Development of Strategic Mark up Decision by Contractors in Saudi Arabia

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ABSTRACT

Development of Strategic Mark up Decision by Contractors in Saudi Arabia

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Competitive bidding is a common practice in business. The main aim of this research is to develop a practical bidding model. This includes studying existing bidding models used by organisations and verifying the developed model.

Various factors have been identified and analysed in order to identify the weight and ranking order of each factor in terms of its influence on the bid mark up size. Interviews have been conducted to explore the current practical practice in setting mark up size in Saudi Arabia and to identify factors that may influence bid mark up size. In addition, a questionnaire has been used to identify each factor's level of importance in Saudi Arabia. The findings have been used to establish a ranking order of factors in terms of their influence on bidding decisions based on contractors' size and main client. An important discovery is that the level of importance and rank of factors that influence bid mark up size differ based on contractors' characteristics and main client. The characteristic which has been investigated in this research is the size of the contractor.

As a result, a bidding model to determine mark up size based on contractors' size and main clients has been developed. The proposed model has been tested and proved accurate in simulating the contractors' decisions.

Key words: Bidding, mark up size, bidding factors, bidding mark up decision

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DEDICATION

To My Family

This dedication for all my family members who support, encourage and be patient during my work to deliver this piece of work

Chapter 1: Introduction

1.1 Background

A successful competitive bidding strategy is one in which a contractor bids high enough to make a profit and low enough to win the contract. Many organisations now use bidding in their procurement systems (Park and Chapin, 1992). Therefore, many bidding managers and researchers are interested in understanding bidding strategy and what is involved in winning a contract.

The ability to understand the factors affecting bidding decisions in order to predict mark up prices is important for organisations in order to win contracts in competitive bidding situations and to increase their profitability.

Many researchers have studied the development and use of bidding models for the optimisation of contractors' bid prices in competitive bidding situations (Park and Chapin, 1992). Since Friedman in 1956 and Gates in 1959 started this area of research, more than 1000 papers have been published debating the principle of applying mathematical models (Cattell et al., 2008). This shows that the area of bidding in general and how it attracts many researchers.

Competitive bidding has increased in non-market environments (Samuelson, 1985). Bidding is used in both the private and public sectors for auction sales and contract procurements. The allocation of contracts using competitive bidding has several advantages, such as securing the most competitive prices and/or contractual terms for buyers or sellers. However, conducting competitive bidding is costly (Samuelson, 1985). Thus, bidding firms need to have a bidding strategy model to help increase

the probability of their winning bids (Riley and Samuelson, 1981). In 2000, £22 billion was paid by four telecommunications organisations for licences to operate 3G services in the UK. This was above everyone's estimates, except those of the team who designed the auction using a game theory concept (Frary, 2009).

Many studies have been conducted to determine the probability of winning a bid or contract. The first mathematical model was produced by Friedman in the 1950s. Most models have not moved beyond academic circles to practical implementation. Additionally, many researchers (Ahmad and Minkarah (1988); Seydel (1990); Moselhi et al., (1993); Shash (1993); Fayek (1998) and Wanous (2000)) have identified factors that influence the markup in a bidding strategy decision. These studies have made a valuable contribution to the study of bidding and markup decisions (Egemena and Mohamed, 2007). However, developing a bidding strategy model that takes into account a comprehensive list of the factors that influence markup decisions and utilises decision making approach is necessary to fill the gap. Additionally, establishing the factors that link a portfolio with an organisation's strategy will add value to a model (Caron et al., 2007). These factors can help to develop proposed bidding strategy models in order to increase the probability of winning bids and contracts.

According to Yoong et al , a contractor's business strategy is impacted by a bidding decision and a markup decision. This relationship influences contractors' bidding strategy models which are used in competitive bidding situations (Yoong et al., 2009).

This research focuses on understanding bidding, a strategic bidding model employing a multi-criteria approach and how to develop bidding strategy models

using the decision making method such as multi criteria decision making in order to solve complex bidding situation. This research will use a mix of quantitative and qualitative methods in order to understand how bidding firms use bidding strategies, how they determine mark up size in the competitive bidding situation in Saudi Arabia and how they can employ decision making method to model this decision. A proper bidding strategy model will then be developed using a multi criteria decision making utilizing utility theory to help businesses make better decisions. This model could take the form of a user-friendly tool, which can be tested by bidding firms at a later stage.

1.2 The Research Problem

Saudi Arabian construction has been experiencing a boom period in the last few years. Most of these projects required bidding decision when invitation received by contractors (Wanous et al., 2000).

Therefore, contractors are interested in understanding competitive bidding strategy models in order for them to understand what factors influence their decisions in determining the markup size.

Competitive bidding strategy models (tendering) have been studied since the 1950s. Many researchers have developed a bidding strategy model in order to increase benefits for organisations. Most of these models are designed for competitive bidding in any industry, while some are designed for a specific industry, such as Stark and Rothkopf's model which has been developed for the construction industry. A large number of these competitive bidding strategy models fail to be used in practice because they do not suit the actual practices of the construction industry (Fayek, 1998).

Ahmad and Minkarah conducted a questionnaire survey among 400 of the top general contractors in order to discover the factors that characterise the bidding decision-making process. The study found that bidding decisions are influenced by many factors that ultimately affect bid/no bid decisions and percentage markup decisions. The questionnaire was an initial step towards developing a microcomputer-based expert system. The developed system was based on a multi-attribute utility model that requires various judgments to be input by the bidder. The model provides a set of criteria for bid/no bid decisions and percentage markup decisions (Ahmad and Minkarah, 1988).

In 1999, Wanous et al. developed a parametric solution for bid/no bid decisions based on a formal questionnaire and six semi-structured interviews. The solution was based on 38 factors that affect the bid/no bid decision (Wanous et al., 2000). Additionally, Lin and Chen have developed a method using fuzzy linguistic that analyze in more accurately by describing or modelling the concepts using the terms of fuzzy logic for bid/no bid decisions. This method considers the multiplicity and ambiguity of the evaluation criteria in competitive bidding (Lin and Chen, 2004). There are many other bidding strategy models that have been developed, such as those by AbouRizk et al. (1993); Abdelraziq (1995) and Wanous et al. (2000).

According to Aminah Fayek, there is still a need to design competitive bidding strategy models that suit the actual practices of construction contractors. It is necessary to consider the following issues when developing a competitive bidding strategy model that is suitable for use in practice:

- A wide range of factors that affect the percentage of markup decision.

- The use of heuristic logic and qualitative and subjective contractor judgment.

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- Other factors that affect winning bids besides the price.

- Quickness and ease of use.

- Avoiding the use of a method based on population-specific data, training, rules, or examples. (Fayek, 1998)

A study which helps contractors to understand the factors that influence their decisions when determining markup size is expected to contribute to the performance of contractors in terms of increasing their profitability and ability to win contracts.

1.3 Research Aim

The aim of this research is to develop a bidding strategy model that support contractors' decisions on markup size using multi-criteria approach for Saudi Arabia contractors.

The research questions are as follows:

- What are the factors which affect bidding markup in Saudi Arabia?

- How do contractors behave when setting the priority for these factors in Saudi Arabia?

- How could these factors be used to develop a competitive bidding model in order to help improve the performance of contractors?

1.4 Research Objectives

The aim of this research as discussed early is to develop a practical bidding model. This includes studying existing bidding models used by organisations and verifying the developed model.

The scope of the research concerns the competitive bidding situation in term of determining mark up size and focuses on developing a computer based model for supporting organization's bid mark up size decision. However, in order to achieve the research aim, the study requires the following objectives to be achieved:

Objective One: To define the characteristics of bidding models through a literature review and empirical research.

Objective Two: To review and understand the factors that influence decisions on bidding markup size in Saudi Arabia.

Objective Three: To investigate and examine the utilisation of a multi-criteria approach or other decision-making methods in developing a bidding strategy model.

Objective Four: To design and develop a bidding strategy model using contractors' information in order to support their decisions on markup size.

Objective Five: To construct a computer-based application that facilitates the process of determining markup size as defined in Objective Four.

Objective Six: To examine the proposed strategy model with organisations in Saudi Arabia that obtains their work or a percentage of it through competitive bidding.

1.5 Research Motivation

This research conducted a literature review to study existing bidding strategies. It found that many researchers and experts have studied the development and use of bidding models for the optimisation of contractors' bid prices in competitive bidding situations and still believe that there is a gap between theorists' bidding models and practical bidding models. This gap is an interesting subject for researchers and experts. However, in addition to this, contractors need a tool (a computer-based application) to organise their decisions on bidding markup size which considers a contractor's current situation.

1.6 Research Model

This research's literature review looked into the two main areas: a multi-criteria approach and models of bidding strategies. A research model has been developed based on the gap discovered during this literature review. Figure 1.1 shows gaps and the procedure used to develop a bidding model.
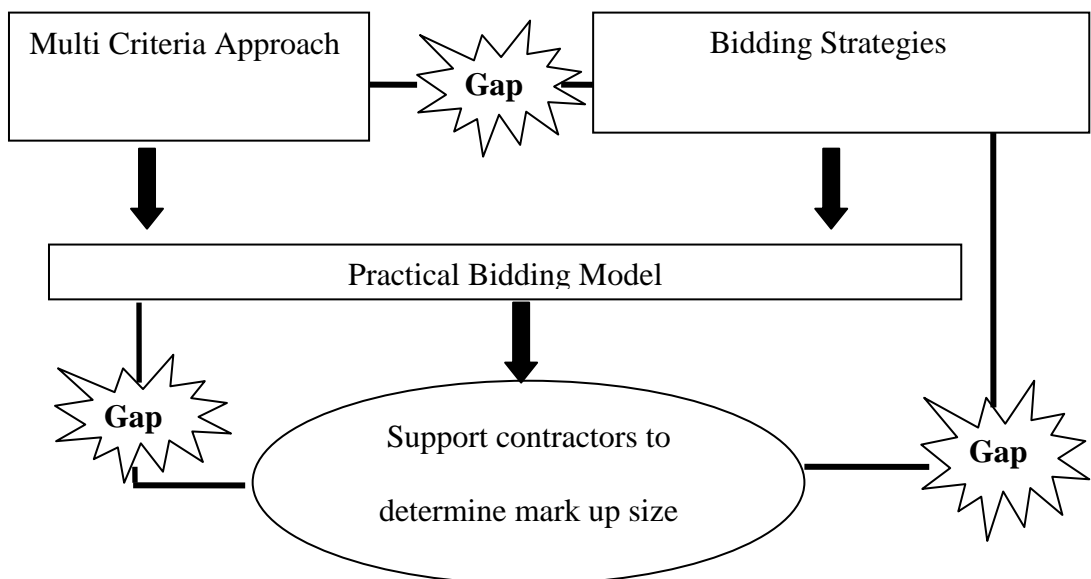
Figure 1.1 Identifying gap to develop practical bidding model

Additionally, Figure 1.1 shows the gap in the relationship between a multi-criteria approach and bidding strategies, which can lead to a practical bidding model. It is assumed that there is a relationship between multiple criteria and bidding strategies. This relationship can help businesses to develop practical bidding models in order to increase the probability of them winning bids.

The following figure, 1.2, shows the research's framework. There is a gap between bidding strategies, decision-making techniques and the factors that influence bidding markup size. By filling this gap, the research aims to find a practical bidding model that can help contractors to determine mark-up size in competitive situation (Figure 1.2).
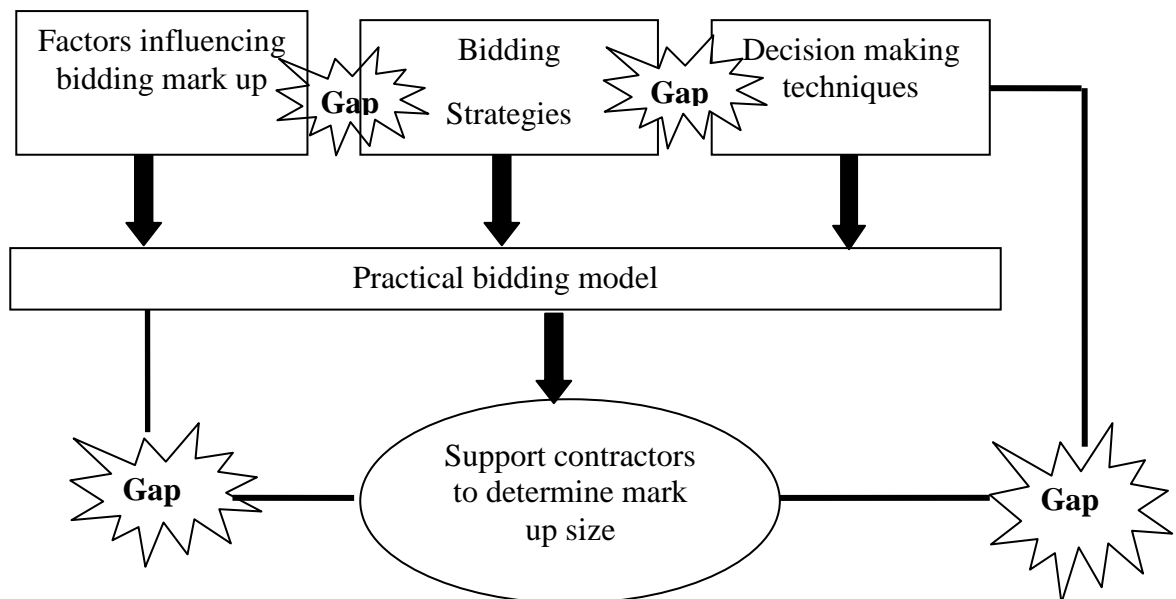
Figure 1.2: Research framework

Additionally, during the literature review it was found that most contractors does not have tool that can support their decision on markup size in a bidding situation

(Ahmad and Minkarah, 1988). Figure 1.3 shows that using a multi-criteria approach and understanding the relevant bidding factors can help an organisation to organise the process of determining markup size.
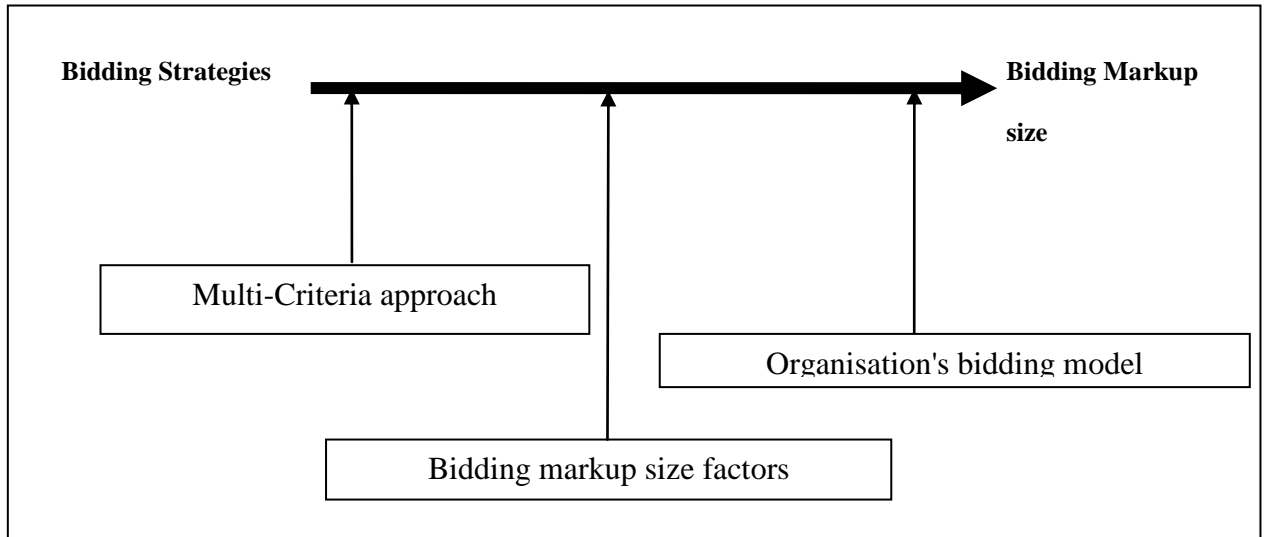
Figure 1.3 Elements support bidding mark-up size decision

1.7 Research Methodology

This research carried out a literature review in order to achieve part of its research objectives. The literature reviewed mainly dealt with bidding strategies and decision-making approaches. This literature review helped towards a better understanding of bidding characteristics and decision-making approaches. This literature review was undertaken to observe and define the factors that influence bidding markup size, as well as to discover the effects of a multi-criteria approach and the bidding process.

