akinbile et al. (2018) add that risks can also be originated by accidents, natural disasters, or any other adversary event of an unpredictable cause.

Project Management Institute (2013) defines risk management as a process which consists of identification, assessment, methods of response, controlling and monitoring possible risks in order to minimise the impact and reduce the probability of occurrence of undesired events.

According to Bowers (2016) is risk management is a mechanism whereby companies ensure that uncertain factors will not negatively affect business goals

Banaitiene et al. (2011) state that each construction project is unique, and risks raise from various sources (Mhetre et al., 2016). Furthermore, industries are exposed to economic, socio-political, technical and business risks within the environment where they are operating (Mhetre et al., 2016). As a result, companies can face challenging situations to bear due to failures in meeting the project quality and operational requirements and the planned delivery date of the project, involving unexpected incurred costs (Mhetre et al., 2016).

In construction industry as in other sectors, the application of risk management process helps the contractor, consultant, client, and supplier to meet defined targets of construction projects and reduce negative impacts on their performance regarding quality, time and cost (Banaitiene et al., 2011). If not correctly identified and analysed,

project risks are likely to lead to failures in meeting contract commitments, and companies may report a high rate of construction abandonment (Akinbile et al., 2018).

According to Mhetre et al. (2016), risks within the Construction Sector can be classified according to the following categories:

Organisational Risks are associated with lack of contractors experience, poor contractual relations, inadequate attitude of participants, poor communication and inexperienced workforce (Akinbile et al., 2018).

Technical Risks are related to insufficient resource availability, change in scope, change in construction procedures and inaccurate information of the project such as insufficient site investigation, unclear specification and incomplete design (Akinbile et al., 2018).

Construction Risks are associated with new technology and high-quality standards, shortage of resources, equipment failure, labour disputes, low labour productivity, non-favourable site conditions, design changes, variation in work quantities and discrepancies in contract documentation (Mhetre et al., 2016 and Akinbile et al., 2018).

Physical Risks arising from accidents, labour injuries, equipment damage, structure damage and material fire and theft (Akinbile et al., 2018).

Financial Risks are related to exchange rate fluctuation, increasing in materials cost, incorrect taxes estimation, payment delays and low market demand (Akinbile et al., 2018).

Socio-Political Risks are associate with corruption, language and cultural barriers, changes in regulations and laws, implementation of new health and safety rules, civil disorder and requirements for construction permits and project approvals (Akinbile et al., 2018).

Environmental Risks consist of weather conditions and natural disasters (Mhetre et al., 2016).

2.7. **Risk Management Procedure**

The model of risk management is a technique which consists of separating the activities related to the identification of risks, activities that evaluate such risks probability and impact, and activities that support the mitigation plan to manage these risks. Therefore, these activities are divided into three categories: identification, quantification and response (Maylor, 2010).

Some scholars explain risk management process differently; however, in general, the principles are similar. Most of the literature describes the process as a learning and on-going process represented as a circular model (Winch, 2010). On the other hand, some researches illustrate the process as a line-shaped model of which the start and end activities are not connected to each other (Simu, 2014). Other scholars have been clamming that this lack of correlation is the cause of which the construction industry frequently faces the same risky occurrences in projects from time to time (Winch, 2010).

Potts (2010) explains that the risk management process is mainly composed by three important phases which correspond to ISO 31000 model (showed in Figure 2.5.), such as risk identification, risk analysis, risk evaluation and risk treatment. These phases are followed by risk monitoring and review during the execution of the project.

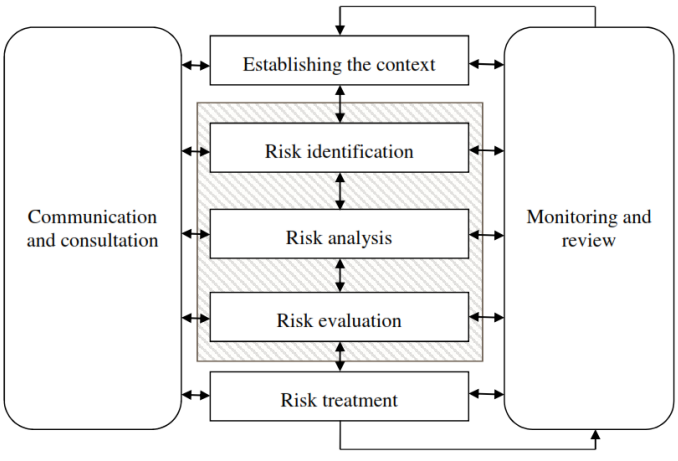

Figure 2.5 – Phases of risk management procedure

Source: Standard ISO 31000:2018

2.7.1. Risk Identification

During the complete lifecycle of a project, the process of risk identification is explained as the on-going activities set. With the progress of the construction project, making changes in the process become difficult as it associated with substantially high costs. Identification of risks at the earliest stage is crucial to govern and manage them effectively (Smith et al., 2014).

The primary task of the risk identification process is to create a risk register which consists of a table where risks with both positive and negative consequences are listed (Project Management Institute, 2013).

According to Bajaj et al. (1997), if not early identified, risk cannot be managed. On the other hand, Potts (2010) states that it is not possible to identify all the risks related to a certain project; thus, a company cannot estimate the tender price based on the assumption that it is possible. Moreover, construction projects vary in nature and specificity what makes each project unique, requiring different analyses of risk identification for each project.

In support of the claims, Winch (2010) states that risk identification is a crucial step in the overall risk management practice. Bajaj et al. (1997) views have concurred the statement by claiming that the key benefits of risk management occur from risk identification phase, rather than the phase of risk analysis. Contrarily, some scholars argue that the risk identification phase is a less formal element in the process of risk management. In order to identify risks, the below methods can be adopted:

2.7.1.1. Information Gathering Techniques

Brainstorming is a popular technique very useful for risk identification. This technique consists of generating ideas from all members involved in a project being one of them a facilitator who briefs about the different aspects and points of view from the

participants. In the end, the facilitator reviews these aspects and eliminates the irrelevant ones (Project Management Institute, 2013).

Delphi Technique is similar to brainstorming; however, the project risk experts are not at the same place, do not consult each other and may not know each other. They participate in this technique anonymously (Project Management Institute, 2013).

The facilitator asks for ideas about the relevant project risks. The ideas are combined and shared with the participants. After a few rounds of this process, consensus may be reached (Project Management Institute, 2013).

Delphi technique avoids the undue influence of one person on the result (Project Management Institute, 2013).

Interviewing participants with vast experience in similar projects, subject matter experts and stakeholders is a great help in identifying and avoiding risks or solving issues generated by these risks (Project Management Institute, 2013).

Checklists are predetermined lists of factors that can affect a project negatively. The checklist which contains a list of the risks identified in projects is based on past experience from similar projects and knowledge that has been acquired. Besides the checklist, participants must properly work on risk identification and consider factors that are not on the checklist. During project closure, the checklist is reviewed according to the new experience acquired useful to apply on future projects analysis (Project Management Institute, 2013).

2.7.2. Risk Analysis and Evaluation

Evaluating the effects of identified risks is the purpose of risk analysis.

Depending on the circumstances, analysis techniques can be quantitative, qualitative or a combination of both (ISO 31000:2018).

The choice of the adequate technique depends on the size of project, the characteristics of the identified risks, the purpose of the analysis, and the available resources (ISO

31000:2018). Moreover, the choice of the technique should be derived from knowledge and experience in risk analysis (Banaitiene and Banaitis, 2012).

In some projects, the analysis may be too superficial and hardly generate sufficient results, in other projects it can be more detailed and a waste of resources.

Usability is the first aspect to be considered, and the result must be expressed in an understandable language.

Furthermore, practical aspects of the analysis techniques have also to be considered. The benefit of the analysis must be more significant than the spending of the resources. Lastly, analysis reliability is considered by the decision-makers. The results must be accurate in order to be the base for decisions making (Banaitiene and Banaitis, 2012).

The following factors should be considered in risk analysis:

- Likelihood of occurrence of events and its consequences
- Nature and scale of consequences
- Connectivity and Complexity
- Volatility and time-associated factors
- Effectiveness of current controls
- Sensitivity and level of confidence

2.7.2.1. Quantitative Risk Analysis

Quantitative risk analysis provides numerical information on the identified risks of a project and their consequences (Project Management Institute, 2013). The outcome of this analysis is a priority matter for projects with potential related risks.

The necessary data for quantitative analysis is provided by specialist's estimates and historical databases. As consequence of subjective estimation, the estimates might contain a certain level of uncertainty.

As quantitative techniques require a high level of knowledge and consume too much time, these techniques are more used when it comes to medium and large-sized projects (Smith et al., 2014).

Because they are based on mathematical features and theories of probability, the quantitative analyses can be complex and hard to perform by hand. Thus, computer-based software are mostly used to perform the calculations (Smith et al.,2014).

According to Radu (2009), the sensitivity analysis, decision trees and Monte Carlo simulation are the most used quantitative techniques.

Sensitivity analysis

According to Mhetre, et al. (2016), sensitivity analysis is a quantitative method, visualised in a diagram, used to determine the uncertain elements that may have a large impact on the project outcome.

Smith et al. (2014) explain that this a financial model which, based on changes in input component, determines how the key components of a project are sensitive to change.

By creating a certain set of components, an analyst can predict how changes in one component would affect the project outcome Smith et al. (2014).

The analysis considers the more important and critical events be for the project (Mhetre et al., 2016).

According to ISO 31000:2018, is recommended for all project-based organisations to perform a sensitivity analysis, since it is a very effective tool.

The analysis also has many limitations which have to be considered (Smith et al.,2014).

In the calculations, the analysis assumes that all other elements remain constant when one of the evaluated parameters change. Although, in reality, events within a project are interconnected to each other and can affect the project outcome simultaneously when one of the variables changes (Smith et al.,2014).

When performed in an early stage of a project, the sensitivity analysis provides analysts with information about the critical features where special attention should be given (Smith et al.,2014).

Smith et al. (2014) state that this is an appropriate method when it comes to projects of which a company does not have enough experience from a similar project.

Monte Carlo Simulation - Probabilistic Analysis

At a different level of uncertainties, Monte Carlo Simulation quantifies the potential impact of risks on projects, their schedules and budgets Mhetre, et. al (2016). For this, the whole Monte Carlo Simulation system is many times stimulated by randomly choosing a value for each probability distribution factor (Mhetre, et. al, 2016).

Also, it is used to analyse how the total risk exposure can be affected by one single risk variability.

Moreover, Akkoyun (2012) affirms that the use of a Monte Carlo simulation can be profitable, for example, when risk treatments are too many and their costs are high.

According to Loizou and French (2012), Monte Carlo simulation has many benefits and it generates clarity and comprehensiveness, leading to appropriated decisions makings. Another advantage of this model is the lower degree of subjectivity of the stimulation that leads the decision-maker to be consistent and rational.

On the other hand, some disadvantages are also pointed out by Loizou and French (2012).

The input data, in which the model is based on, come from subjective estimates or historical information which can be not accurate. Thus, an adequate probability distribution to each element can often not be easy to find. Therefore, Loizou and French (2012) concluded that for Monte Carlo simulation to be effective, it should be used in combination with other risk management methods.

In this context, Chan and Malmborg, (2013) divide Monte Carlo simulations into four following stages.

The first stage is where the type of probability distributions, to be applied in the simulation, is decided (Chan and Malmborg, 2013).

In the second stage, data within a particular range is randomly generated. To have a wide spectrum of data, the random sampling for each component generates a large number of sets of data. For better analyse, data can also be divided into ranges. In this stage, the correlations of all the elements are also set (Chan and Malmborg, 2013).

Every set of data is analysed in order to confirm if the set meets the specific criteria, in the third stage (Chan and Malmborg, 2013).

In stage 4, a sensitivity analysis is created from the generated data (Chan and Malmborg, 2013).

More than 1,000 iterations might be needed in order to have a representative sample (Smith et al.,2014).

Decision Trees

Decision trees are helpful to evaluate options and formulate a problem (Mhetre, et. al, 2016).

According to Smith et al. (2014) this technique is based on a graphical model which consist of a chance node and a decision node.

Through this graphical model, it is possible to visualise how each decision made will affect the probability of an event occurrence during the execution of the project (Mhetre, et. al, 2016).

The chance node indicates the possible risks and the decision node represents decisions that must be made. To illustrate how the concerned events connected to each other, they are interrelated by arrows (Mhetre, et. al, 2016).

Smith et al. (2014) state that this method can be used either as a quantitative technique or as a qualitative technique. If necessary, the decision-maker can exclude from the network, the probability of events occurrence, thus the method is classified as qualitative. In this case, the model may include information about the risk exposure for the events and how much the implementation of the decisions will cost (Smith et al., 2014).

The main advantage of using this method as quantitative is that it ensures that decision-makers will have a global vision of all available options in the early stages of a project. Also, potential scenarios in the project can be connected for the project team to get a deeper understating about the project (Smith et al., 2014).

This method is adequate for small and medium-sized projects or when decision-makers have to analyse a specific event in a major project (Lyons and Skitmore, 2004).

Due to the complexity of the method, it can be difficult to use and analyse in larger projects (Lyons and Skitmore, 2004).

2.7.2.2. Qualitative Risk Analysis

The qualitative method of risks analysis is the process that prioritises risks to analyse further through assessing and integrating the probability of occurrence of events and its consequences (Project Management Institute, 2013).

Based on descriptive scales, qualitative risk analysis approach aims to evaluate the probability of occurrence and impact of identified risks using techniques which brings results quickly and simply (Mhetre et al., 2016).

Due to the limitation of time for risk analysis in some firms, qualitative analysis methods have become popular since 1998, according to a study conducted by Baker et al., (1998).

Lyons and Skitmore (2004) state that while customers frequently use quantitative techniques, contractors tend to use more qualitative techniques.

The primary objective of qualitative analysis is to elaborate a list of prioritised risks and identify the ones with the most harmful impact which would require further solutions (Lyons and Skitmore, 2004).

According to Smith et al. (2014), qualitative analysis is often used when the complexity of a project is low or in small to medium-sized projects.

Additionally, Radu (2009) addresses that qualitative risk analysis techniques should be used when there is a lack of numerical information or limited availability of data acquired by a firm at the early stage of a project. In this case, a firm risk analysis has to start by a qualitative approach until it has enough information to carry on with a quantitative approach (Smith et al.,2014).

The most often used technique is the risk matrix method, however a few number of other methods also exist (Project Management Institute, 2013).

Potts (2010) suggests two qualitative methods such as the risk tree approach and expected monetary value.

Probability methods are used to evaluated how likely an risky event can happen. By designing a probability interval, the likelihood is estimated and then a number is picked on the scale. Thus, quantitative analysis adopts the first while quantitative analysis adopts the second approach (Smith et al.,2014).

The probability is measured in percentage of the event occurrence likelihood. The probability interval includes events from most improbable to highly likely occurrence during a project Mhetre, et. al (2016).

The impact of the risks can also be estimated in a similar basis. Also, the impact is often rated in time unit or monetary. The impact interval ranges from events with critical effect on the project to events with low harm (Maylor, 2010).

According to Mhetre, et. al (2016), risk probability and impact, probability/impact risk rating matrix, and risk categorisation and urgency are the most used methods of quantitative analysis.

Risk probability and impact assessment

Using the method 'Risk Probability and Impact Assessment', the likelihood or probability of a specific risk to occur can be examined ISO 31000:2018. It is assessed to explore the impact of risks in positive and negative terms of both to assess the opportunities and threats. For this assessment, there is a need to define and tailor the probability and impact as per a specific product (Project Management Institute, 2013). It demands a clear definition of scale and scope, explaining the nature, objectives, and criteria of the project. In this regard, Project Management Institute (2013) has defined an exemplary probability range, ranging from 'very unlikely' to 'almost certain,' and the impact scale ranges between 'very low' and 'very high.'

Probability/impact risk rating matrix

According to Project Management Institute (2013), the previous step assesses the probability and impact of risks, which is used further as the key basis of quantitative analysis. Due to this reason, the findings drawn on the assessment are prioritised using different calculation methods that are highlighted in the literature.

The rating, priority score range, and the colour is assigned to different risks to highlight their importance. In this, the threats identified with high likelihood and impact are acknowledged as high risk and, thus, demand an immediate response, whereas low priority score threats require monitoring with actions, when or if needed Project Management Institute (2013).

Probability and Impact Matrix

Probability	Threats					Opportunities				
0.90	0.05	0.09	0.18	0.36	0.72	0.72	0.36	0.18	0.09	0.05
0.70	0.04	0.07	0.14	0.28	0.56	0.56	0.28	0.14	0.07	0.04
0.50	0.03	0.05	0.10	0.20	0.40	0.40	0.20	0.10	0.05	0.03
0.30	0.02	0.03	0.06	0.12	0.24	0.24	0.12	0.06	0.03	0.02
0.10	0.01	0.01	0.02	0.04	0.08	0.08	0.04	0.02	0.01	0.01
	0.05/ Very Low	0.10/ Low	0.20/ Moderate	0.40/ High	0.80/ Very High	0.80/ Very High	0.40/ High	0.20/ Moderate	0.10/ Low	0.05/ Very Low

Impact (numerical scale) on an objective (e.g., cost, time, scope or quality)

Each risk is rated on its probability of occurring and impact on an objective if it does occur. The organization's thresholds for low, moderate or high risks are shown in the matrix and determine whether the risk is scored as high, moderate or low for that objective.

Figure 2.6 - Probability and impact matrix

Source: Project Management Institute (2013)

Risk categorisation and Risk Urgency Assessment

The process of systematising project threats is known as risk categorisation (Smith et al., 2014). In order to identify the project areas that are most vulnerable to risks, different tools are available under the risk categorisation method. These tools are risk breakdown structure (RBS) and Work Breakdown Structure (WBS), which help in developing effective response over risks. RBS helps in categorising risks and highlights their dependencies, whereas, WBS helps in breaking down the large activities into manageable and small units, and helps in creating linked and hierarchal network of independent activities (Project Management Institute, 2013). On the other hand, Risk Urgency Assessment helps in prioritising risks as per the quick response required to address the activities of the risk (Project Management Institute, 2013).

2.7.3. Risk Response

The risks are evaluated through an established risk acceptance criteria (Smith et al., 2014).

(Project Management Institute, 2013) states that risk response is concerned with planning, aiming at developing some options, and effective actions to increase opportunities and reduce threats in attaining the objectives of the project. In this context, Smith et al. (2014), argues that the treatment or response process aims to modify those risks until they can be controlled and accepted by decreasing the probability of the risks occurrence and decreasing their impact on the project. Moreover, the process develops actions that should be considered towards the identified threats to project objectives.

The response strategy depends on the type of threats concerned (Smith et al., 2014).

2.7.3.1. Risk Response Strategies

Strategies applied when companies are dealing with threats or risks that may occur and have a negative impact on project objectives are avoidance, transference, and mitigation (Project Management Institute, 2013).

According to Project Management Institute (2013), The acceptance strategy can be used for threats or negative risks and opportunities or positive risks, as well.

These risk response strategies should match the probability and impacts of the risks on the project. Each strategy has a singular influence on the risk condition (Banaitiene and Banaitis, 2012).

For critical risks, Mitigation and Avoidance strategies are usually good options, while acceptance and transference are usually used in response to risks with low overall impact (Banaitiene and Banaitis, 2012).

In context to this, the following sub-headings describe the major strategies that can be used to deal effectively with the threats or negative risks:

Avoid

It involves changes in the project management plan in an attempt to completely eliminate the risk and protect the project from its impact (Project Management Institute, 2013).

The project objectives found in jeopardy can be isolated by the project manager from the impact of the risk and further changes in objectives (Project Management Institute, 2013). For example, the change in the strategy, reduction in scope, or extension of schedule. Herein, the shutting down of the project is the most radical strategy of avoidance (ISO 31000:2018). There are some risks in the project that can be dealt with by avoiding through gaining information, explaining requirements, acquiring expertise, and enhancing communication (Project Management Institute, 2013).

Transfer

This response strategy focuses on finding out some other party, ready to take the responsibility of managing and bearing the liability of risks on its occurrence. Transfer of risk does not eliminate the threats, rather it prevails, and only the other party gets accountable to own and manage it. In dealing with financial exposure, transferring risk has been examined in an effective way (Banaitiene and Banaitis, 2012). The aim of the strategy is to ensure effective ownership and management by a party who is able to deal with the risk effectively (Project Management Institute, 2013).

Mitigate/Reduce

The risk mitigation or reduction strategy focuses on reducing the probability and effects of an adverse event of a risk to the acceptable threshold. Herein, taking early action helps in reducing the probability and/or impact of risk effectively, rather than making an attempt to repair the damage on or after the occurrence of the risk (Banaitiene and Banaitis, 2012).

2.7.3.2. Contingency Plan

The approach focuses on using the fallback plan on the occurrence of the risk. Contingencies can be available by way of keeping something secure in the reserve or in terms of costs to deal with some unknown risks (Project Management Institute, 2013).

2.8. Risk Controlling and Monitoring

The plans of risk response involve a sequential process, encompasses the tracking of identified risks, the examination of residual risks, identification of new risks, and evaluation of the effectiveness of risk process throughout the lifecycle of the project (Project Management Institute, 2013). Herein, the risk treatment options can be applied individually, as well as in combination with other methods to attain the best results. While determining the best-suited treatment option for risk, the decision-makers should balance the costs and efforts for the activity of risk treatment against the provided benefits (ISO 31000:2018).

2.9. **Risk Review**

This is the last step of the risk management process that needs to be performed after implementing response actions (ISO 31000:2018). The tracking and recording of the effectiveness of actions and changes to the risk profile is made in the step (Project Management Institute, 2013). A detailed assessment of the effect of response actions, positive or negative on the project objectives, is made. Responses made to tackle the risks also documented at this step for future project plans and reference (Project Management Institute, 2013).

CHAPTER 3: Research Methodology

This chapter describes the methodology adopted to conduct this research, meet its objectives and answer its research questions presented in Chapter 1.

The research design, the group of people involved in the study, the methods used for data collection, processing and analysis are presented in this chapter.

3.1. Qualitative Research Method

According to Creswell (2012), qualitative research is a combination of concepts, descriptions, meanings, and definitions regarding a certain topic.

In contrast to quantitative methods where the collected data is measurable, qualitative methods focus on answering questions considering points of view, perspectives and experience of participants through techniques such as group discussions in order to investigate beliefs, attitudes and behaviour; semi-structured and depth interviews with key participants in order to understand and collect background information, experience, conditions, concerns and personal and institutional perspectives; and analysis of documents such as journals, media articles, institutional reports, norms and other credible sources of information (Gill et al., 2008).

Johnson and Christensen (2012) state that qualitative research methods techniques for data collection are unique since they allow the generation of factual information. For example, this type of research helps scholars to gather non-numerical data from participants through a more descriptive approach. Thus, Leedy & Ormrod (2015), concludes that this approach generates surplus data on real-life facts and leads to an easy understanding of participants experiences since there is an opportunity to directly interact to them.

The emergence of theory from data is one more feature of qualitative research methods noted by Eyisi (2016). For instance, after interpreting the originality and nature of facts,

instead of testing somewhere else the data obtained, some scholars reconstruct those theories whenever it is appropriated.

3.2. Quantitative Research Method

Eyisi (2016) addresses that quantitative research is a numerical approach used by the researchers to meet the research objectives through questionnaires surveys and experiments.

Eyisi (2016) also explains that when a large population is studied, researchers can save time and resources as they can utilise statistical data tools as SPSS to manipulate numbers, percentages and figures. Thus, this method is less time consuming than the quantitative research method.

3.3. Research Design

Research design is a plan or framework for conducting a research by specifying procedures and methods for collecting data and performing analysis (Creswell and Creswell, 2018).

In this study, the type of research design followed is exploratory research. According to Salaria (2012) This type of research design is based on an investigation of problems that have not been studied before, in order to have a better understanding of a certain topic.