To understand and determine the factors influencing the bidding markup decision, a mix of methods (qualitative and quantitative methods) has been used in this research. Two types of study have been carried out - firstly, confirmatory studies to verify the factors influencing the bidding markup decision that are applicable to the Saudi

Arabia construction industry; and secondly, exploratory studies that explore the link between these factors and the current situation with respect to bidding markup size decisions.

In the first type of study, the questionnaire, together with the literature review, provided a better understanding of the factors that influence bidding markup decisions in Saudi Arabia. The second type of study investigated how the factors influencing bidding markup can be used to develop a bidding strategy which utilizes a decision-making approach (multi-criteria approach) in order to support contractors' decisions on setting the markup size in bidding situations.

Both methods have been employed successfully to achieve the research aim of developing a bidding strategy tool that enables contractors to organize their decisions on setting the markup size in bidding situations. However, the research methodology has been designed in four phases: each phase was carried out in line with the research objectives. Phase One (the literature review) was conducted to gather background information about the research and to help understand the research problem. Phase Two (the interviews) was conducted to explore the factors that influence bidding markup sizes and are applicable to the Saudi construction industry and how contractors make the bidding markup size decision. Phase Three (the questionnaire) was conducted to confirm the factors influencing bidding markup sizes and to determine the level of importance of each of these factors. In Phase Four (developing the computer-based tool) the analysis of interviews and questionnaires resulted in the production of a solution to the problem and validation of the tool was performed by contractors in order to obtain feedback from contractors after testing of the developed tool.

1.8 Research Outcome

Based on the conclusions of the literature review, preliminary study, the questionnaire survey and the qualitative interviews, an integrated computer-based model was designed and developed to support the decision maker in making a bidding markup size decision. Thereafter, the final model was designed, using a computer-scripting language called ASP (Active Server Pages).

The model considered identification of contractors size , client type and establish level of assessment for factors influence bidding mark up size by collect information from contractors related to project characteristics, project documentation, clients, company situation , economic situation , project finance and contracts.

This model has been developed to contribute to the improvement of the contractors' practice and performance, especially with regards to the practice of setting markup sizes. The benefits of such a model are: modelling the decisions made in setting the markup size in bidding situations, systemically determining mark up size, and reducing the time consumed on the bidding mark up process.

1.9 Structure of Thesis

This thesis comprises nine chapters: Introduction; Literature Review: Bidding Strategy, Literature Review: Decision Making; Research Design and Methodology; Questionnaire Design and Results; Interview Results and Discussion; Developing the

Model; Testing and Validation; and Conclusion. The content of each chapter is as follows:

Chapter 1: Introduction

This chapter introduces the research problem and the aims and objectives of the research. After that, this chapter presents the research methodology and model.

Chapter 2: Literature Review: Bidding Strategy

This chapter investigates bidding definitions and the bidding process, followed by an assessment of bidding strategy models. Additionally, this chapter presents an overview of factors that influence the bidding markup decision.

Chapter 3: Literature Review: Decision Making

This chapter presents decision-making approaches and definitions.

Chapter 4: Research Methodology

This chapter starts by presenting a literature review about the problem, followed by the research methodology which has been adopted in this study in order to achieve its research objectives.

Chapter 5: Interview Results and Discussion

This chapter analyses the interviews and includes a discussion and summary of the interviews' results.

Chapter 6: Questionnaire Design and Result

This chapter presents the questionnaire questions and the methods of data collection. This is followed by an analysis of the data and some conclusions.

Chapter 7: Developing the Model

This chapter presents the development of the bidding markup size model.

Chapter 8: Testing and Validation

This chapter presents the process followed to test the proposed model.

Chapter 9: Conclusion

This chapter presents the research's conclusions and limitations. This chapter also presents recommendations for further studies.

After these nine chapters this document contains nine appendices: appendices are about interview questions and scripts, Questionnaire and includes papers and poster which have been published and are related to this research.

Chapter 2: Literature Review - Bidding Strategy

2.1 Introduction

The previous chapter introduced the aims of this study and gave a complete overview of it, including the objectives, methodology, research outcome and an outline of the thesis. In this chapter, background knowledge related to this research is presented. The aim of this presentation is to justify the research problem, the direction of the research, and the research approach adopted. Previous studies concerning bid-price decisions, bidding strategies, pricing strategies and bidding factors are carefully considered in relation to this research topic. This chapter presents the importance of the bid markup decision and discusses the link between the above topics and the problem of bid-price decision making. In addition, it presents previous research that has considered the bidding decision, factors affecting the bid price decision, and methods of modelling the bid price decision.

Literature review is the starting point of this research, which is done to understand the concepts in general and particularly focusing on two areas Bidding Strategies in this chapter and Decision Making in next chapter.

Taking Bidding Strategies as a baseline, literature specifically in relation to Bidding Model, decision making, Bidding Mark up size context was reviewed to understand the Bidding Strategies Model perspective.

The literature review has been discussed and summarized from published paper by different researchers. The access for published work was through university libraries

including online sources specifically that guide research objectives. The review of journal articles helped to refine the research objectives and gave an overview of the work that achieved by previous researchers.

2.2 Background

The majority of revenues generated by construction contractors come from open bidding projects (Wanous et al., 2000). In a competitive bidding situation, to have a successful bid a contractor needs to set a markup high enough to gain a reasonable profit, but low enough to win the contract. When bidding, bidding efficiency is the key to success; Park and Chapin (1992) defined bidding efficiency as the ratio of actual profits to the amount which can be gained by maximising potential profit when defeating all of the competition by giving the lowest price. Competitive bidding requires the application of a bidding strategy. According to Park and Chapin (1992) management's judgement is the most significant contributing factor in determining the success of such a strategy. It has been proven that many businesses fail because of poor management judgment and poor business strategy (Park and Chapin, 1992).

According to Bansard et al (1993), Competitive bidding can be defined as buyer's power to define the requirement and request for proposals in order to select best supplier proposal that match buyer's need and price criterion.. The aim of this bidding is to gain goods and services at the lowest price possible. The main difference between open competitive bidding and closed competitive bidding is the open competitive bidding is conducted at a public venue. In competitive bidding, buyers define their needs and request proposals from suppliers and contractors. After

this, buyers select one of the proposals based on various criteria, one of which is price (Bansard et al., 1993).

The advantage of competitive bidding is that by maximising competition, buyers gain a competitive price or better contractual terms. However, the competition can affect cost, as conducting and evaluating the bidding process is expensive. In addition, when many organisations are involved in the bidding competition, each organisation spends time and resources, even though they may have very little chance of actually winning the contract. This can result in financial losses for these organisations (Samuelson, 1985).

According to King and Mercer (1985), the problem of determining appropriate bidding strategies has been debated for the last 30 years, as companies in the construction industry obtain a large portion of their business through competitive bidding. Having proper bidding strategies is therefore important for their planning. However, there are still no general bidding strategies agreed upon that can help businesses to solve their bidding problems (King and Mercer, 1985).

In the context of real-word bidding problems, bid/no bid and bidding price decisions are made based on multiple conflicting and incommensurate criteria or attributes. Several researchers such as Bageis (2008) have proposed multi-criteria decision making, with discrete alternatives such as multiple-attribute utility theory, the analytic hierarchy process and other methods, to solve decision-making problems in public sector areas such as healthcare, planning and macroeconomics. However, it is only recently that multi-criteria decision making with discrete alternatives has started to be used in order to solve competitive bidding decision problems (Shi and Zeleny, 2000).

Competitive bidding is a game between buyers and suppliers. The objective of competitive bidding is to provide the buyers an opportunity to find the best price to maximise benefits and best price for contractors that help to increase probability of winning bids (Perng et al., 2006).

Bids can be categorised as either open bids, sealed bids or a combination of the two types, collectively known as single-stage bidding. Alternatively, two-stage bidding can occur in a market where there is a separate submission of a price and a solution. This happens mostly for large and complex projects. The first stage involves the submission of a technical solution, and after agreeing on acceptable technical standards with the tendering board, a submission of price takes place in the second stage (Harris et al., 2006).

As mentioned above, competitive bidding strategy models (tendering) have been studied since the 1950s. Many researchers have developed bidding strategy models in order to increase benefits for organisations. According to Stark and Rothkopf (1979), most of these models are designed for competitive bidding in any industry, while some are designed for a specific industry, such as Stark and Rothkopf's model, which has been developed for the construction industry (Stark and Rothkopf,1979). A large number of these competitive bidding strategy models are never used in practice because they do not suit the actual practices of the construction industry (Fayek, 1998).

Competitive bidding has been become common practice for businesses, governments and institutional markets since 1980s (Cova and Allen, 1989). Competitive bidding is used as a method for procurement management, to bring value to a portfolio. Strategic bidding models are designed using mathematical techniques to evaluate the

optimal price to bid in a competitive bidding situation (Cattell et al. 2008). To determine a suitable competitive strategy, it is necessary to identify the organisation's objectives. With a bidding strategy, the most common decision made is the price of a bid. This decision involves many variable factors which can be hard to process, even when using a computer, even if we assume that all of these factors can be identified. Usually some of the factors cannot be identified (Park and Chapin, 1992).

There are powerful tools which can help an organisation's management to have better judgment in the decision-making process. Some examples of these tools are statistics, probability theory, operational research, criteria for decision making, analytic hierarchy process, utility theory, goal programming and game theory. In bidding strategy, criteria for decision making can be used to analyse a competitive situation. Decision analysis principles can be helpful for management, helping them to understand complex competitive situations (Park and Chapin, 1992).

2.3 Bidding Strategy

According to Wanous et al. (2000), a bidding strategy can be defined as contractors' long-term objectives and goals in terms of selecting the best project to bid for, determining markup size and preparing bidding documentation. This research focuses on contractors' bidding strategies in terms of determining the proper markup size in a competitive bidding situation. The most important activities of contractors are activities that occur during competitive bidding, as these can lead to the contractor either being successful or failing (Wanous et al., 2000).

Adopting a bidding strategy in a tender situation is quite difficult in practice and problems can occur. In theory, blind bid tenders assume that buyers force sellers to

bid at their lowest acceptable price for delivering a specific product and quality at a specific time. Sealed bids are opened at a specific time to select the seller who is to provide the product or service at the lowest price. There is no negotiation in this type of bidding and also the bidder cannot re-evaluate his bid price. In this type of bidding, the bid price is the only way to win the contract. In practice, however, things are often quite different.

According to Chapman et al. (2000), the most common format for the bidding process involves competitors being invited to work on a contract, with the contractor who submits the lowest bid winning the contract, with all other things being equal. In this process, the client's decision is straightforward, but the contractor's decision is quite difficult, because bidding at a level with a high return can decrease the chance of winning the contract. On the other hand, bidding low increases the chance of winning the contract, but reduces profitability (Chapman et al., 2000).

Figure 2.1 presents two cases of the procurement bidding process. In the case of open bidding, the bid starts by inviting all competitors to become involved in the bid and each bidder submits a sealed bid. After that, the lowest bid price will be selected to win the contract. In the case of selective bidding, the bid also starts by inviting all competitors. However, the document of a bidder is checked to evaluate the bidder and a list of approved bidders is created. Only approved bidders can submit sealed bids. The bidder who submits the lowest price wins the contract (Cova and Allen, 1989).
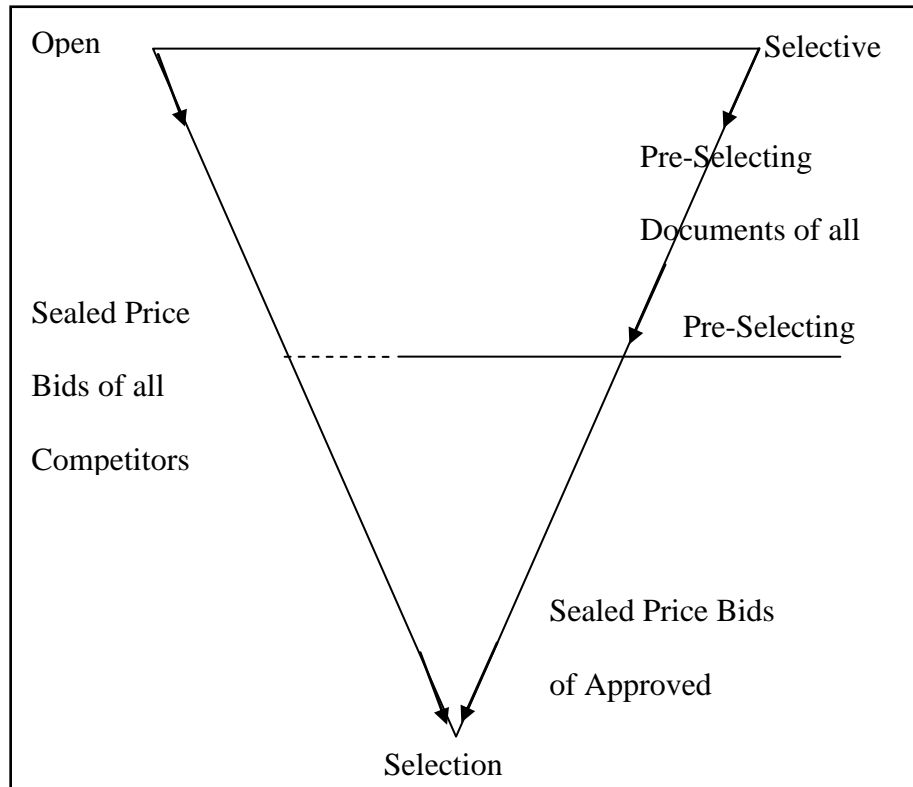
Figure 2.1: Competitive bidding process (Cova and Allen 1989)