Exploratory research aims to is to gather information and collection of new data to develop improved analysis, techniques and method for future studies. This type of research design answer questions such as what, how and why (Creswell and Creswell, 2018).

The methods used for data collection are described in subchapter 3.7.

3.4. Focus Group

The focus group studied in this research are people who directly or indirectly work in commercial or tender departments in construction companies in Mozambique. This group consists of estimators, project managers, tender managers, business development managers, architects, engineers, contracts managers, managing director, and others.

3.5. Sample Size

The sample size includes ten senior managers, from seven different construction companies operating in Mozambique, who participated in the interview, and forty-seven respondents actively associated with Commercial/Tender issues in the construction industry in Mozambique, participated in the online survey.

3.6. Questionnaire Development

Experienced participants were selected to share relevant information and insights related to what they frequently face during the construction tendering process, what risks involved are in the process and how these risks are managed.

Divided into two chapters (tendering process and risk management), the questionnaire was developed and structured in order to be possible to extract the maximum information about the topic from the participants.

It has an open-ended format, starting with a question that is followed by a subsequent question based on the previous answer.

The online survey was also sent to experienced participants who responded to more generic questions.

3.7. Data Collection and Procedure

For data collection and research, primary and secondary research methods were adopted in order to elaborate a comprehensive analysis, identify trends and relationships within the data collected and interpret the findings.

The primary data sources used in this research were interviews via video call, which respondents were able to their opinion about the research topic, and online surveys.

These research methods were used to study behaviour, trends and opinions of the group of people selected.

The secondary data source used in this research are company internal documents and policies, government documents, credible online sources and academic literature as textbooks, articles, magazines and other publications.

The research design was based on resources and participants availability. Only employees who are associated with Commercial/Tender Departments in Construction Companies in Mozambique were considered in this study.

3.8. Data Analysis

The software used for quantitative analysis was Microsoft Excel.

3.9. Limitations

Travel banners due to COVID 19 outbreak did not allow to conduct interviews in person, but only voice and video call instead.

Another barrier was the limited time to conduct the research which did not allow to collect data from all construction companies operating in Mozambique.

3.10. Ethical Considerations

National College of Ireland defined ethical guidelines which were carefully considered in this study.

The participation of the respondents and interviewees was voluntary and anonymous. The information provided was treated with confidentiality and privacy.

If wished, the respondents and interviewees at any point could withdraw from the study.

CHAPTER 4: Analysis and Findings Discussion

In this chapter, findings from the survey, interviews, and internal documents of companies will be presented.

Ten senior managers from seven construction companies operating in Mozambique were interviewed, and a total of forty-seven employees who work directly or indirectly in Commercial/Tender Departments in Construction Companies were considered in this study, as well.

Distribution of jobs positions

- *Online Survey*

Table 4.1 and Figure 4.1 show the distribution of the job positions of online respondents.

The four dominant job positions from the sample are 17 Estimators, 7 Tender Coordinators, 6 Project Managers and 5 Tender Managers.

Job Position	Nr	%
Managing Director	2	4,3%
Contracts Manager	1	2,1%
Project Manager	6	12,8%
Business Development Manager	2	4,3%
Tender Manager	5	10,6%
Tender Coordinator	7	14,9%
Estimator/ Quantity Surveyor	17	36,2%
Estimator Assistant	4	8,5%
Architect	2	4,3%
Safety and Quality Manager	1	2,1%
TOTAL	**47**	**100%**

Table 4.1 - Jobs positions of online survey respondents
Source: Field data, 2020

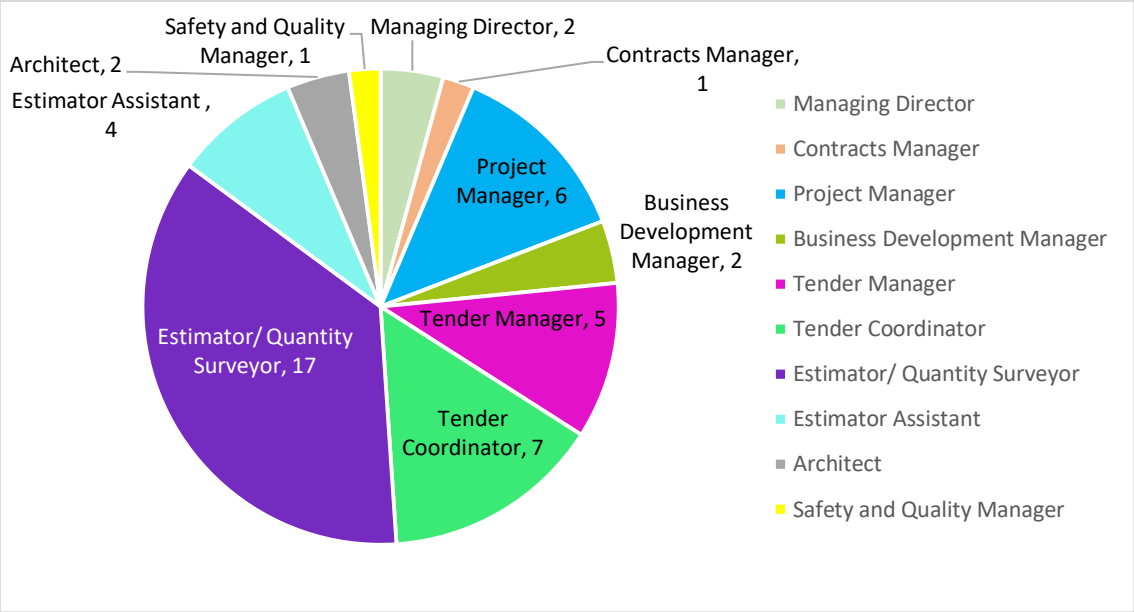

Figure 4.1 - Jobs positions of online survey respondents
Source: Field data, 2020

- *Interviews*

Table 4.2 and Figure 4.2 show the distribution of the job positions of participants of the interviews within the seven chosen companies A, B, C , D , E, F and G.

The four job positions considered in the interviews were primarily 5 Tender Managers, then 2 Managing Directors, 2 Project Managers and 1 Business Development Manager.

50% of the sample are Tender Managers as they are in the most adequate position to describe how the Tender or Commercial Departments work in each company.

Job Position	Company	Nr	Percent
Managing Director/Chief Executive	A, B	2	20%
Tender Manager	A, C, D, E, F	5	50%
Project Manager	B, G	2	20%
Business Development Manager	G	1	10%
TOTAL	**7 Companies**	**10 Participants**	**100%**

Table 4.2 - Jobs positions of interview participants
Source: Field data, 2020

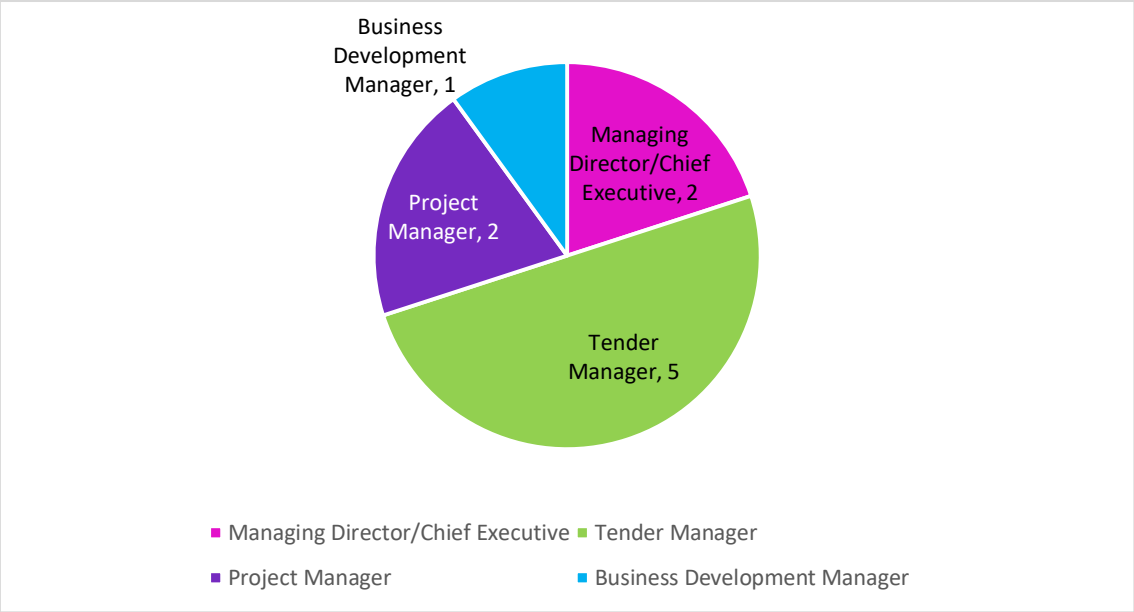

Figure 4.2 - Jobs positions of interview participants

Source: Field data, 2020

Area of Expertise

According to Table 4.3 and Figure 4.3, 70% of the respondents to the survey work in commercial construction while the remain 30% of the participants work in general civil construction works; however associated with commercial departments as well.

Area of Expertise	Number	Percent
Commercial/Tender/Estimation	33	70%
General (Civil Construction)	14	30%
TOTAL	47	**100%**

Table 4.3 - Area of Expertise
Source: Field data, 2020

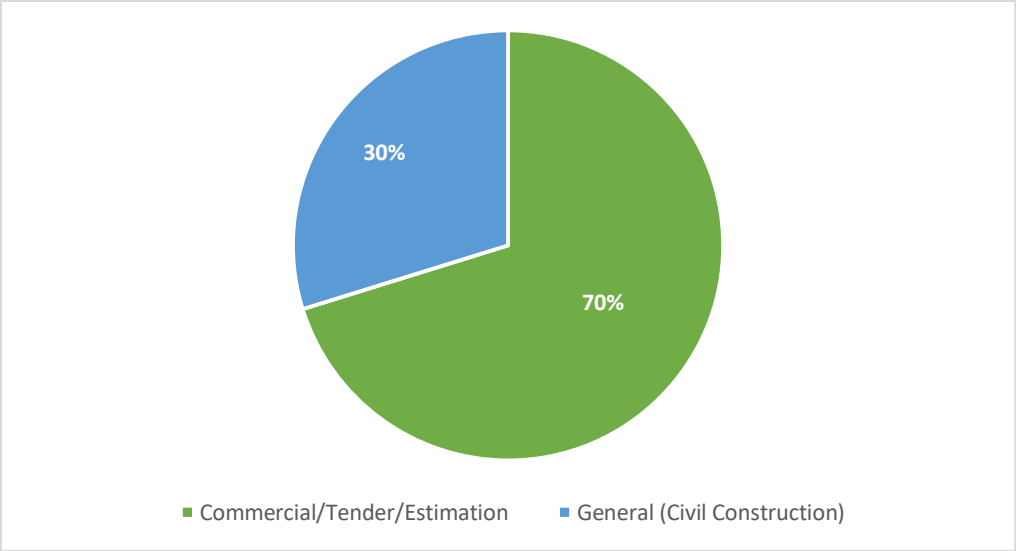

Figure 4.3 - Area of Expertise
Source: Field data, 2020

Work Experience in Preparing Tenders

The participants were asked about how many years of work experience they have in preparing tenders. Thus, the result is shown in Table 4.4 and Figure 4.4.

Work experience in preparing tenders	Number	Percent
Less than 2 years	11	23%
2 - 7 years	17	36%
7 - 12 years	15	32%
More than 12 years	4	9%
TOTAL	**47**	**100%**

Table 4.4 - Work experience in preparing tenders
Source: Field data, 2020

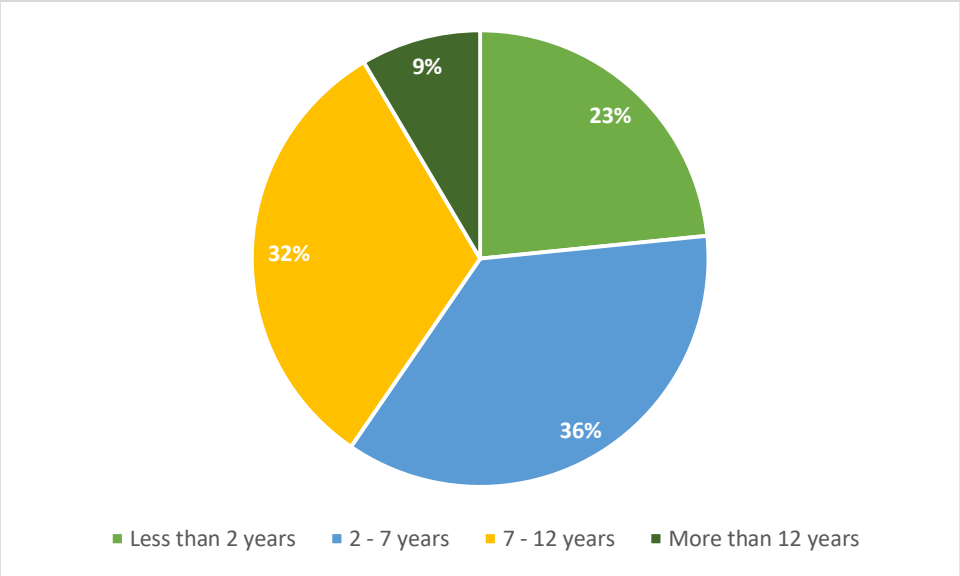

Figure 4.4 - Work experience in preparing tenders
Source: Field data, 2020

Most of the respondents (36%) have from 2 to 7 years work experience in preparing tenders, 32% belong to the range from 7 to 12 years, 23% have less than 2 years and 9% have more than 12 years' work experience in preparing tenders.

Project Types

In this section, the survey participants were asked about the type of projects they have been involved in.

Project types	Number	Percent
Residential, commercial and industrial buildings	30	45,5%
Roads/highways/railways/bridges	15	22,7%
Water infrastructure and networks	10	15,2%
Electrical infrastructure and networks	9	13,6%
Geotechnical Works	1	1,5%
Oil and Gas	1	1,5%
TOTAL	**66**	**100%**

Table 4.5 – Type of projects
Source: Field data, 2020

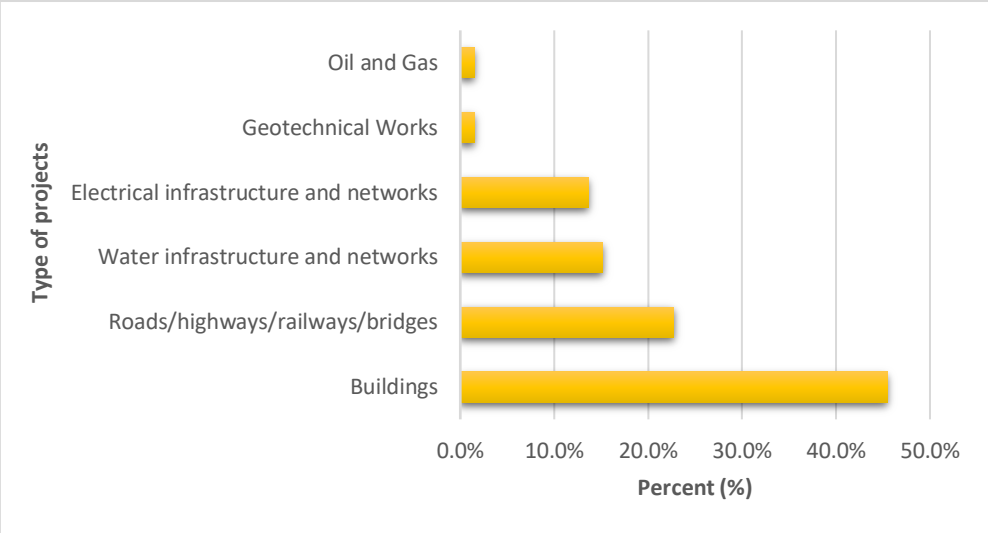

Figure 4.5 - Type of projects

Source: Field data, 2020

As presented in Table 4.5 and Figure 4.5, the respondents to the survey are involved in diversified types of projects. However, it is clearly noticeable that they mostly work for companies of which construction of buildings is the core business. Therefore, these companies represent 45,5% of the survey.

The second project category in which the respondents are mostly associated with is roads/highways/railways/bridges with 22,7%, followed by water infrastructures and networks with 15,2%, electrical infrastructures and networks with 13,6%, and oil and gas and geotechnical works with 1,5% each.

There are 66 answers for this question because some companies are involved in more than one project types or categories.

In fact, there are more local or foreign construction companies in Mozambique dedicated to Buildings than other types of engineering projects (Maugeri, 2015).

Relevant project factors analysed before deciding to tender

When asked to choose five most relevant project factors analysed before deciding to tender, the respondents selected the factors indicated in Table 4.6 and Figure 4.6.

Project factors	Number	Percent
Current workload	1	0%
Use of nominated subcontractor	2	1%
Number of competitors	2	1%
Economy (availability of work)	4	2%
Tendering duration	9	4%
Duration of the project	11	5%
Tender currency	13	6%
Availability of complete documentation	15	6%
Complexity of the project	15	6%
Experience in similar projects	16	7%
Client's special requirements	17	7%
Client (Public/Private)	18	8%
Location of the project	19	8%
Project cash flow	21	9%
Size of contract	24	10%
Type of contract/procurement	24	10%
Funding entities	24	10%
TOTAL (5 choices per person)	**235**	**100%**

Table 4.6 - Project factors considered before deciding to tender

Source: Field data, 2020

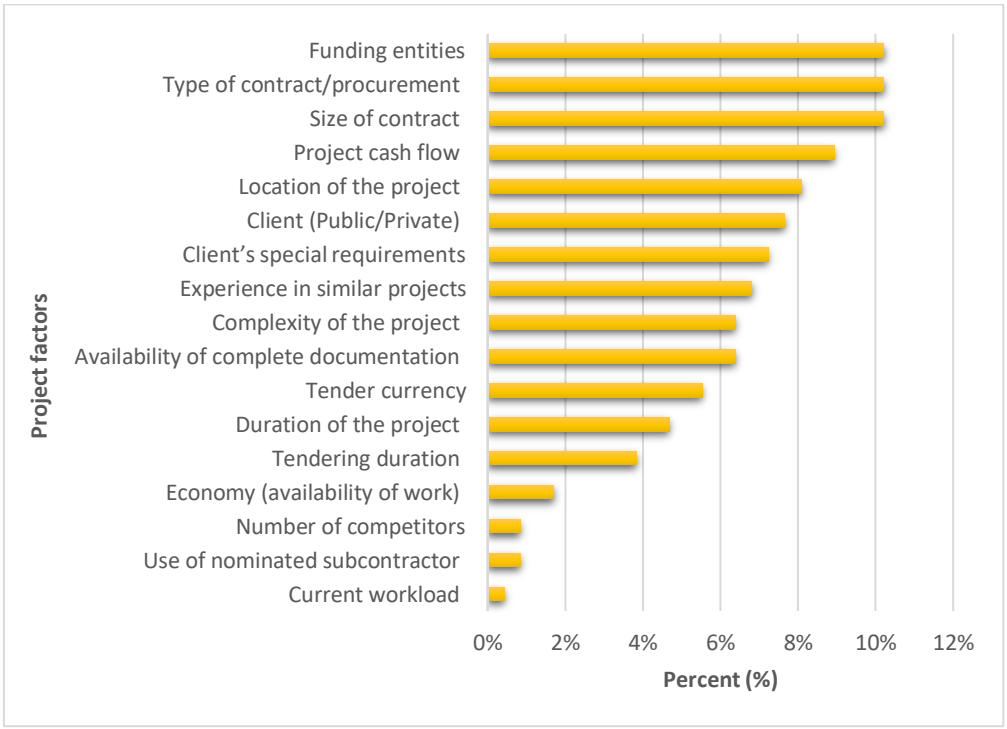

Figure 4.6 - Project factors considered before deciding to tender

Source: Field data, 2020

The most common factors they primary analyse are the source of funding or funding entities are (10%), the type of contract/procurement (10%) as it defines less or more responsibilities and project risks allocated to the contractor, the size of contract (10%) because small projects may not give the return large firms seek for and large projects may not suit small firms, project cash flow (9%), location of the project (8%) and client if the is a public or private entity (8%).

Contrarily, Bajaj et al. (1997) claim that most important factors to be verified before decide to tender are project type, contract conditions, currency, project complexity, available resources for its execution, tender deadline, and the number of companies willing to bid.

Addicionally, Brook (2016) states that sometimes contractors may tender on a project even if it is not attractive just to build connections with new clients or simply reactivate the old ones. Thus, contractors.

During the interviews, most of the participants stated that the source of funding is a critical project factor to be verified before deciding to tender. If the funding entity is reliable, it gives the company the assurance that the work will be fairly paid in time and according to the contact.

This concern can also be combined with the factor of the client being a public or private entity. According to the interviewees, public entities tend to delay in payments, fact that increase contractors risk of financial issues. However, if the client is a public body and the project is funded by a foreign and reliable entity, thus the project is more captivating.

The most common funders of public construction works in Mozambique are World Bank, European Investment Bank, African Development Bank and KfW Bank for large projects. Some Japanese and Chinese entities as JICA (Japan International Cooperation Agency) and China Development Bank also support investments in Mozambique.

Most of the interviewees also affirm that the larger the project, the lower risks it has. For instance, suppliers and subcontractors are likely to sell products and services at lower prices due to the large quantity requested by the contractor. In this case, the

money saved from these discounts could be used to manage risks or harmful events that may happen.

Projects value

As shown in Table 4.7 and Figure 4.7, the survey participants work on a vast range of project values.

Value of projects	Number	Percent
Under USD 5m	17	36,2%
USD 5m - 10m	13	27,7%
USD 10m - 15m	6	12,8%
USD 15m - 20m	7	14,9%
Over USD 20m	4	8,5%
TOTAL	**47**	**100%**

Table 4.7 - Value of projects

Source: Field data, 2020

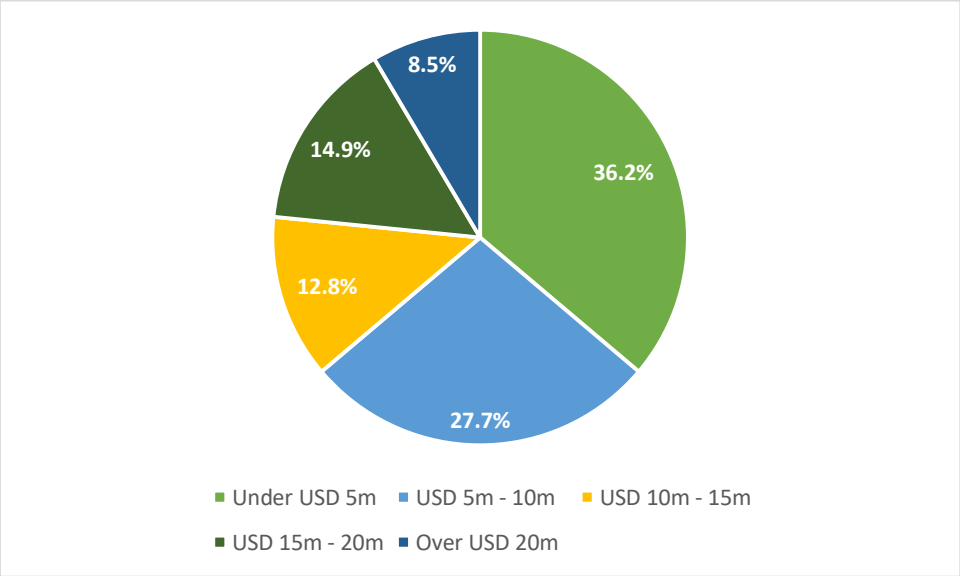

Figure 4.7 - Value of projects

Source: Field data, 2020

The majority or 36,2% of the survey participants usually work on project below 5 Million USD. 27,7% of the respondents said they the value range of projects they usually work on is from 5 Million to 10 Million USD, 12,8% from 10 Million to 15 Million USD, 14,9% from 15 Million to 20 Million USD and 8,5% above 20 Million USD.