Figure 2.2 illustrates the complexity of the bidding process model. There are some changes to the competitive bidding process of Figure 2.1, such as the introduction of an approved list of bidders. Additionally, the criteria for the acceptability of factors are encompassed in the bidding process. The price of bids is still important but sometimes there are other factors that affect the winning of a bid, such as the volume and quality of the item. Moreover, a negotiation stage has been added to the process in order to negotiate on all items with short-listed bidders (Cova and Allen, 1989).
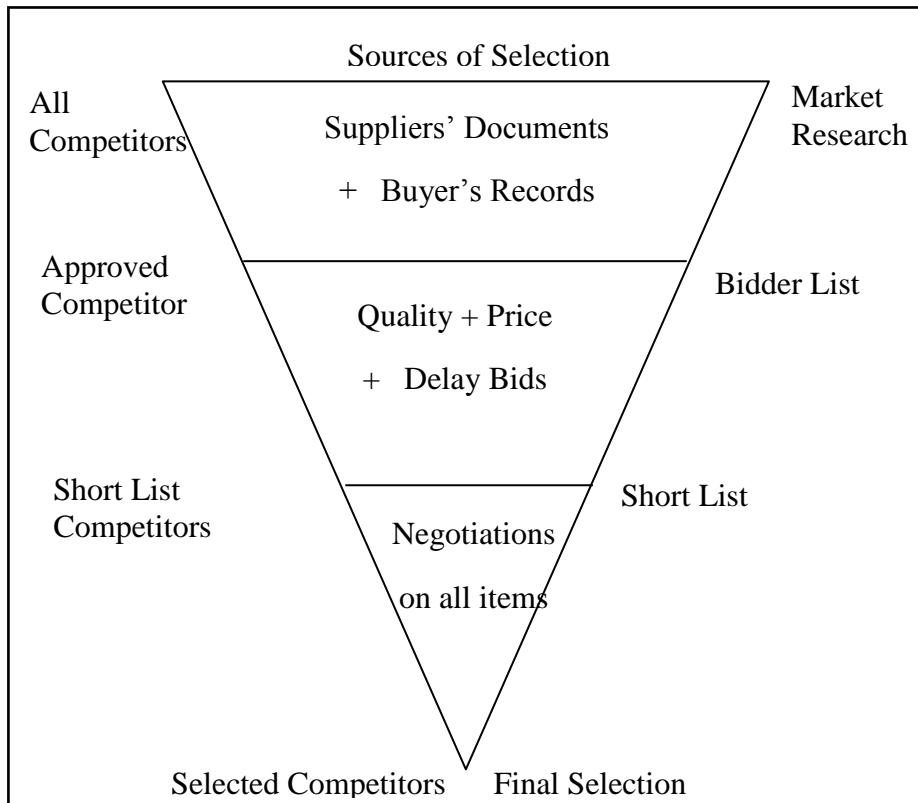
Figure 2.2: Progress of the competitive bidding process (Cova and Allen 1989)

A variety of mathematical models have tried to solve the problem of determine mark up size for contractors in order to help them to increase their probability of winning contracts by determining the optimal bid. One of the most common models is that developed by Friedman (Chapman et al., 2000). A variety of mathematical models will be discussed in next section 2.5.

Construction companies are required to meet two business requirements in order to determine their bidding prices strategy so that they are a successful company. These two requirements are that prices have to reflect a reasonable profit for the company, and that prices have to reflect customer requirements in order for them to make the purchasing transaction (Mochtar, 2010).

There are basically two pricing strategies: cost-based pricing and market-based pricing (Best, 1997). According to Best (1997) in the construction industry, there are

high risks and low margins of profit compared to other industries. Currently, the strategic approach used to determine the bid price in the construction industry is cost-based pricing (Best, 1997). In this approach, the cost of a project is calculated and then the markup is added. Many researchers have proposed bidding strategies based on this approach. Examples of these researchers are Ahmad and Minkarah (1988); Loannou and Leu (1993); Moselhi et al. (1993); Fayek (1998) and (Best, 1997).

The other alternative approach used is market-based pricing, which is mostly used in the manufacturing industry. However, this approach can be limited because it requires sensitive data such as minimum and maximum markup size, which is set by competitors, and some other sensitive data regarding customers and owners (Best, 1997).

2.4 The Importance of Bid Price Decisions

Improving the bidding process by determining bidding markup sizes requires the identification of factors that influence the decision that determines markup size. The decision determining bidding markup size is important in the bidding process, as well as the bid/no bid decision, because these decisions affect day-to-day operations and long-term organisational performance (Ahmad, 1990).

Previous studies have identified and explored the levels of importance of different factors that influence bid decisions such as bid/no bid and bid markup size. This research focuses on improving organisational performance in terms of the bid markup size decision. This decision considers factors that help to determine an organisation's bidding strategy. Previous research identifying factors that influence the bid markup size decision in various sections of the construction industry has

often relied on the prominent study conducted by Ahmad and Minkarah in 1988. Many factors presented in this research are not presented in others. Moreover, the level of importance given to each factor differs from one study to another. However, this gives an opportunity for this research to re-explore and re-examine these factors in order to establish an importance index for factors influencing the bidding markup size decision in the Saudi Arabian construction organisation environment.

2.4.1 Factors Influencing the Bidding Decision Process

Ahmad and Minkarah (1988) have tried to answer the question 'How are bid decisions made?' In their research they state that input from the construction sector is important in order to have a meaningful bidding decision model. However, a comprehensive answer to this question was not easy to come by because bid decisions are made on experience, judgment and perception. Therefore, the researchers undertook further work in order to explore the factors that affect the bidding decision process in terms of two stages, the bid/no bid decision and the bid markup size decision.

The initial step of Ahmad and Minkarah's research involved the use of a questionnaire in order to get information about the firm and evaluate the level of importance of 31 factors that can affect the bidding decision. Questions were also asked about the policies and practices of the firm which might affect the bidding process. Their research came up with some important findings, which can be summarised as follows:

1. Competition and profitability are not the only factors of importance in bidding process decisions.

2. Experience, judgment and subjective assessment are used by contractors in the bidding process. However, statistical and mathematics tools are not utilised.

3. The level of importance of certain factors differs when comparing the bid/no bid decision and the bid markup size decision.

The findings of this research provided the researchers with new information for identifying the factors that affect the bidding decision process. This new information allowed them to develop a system that could help contractors to make bid decisions. The system is based on a multi-attribute utility model, where a bidder inputs a judgment into the system in order to get help with the bidding process (Ahmad and Minkarah, 1988).

In 1993, a study to identify factors affecting bid/no bid and bid markup size decisions was conducted in the UK by Shash. The research used a questionnaire method in order to collect data. The questionnaire was designed in a similar way to the questionnaire used by Ahmad and Minkarah in 1988. However, 55 factors were presented in the questionnaire. The findings of this research can be summarised as follows:

1. Top contractors rely on a mental model when making bidding decisions, using judgment and perception.

2. The use of statistical or mathematical models is not common among top contractors.

3. Top contractors are comfortable with how they make their bidding decisions.

Most of these findings agree with the findings of Ahmad and Minkarah (1988). Nevertheless, the findings of Shash's research provide a foundation for further research into the development of a realistic bidding model (Shash 1993).

Regarding factors that influence bidding decisions in the Saudi Arabian environment, a study by Shash and Abdel Hadi was conducted in 1990 in order to determine the factors that affect the bidding markup size in the bidding process and to test whether the levels of importance of these factors differs depending on the size of the contractor. The research identified 37 factors, which were classified into five groups. These groups were project characteristics, project documents, company characteristics, the bidding situation, and the economic situation. The study used a modified version of the questionnaire used by Ahmad and Minkarah in 1988. The study highlighted the factors that affect markup size decisions in the bidding process in the Saudi Arabian environment and laid the foundations for other researchers to develop an expert system that could help contractors to determine the right markup size in their bidding processes (Shash and Abdel Hadi, 1993).

Another study conducted in Saudi Arabia was that of Abdulrahman Bageis in 2008 under the supervision of his supervisor Chris Fortune. The aim of their study was to identify factors that affect the bid/no bid decision in order to develop a bid decision tool to help contractors make bid/no bid decisions. The main finding of this research was that the level of importance of the various factors is affected by the characteristics of the contractor and their main clients. Due to this, the model proposed by their research to help contractors make bid/no bid decisions considered the contract type and the main client in order to determine the levels of importance of the factors that affect the bid/no bid decision (Bageis 2008).

Another study conducted in a different region of the world was that of Mohammed Fadhil and Hong Guo Shan in 2002. Their study was about the construction industry in Singapore and included a literature review of Ahmad and Minkarah (1988), Shash and Abdulhadi (1992) and Shash (1993). Based on this literature review they identified 40 common factors that influence bidding markup size. They found that these factors differ between medium- and large-sized contractors. Additionally, they found that large-sized contractors are concerned about the type of work, whereas meduim-sized contractors are more concerned about their company's finances. Their study was a starting point for the development of a bidding strategy model (Dulaimi and Shan, 2002).

Aminah Fayek (1998) conducted a study that identified 90 factors that influence bidding decisions in terms of setting margin size. The study used the fuzzy set theory to develop a competitive bidding strategy model which improved the quality of the decision making process used when setting a margin (Fayek, 1998).

Yng Ling and Lie (2005) identified the factors affecting the markup decisions of a profitable contractor in Singapore. They investigated 52 factors and found that there were 21 significant factors which influenced bidding markup decisions (Yng Ling and Liu, 2005).

Egemena and Mohamed (2007) identified the key factors which help a contracting organisation reach the correct bid/no bid decision, as well as the correct markup size decision. The study confirmed that factors relating to strategic consideration have a significant role in both bidding process decisions. This study helped to complete a framework for a knowledge-based system model (Egemena and Mohamed, 2007).

The following table (Table 2.1) presents the methods and findings of previous studies. This table 2.1 summarize the literature review of previous studies that conducted to identify factors that influence bidding decisions. Table 2.1 presents researcher, period of research, country of the research, the methodology used to identify factors influencing bidding mark up size, response rate and the main finding of the research.

Source	Period	Country	Methodology	Response Rate	Main Finding
Ahmad and Minkarah	1988	USA	Questionnaire	34.13 % 129 questionnaires received	Competition and profitability are not the only factors that are important in bidding process decisions.
Shash	1993	UK	Questionnaire	28.3 % 85 questionnaires received	Top contractors rely on mental models, such as judgment and perception, when making bidding decisions.
Ali Shash and Abdul-Hadi	1990	Saudi Arabia	Questionnaire	24 % 71 questionnaires received	This study highlighted the factors that affect markup size decisions in the bidding process in the Saudi Arabian environment.
Aminah Fayek	1998	Australia	Questionnaire	30%	A competitive bidding strategy model for use in setting a markup.
Dulamimi and Shan	2002	Singapore	Questionnaire	21.3% 32 questionnaires received	Large-sized contractors are concerned about the type of work, whereas meduim-sized contractors are concerned about their company's finances.
Yng Ling and Lie	2005	Singapore	Questionnaire	20% 29 questionnaires received	This study can be used as a base for a global study of the factors which affect project profits and tender success rates.
Egemena and Mohamed	2007	Northern Cyprus and Turkey	Semi-structured interviews and questionnaire	80 questionnaires distributed	A bidding framework.

Table 2.1: Summary of studies conducted to identify factors that influence bidding decisions

Reviewing the above literature and interview have led to identification of 60 potential factors that could influence a contractor's bid mark up size decision, as shown in Table 2.2 below. Some of factors that are presented in Table 2.2 but not marked were introduced by the interviewees. However, these factors have been used to explore factors that influence Saudi Arabia contractors' to determine mark up size in a competitive bidding situation. These factors were a part of the research interviews and questionnaire.

		Ahmad and Minkarah (1988)	Shash (1993)	Ali Shash and Abdul-Hadi (1990)	Yng Ling and Lie (2005)	Egemena and Mohamed (2007)
1	Type of job	√				√
2	Size of job	√	√		√	
3	Warranty issues, which might possibly create risks					√
4	Design quality		√	√	√	
5	Contractor involvement in the design phase				√	
6	The amount of changes expected throughout the execution of the project					
7	Qualification requirements					
8	Degree of difficulty considering delays, shortages					
9	Project related contingency		√		√	
10	Degree of hazard (safety)	√	√		√	
11	Project duration	√	√	√		√
12	Labour requirement					√
13	Equipment requirement			√		
14	Location	√	√	√	√	√
15	Project start time	√	√	√		
16	Number of subcontractors			√		
17	Tendering method (selective, open)			√		

		Ahmad and Minkarah (1988)	Shash (1993)	Ali Shash and Abdul-Hadi (1990)	Yng Ling and Lie (2005)	Egemena and Mohamed (2007)
18	Completeness of the documents			√		
19	Tendering duration		√	√	√	√
20	Owner / Client	√				√
21	Size of client			√	√	
22	The client requirements				√	
23	The project matches the company's strategy and future					
24	Need for work	√		√	√	
25	Management of similar sized projects in the past					
26	Return of investment		√			
27	Reliability of company cost estimate		√	√	√	
28	Historic profit			√	√	√
29	Current work load			√		
30	Uncertainty in estimate			√	√	
31	Availability of other projects					
32	Confidence in workforce	√		√		
33	The ratio of the firm's current market share to the expected or aimed share					
34	General overheads	√		√	√	
35	Availability of equipment			√		
36	Supervisory availability		√		√	
37	Policy on production cost savings					
38	Labour environment					
39	Policy on economic use of building resources					
40	Tax liability	√	√			
41	Risk of investment	√	√	√		
42	Number of possible upcoming profitable projects out for tender in near future					

		Ahmad and Minkarah (1988)	Shash (1993)	Ali Shash and Abdul-Hadi (1990)	Yng Ling and Lie (2005)	Egemena and Mohamed (2007)
43	Economic condition	√		√	√	
44	Market's direction (whether it is declining, expanding, etc.)					
45	Government regulations		√	√		
46	Risk of fluctuation in material prices		√		√	
47	Risk of fluctuation in labour prices				√	
48	Capital requirement		√	√	√	
49	Project cash flow			√		
50	The current financial capability of the client					
51	The history of the client's payments on past projects				√	
52	Project terms of payment (monthly/quarterly)					√
53	Degree of difficulty in obtaining bank loans					
54	Contract conditions		√			
55	Type of contract			√	√	√
56	Clarity of the work and specifications					√
57	Competition	√		√		
58	Identity of competitors		√		√	
59	Strength of the firm	√	√	√		
60	Number of competitors tendering				√	

Table 2.2: Factors identified from literature review

The above factors can be categorised into seven groups. The groups' categorization

was built based on the previous studies and result of interview analysis. At some

point in each interview, the interviewee has been asked to categorize the group of

factors that influence bidding mark up size. From these interviews, the groups has been decided to be as following: Project characteristics, Project documentation, Client characteristics, Company characteristics, Economical situation, Project finance and Contract (as shown in Figure 2.3). These groups and the factors which belong to each group will be discussed in details in chapter 5 and 6.
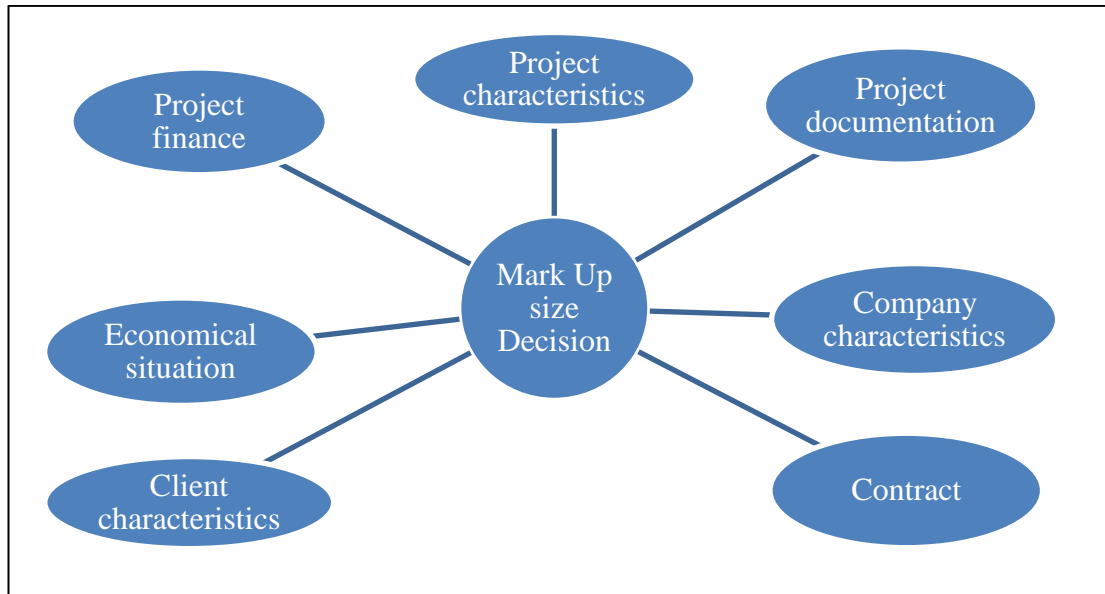
Figure 2.3: Grouping of factors that influence bidding mark up size decisions

2.5 Bidding Strategy Models

Many bidding models have been developed since the 1950s. The most common bidding models are those of Friedman (1956), Gates (1959, 1966), Stark (1968, 1972, 1974), Teicholz and Ashley (1978), Diekmann et al. (1982), Vickrey (1961), Cattell (1987), and Tong and Lu (1992). The common objective of these models is to maximise benefits for businesses (Cattell, Bowen et al. 2008). The bidding competition process has attracted the attention of researchers, who have tried to design a winning model which can be used by firms to increase the probability of them winning bids. Two of the main pieces of research in this area are:

- Work done by Lawrence Friedman using operation research and probability models;

- Work done by Vickrey using game theory models; (Cova and Allen, 1989).