According to interviewees involved in buildings projects, the execution of these projects usually not exceed the value of 10 Million USD.

Size of estimating team

The size of the team in Commercial/tender departments was also analysed. Therefore, respondents were asked about the size of the estimating team in the company they work and the results can be seen in Table 4.8 and Figure 4.8.

Size of estimating team	Number	Percent
Less than 4 members	18	38%
4 - 7 members	17	36%
7 - 10 members	4	9%
10 – 14 members	3	6%
More than 14 members	5	11%
TOTAL	**47**	**100%**

Table 4.8 - Size of the estimating team

Source: Field data, 2020

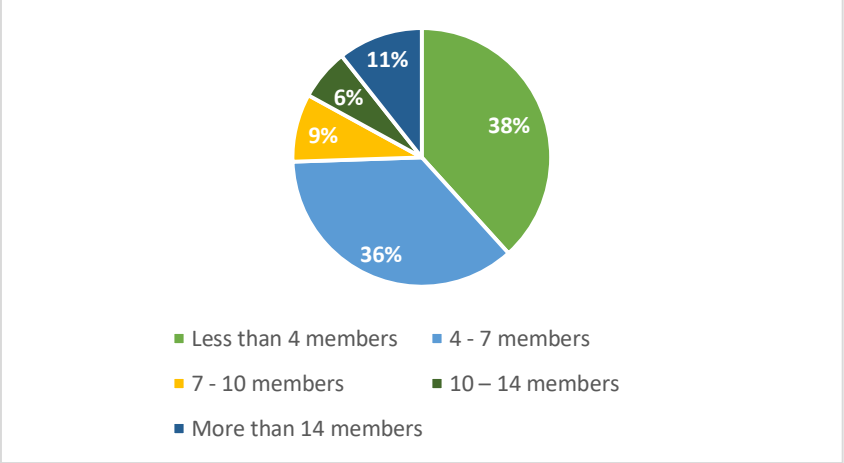

Figure 4.8 - Size of the estimating team

Source: Field data, 2020

38% of the respondents work in departments with less than 4 members what turns more challenging to analyse the projects in detail before submitting the proposal to the client. 36% work in departments where the range of staff varies from 4 to 7 members.

Very few respondents work in companies where the commercial team has a significant size as only 9% has 7 to 10 members, and 6% has 10 to 14 members.

However, respondents from larger companies work in bigger tender departments with more than 14 members. From the conversation with Tender Managers from these companies, they hire more staff due to the variety of projects in which the team is involved that may require specialists from different areas. Also, they are involved in more complex projects, and they work on more projects at once. Thus, to reduce the risks of errors in pricing and to properly analyse the project, the number of members must be enough and the team capable of coping with such projects demand. However, they all complained that the price to tender is never enough to evaluate in detail the project and all the risks involved.

Similarly, Tower and Baccarini (2012) state that in pricing for tenders, the number of the team and the category of the staff involved varies with the size of projects.

Number of projects

The respondents were asked how many projects they work on at once in Tender departments.

As can be seen in Table 4.9 and Figure 4.9, 30% of them work on 3 to 4 projects at once, 21% work on 1 to 2 projects, 23% from 2 to 3, 15% from 4 to 5 and 11% work on more than 5 projects at once.

Nº of projects employees work on at once	Number	Percent
From 1 to 2	10	21%
From 2 to 3	11	23%
From 3 to 4	14	30%
From 4 to 5	7	15%
More than 5	5	11%
TOTAL	**47**	**100%**

Table 4.9 - Number of projects employees work on at once in tender departments

Source: Field data, 2020

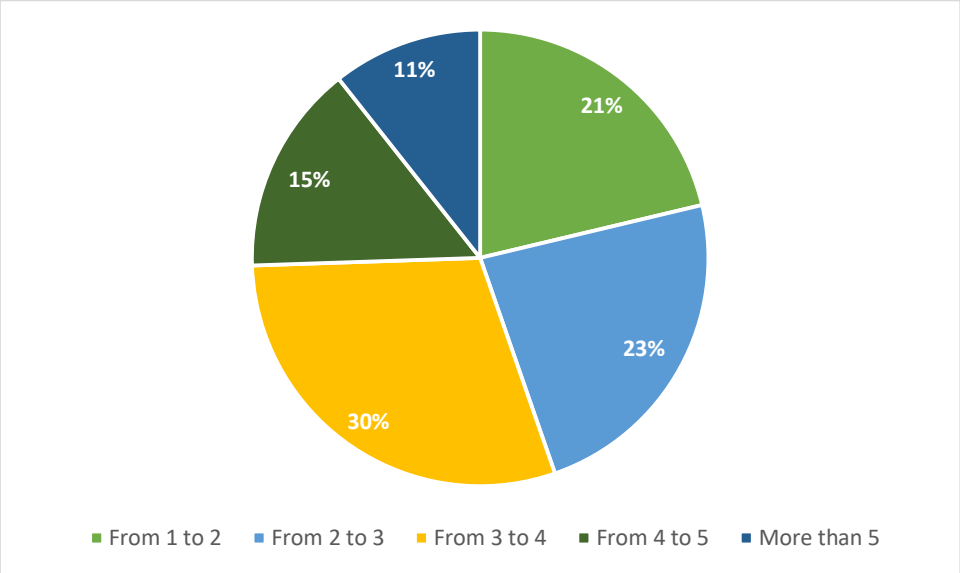

Figure 4.9 - Number of projects employees work on at once in tender departments

Source: Field data, 2020

The majority of the survey respondents work on 3 to 4 projects at once and also have less than 4 members in their estimating team.

The lack of time to analyse and evaluate the project properly during tender process increase the risks of failure in the next stages of the project (Choon at el., 2016).

According to interviewees working under this condition, they mentioned that usually time is not enough to have an accurate evaluation of the risks involved in projects and at this phase regularly the price for manage eventual risks is not included in the cost estimate.

Transparency of evaluation and decision criteria

Transparency of evaluation and decision criteria	Frequency	Percent	Valid Percent	Cumulative Percent
Agree Very Strongly	4	9%	9%	9%
Agree Strongly	2	4%	4%	13%
Agree	20	43%	43%	55%
Disagree	18	38%	38%	94%
Disagree Strongly	3	6%	6%	100%
Disagree Very Strongly	0	0%	0%	
Total	**47**	**100%**	**100%**	

Table 4.10 - Transparency of evaluation and decision criteria

Source: Field data, 2020

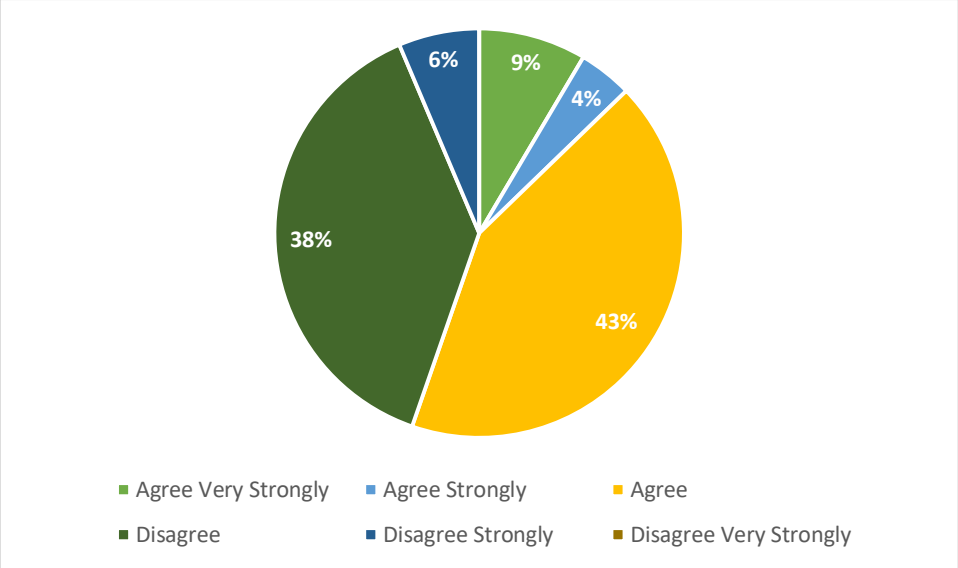

Figure 4.10 - Transparency of evaluation and decision criteria

Source: Field data, 2020

Table 4.10 and Figure 4.10 indicates that 9% of the respondents agree very strongly that the evaluation and decision criteria is fair, clear and transparent, 4% strongly agree and 43% agree. However, another large group of respondents of 38% disagree and 6% disagree Strongly.

When asked when they disagree, the majority indicated that corruption is the main reason leading to an unfair tender result.

Moreover, the lowest price criterion is mostly used by clients, even if the project in the case is complex and require a more technical approach. This fact discourages contractors from adding all the risks they should consider in the tender price.

Similarly, Cruz et al., (2018) address that the construction industry in Mozambique is currently affected by corruption, reduced transparency and inadequate process.

In contradiction, GIZ and ACIS, 2011 claims that two major principles govern procurement regulation in Mozambique are transparency and equal treatment.

Methods of obtaining direct costs for tenders

Respondents to the survey were asked how they obtain direct costs. According to Table 4.11 and Figure 4.11, 40% obtain direct cost from suppliers and subcontractors quotations, 11% from experience from previous similar projects, and the majority of 49% obtain direct costs using both options.

Methods of obtaining direct costs for tenders	Number	Percent
Quotations from suppliers/subcontractors	19	40%
Experience from previous similar projects	5	11%
Both	23	49%
TOTAL	**47**	**100%**

Table 4.11 – Methods of obtaining direct costs for tenders

Source: Field data, 2020

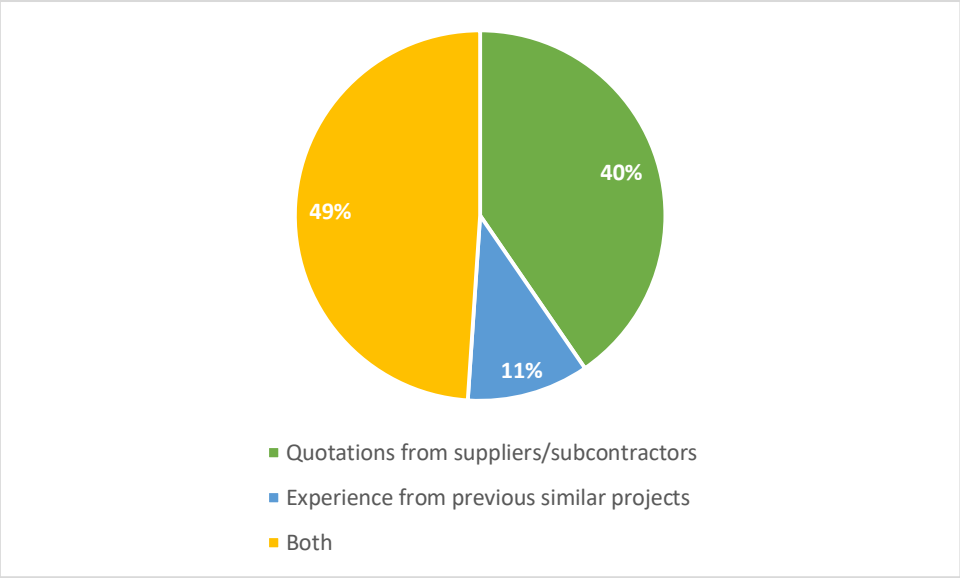

Figure 4.11 - Methods of obtaining direct costs for tenders

Source: Field data, 2020

Project cost obtained from experience

Table 4.12 and Figure 4.12 indicate how often direct costs are based on experience gained from previous projects.

Project cost obtained from experience	Frequency	Percent	Valid Percent	Cumulative Percent
Always	5	11%	11%	11%
Very Frequently	18	38%	38%	49%
Occasionally	23	49%	49%	98%
Rarely	1	2%	2%	100%
Very Rarely	0	0,0%	0,0%	
Never	0	0,0%	0,0%	
TOTAL	**47**	**100%**	**100%**	

Table 4.12 - Project cost obtained from experience

Source: Field data, 2020

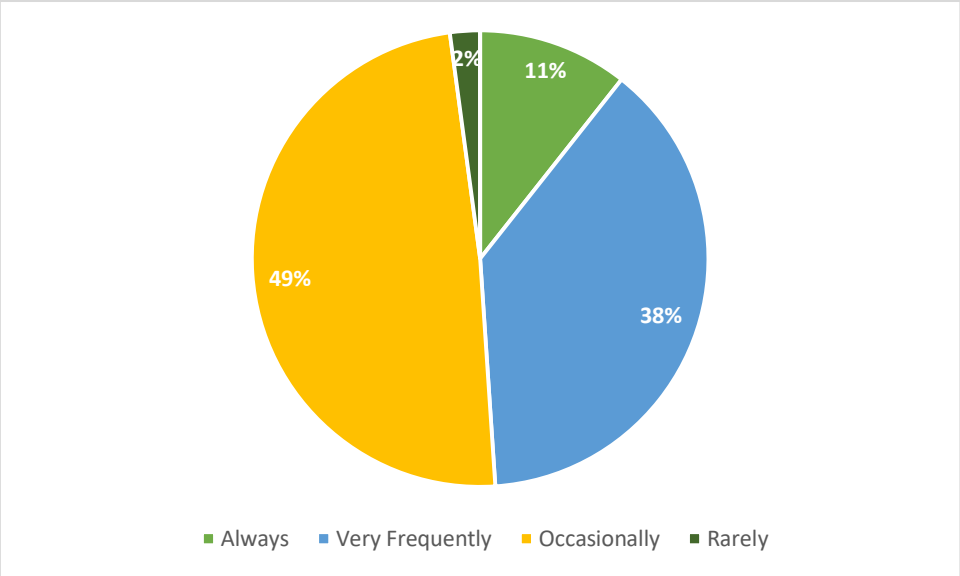

Figure 4.12 - Project cost obtained from experience

Source: Field data, 2020

Most of the respondents (49%) occasionally use this method to obtain prices when pricing for tenders. 11% always, 38% very Frequently, and only 2% said it happens rarely.

All the interviewees affirmed that at some point they all use previous experience to obtain direct costs, especially because the time to tender tends to be insufficient and suppliers/subcontractors cannot send their quotations in time. This is also one of the reasons why the intuition and experience of the estimator are very important. Otherwise, the risk of having wrong costs estimate can be high.

Intuition and experience in determining the risk price for tenders

Survey participants were asked how relevant intuition and experience is in determining the risk price for tenders.

Estimator intuition and experience	Frequency	Percent	Valid Percent	Cumulative Percent
Very Important	33	70%	70%	70%
Important	12	26%	26%	96%
Moderately Important	2	4%	4%	100%
Slightly Important		0%	0%	
Not Important		0%	0%	
	47	**100%**		

Table 4.13 - Estimators intuition and experience

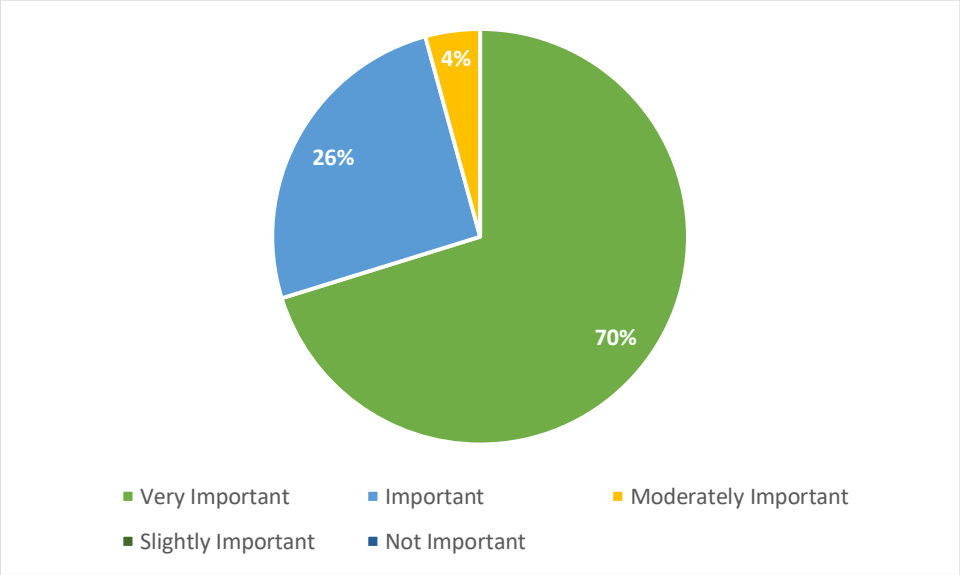

Figure 4.13 - Estimators intuition and experience

As can be seen in Table 4.13 and Figure 4.13, 70% of the respondents say it is very important, 26% say it is important, and only 4% moderately important.

Interviewees also shared the same opinion and agreed that intuition, knowledge and experience are very important while pricing not only for base cost estimate but for risks as well. One of the interviews added that it is difficult to predict the real probability or impact of a risk if the estimator has never experienced its implications. Thus, team members primarily involved in risk pricing for tenders must have plenty of experience.

This opinion also comes because most of the contractors who have participated in this study rely on intuition to price risks, and those risk prices added to tender estimates, most of the times they are based on feelings or subjective judgement.

This finding matches to Tower and Baccarini (2012) study which says that intuition and experience play a crucial role in pricing for tenders and related risks.

Ultimately involved in the risk pricing for tenders

Respondents of the survey were asked who the last person involved in the risk pricing for tenders is.

Ultimately involved in the risk pricing for tenders	Frequency	Percent
Estimators	6	13%
Tender Coordinator	5	11%
Tender Manager	15	32%
Managing Director	21	45%
TOTAL	**47**	**100%**

Table 4.14 - Ultimately involved in the risk pricing for tenders

Source: Field data, 2020

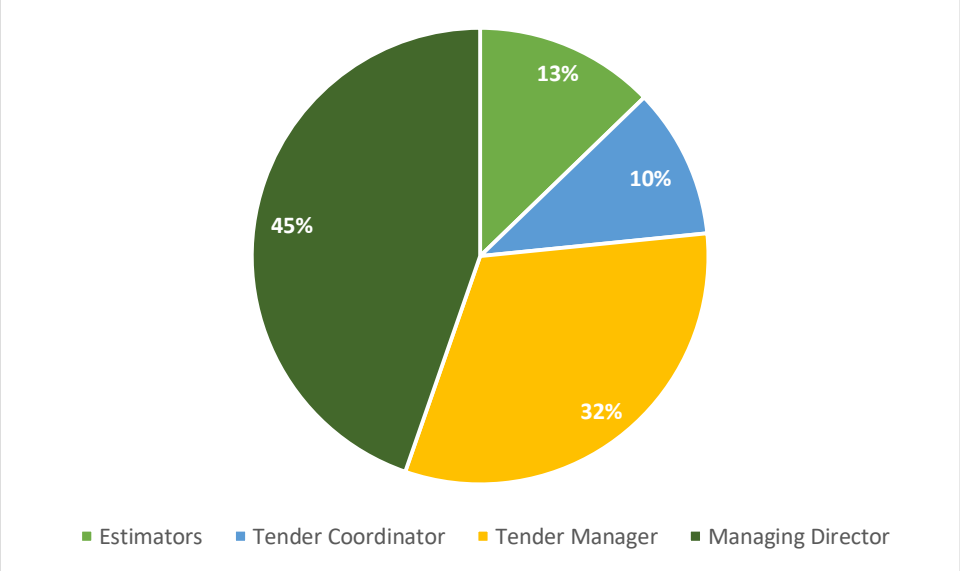

Figure 4.14 - Ultimately involved in the risk pricing for tenders

Source: Field data, 2020

Table 4.14 and Figure 4.14 register that in 13% of the cases the estimators are the ones determining the price of the risk, 11% and 32% of the respondents indicate that it is the Tender Coordinator, and Tender Manager, respectively.

However, the majority of 45% indicate that the ultimately involved and making the last decisions regarding risks, is the Managing Director.

The same scenario was also seen during the interviews as most of the participants addressed that the Managing Director or Chief Executive is the person who lastly defines or approve the price of risk.

According to the findings and Tower and Baccarini (2012), project complexity, value and size tend to have a positive correlation with the number of team members involved in risk pricing. Therefore, the larger the contract, the more members involved in risk pricing.

Interviewees explain that the involvement of more members to analyse larger projects is due to the complexity of the projects whose risks have to be identified soon so that risk responses and monitoring plan can be adequately defined in time. Otherwise, the company might face severe threats in the following phases of the project and harm the company goals.

Critical factors that may influence negatively on the accuracy of cost estimates

During the survey process, respondents were requested to indicate 5 critical factors that may influence negatively on the accuracy of cost estimates.

The result can be seen in Table 4.15 and Figure 4.15.

Factors of risk	Frequency	Percent
Team size	4	2%
High quality standard of the project	5	2%
Overload of work in the department	8	3%
Supplier/subcontractor disability	12	5%
Complexity of the project	14	6%
Estimators expertise and experience	15	6%
Lack of quotations from suppliers/subcontractors	16	7%
Calculation errors	16	7%
Inadequate site investigation	24	10%

Documentation errors	25	11%
Insufficient time for tender	25	11%
Inadequate specification	32	14%
Design errors/incomplete design	39	17%
TOTAL (5 choices per person)	**235**	**100%**

Table 4.15 – Critical factors which may influence negatively on the accuracy of cost estimates

Source: Field data, 2020

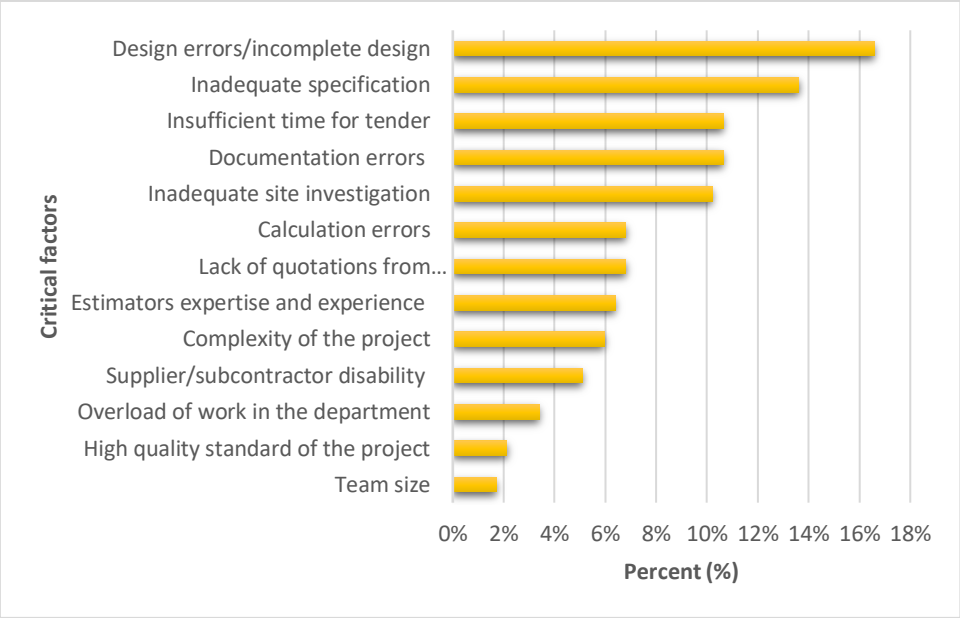

Figure 4.15 - Critical factors which may influence negatively on the accuracy of cost estimates

Source: Field data, 2020

According to the respondents, the dominant risk factors are design errors/incomplete design (17%), inadequate specification (14%), insufficient time for tender (11%), documentation errors (11%), Inadequate site investigation (10%).