These models were designed to help organisations achieve their goals in relation to bidding, and some of the models are helpful in setting a markup for projects. However, since the 1950s a large number of competitive bidding strategy models that have been developed have been found not to work in practice (Fayek, 1998).

In this section, common bidding models will be presented and discussed. These models are Friedman's model, Gates' model, Carr's competitive bidding model, the optimal bid approximation model, Stark, Teicholz and Ashley's model, the Diekmann et al. model, and the Vickrey bidding model.

Previous models developed by researchers which have investigated bid markup decisions and developed a bidding decision model which solves the problem of determining markup size include those developed by Friedman (1950s), Ahmad and Minkarah (1990), Dozziand and AboRisk (1996), Aminah Fayek (1998), Moselhi and Hegazy (1993) and Seydel and Olson (1990) will be discussed as well in this section.

2.5.1 Friedman's Model

The first model developed as a bidding strategy was that of Friedman in the mid-1950s. Friedman developed a mathematical model in order to maximise the expected profits of bids (Egemena and Mohamed, 2007). Friedman saw that organisations have objectives when submitting a bid. One of these objectives is to maximise profit. Other objectives are to minimise loss and avoid project risks. Friedman built his

model based on the aim of maximising profits, because this is the main objective for most organisations (Sparks, 1999).

Friedman developed a mathematical model to determine the bias of an estimated cost by comparing the estimated cost with the actual cost of a previous organisation's bid. He developed an equation for calculating the estimated cost bias and expected profit. However, determining the probability of placing a winning bid was not simple. Therefore, Friedman suggested that in order to determine the probability of winning, one should examine the bidding patterns of competitors in relation to the contractor's own bidding pattern. If not all of the competitors are known, the average bid concept developed by Friedman can be used to determine the probability of winning (Sparks, 1999).

2.5.2 Gates' Model

Gates' competitive bidding model is similar to Friedman's model in that it aims to maximise organisational profits. The difference is that Gates introduced strategies for six different situations, which can be used by an organisation to calculate the value of a project and determine their probability of winning. In one of Gates' situations, the contractor or supplier is the only the bidder. In this case, Gates suggests that the probability of the supplier winning is based on the supplier's estimation of the highest bid that the owner will accept.

Another situation is one in which there are two bidders, and the contractor is one of them. In this case, the contractor should carefully estimate the probability of winning with certain bid amounts, and afterwards the contractor can raise his bid because the competition is limited. Another situation is the most common, in which there are many competitors involved in the bid. In this case, Gates suggests using the average

bidder to represent other competitors. The contractor uses historical data to study the relationship between his bid and the lowest bid. In this situation, the contractor has the historical data of other competitors. The contractor will use the strategies of all known bidders. In such a case, the solution is similar to that of the many-bidders case, but the difference is that the data are sorted to find out which competitor was the lowest bidder. After this, a separate analysis similar to the many-bidders strategy is carried out for each opponent (Sparks, 1999).

2.5.3 Carr's Competitive Bidding Model

Carr's competitive bidding model was designed in 1982. This model compares an organisation's bidding strategy with that of its competitors, by looking at the ratio of opponents' bids to the organisation's estimated cost. Carr developed an equation to calculate the probability of winning a bid; the lowest bid of opponents for a project will exceed the contractor's bid-to-cost ratio.

This equation is valid only if the following conditions apply: bidders have the same variance in their cost estimates; and variances in cost estimates are substantially greater than the variances in markup and the magnitude of markups. In this model, a multiple regression technique is involved. By developing a list of project characteristics, a contractor can use multiple regression to find the ratio of a project's lowest bid to the contractor's estimated cost (Sparks, 1999).

2.5.4 The Optimal Bid Approximation Model

In 1980, Sugrue developed a simple competitive bidding model called the Optimum Bid Approximation model. This model fits Carr's multiple regression models into a single equation. In this model, an organisation calculates the ratios between the lowest competitor's bid and their estimated costs for past projects. Using this

information, an organisation can determine the optimum bid by multiplying estimated costs by the optimum bid-to-cost ratio. However, for this model to continue to be valid, it should regularly be updated with new bid results (Sparks, 1999).

2.5.5 Stark, Teicholz and Ashley's Model

Stark (1968), Teicholz and Ashley's model (1978) largely includes the model designed by Gates. Stark, Teicholz and Ashley's model used complex mathematical solutions supported by simple linear programming solutions. Stark, Teicholz and Ashley agreed with Gates that there is a risk when a contractor opts for an unbalanced bid and so, to avoid this risk, they recommended using sensitivity analyses. Stark, Teicholz and Ashley's approach can be described as deterministic in nature (Sparks, 1999; Cattell et al., 2008).

2.5.6 The Diekmann et al. Model

In 1982, Diekmann, Mayer and Stark improved Stark and Ashley's original model by adding a probabilistic formulation to minimise the risk of opting for an unbalanced bid, as in the original model. However, in this model they failed to consider the benefits of item price loading, except in relation to cash flow. In 1984, Cattell designed a mathematical model taking into account all the benefits which can be gained from item price loading. These benefits included cash flow, variations and escalation. However, the model failed to consider proper estimation risk (Cattell et al., 2008). The Tong and Lu model, which was developed in 1992, aimed to optimise the advantages of what they called 'error exploitation unbalancing'. This model did not consider the benefits of cash flow and escalation, as previous models had done

(Tong and Lu, 1992).

2.5.7 The Vickrey Bidding Model

The design and analysis of auctions is one of the accomplishments of game theory. Auction theory was pioneered by the economist William Vickrey in 1961. Its practical use became apparent in the 1990s, when auctions of radio frequency spectra for mobile telecommunication raised millions of dollars. However, many principles for sound bidding can be illustrated by applying game-theoretic ideas to simple examples (Turocy and Stengel, 2001).

Until Vickrey developed his model, game theory was largely ignored in bidding models. However, his model prompted researchers to develop other models utilising his theory of bidding auctions, laboratory experiments and testing the designed model using field data (Ausubel and Milgrom, 2006).

Vickrey's model provides a mechanism for a dominant bidder strategy in order to state their true values (Ausubel and Milgrom, 2006).

Most previous bidding models have focused on determining a project's overall bid price, which this research also aims to do. However, some of the models discussed above have also focused on individual price loading. This focus helps contractors to submit separate prices for each element in a bid, and the sum of the elements' prices then becomes the overall project price. Contractors can benefit from individual price loading by shifting the profit margin to items with high prices. Cattell et al. (2007) identified that recent unbalanced bidding models helped increase profits and reduce risk (Cattell et al., 2008).

2.5.8 Ahmad and Minkarah's Model

Ahmad and Minkarah developed an expert system called BIDEX (Bidding Expert) that helps contractors to make bid/no bid decisions and determine markup size. This

system was built based on the results of a questionnaire conducted by them in 1988. Through the questionnaire, Minkarah and Ahmad identified factors that influence bidding decisions. The technique they used to develop the model was utility theory. They found that the factors which influence bidding markup size decisions are uncertain factors. Examples of these factors are the degree of difficulty, uncertainty of the estimate, and the risks involved in investment (Minkarah and Ahmad, 1989).

In summary, the development of this model proves that utility theory can be used to solve the problem of determining markup size in bidding. The model has since been used and developed commercially.

2.5.9 Dozziand and AboRisk's Model

Dozziand and AboRisk (1996) developed a utility theory model in order to help contractors to determine project markup size. Their model was developed using 21 criteria which were identified through the survey conducted by Ahmad and Minkarah (1988). These criteria can be categorised into three groups: environmental factors, company factors and project factors. In order for the contractor to determine the project markup size, the following three elements have to be defined: criteria, scale, and classification (Dozzi et al., 1996). This continues in the procedure of the developed structure utility model, which involves developing a criteria structure, identifying utility functions, identifying a common scale for utility functions, and determining the expected utility and markup utility functions. In this model, for each bidding criteria a utility function method is used, as follows:

1. Set upper and lower limit for each criteria.
2. Identify the neutral point of contribution for each criteria, threshold and most preferred point.

3. Define a cardinal utility scale.

4. Use a straight line or exponential function to develop utility function.

However, utility functions can be created by a straight line equation or exponential equation. The following are the two equations (Dozzi et al., 1996):

Straight line equation:

$$u_j(y_j) = A_j y_j + B_j$$

Exponential equation:

$$u_j(y_j) = A_j e^{B_j y_j} + C_j$$

Additionally, the factors which are assigned to each criterion have a weight (Wj). The sum of each classification and sub-classification is equal to 100. The scaling factors of the classifications are adjusted by the following equation:

$$S_j = \text{Classification scaling factor}/100 \cdot W_j$$

This equation ensures that no errors occur when assigning or adjusting scaling factors.

In this model, utility theory is used to determine the markup size in a competitive situation by identifying the following:

1. Most preferred option.

2. Worst-case option.

The output of this model is as follows:

1. Most common markup size for the company.

2. Smallest markup size for the company.

3. Largest markup size for the company.

In summary, the utility theory model thus developed demonstrates an application of a multi-criteria analysis that uses subjective and quantitative information to successfully determine markup sizes for construction projects.

2.5.10 Aminah Fayek's Model

Fayek developed a bidding strategy model that used the fuzzy set theory. The aim of this model is to determine bidding markup size. Fayek identified three objectives for determining the markup size using the model, as follows:

1. To win the project;

2. To explore new geographical areas;

3. To maximize the project's contribution (Fayek, 1998).

Based on these objectives, a factor's level can be identified. However, a company gives a possible bid price based on one objective or a combination of objectives. Figure 2.4 (below) demonstrates that contractors can set several objectives and link them with the factors that could influence their decision when setting the markup size. From this, markup size can be determined based on the relationship between the factor's importance level and the objectives set by contractors.
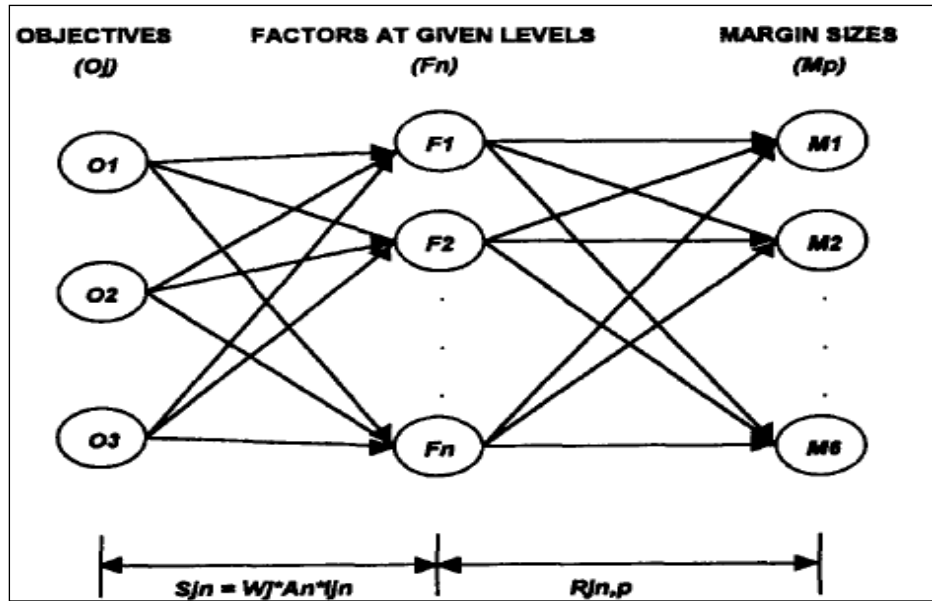
Figure 2.4: Relationship between components in the competitive bidding strategy

(Fayek, 1998)

This model enables users to set a range for the markup size. This range is divided into six markup sizes, as follows:

$M_1 = X\%$

$M_2 = (Z + X) \%$

$M_3 = (2Z + X) \%$

$M_4 = (3Z + X) \%$

$M_5 = (4Z + X) \%$

$M_6 = (5Z + X) \% = Y\%$

Users also identify the following in the model:

1. Each objective (O_j) has a weight (W_j), which indicates the degree to which the objective is desired in the bid situation. The user is able to provide a value for each weight, from 0 to 100.

2. The degree of applicability of the given factors given at a given level of bid (this degree (F_n) has a scale: 0 'False' to 100 'True').

3. The degree of influence the factors have on markup size (the weight (I_{jn}) indicates the degree of influence of each factor (F_n)).

4. The degree to which markup size would optimise the objective (the weight $R_{jn.p}$ is calculated by a model based on the most suitable markup size). Each element of $S(O_j, F_n)$ can be calculated as follows:

$$S(O_j, F_n) = W_j * A_n * I_{jn}$$

Fayek's model utilised fuzzy set theory in order to determine bidding markup size. However, his model was limited to specific objectives. This model could be enhanced based on the objectives of contractors and the identification of contractors' needs.

Based on Fayek's model, the total strength of a recommendation can be calculated as follows:

$$Q(O, M_p) = \left[\sum Q(O_j, M_p) \right] \bigg/ \sum W_j \quad \text{for} \quad j = 1 \text{ to } 3$$

In summary, this model proves that fuzzy set theory can be used to develop a bidding strategy model that helps contractors to determine their markup size in building construction projects. However, the model is limited to considering only three objectives.

2.5.11 Moselhi and Hegazy's Model

Moselhi and Hegazy introduced a bidding strategy model that estimates markup size using a neural network method. At the beginning of the development of this model, characteristic factors were required to formulate a bidding strategy. These factors were identified in the study conducted by Ahmad and Minkarah in 1988. From this study, the top 30 factors that affect bid markup size decisions were identified. This model has two alternative designs. The first is a single network and the second is a hierarchical system. Figure 2.5 Moselhi and Hegazy present 30 input attributes that represent the project environment and 7 output attributes that represent system outputs using a neural network method to introduce bidding strategy model that can estimates markup size.
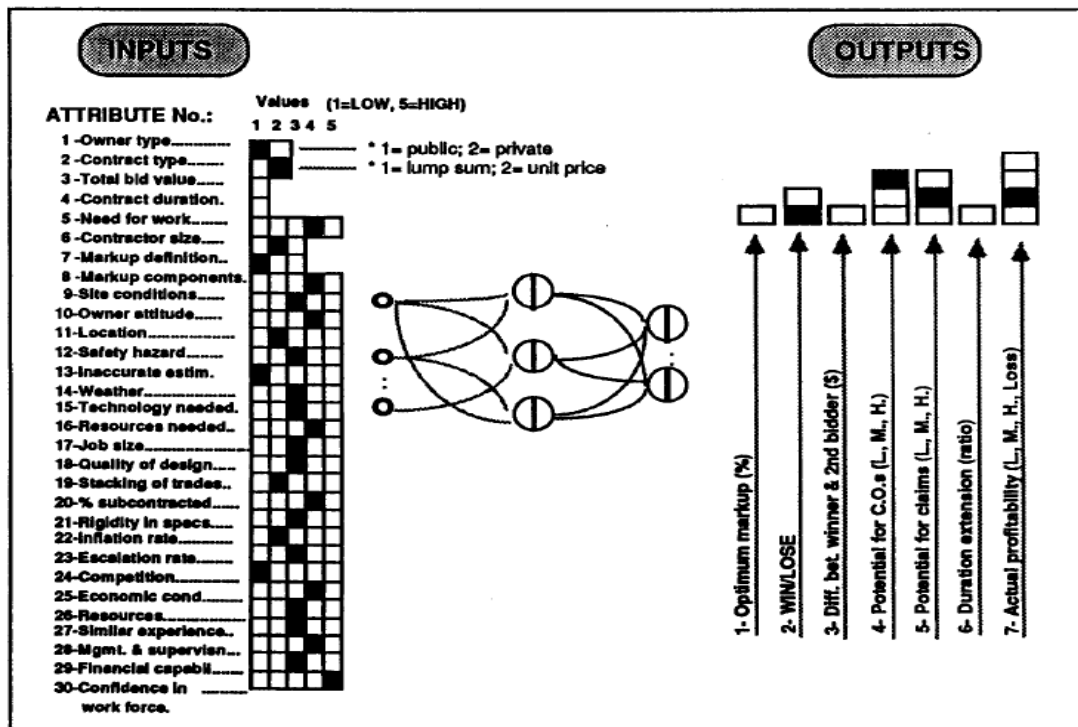
Figure 2.5: Single neural network system to solve the mark up size problem

(Mosellhi and Hegazy, 1993)

60

The alternative method is a hierarchical system based on four factor groups. These groups are job uncertainty, job complexity, market conditions, and company complexity (Moselhi, Hegazy et al. 1993). The input and output of the hierarchical neural network system is shown in Figure 2.6, which presents sub-networks as input and sub-decisions as output from Moselhi and Hegazy presented in their study. Generally, the neural network model demonstrates several characteristics.
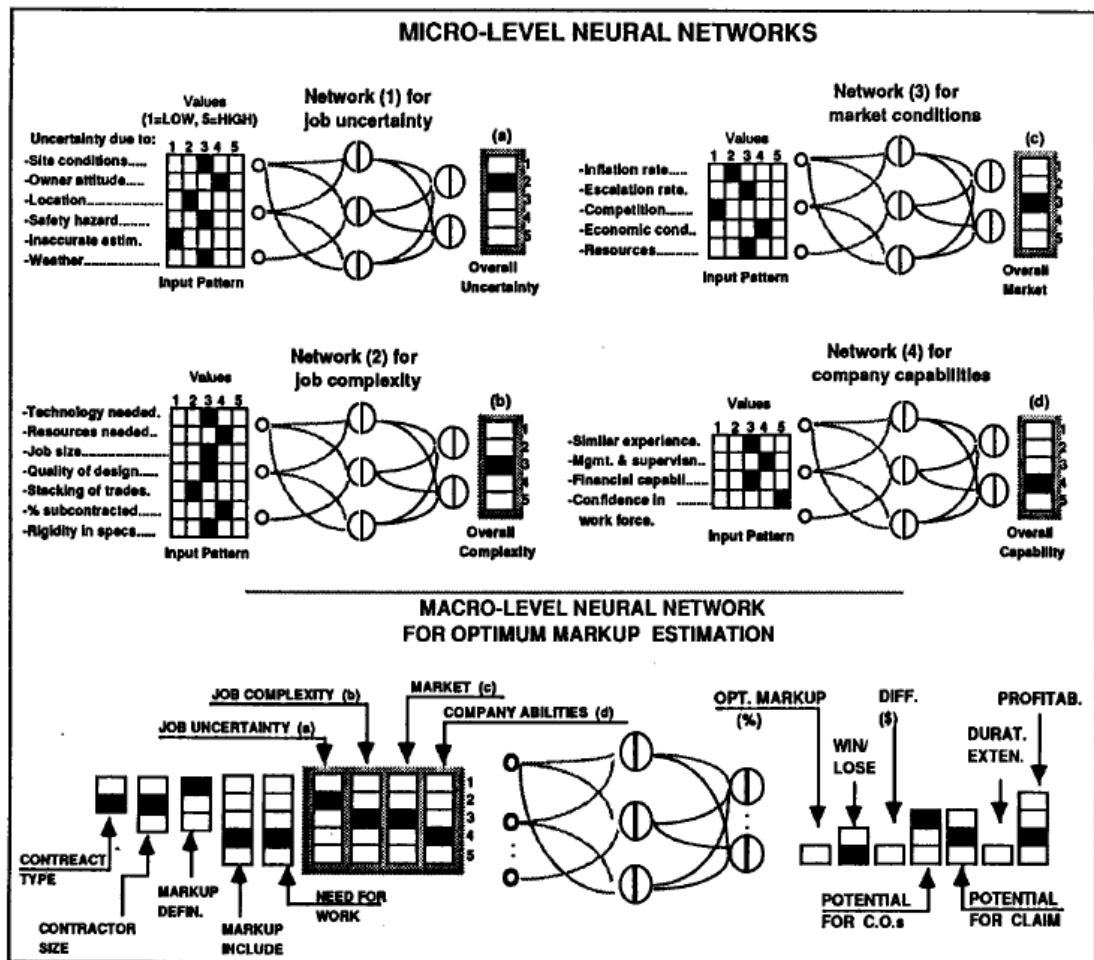
Figure 2.6: Hierarchical neural network system to solve mark up size problem

(Moselhi and Hegazt 1993)

In summary, the development of this model proves that the neural network is capable of solving markup estimation problems. However, this method requires examples for training and also requires historical data to be collected.

2.5.12 Seydel and Olson's Model

Seydel and Olson developed three criteria that can guide a small firm when determining bid markup size. These criteria are profitability, risk exposure, and work force continuity. They considered the relationship between these criteria in terms of their affect on markup size. In their research they examined historical data, finding that bid price is between 87.5% and 127.5% of the cost estimation (Seydel and Olson 1990).

In order to consider the attainment of all criteria, Seydel and Olson developed a system of relative weight for these criteria. The judgment scale for pairwise comparison was used to develop a criteria matrix. Their results were as follows:

$$
\begin{array}{c}
\text{profit } (P) \\
\text{continuity } (C) \\
\text{risk } (R)
\end{array}
\begin{array}{ccc}
P & C & R
\end{array}
\begin{bmatrix}
1 & 2 & 5 \\
1/2 & 1 & 3 \\
1/5 & 1/3 & 1
\end{bmatrix}
$$

A weight for all markup size alternatives can be generated for each criterion. The weight of all markup size alternatives can be determined in a similar way to the criteria for relevant weight. There is a bid markup size alternative for each criterion. This turns a set of alternative vectors into an alternative criteria matrix. Seydel and Olson were able to develop a competitive bidding model according to their criteria of

profitability, risk exposure, and work force continuity, using an analytic hierarchy process.

In summary, the development of this model involved the following eight steps:

1. Organise a problem into a hierarchy of goals, criteria, sub-criteria and alternatives.
2. Define probabilities for each markup alternative.
3. Calculate project cost ratio.
4. Develop the distribution of cost ratios for the project.
5. Determine the outcome for each markup alternative using each criterion.
6. Determine relative weights for each criterion via pairwise comparisons.
7. Determine relative or scaled weights for each alternative using each criterion.
8. Assess outcomes for the composite scores to choose an alternative. (Seydel and Olson, 1990)

2.6 Summary

This chapter has presented the importance of determining the bid markup size and given details of previous research that has studied factors that affect bid markup size decisions, as well as methods of modelling the determination of bid markup sizes.

The main objective of this literature review chapter was to validate and justify the research topics. The literature review has supported the need to explore the factors that influence bid markup size decisions because it has shown that existing findings regarding the level of importance attached to factors that influence bid markup size differ from one study to another and from one country to another. Identifying these factors will help to develop a bidding strategies model.

The issue of bid markup size decision making has received limited attention in Saudi Arabia as a research topic. Thus, this research will increase interest in this area of research in the Gulf region.

The literature review has also shown that most of the models developed for bidding strategies have stayed in the academic loop and have not been put into practical use around the world. Therefore, establishing a link between contractors' strategies and the proposed model to determine the markup size will help contractors to move the model into practical application. Additionally, customising the model based on the user's requirements will allow the model to meet the contractor's needs, and developing a computer-based model will enable contractors to use the model and move it one step forward towards practical usage.

In conclusion, several approaches are available for solving bidding markup size problems; one of these approaches is multi-criteria decision making. For example, Ahmad and Minkarah used multi-dimensional utility theory to determine markup size in a competitive bidding situation (Shi and Zeleny 2000).

From the literature review presented, 60 factors have been identified as potentially influential to the bid markup size decision. It has been found that factors have different weights and ranks in terms of their importance for the bid markup size decision. The weight of importance given to each of these factors is inconsistent, and is affected by the characteristics of the company and the contractor type.

This chapter has helped to identify a direction for this research and has helped with the development of a plan for achieving the research objectives.

Chapter 3: Literature Review - Decision Making

3.1 Introduction to Decision Making

Complex decision making has become common in the world (Cova and Allen, 1989). According to Anderson et al (2011), in general decision making associated with problem solving process. The decision making begins with identify and define the problem and ends with the choosing of an alternative solution (Anderson et al, 2011).

According to Adair (2009), Decision making process contains five steps namely defining the objective, collecting information, developing options, evaluating and deciding, and then implementing the decision. Monitoring consequences will then follow the decision making process. Figure 3.1 shows these steps of the decision making model (Adair, 2009).
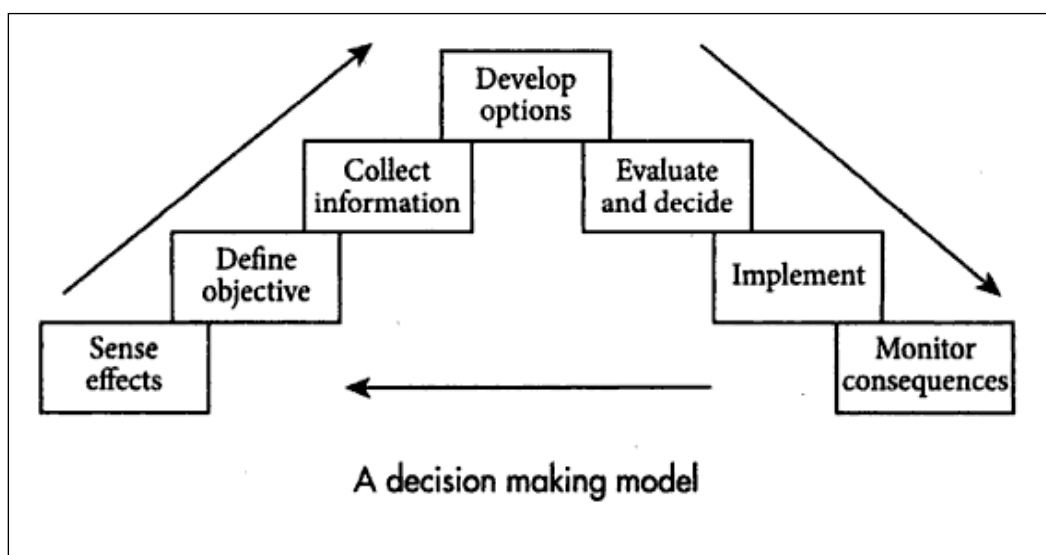
Figure 3.1: Decision making model (Adair, 2009)

Decision analysis is a proven methodology that can be used to characterise difficult decisions according to uncertainty, complexity, risk, and tradeoffs. The decision analysis cycle contains four steps, namely problem structure, deterministic analysis, probabilistic analysis, and informational analysis. This iteration process leads to the decision. Figure 3.2 shows the analysis decision cycle (Rice, 2005).
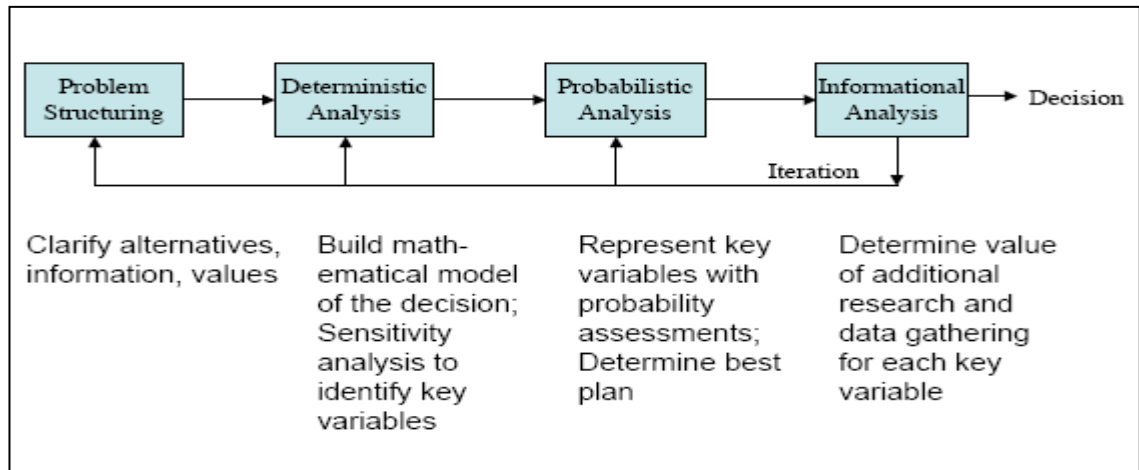
Figure 3.2: Analysis decision cycle (Rice, 2005)

Decision analysis tools are used to solve problems that have a finite number of alternative choices. These tools depend on the types of problems involved. The types of problems depend on the type of data, and data types are deterministic, probabilistic and uncertain. Each of these problem types has its own tool. According to Taha (2003) for decision making in a condition of certainty, the analytic hierarchy process (AHP) is an important tool for solving these types of problems. For decision making in uncertain conditions, game theory and criteria reflecting helps the decision maker to determine risk. Other types of problems can use decision trees in order to deal with decision making (Taha, 2003).

The objective of exploring different decision analysis methods including multi criteria decision making in this chapter is to identify that which decision analysis

method can be used to build a decision model can help contractors make their decision on the size of the mark up utilizing the factors that can influence bidding mark up size in competitive situation.