All the interviewees claim that incomplete design, inadequate specification and documentation errors are very common factors when it comes to tender process in Mozambique. They do not remember a single project where there was no contradiction or any missing information in tender and project documents. These factors turn it challenging to obtain accurate prices for the works in case, rising the level of risks for contractors.

This finding goes accordingly to Peansupapa and Lyb (2015) who state that design errors are considered the most critical problem in construction projects and such errors can be design conflicts, mistakes or omissions.

Tower and Baccarini (2012) similarly agree with this statement and address that this risk factor is considered high also because, being an external factor, contractors have limited or no control over it.

It is noticeable severe issues in projects designed by Mozambican and local companies due to the lack of capacity of the designers, especially when it comes to projects of more complexity (Coughlin, 2018). Similarly, the interviewees stated that regularly is usual to find considerable discrepancies between all the documents of the project and that this fact is even more frequent in public tenders.

To avoid this risk, interviewed contractors said that they ask the client or designer for clarifications and when the clarifications are still not satisfactory, so prevent from loses, the contractor price of the items according to specifications that are more usual in the market and they make clear in the method of statement what are the specifications of materials considered in the tender price.

General factors of risk usually considered when pricing tenders

Factors of risk	Frequency	Percent
Overload of work in the department	5	2%
Estimators expertise and experience	8	3%
Inadequate specification	11	5%
Insufficient time for tender	13	6%
Team size	14	6%
High quality standard of the project	16	7%
Documentation errors	18	8%
Complexity of the project	19	8%
Incomplete design	22	9%
Inadequate site investigation	24	10%
Lack of quotations from suppliers/subcontractors	24	10%
Calculation errors	30	13%
Supplier/subcontractor disability	31	13%
TOTAL (5 choices per person)	**235**	**100%**

Table 4.16 - Factors of risk usually considered when pricing tenders

Source: Field data, 2020

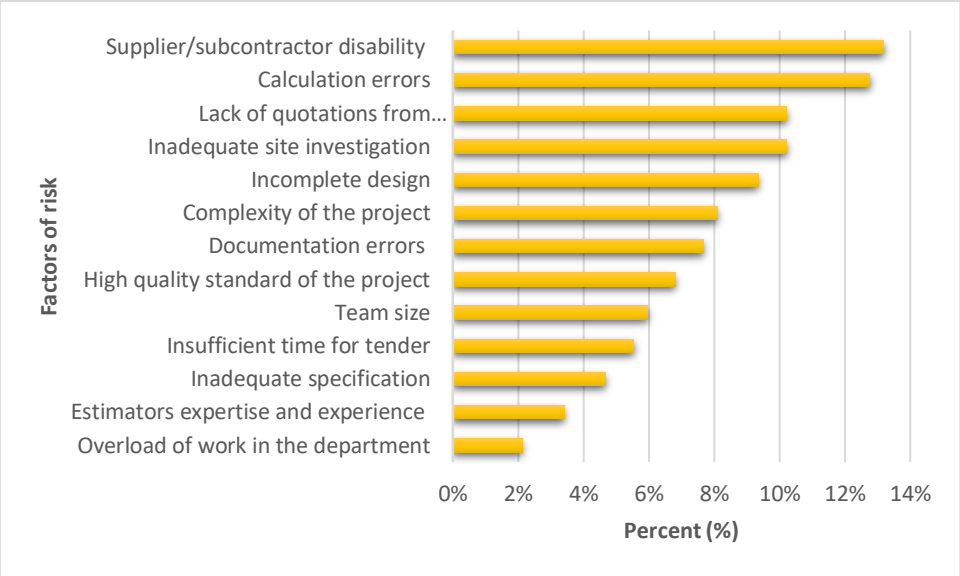

Figure 4.16 - Factors of risk usually considered when pricing tenders

Source: Field data, 2020

When asked to indicate 5 general factors of risk usually considered when pricing tenders, survey participants pointed out the factors shown in Table 4.16 and Figure 4.16. The most common factors are supplier/subcontractor disability (13%), calculation errors (13%), lack of quotations from suppliers/subcontractors (10%), inadequate site investigation (10%) and incomplete design (9%).

Most of the interviewees show themselves uncomfortable when it comes to working with a subcontractor who they never worked with before.

They agreed that this factor represents a risk that they will not be fully aware of until the subcontractor starts the work.

Calculation errors are the second most selected factors. This fact was explained during the interviews as the companies already came across situations where there were calculation errors and lack of consideration of essential resources in the tender price. These events had negative impacts on the project cost, project duration and quality of the final work delivered.

Frequency of consideration of factors of risks when pricing for tenders

The above factors are considered when pricing for tenders according to the frequency indicated in Table 4.17 and Figure 4.17.

Frequency of consideration of factors of risks when pricing for tenders	Frequency	Percent	Valid Percent	Cumulative Percent
Always	8	17%	17%	17%
Very Frequently	10	22%	22%	39%
Occasionally	16	35%	35%	74%
Rarely	10	22%	22%	96%
Very Rarely	2	4%	4%	100%
Never	0	0%	0%	
TOTAL	**46**	**100%**	**100%**	

Table 4.17 - Frequency of consideration of factors of risks when pricing for tenders

Source: Field data, 2020

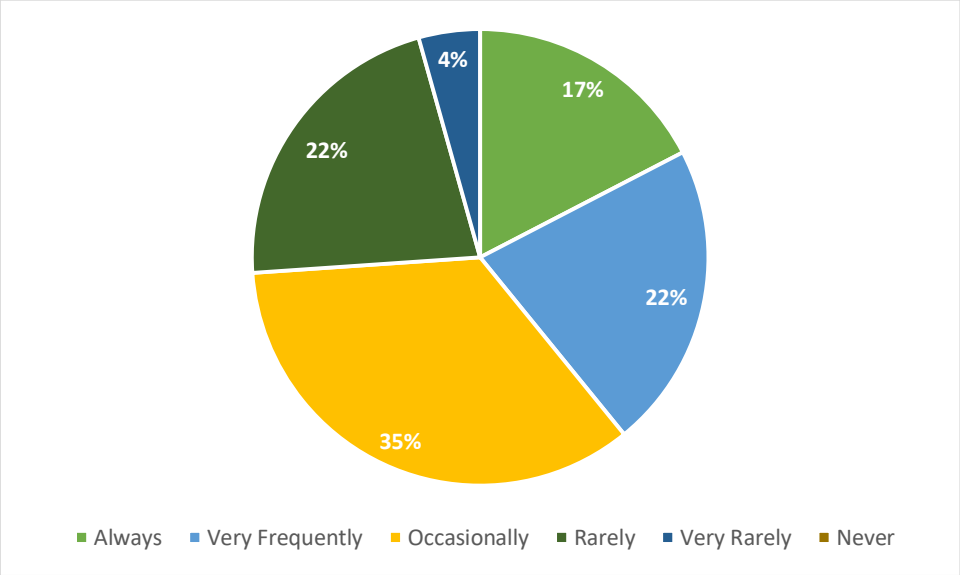

Figure 4.17 - Frequency of consideration of factors of risks when pricing for tenders

Source: Field data, 2020

17% of respondents include in their proposals risk factors they find are relevant and harmful for the project, and 22% of the respondents include it very frequently. Most of

the participants (35%) include the risks factors in case occasionally and a considerable number of correspondents rarely (22%) and very rarely (4%) consider the risk factors.

According to the interviews conducted, around 40% of participants said that risks factors are most of the times not considered because it would represent an increase in the tender price and therefore the chance to award the contract would be lower.

Procurement and payment methods

When asked what the more usual procurement methods is, all the interviewees agreed that it is design-bid-build method where the project design is not part of contractors responsibility.

According to Potts (2010), the design-bid-build method benefits the contractor as there are fewer risks since they only focus on construction.

Moreover, the more usual payment method is unit price contract. Choosing this method, the client pays the contractor invoices based on the amount of work done (Smith, 2017).

This method can represent a higher risk for the client as the final cost of the project remains unknown until the construction phase is complete Smith (2017).

On the other hand, such uncertainty can be risky as it turns challenging for the contractor to manage his financial proposal. If the works are less than it was expected, thus the contract will make less profit, as the markup is a percentage equally distributed to all items in the bill of quantities (Smith, 2017). Also, the resources that initially were allocated for the execution of the work might not match anymore with the amount of work that has to be done. This fact can represent unnecessary costs overrun for the contractor.

Overall Risk management

All the senior managers who participate in the interviews agreed that the evaluation of risks at this early stage of the project is important.

Overall, the interviewees say that within the tender/commercial department, risk management activities are managed in a very arbitrary way, which is repeatedly reflected in the next stages of the project.

However, they say that as time passed by, awareness of risk exposure has increased, which resulted in more restricted attitudes to risks.

Project managers (B and G) revealed that more often than it should, during the constructions phase, Procurement Managers and Site Managers come across risk events that were not considered in the tender price. These events may have negative implications, for instance, an increase in project costs and therefore cut of profit margin; project delays; and a lower quality of the final work delivered.

They all agree that the companies have to prioritise risk management process in the future and highlight its relevance not only in Tender Departments but in every sector within the companies.

Risk identification

All interviewees address that the identification of project risk is a responsibility of all tendering team members. However, their answers slightly differed on how the process is executed.

Business Development Manager (G), Project Manager (G) and Managing Director (B) say that the initial identification of risks is usually performed by the Tender Coordinator or Tender Manager. They also say that the person responsible for the Tender Department should analyse the bidding documents and make a list of all potential risky events that may occur during the execution of the project. Moreover, they claim that each team member should be able to analyse different perspectives of the projects and add critical risks to a risk list as they arise during the tendering process.

Contrarily, Tender Managers (C, E and F) explain that the risk identification process starts as soon as tender documents are collected, and all the members of the tender team collectively participate in this process.

Furthermore, Tender Manager (C) addresses that the tender coordinator is the person responsible for dividing the risk identification tasks and delegating it to each team member, accordingly. Basically, the principle is that the person who is responsible for a particular tendering section or the group members, who work on a specific part of the tender, identifies its related risks.

However, they all strongly agree that the risk management process is somehow unstructured within the Tender Department in their respective companies, and they do not follow any specific procedure for this purpose.

Even though very simple, only Tender Managers (A) and Managing Director (A) were able to describe the procedure followed by the team. They state that they usually use a pre-defined risk register in an excel sheet which they adjust according to each project. They also address that to simplify the process, projects are primarily analysed according to project categories as similar projects are likely to have similar risks, in general. Thus, a large number of risks can be easily identified as they are repetitive from one project to another. It is more difficult to identify risks when it comes to projects with unique features.

However, only risks with high probability to occur and significant impact on the project are transferred to the register and considered in project pricing calculations.

Risk analysis and evaluation

Managing Directors (A and B) say that the tender team should estimate all the risks probability of occurrence and their impact on the project. Once the value of the risks is known, it risk cost included in the tender estimate.

However, most of the Tender Managers interviewed addressed that, in reality, the value of risks is a global amount set without any accurate calculations or analysis.

Tender Managers (D), even mentioned that, when considered, risk costs are simply based on superficial analysis, experience in similar projects and feelings, without further evaluation. One of the reasons pointed out was the low time to tender and evaluate in detail the project and the risks involved.

Some of the interviewees affirm that project risks are often discussed during separate meetings in negotiation tendering phase, after proposals submission, to avoid nor being competitive and therefore not being shortlisted by the client. However, some clients are not so flexible when it comes to an increase in tender price during the negotiation phase. At this point, Managing Directors, Project Managers and Site Engineers also give inputs in quantifying risks with substantial impact.

Risk Response

According to all participants of the interview, risk responses depend on the specificity of the risks identified.

They all address that if an uncertainty shows up in tender documents, the contractor can request the client for clarifications whose response must be sent to all the bidders.

Tender Managers (A, C, D, E and F) added that this only happens if the company is not willing to accept the risks related to such document uncertainties.

Moreover, they complain that when it comes to public procurement, it is more difficult to get clarifications from the client in time. The public sector is less agile and flexible than the private one what increases the chance of risk and negative events as the contractors are more likely to accept all the client conditions in order to establish a good relationship for future projects.