3.2 Decision Analysis Methods

There are many decision analysis methods that can be used to solve complex decision problems. The aim of this section is to present different decision analysis methods, including probability and statistical distributions, game theory, criteria for decision making, the analytic hierarchy process, utility theory, and goal programming.

3.2.1 Probability and Statistical Distribution

Probability can be defined as calculating the chance of a given event occurring. The result of this will be expressed as a number between 0 and 1, where 1 is certainty. In this case, mathematical probability is expressed as the number of occurrences of a targeted event divided by the number of occurrences *plus* the number of non-occurrences. This decision analysis method can be used to determine markup size and was utilised in the earliest bidding models. For example, Friedman's model in 1956 and 1957calculated the probability distribution of the most competitive bid prices.

Probability and statistics are related to each other in an important way. Probability can be used as a tool to evaluate the reliability of conclusions drawn from a population when information has been taken from only a sample (Mendenhall et al., 2008).

3.2.2 Game Theory

Game theory aims to develop optimal solutions to solve situations of conflict and cooperation. The assumption is that players in a game are rational and that each player acts in the best manner (Kelly, 2003). Game theory was introduced in 1944, with the publication of von Neumann and Morgensten's *The Theory of Game and Economic Behaviour*. Game theory is a theory that considers the outcome of decisions taken by two or more players, where no single player has full control over the decision that will decide the outcome. This decision could be an independent or interdependent decision (Kelly, 2003). Game theory can be applied when a major part of the decision-making process involves uncertainty (Biswas, 1997).

Game theory was invented as an aid to understanding how people and organisations behave in a strategic environment (Dixit and Nalebuff, 1997). Game theory has been recently used to develop bidding strategy models and auction mechanisms. In 1994, game theory played a major role in the development of bidding rules for unusual auctions to sell the air when the US government was selling the airwave spectrum (Turocy and Stengel, 2001). *The Handbook of Game Theory with Economic Application*, which was written by Aumann and Hart (1992), found that many rules of bidding and auctions are in line with game rules, which makes game theory a suitable approach to use to understand and improve bidding.

The game elements are player, action, payoff and rules (Rasmusen, 2006). However, there are also basic criteria which have to be applied for any type of game to be called a game; these criteria are common experience, equality, freedom and activity. If the game has rules it will be called a game with rules, and in this case there are

other criteria involved, namely game rules and goals. The course of the game is never the same because chance and competition influence the outcomes.

According to Chatterjee (2001) game theory has played a major role over the last twenty-five years in many practical problems, including antitrust analysis for monetary policy, the design of auction institutions, and the structuring of incentives within firms. Game theory has also been used in business applications to model and analyse businesses so that they make better decisions. Game theory can be utilised in different business functions, such as accounting and finance, strategy management, and organisational design. Many game theory applications are concerned with competitive decision settings. These applications cover market competition, bargaining, auctions and competitive bidding. In these applications, games have rules and players take actions based on these rules. A player's payoff is based on his and other players' actions (Chatterjee, 2001).

According to Nalebuff and Brandenburger, a game method is useful in competitive bidding. Changing one of main elements of the game, such as players, added value, tactics, rules and scope, can cause a major change in the game's payoff (Nalebuff and Brandenburger, 1996). The design of a bidding game provides players with an opportunity to formulate strategies for procurement projects in order to make bidding decisions. The aim of players is to win the bid in each round. The context of a bidding game must make the game realistic, attractive and motivating for the players (Perng et al., 2006).

The bidding process is more or less the same in all sectors; it begins with finding bid opportunities. After that, organisations can use several methods to seek out bids, such as Telephone buy (T-buy), Request for Quotation (RFQ), Invitation to Tender

(ITT), Request for Proposal (RFP), and Request for Supply Arrangement (RFSA). Next, businesses will select one of these methods to complete the bidding process (Government of Canda, 2009). Competitive bidding can be designed as a single buyer requesting a product or service and procuring it through a sealed bid auction. According to auction rules, the buyer will accept the lowest bid (Riley and Samuelson, 1981).

A cooperative game is a game where there is communication between players. Players can be groups, each of which has a particular purpose in the game. Players in a group communicate with each other in order to compete with other groups of players. However, a cooperative game is a game in which joint action and agreement are possible. Such agreement may be to share the outputs of the game or to coordinate strategies (Jones, 2000). On the other hand, a non-cooperative game is a game in which there is no communication between players. In such a game each player plays the game independently with no cooperation with other players as part of the game rules (Curiel, 1997). Dixit and Skeath (2004) state that a non-cooperative game is a game in which joint action and agreement are not possible.

The concept of a Nash equilibrium was introduced by John Forbes Nash. It is a game in which each player assumes that he knows other players' equilibrium strategies. A situation in which a player cannot gain any benefit from changing his own strategy while other players keep to their strategy constitutes a Nash equilibrium. Another type of equilibrium is a Bayesian equilibrium; a game in which at least one player is uncertain about another player's payoff is called a Bayesian game. In such a game the Nash equilibrium is called a Bayesian Nash equilibrium, whereby the players' responses are the best responses to each other. In a dynamic game with incomplete information, the best Bayesian Nash equilibrium occurs when players' strategies are

sequentially rational and players are uncertain about the history of any prior play. Where possible, beliefs should be determined by Bayes' rules for the players' equilibrium strategies (Turocy and Stengel, 2001).

Cooperation and collective decision making is usually preferred to non-cooperative decision making when the cost of non-cooperation is high (Kelly 2003). According to Lucas, cooperative games can be recognised by the possibility of communication between players and of making binding contracts. Nash (1951) suggested that in cooperative games, players communicate with each other - additionally, in an extensive non-cooperative game, they have a commitment to each other's formal moves (Lucas, 1982).

3.2.3 Decision Trees

Decision trees have been used for about 50 years in decision analysis science and they are considered an effective tool for the evaluation of projects that involve contingent decisions. A decision tree shows a strategic road map, depicting alternative decisions, their cost, their possible outcomes and profitability, and the payoff of the outcomes. Decision trees are also called decision flow networks and decision diagrams (Kodukula and Papudesu, 2006). Figure 3.3 shows an example of a decision tree.

A decision tree is a powerful tool for multiple-variable analysis. This analysis can be used for traditional statistical analyses such as multiple linear regressions, as well as multidimensional reporting and analysis. Decision trees can be identified through algorithms that produce various ways to split data into branches, like segments. These segments originate with a root node at the top of the tree. Each segment is called a node and the bottom of the node is called a decision tree leaf. As mentioned

above, decision trees have been used for over 50 years to model decision making problem (Ville, 2006).

Decision tree analysis can help decision makers to understand the decisions made as events unfold. Decision tree analysis incorporates both complexity and flexibility into decision making, making management situations interesting (Crundwell 2008).
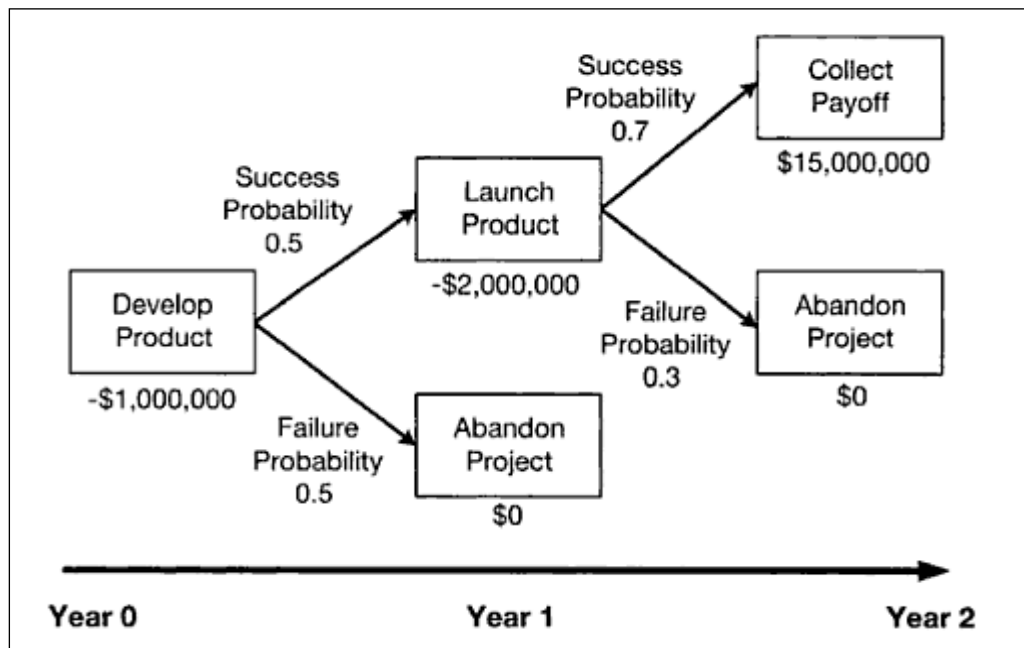
Figure 3.3: Example of a decision tree (Kodukula and Papudesu, 2006)

3.3 Multi Criteria Decision Making

Multiple Criteria Decision Making is a well-known branch of decision making. According to Triantaphyllou (2000), MCDM can be divided into multi-objective decision making (MODM) and multi-attribute decision making (MADM). MODM studies decision problems in a decision space that is continuous, whereas MCDM/MADM concentrates on problems within a discrete decision space. Each MCDM problem is associated with multiple attributes. Attributes are also referred to

as goals or criteria. Attributes represent the different dimensions from which the alternative can be viewed. If these criteria are large they can be arranged in a hierarchical manner (Triantaphyllou, 2000).

There are many ways to classify MCDM methods. One way is to classify them based on the type of data used, so they may be classified as deterministic, stochastic or fuzzy. Another way to classify them is according to the number of decision makers involved in the decision process; for instance, a single decision maker or a group of decision makers (Triantaphyllou, 2000).

Determining the best possible solution is the role of multiple-criteria optimisation. In MCDM, the criteria of problems are characterised as non-commensurable and conflicting criteria. To solve these problems, MCDM methods define quantitative weights for criteria in order to rank the importance of these criteria. There are some multiple-criteria decision-making methods that are widely used, such as the weighted sum model (WSM), the weighted product model, and the analytic hierarchy process (Triantaphyllou, 2000).

3.3.1 Analytic Hierarchy Process

The analytic hierarchy process (AHP) was introduced by Saaty (1977). Saaty defined AHP as the theory of measuring pairwise comparisons and the judgements of experts, providing a priority scale for these pairs. The scale measures intangibles in relative terms in order to compare how one element dominates another with respect to a given attribute. These judgements can be inconsistent. Therefore, AHP is concerned with obtaining better consistency to improve judgements (Saaty and Vargas, 2000).

According to Dyer (2000), AHP can be defined as a procedure for ranking alternatives. This procedure produces an arbitrary rank. An AHP technique is used for identifying subjective estimates of strength of preference on a cardinal scale. Figure 3.4 shows an example of the procedure of ranking alternatives of AHP.
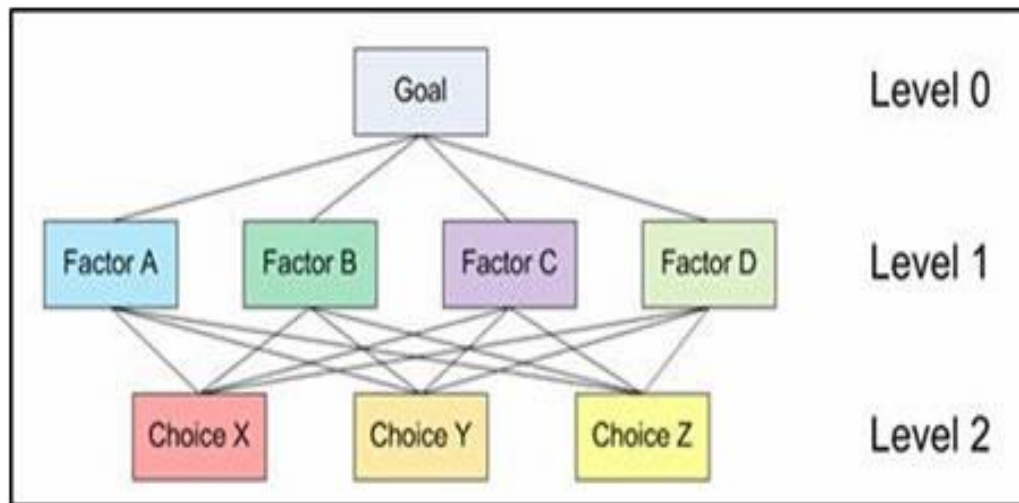
Figure 3.4: Analytic Hierarchy Process (Saaty and Vargas, 2006)

The analytic hierarchy process is a basic approach to decision making. It is designed to select the best from a number of alternatives evaluated with respect to several criteria. The structure of a decision problem can be simple, such as one with a hierarchy consisting of three levels; the top level (0) is the goal of the decision, the second level (1) consists of the criteria for alternatives, and the third level (2) the evaluation (Saaty and Vargas, 2000).

3.3.2 Analytic Network Process

The analytic network process (ANP) has a different structure to the AHP, as a hierarchy is a linear top-down structure while a network structure is spread out in all directions and involves cycles between clusters and loops within the same cluster.

The structure of an analytic network process is built based on sources and sinks. A source is an origin of paths of influence. A sink is a destination of paths of influence. Figure 3.5 shows the structure of a linear and non-linear network (Saaty and Vargas, 2006).
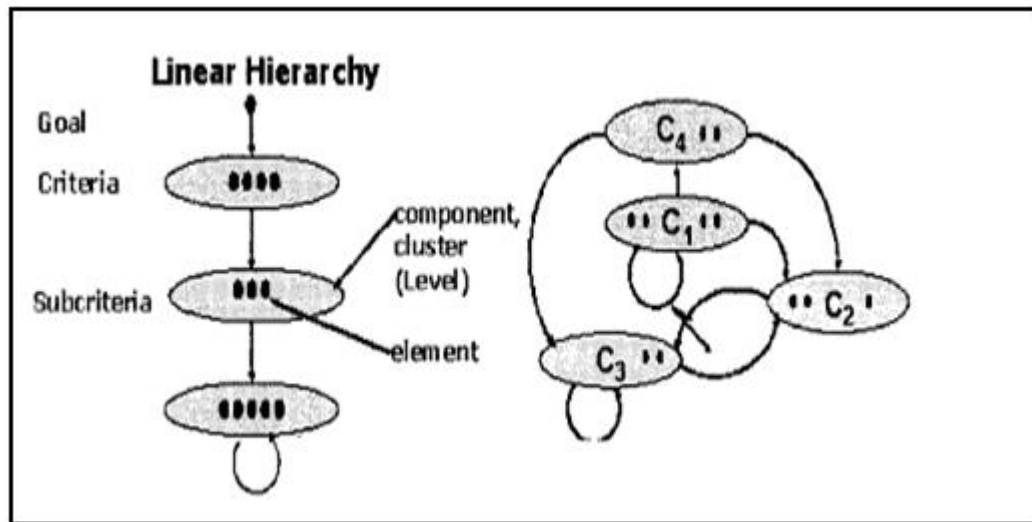
Figure 3.5: difference between hierarchy and network structure (Saaty and Vargas, 2006)

From Figures 3.4 and 3.5 it can be seen that the analytic network process (ANP) is a more general approach compared to the analytic hierarchy process (AHP), although both of them are used for multi-criteria decision analysis. AHP structures a decision problem into a hierarchy with a goal, decision criteria, and alternatives, while ANP structures the problem as a network. Both of them use a system of pairwise comparisons to measure the weights of the components of the structure, and finally to rank the possible alternatives in the decision (Saaty and Vargas, 2006).

3.3.3 Utility Theory

Ahmad and Minkarah (1988) utilised utility theory for construction bidding by designing a model to determine markup in a competitive bidding environment. They used a multidimensional utility theory. Their model was divided into three separate categories: overhead, loss, and profit. Each category was described by a separate multidimensional utility function which were then combined with a weighting factor to form a single utility curve (Dozzi et al., 1996).

The expected utility theory deals with the analysis of choices among risky projects with possible multidimensional outcomes. The expected utility model was first proposed by Nicholas Bernoulli in 1713 and solved by Daniel Bernoulli in 1738 as the St. Petersburg Paradox. Bernoulli argued that the paradox could be resolved if decision makers displayed risk aversion and argued for a logarithmic cardinal utility function. The first important use of the expected utility theory was that of John von Neumann and Oskar Morgenstern, who used the assumption of expected utility maximisation in their formulation of game theory (Hald, 2003).

3.4 Summary

In summary, this chapter has presented various approaches for solving problems using decision-making analysis, the behaviour of decision making, and methods for modelling bid markup decisions. This chapter and the previous chapter validate and justify the research topic, which was one of the main objectives of the literature review chapters. Additionally, the literature review has confirmed that the bid markup size decision can be considered to be a strategic decision. Building a bridge between factors that influence bidding strategies and multi-criteria utility theory is fundamental in terms of developing a successful bidding model strategy.

In conclusion, from the literature review it was demonstrated that a bidding strategy model can be developed to determine mark up size in competitive situation. Thus, a company has to review its current situation in order to decide whether to change the weight of importance for each factor as appropriate, or to keep it as it is. This emphasises the importance of understanding the behaviour involved in setting the importance levels of the factors and their associated priorities. Additionally, considering the size of contractors and the type of owner is important when developing a bidding markup size model.

The many models that have been developed in order to help contractors determine markup size in competitive bidding, but which have stayed in the academic loop and have not proceeded into practical usage, do not lack techniques; however, there is a need for a framework to enable the logical organisation of these techniques into a flexible process which supports the bidding process. Consideration of a method that provides information about a project's situation and specifies the owner type and the size of contractor will enhance the bidding model strategy. Moreover, producing a computer-based model with a database facility to establish a recording mechanism for determining bid markup size will help to capture the relevant strategy and situation of the bidding at the time of the decision.

Chapter 4: Research Design and Methodology

4.1 Introduction

This chapter aims to identify the research strategy which has been followed in this research and to identify the collection of different methods used: qualitative and quantitative methods. In qualitative approach, interviews, observation and the beliefs of people are investigated while on the other hand, in quantitative approach, statistical methods are used to test a theory.

In this chapter, the definitions for qualitative and quantitative methods will be explored and both research methods identified. Additionally, a mix of qualitative and quantitative methods will be investigated. The strategy of this research and the method of data collection will also be described.

4.2 Definition of Qualitative and Quantitative Research Method

According to Lindlof et al (2002), a quantitative approach can be defined as the generation of numerical data that describe result which can be converted into numbers, for example the importance of factors or the rank of factors. In this type of research a statistical tool can be used in order to understand and make calculations of the obtained data. Examples of quantitative research techniques are questionnaires and surveys (Lindlof et al, 2002).

By contrast, according to Lindlof et al (2002), a qualitative approach can be defined as way of understanding and exploring people's beliefs, experiences, attitudes,

behaviour and interactions. Qualitative research is used to generate non-numerical data, such as the factors influencing bidding markup size (Lindlof et al, 2002).

In this research, qualitative techniques have been used to identify the factors which influence bidding markup size. Examples of qualitative research techniques are focus groups, interviews, business cases, and observation.

4.3 Features of Qualitative and Quantitative Research

According to Thomas (2003), the following are the main features of qualitative research:

- Qualitative research aims to collect descriptive data such as case study, interview, life story and visual text

- Qualitative research is subjective, since individuals' make sense of personal stories and observation or in-depth interviews.

- Qualitative research, obtaining qualitative data, is more rich, time consuming, and less able to be generalised.

In comparison, the main features of quantitative research are (Thomas, 2003):

- Quantitative research aims to collect numbers in order to use statistical methods to seek numerical measurement.

- Quantitative research is collecting quantitative data which is more efficient and useful for testing hypotheses.

In quantitative research, recommendations can be present during only the latter phases of research projects (Thomas, 2012).

4.4 Qualitative Research Methods

According to Ewings et al. (2003) there are numbers of methods used qualitative research in order to collect data such as: focus groups; direct observation; and in-depth interviews. In this section these methods will be explored (Ewings et al., 2003).

4.4.1 Focus groups

In this method, the researcher brings together a group to discuss an interesting topic, the group size preferably being small so that each member can express his/her opinion freely (Lindlof et al, 2002). Usually, the researcher prepares beforehand how they will guide the discussion and chairs the group. The researcher should ensure that the different subjects related to the topic have been explored. Most properly the discussion is recorded in order to make later transcription and analysis possible (Lindlof et al, 2002).

4.4.2 Direct Observation

In this method, according to Lindlof et al (2002) the data can be collected either by an external observer or by a participant observer who is undertaking their usual duties whilst observing the processes. The research aim of this method is to become immersed in or become part of the population being studied, in order to understand the details of the values and beliefs held by members of that population. The researcher prepares a list of observations that they are going to look for or he can be the observer and make notes in order to analyse the observation (Lindlof et al, 2002).

4.4.3 In-Depth Interviews

According to (Lindlof et al, 2002), in-depth interviews can be defined in a similar way to focus groups but subjects are discussed or interviewed individually. In qualitative research, interviews involve discussing a wide-ranging subject in detail rather than asking a set of predetermined questions, as would be the case in quantitative surveys. In this method, the researcher encourages the interviewee to express their views and comments on real events and use such instances to form generalisations. However, while in this method the researcher can obtain more details for each subject, the debate and exchange of views which can occur in focus groups is lost.

4.5 Quantitative Research Methods

According to (Lindlof et al, 2002) there are several methods by which to collect quantitative data; all of these methods focus on quantities such as numbers. The main methods for quantitative research are: experimental, quasi- experimental and surveys. In this section all these methods will be explored.

4.5.1 Experimental

Experimental research goals is to determine cause and effect. The concern of experimental research is to study the relationship between independent and dependent variables. However, experimental research usually associated with three concepts: Controlled observation, reliability and validity (Phelps et all, 2004).

4.5.2 Quasi- Experimental

According to (Shadish et al, 2002), the difference between experiments and quasi-experiments is that in quasi-experimental situations there is no randomisation of subjects between levels of the independent variable. This method is used commonly in medical research where it is difficult to split participants into different groups for ethical and practical reasons.

4.5.3 Surveys

The survey can be defined as a method in which a data collection tool is used to gather information about individuals. This method is the one most used in quantitative research, and is usually used in psychology research to collect data from study participants (Creswell, 2003).

4.6 Methodology of data collection

In this research, as one of its objectives is to explore the bidding mark up process in Saudi Arabian contractors and build a computer based tool to support contractors to determine their bidding mark up size, interviews with numerous experienced bidding mangers - who have explained how they set their mark up size in a competitive bidding situation - have been conducted in order to link the literature review with the practice of organizations. A request has been sent to fifteen engineers, twelve of them accept to conduct the interview. Therefore, twelve semi-structured interviews were conducted in order to understand and investigate how the important factors affect mark up decisions made by organizations, and to find links between these factors and decision analysis methods in order to develop a practical bidding strategy model. The interviews were conducted both face-to-face and via the telephone. However, these interviews were analysed using meaning categorisation and in case

of length participant dialogue a satisfactory answer for the question for the research objectives was treated as important, where some other part treats as unimportant. Also, through the interviews, the most important factors that influence the bidding mark up decision have been discovered, along with their link to the bidding mark up decision. This has shed light on how decision analysis methods can be applied in order to make better decisions about mark up. The main objective of these interviews was to gain an overall understanding so as to develop a bidding strategy model which can be used in practice. This has helped to validate the bidding strategy model developed using a multi criteria approach in order to increase the chances of organizations winning bids in a competitive bidding situation.

In this research, a quantitative method has been used in order to identify the factors that influence the bidding mark up size in Saudi Arabia contractors and their priority. Therefore, a two phase questionnaire has been used. The questionnaire was developed using an electronic method, but also included a paper copy. The questionnaire was distributed to practitioners from various industries who work in the area of competitive bidding strategy. These practitioners included bid managers, financial managers, project managers, and those at top management level. The questionnaire was distributed to a number of companies selected from a list of companies provided by the Jeddah Chamber of Commerce and Industry in Saudi Arabia. A review and pilot questionnaires were conducted to refine the questions before deciding on the format of the actual questionnaire.

Based on the results of the questionnaire and semi-structured interviews, a conceptual bidding model has been developed in order to help contractors to determine bidding mark up size. After that, others interviews were conducted in order to validate the findings and propose a competitive bidding strategy.

To meet the research aim and objectives, the following research plan has been designed in order to collect the data which are needed for this research. Table 4.1 presents the research plan which has been followed. Phases 2 and 3 were carried out in parallel in order for each phase to achieve the research objectives.

Phases	Required Data	Research Method	Research Techniques
Phase 1	Identify the factors that influence markup size including previous research on related topics	Qualitative	Literature review
Phase 2	To understand the contractor's behaviour and factors that influence bidding markup size in the Saudi Arabian environment Identify the bidding markup size process in Saudi Arabian contractors.	Qualitative	Interview
Phase 3	Investigate the factors that influence bidding markup size and examine the importance level of factors influencing bidding markup size decisions	Quantitative	Questionnaire
Phase 4	Test and validate the developed Model Confirm the result of the questionnaire Validate the initial conceptual model	Qualitative	

Table 4.1: Research Plan

4.7 Summary

This chapter presented qualitative and quantitative research method and in this chapter qualitative and quantitative data analysis and interviews were discussed.

The research plan was applied in four phases. Phase One involved collecting information about previous research and built a baseline for this research. During this phase, data were collected through a literature review. Phase Two investigated contractors' behaviour when they perform their markup size decisions in bidding situations and understand how contractors in Saudi Arabia perform the bidding markup size process. In this phase the data were collected through interviews with experts in the field in Saudi Arabia.

In Phase Three a questionnaire was conducted in order to examine the factors that influence bidding markup size and the importance level of such factors. . Phase Four took place in order to validate the model developed; interviews with experts in the field along with a practical test of the model were performed during this phase.

Chapter 5: Interview Results and Discussion

5.1 Introduction

Defining the factors that affect bidding mark up size has been discussed in previous chapters, and is based on previous studies. This chapter will discuss the results of the analyses and findings of phases two and four of this research, (interviews conducted during the period of November 2010 to January 2011), and present findings on how these factors affect contractor's bidding mark up size can help contractors decide on mark up size. The result of these findings will help build the relationship between the reviewed literatures and practical work, and build a decision model for contractors to help use the mark up size decision.

The objective of these interviews is to identify factors that affect a contractor's mark up size decision in practice, and how these factors can be used to build a decision model, to help contractors make their decision on the size of the mark up.

This chapter begins with identifying the interview structure and questions, the method of accessing and securing data access, as well as covering data gathering and data analysis processes and techniques. Twelve semi-structured interviews were carried out with senior projects experts and knowledgeable people in the private sector in Saudi Arabia. The interviews began after the literature review to address the research questions and to explore the factors that influence the bidding mark up size and bidding mark up models. A questionnaire was distributed for each interviewee to set a level of importance for each factor that could influence bidding mark up size.

5.2 Interview Structure

Identifying the structure and content of the interviews is very important in achieving the research goal and answering its questions. The interview includes the following sections:

(1) Understanding the bidding process and how organisations make their bidding decision and determine mark up size.

(2) Exploring the factors influencing bidding mark up size decisions in Saudi Arabia, and how contractors set priority levels for these factors.

(3) Investigating how contractors set the weight of importance for factors that influence their mark up size decision, and their use of any concept or mathematical tool.

(4) Validating the initial concept of the model and paying attention to their suggestions or recommendations.

The first section of the interview structure was to understand the practical bidding process of contractors in Saudi Arabia, including the processes and procedures of how contractors set their mark up size, and how they take decisions. The aim of this section is to find if there is a relationship between the factors that influence bidding mark up size, discovered in the literature review, and the practical bidding process in setting mark up size.

The second section was to explore the factors that influence a contractor's bidding mark up size decisions in Saudi Arabia, and their behaviour in setting priority levels for these factors. Considering previous literature review, the importance of these factors differs from one contractor to another. The size of a contractor could affect

the importance weighting for these factors. The aim of this section is to understand a contractor's behaviour in setting their importance weighting for factors that influence their mark up size decision.

The third section is aimed at understanding how contractors set the priority for factors that influence bidding mark up size decisions in Saudi Arabia. It is found from previous literature reviews, that different contractors have different priorities for factors that influence bidding mark up size. Understanding the contract environment, and the behaviour of priority setting for these factors, can help build a conceptual model to support their decision in setting mark up size.

The last section is aimed at validating the conceptual model of setting mark up size, and validating the factors that will be represented in the questionnaire and the conceptual model.

The main output of these interviews helps to achieve the following objectives from the research:

1- To define the characteristics of bidding models through a literature review and empirical research.

2- To review and understand the factors that influence decisions on bidding markup size in Saudi Arabia

3- To investigate and examine the utilisation of a multi-criteria approach or other decision-making methods in developing a bidding strategy model.

5.3 Interview Approach

Based on the interview structure identified in previous sections, it is clear that exploratory and confirmatory study is required to obtain the required data. Therefore, this interview has been conducted in order to understand and investigate how these important factors affect mark up decisions made by contractors, and to find links between these factors and decision analysis methods, in order to develop a practical bidding model. These interviews were face to face interviews, as well as phone interviews. All interviews was in Arabic and translated to English by the researcher and interviewees gave permission to voice record the interview session in order to assist in transcribing and post-interview analysis. However, to reduce the error this transcript has been reviews by PhD student who speak English and Arabic language.

5.4 Data Collection

Accessing data and information for any contractors is the most difficult part of this research and sometimes this process is lengthy process. The access had been secured to collect the required data from targeted companies through two main channels: firstly was through the support from the Saudi Engineering Council which is Saudi Arabian professional body for engineers and it operates under the supervision of Ministry of Commerce. Secondly, was through personal communications with related people in an organization. Both approaches have been utilized in order to reach the required number of interviews required for this research. A request letter to conduct an interview has been sent to fifteen engineers, twelve of them accept to conduct the interview. Twelve semi-structured interviews have been conducted focusing on finding an answer to the research questions.

The interview guide was prepared with research questions, keeping in mind the clarity of questions to get meaningful response and the duration of the interviews. As projects professionals' schedules are loaded with activities, so the interview guide was designed in a way to restrict the duration of the interview to within one hour. The interview guide was designed and revised in consultation with the supervisor and research students (Appendix 1). Initial interview were conducted with the associate students to verify the clarity of questions and assess the length of the interview time and to get familiarised with the process. The same interview questions were used with all the interviewees; however the way the questions were asked was refined as the interviews progressed. All the interviewees gave permission to voice record the interview session in order to assist in transcribing and post-interview analysis.

The interview guide questions (Appendix 1) consisted mainly of two parts. The first part covers biographical data, qualifications, company information and job experience. The second part covers the bidding process in the company; factors influencing the bidding mark up size decision and how the company determine the mark up size during the bidding process and the final question asked about potential improvements to support companies to determine an appropriate mark up size during the bidding process.