On the other hand, if positive risks are identified by the department, they can opt not to contact the client for clarifications.

Another risk response strategy frequently adopted by the participants of the interview is the transference of risks to subcontractors in contractual clauses. Therefore, subcontractors can take all the responsibility of a specific part of the project assuming all risks attached to this particular work.

Managing Director (A) and Tender Manager (A) do not apply the same strategy as they have their one staff and machinery to execute the projects which belong to their core business.

As Mozambique benefit from external funders, it is frequently to see projects with specification and references that are not applied in Mozambique or materials that are difficult to find in the local market or markets in nearby countries such as South Africa.

In this case, to minimize the probability of risks occurrence related to project delays and high prices, contractors mitigate the risk by proposing to the client alternative solutions more adequate for the project. These alternative solutions can be changes in engineering solutions, material brand and specifications and adopted execution methods.

Another way of mitigating risks that the interviewees commonly experience is a selection of specialists, credible and well-known suppliers and subcontractors to perform more sensitive activities. This selection is made before the execution of the project during the tendering stage.

This method of risk response is considered as a combination of avoidance and acceptance (Keshk et al., 2018).

Calculation of risk

Participants in the interview were asked to describe how they calculate and incorporate the risk price in the base cost estimate. Thus, the ten participants described some different methods of pricing risk in tenders, as follows.

Two interviewees explained that they usually add a contingency amount in each trade as the base cost estimate is being elaborated.

Other two interviews said that they simply include a contingency amount in the mark-up applied to all trades.

Three of the companies use a combination of the 2 previous methods.

One participant said that if the project is large, the company use Monte Carlo Simulation technique in order to determine an overall contingency value.

The rest of the participants said either risk are merely calculated based on the construction period defined by the client or risks are not considered at this stage at all.

Pricing of Risk Process

When asked how they relate risk pricing to a base cost estimate, only two interviewees stated that risk pricing is an integral part of elaborating the base cost estimate. The majority said that, when considered, risk pricing it is a separately performed process from the base cost estimate and it is not taken into account until the base cost estimate has been finalised.

However, most of them stated that it is very usual not to include risks at this stage in the proposal to keep it competitive.

Familiarity with the standard ISO 31000

When asked they familiarity with the standard ISO 31000, most of the interviewed managers said that they are moderately familiar with this standard as they have some notion about it, but no further detail about its content.

Only Managing Director (A) showed that he was extremely familiar with ISO 31000 as the risk management policies followed by the company correspond with ISO 31000 practices, however not precisely in the Tender Department. He also explained that ISO 31000 is a risk management standard aimed to guide managers on choosing and applying appropriate techniques to deal with risks in a variety of situations. Where there are risks or uncertainties, such techniques are used to provide information about risks and to assist in making decisions as part of managing risks process.

Moreover, Managing Director (A) revealed that the company use a supportive tool, suitable for risk management; however, it is not currently being used in tendering processes.

CHAPTER 5: Conclusion and Recommendations

This chapter summarises the most relevant points discussed in this research paper and provides appropriate recommendations.

Many changeable internal and external factors affect the tendering process for construction companies. Moreover, in most cases, tendering documents required are extensive, and the period to bid defined by the client is short.

The tender price has a significant influence on a company's business due to the high project's risks. For this reason, the final tender price is usually decided and approved by the company representatives who have to find the best equilibrium of price in order to submit a proposal whose price is low enough to win the bid and high enough to maximize the profit (Tower and Baccarini, 2012).

Risk management is a combination of techniques to identify, analyse, evaluate and respond to risks. Thus, the knowledge of risk management techniques enable companies to achieve their goals, improve success rates and enjoy financial savings by managing risk more efficiently. Moreover, risk management is described as being associated with construction project success in terms of three major aspects such as project cost, time and quality.

The findings show that risk management practices applied by the construction firms in the tendering process in Mozambique, slightly differ from the risk management theories studied in this research paper. Contrarily, these companies follow their own practices, internal documentation and established routines. Moreover, overall they are not familiar with ISO 31000 or PMBOOK, which are guidelines for an adequate risk management process.

On the other hand, some construction firms affirmed that they never considered risk costs while tendering for a project, even though some scholars believe that risks are one of the most significant expenses of a construction project.

When considered, risk costs are determined in an unstructured manner based on feelings, intuitions and experiences from similar projects previously studied.

For this reason, 70% of the survey respondents agreed that intuition and experience of the estimators are very important.

Clients can allocate risks to the contractor through methods of procurement and payment (Potts, 2010). According to the findings, in Mozambique construction projects are mostly procured by design–bid–build unit price method, where the project design is the client responsibility, and it is part of the documents supplied during the tender phase of the project. According to Hughes et al. (2015) represents less risk to the client than to the contractor. However, the findings also show that two of the most common and highest factors of risk during the tender process is precisely the incomplete design and inadequate project specifications.

When considered, the most significant risks priced in tenders are supplier/subcontractor disability, calculation errors, lack of quotations from suppliers/subcontractors, inadequate site investigation and incomplete design. These risk factors are external, and therefore, contractors have limited or no control over them.

Overall, it can be concluded that neglecting risk management during the tendering process can provide negative consequences in all coming next stages of a project.

Recommendations

According to Nhabinde et al. (2015), Mozambique is the Sub-Saharan country with the strongest growth perspective regarding the Construction Sector across Africa. Under this circumstance, it is time for the companies operating in the Mozambican field to start embracing new techniques, experience and knowledge in order to be capable of successfully dealing with larger and more complex projects that are about to come.

In this context and after combining the information studied in the previous chapters, some recommendations are suggested regarding risk management in the tendering process:

- Getting familiarized with risk management standards and guidelines;

- Implementation of structured risk management strategies in the Tender Department;
- Combination of quantitative and qualitative methods should be applied in risk analysis;
- Most of the interviewees stated that currently, only a few team members in the Tender Department identify and evaluate projects. Thus, it is recommended to implement a plan where more parties are involved in the process, since it is important to have different perspectives of everyone, and the process requires knowledge and experience. The other parties could be people who also work on the field as site engineers as they have more awareness of the day to day risks during the construction stage of the projects;
- Investment in training and qualifying estimators;
- Inclusion of risks as an integral part of the tender proposal to avoid unpleasant events and unexpected expenses during the following stages of the project;
- Project design errors is the most critical risk factor pointed by some researchers and by the participants of this study. Thus it is always recommended to analyse the project design deeply, identify its risks, and evaluate the impact of its incomplete or inadequate elements. Depending on the complexity of the project, a straightforward way to avoid or mitigate this risk is by directly asking the client for clarifications and explaining this risk implication in terms of costs, project delivery delays and quality of the final work;
- Choice of the better balance between risk acceptance, competitiveness and profit;
- Use of the information and data provided in this research paper to develop improved analyses, practices and methods for future studies.

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Appendix

- Online Survey

1. **Which of the following best describes your job position?**
    - Chief Executive
    - Managing Director
    - Contracts Manager
    - Project Manager
    - Business Development Manager
    - Tender Manager
    - Tender Coordinator
    - Estimator/ Quantity Surveyor
    - Estimator Assistant
    - Other_____

2. **How long have you been working at the company/organisation?**
    - Less than 2 years
    - 2 - 7 years
    - 7 - 12 years
    - More than 12 years

3. **What is your area of expertise?**
    - Commercial/Tender/Estimation
    - General (Civil Construction)

4. **How many years' work experience do you have in preparing tenders?**
    - Less than 2 years
    - 2 - 7 years
    - 7 - 12 years
    - More than 12 years

5. **Which of the following best describes the type of projects you have been involved in?**
    - Residential, commercial and industrial buildings

- Roads/highways/railways/bridges
- Water infrastructure and networks
- Electrical and telecommunication infrastructure and networks
- Other_____

6. **What are the most relevant project factors analysed before deciding to tender? Please select 5.**
    - Size of contract
    - Type of contract/procurement
    - Client (Public/Private)
    - Client's special requirements
    - Funding entities
    - Tender currency
    - Tendering duration
    - Current workload
    - Availability of complete documentation
    - Location of the project
    - Complexity of the project
    - Duration of the project
    - Project cash flow
    - Experience in similar projects
    - Use of nominated subcontractor
    - Number of competitors
    - Economy (availability of work)

7. **What is the value range of the projects you have been working on?**
    - Under USD 5m
    - USD 5m - 10m
    - USD 10m - 15m
    - USD 15m - 20m
    - Over USD 20m

8. **What is the size of the estimating team in the company you work for?**
    - Less than 4 members
    - 4 - 7 members
    - 7 - 10 members
    - 10 – 14 members

- More than 14 members

9. Usually, how many projects do you work on at once?

- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- More than 5

10. The evaluation and decision criterion is fair, clear and transparent.

- Agree Very Strongly
- Agree Strongly
- Agree
- Disagree
- Disagree Strongly
- Disagree Very Strongly

11. If you disagree, please explain why

_____

12. Which of the following best describes how you obtain direct costs?

- Quotations from suppliers for materials and subcontractors for specialised works
- Experience gained from previous similar projects
- Both
- Other_____

13. How often is your cost estimate based on experience gained from previous similar projects?

- Always
- Very Frequently
- Occasionally

- Rarely
- Very Rarely
- Never

14. Please indicate 5 critical factors that may influence negatively on the accuracy of cost estimates

- Desing error/incomplete design
- Documentation errors
- Inadequate specification
- Inadequate site investigation
- Complexity of the project
- High quality standard of the project
- Supplier/subcontractor disability
- Lack of quotations from suppliers/subcontractors
- Estimators expertise and experience
- Calculation errors
- Insufficient time for tender
- Overload of work in the department
- Team size

15. Is the time to tender enough to evaluate in detail the project and all the risks involved?

_____

16. In the company you work for, who is ultimately involved in the risk pricing for tenders?

- Estimators
- Tender Coordinator
- Tender Manager
- Managing Director
- Other_____

17. How relevant is intuition and experience in determining the risk price for tenders?

- Very Important
- Important
- Moderately Important
- Slightly Important
- Not Important

18. **Please indicate 5 general factors of risk usually considered when pricing tenders.**
    - Weather implications
    - Site health and safety requirements
    - Environmental sustainability
    - Resource availability
    - Equipment failure
    - Low productivity
    - Project inconsistencies and contradictions
    - Completion time
    - Political uncertainty
    - Exchange rates
    - Possible changes in scope
    - Changes in legislation/regulations
    - Financial failure of the owner

19. **How often are your chosen factors considered when pricing for risk in your tenders?**
    - Always
    - Very Frequently
    - Occasionally
    - Rarely
    - Very Rarely
    - Never

- Interview Questions

TENDERING PROCESS

- Generally, describe the tendering process.
- What is your current role in the firm?
- How long have you been in this position?
- How long have you been working in the firm?
- How is the division of work among the estimating team?
- Are the team members roles affected by the characteristics of a project?
- Are there used different approaches and strategies for projects with different characteristics such as size, nature of the project, contract form and others?
- What are the most usual procurement and payment methods applied by clients?

RISK MANAGEMENT

- Define risk and uncertainty.
- What is the risk limit the company is allowed to take?
- What are the most common risks identified during the tendering process?
- How familiar are you with ISO 31000?
- What is the purpose of following a risk management process? In your opinion, is this process adequately performed within the tendering department? What improvements do you suggest?
- Who is the responsible and last person involved in the risk pricing decision?
- In your opinion, does the board contributes to overall better risk management?
- How are quantified the identified and not identified risks?
- How are the identified risks usually treated?
- When estimating project costs for tenders, how does the risk pricing relate to base estimate?
- How do you calculate and incorporate the risk price in the base estimate?
- What is included in the contingency cost? How is it quantified?
- How risky can be an estimation error? And how does the site engineer deal with such a situation?
- Do you think there is the necessity of implementation risk management methods within the tender department? In your opinion, would it help to reduce the chance of project failures in the following stages of the project?
- Do you think there is a considerable need for identifying and evaluating risks at this early stage of the project?