The interviewees' industries were selected in consultation with the supervisor and most interviews were in the construction industry as it is the main area where the bidding process is applied.

The support of the Saudi Engineering Council helped to send interview invitation for fifteen interviewees. The advantage of the support from Saudi Engineering Council

is the practitioners were interested to share knowledge an support as they are member of the Saudi Engineering Council.

Requests were sent to owners and senior projects managers who participate in bidding process in various industries of Saudi private sector. However, only twelve of them agreed to be interviewed. These twelve interviews were valuable and mix of perception from both the operative and management level. These interviews were appropriate for the analysis and research objectives as the answer of interviewees become similar and answers are repeated.

The experience range of the interviewee were from 5 years to 30 years, with extensive knowledge of cost calculation, bidding process and bidding mark up size.

Table 5.1 present the Profiles of interviewees.

	Job Title of Interviewee	Experience	Industry	Duration
1	Project Manager	8 years	Oil and Gas (Services)	40
2	Sales Engineer	10 years	Power Industry	33
3	Department Manager	11 years	Power Industry	41
4	Sales Department Manager	12 years	Engineering Services	85
5	Sales Project Manager	5 years	Engineering	38
6	Project Manager	N/A	Engineering Services	39
7	Contractor Relation Manager	11 years	Engineering	34
8	Department Manager	10 years	Power Industry	18
9	Project Manager	10 years	Construction	29
10	Project Manager	36 years	Construction	26
11	Project Manager	10 years	Construction	23
12	Project Manager	8 years	Construction	42

Table 5.1: Profiles of interviewees

However, in order to analyse the interviews, data have been prepared in a format suitable for analysis. All interview transcriptions have been attached to this thesis (Appendix 2). The two main steps in order to analyse the data collected through the interview were transcribing and coding the data.

5.5 Interview Analysis

Analysing qualitative data (interview) is not an easy process because it is not as clearly defined as quantitative data. The data collected through semi-structured interview has open ended questions, which makes it difficult to analyse.

There are few methods that can be used to analyse the categories of interview text to bring meaning into a form, or group of ideas, which can then be presented to code the interview topics. According to Kvale (1996) there are five approaches to analysing interviews. These approaches are:

1- Meaning condensation: this approach reduces the large interview text into a short form.

2- Meaning categorisation: in this approach the interview text is coded into categories. Therefore, the large interview text is coded into categories.

3- Narrative structure: in this approach sequential and social structure of a text to bring out its meaning.

4- Meaning interpretation: in this approach, it goes beyond a structuring of the obvious meanings of a text.

5- Generating meaning through ad hoc methods: in this approach, sophisticated textual or quantitative methods can be used to analyse the meaning of interview text. This meaning can be generated from words, figures, or number combination.

However, following these approaches interview scripts were analysed using meaning categorisation and length participant dialogue was treated as important when it had a satisfactory answer for the question for the research objectives, where some other part treat as unimportant.

5.6 Reliability and Validity

The reliability of the data collected through interview is very important to ensure the analysis and findings of these interviews are correct. According to Kirk and Miller (1986) reliability is important to ensure and assist qualitative research against the background of a specific theory, and the use of methods studied for this research.

Therefore, reliability in this interview is confirmed by the background of the interviewer and interviewees regarding the topic of the bidding process in practice in Saudi Arabia.

In this research all interviews were conducted with interviewees who managed the bidding mark up size decisions, and work in an area directly related to the bidding process in Saudi Arabia.

Validity is another important point in any data collection. Validity means, in this case, the interviewees telling the truth. However, in semi-structured interviews, interviewees are able to talk in-detail and in-depth about the research topic under study. From the interview script all interviewees provide answers for the questions

which agreed with previous studies and there is no conflict with the general bidding process.

5.7 Interview Findings and Results

This section aims to present, discuss and analyse the interviews by generating meaning as one of the methods used to analyse qualitative scripts. As discussed earlier, the interviews contain four main contexts, which are used to analyse and present the findings. The following section will present the findings from the interviews based on each section from interview context.

In the following sections, the findings of the interviews are presented in two ways:

1- The content analysed by the researcher for key elements.

2- Data extracted from qualitative interviews to support the findings.

5.7.1 Bidding mark up decision in Saudi Arabia

To explore the current bidding mark up size decision process in Saudi Arabia, and understand how the process starts, and who is involved in decision making, it is important to establish a common understanding of how those involved in the process, make the decision.

Interviewees were asked an open question about how they describe the bidding mark up process in their organisation, from the beginning until they determine the bid price. This open question allows the researcher to understand the whole bidding mark up process, and compare the process between organisations, to illustrate differences.

Researcher: "*How do they make a decision on the bidding process? Bid or no bid, and mark up size*"?

The responses to this question varied in term of details answered. Some interviewees answered the question by detailing the procedure; starting from looking to bid, factors affecting their decision to bid or not, followed by estimating the cost and determining the bid price and adding the mark up size to calculate the bid price. Others provided a very short answer. The answers were not organised; each interviewee's answer had a different emphasis point in the process, based on his organisation's internal process.

However, all interviewees agreed that the process of setting mark up size depends on judgment and top management agreement.

Interviewee 1 "*will mostly be based experience and judgment*".

In general, the current practice for a Saudi Arabian contractor setting the mark up process will start from calculating the cost and overhead cost, and then management will decide on the mark up size.

Interviewee 2 " *The team estimator calculates the project cost and the department manager judges the mark up size based on the situation.*"

Also, setting mark up size depends on an organisation's internal policy and strategy. The organisation's strategy affects the bidding mark up size and affects the management decision on setting mark up size.

Interviewee 3 "*For example, management have internal agreements for mark up size with headquarters. If you can participate in this project, and at the same time you can manage to maintain the internal target agreement, you can participate in the*

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bid. But if the project has a strategic approach or entrance into a new market in this case the mark up size could be changed. All of these depend on sector, and change from one sector to another. There are major projects in this sector but we have to compare our bid price from region to region and from one country to another"

An organisation could increase their mark up size in order to avoid the acceptance of the bid price from the vendor, or in order to sell a specific project scope for the customer.

Interviewee 4 " *First of all, we calculate our cost and we have to cost approach, one with delivery and the other one without delivery, then we add the mark up size. And customers do both calculations to compare which is cost effective for him. Also, there are other factors that affect mark up size. When we offer a price with delivery, we increase the mark up size in order for the customer to select the price without delivery. This helps us to avoid any additional work and overhead*"

Other interviewees clearly state that the process of setting mark up size starts from cost calculation but each project could have a different mark up size based on different factors and company situation. Below is what interviewees 5 and 6 stated.

Interviewee 5 " *Usually our customer request for quotation is prepared by our sales department, then it is moved to our engineering department to calculate the material required, time of work and overhead, and to add the mark up size to the quotation"*

Interviewee 6 "*Each project has a different process. For example, is it our specialism and there are many other factors such as size of customers, new market entrance, or is it a repeat project*".

Other organisations stated that they decide the mark up size using software, where they enter all input values for the project, and the calculation will be depend on factors such as project size and scope. Some organisations use a fixed mark up size strategy, where they have a fixed mark up size based on project cost. The interviewees below (7, 8, 11 and 12) stated the difference between these two different approaches.

Interviewee 7 "F*or example, when the customer requests the bidding price from the contractor, the contractor will send the request to us. For example, if it is less than $50,000 we will tell our contractor that you have a commission of these amounts, and in our sales department and we have a factory that produces the product required by customer. Each factory sells internally to the sales department based on product and country. When the price is received by the sales department that already has a factory mark up size. We will add mark up size based on company strategy and based on product when there is no competition. When there is competition, we reduce our mark up size.*"

Interviewee 8 " *We calculate our cost on material, labour, overhead, and we input all of these in software, then after that we add a mark up size based on the project size and the scope of the work.*"

Interviewee 11 *"... Then we evaluate some factors in an excel sheet, such as customer type and other factors, and then it will be decided by top management. The mark up size also will depend on the competition. Also, there will be a company strategy for a lower mark up size. For example, in a project where there are many competitors we determine a lower mark up size. Where there is no competition, we can have higher"*

Interviewee 12 " *engineers will determine the price of each element required in this project, including material, labour cost, etc. Based on that, we can calculate the dry cost for the project. After that we determine the mark up size by 10% or 15% or 20%.*" .... "*The dry cost, which we calculate, covers all costs apart from overhead, and usually the average contractor adds 25% as mark up size. Sometimes during the bidding process we can send a letter stating that we can reduce the bidding price with a specific percentage. And the important fact here, you have to know how much the dry cost for this project is, and the percentage above the dry cost (mark up size) depends on the contractor*" ... ."*Usually the owner determines the mark up size, or the portfolio project manager. And the important cost for us is the dry cost, because the mark up can be low in order to win the contract t*".

Other interviewees confirm that judgment and top management decisions are common practice in deciding mark up size, as they add experience and a systematic approach. Some interviewees confirm that decision on mark up size is affected by the internal company situation and project situation. Below interviewees 9 and 10 stated:

Interviewee 9 "*Usually we set up mark up size based on couples of points experience, top management decision , additional overhead. Also, we set the mark up size, not in a systematic approach, but based on the judgment from a decision maker*"

Interviewee 10 " *There are many factors that affect how we determine our mark up size. First of all there are internal company factors, secondly, the project itself, and thirdly, the owner of project, all of these factors affect the mark up size. For example, when the company won many project and there is a shortage in resources then we*

increase the mark up size, and when the project is important for the company we reduce the mark up size. Also, when the owner of the project has a good customer payment history the mark up size will be lower than other customers who usually delay the payment. This how we control our risk. Also, there are other factors that affect the mark up size, which is the competition in the bid. Are they the same size or are have they overheads or not, so we can decide how we can determine our mark up size"

5.7.2 Factors influencing bidding mark up size in Saudi Arabia

The second part of the interview concerns the factors that influence bidding mark up in Saudi Arabia. Interviewees agreed that numerous factors influence bidding mark up size in Saudi Arabia. The interviewees below stated:

Interviewee 10 " *There are many factors that affect how we determine our mark up size. First of all there are internal company factors, secondly, the project itself ……."*

Interviewee 11 "*Yes, there is a list of these factors that are important for us, for example, type of clients……"*

Other interviewees named factors that influence bidding mark up size in Saudi Arabia. Some of these factors are: competition, a new project, market entrance, project duration, internal management approval, contract, customisation of the product (design), time to deliver, and influence in price for material, labour, etc.

Interviewee 3 "*First of all, the market price level, which includes competition. Secondly, existing integration based on the new project or system. The customer, I cannot say is critical, but it should be added, but not as significant. Also, the market*

entrance, if you would like to invest there in order to win other projects in that area. Other factors are internal management approval. For example, shareholders of the company can say that they do not want to sign a contract less than x% as mark up size, but let us say that this one of the major factors"

Interviewee 12 "*Each project needs the required details studied in order to determine the mark up size, and each project has a competitor and the project duration is a critical point of any project*"

Interviewee 6 " *both type of clients we are deal with and most of our customers will get the same price. When they get a similar contract with our required customised engineering.   And our clients usually required to customized product with consultancy and factory include our mark up size. And in Mega project our customers required budget re-quotation as Engineering department So, in this case, the mark up size at this stage, you have to add a higher mark up size for clarification, time factors, and price change. When questions arise, the general quotation will become clear, and in this case the scope will be agreed between us and the customer. Then the customer can send the office purchasing order and our contractor will get a percentage from our subcontract bidding price*"

Also, interviewees agreed on other factors that influence bidding mark up size. These factors are: type of work, value of contract, warranty after the job, who does the design phase, customer, criticality of job, resource availability, organisation standard profit margin, owner, payment history, requirement design , customer type, size of the project, government enforcement, and if bidding only for the approved contractor.

Interviewees (1, 3, 4, 8 and 9) stated below:

Interviewee 1 "*From vendor point of view, the top factors affecting their decision could be: criticality of job, resource availability, organisation standard profit margin, owner, payment history, requirement design and the other factors, such as government enforcement. However, there are other factors where people guess it is very important where it is not, such as the possibility of a change request is not an important factor in bidding decisions*"

Interviewee 4 "*Yes, sure the customer payment history is very important. Also customer name and number of projects per year will affect the mark up size for his project, in order to be one of his approved list contractors. And as the customer usually has a mega project, we will try hard to win his contract with a very low mark up size, to enter his contractor list and win him as customer. Also, if I would like to enter a new market I would do the same *".

Interviewee 4 "*Okay, do you want us to go through all factors, it is better for me and I would like to add comments for each factor. Let us talk about the type of work. This affects the mark up size, and based on company strategy and the required type of work, it will affect the mark up size. Also, regarding the value of contract or job, when the value of contract increases the mark up size it will be very low, and this is usually what happens in work and it could be only 1%. We have different mark up sizes based on the scale of the value of project. The warranty after the delivery, this does not affect our company because we do not give any local warranty, but there will be a warranty by external parties with no extra cost to the customer. Also, some other factors are not applicable to us, such as the designing phase or participation in the design phase. This is only when a customer requires a design based on his requirement, and the customer will have usually proposed the design with the required quality. In this area the mark up size will be high, because it requires*

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knowledge and know-how skills. The customer usually involves the top contractor in writing the proposal for the project, before participating in the opening bid"

Interviewee 3 "*Also customer name and number of projects per year will affect the mark up size for his project, in order to be one of his approved list contractors. And as the customer usually has a mega project, we will try hard to win his contract with a very low mark up size, to enter his contractor list and win him as customer. Also, if I would like to enter a new market I would do the same*"

Interviewee 8 "*It depends; the main factor influencing the mark up size is the size of the project itself. The percentage of mark up size will be based on each item in the project, so we do not add an overall mark up size for the whole project. I can provide you with a template to calculate the project cost and how to set mark up size*"

Interviewee 8 "*No, there are many other factors such as competition, project start date, project duration, region of the project and especially the size of the project. Also it depends if it is a private project or public project*".

Interviewee 9 "*Yes, that's correct. For example, a private client may not pay the final payment, so I will increase the mark up size*".

Interviewees identified numerous factors that influence bidding mark up size decisions and agreed to categorise these factors into groups. The groups are; project characteristics, project documentation, project finance, economic situation, company situation and contract.

Interviewee 6 "*Each group you talk about affects the mark up size, and there is no clear way how these affect the mark up size. However, setting mark up size differs*

from one company to another. From my practical experience there is a judgment and internal agreement inside the company about the percentage of mark up size. This is the way to set the mark up size, but there is no clear approach to set the mark up size taking into consideration the competition. After we calculate the cost we can add the percentage of mark up size, and sometimes after we do all of that, we re-evaluate the whole project and find this price is acceptable to win the job"

Interviewee 2 " *All of these groups are important. You cannot rank it, but let us say that the important one scope of work which mean project characteristics because without know project characteristics you can not evaluate the mark up size, then who is the competitors. As well the company situation and it is work need*"

From table 2.2 60 potential factors that could influence a contractor's bid mark up size decision has been identified 14 factors that are presented in Table 2.2 but not marked were introduced by the interviewees while the other remaining 46 factors are from the review of previous literature. Total of 60 factors have been identified and 7 groups was proposed from interviews in which to categorise the factors that influence bidding mark up size. Table 5.2 below presents the factors and proposed categories that influence bidding mark up size in Saudi Arabia. These factors were used to develop the questionnaire that explores the levels of importance that influence bidding mark up size in Saudi Arabia. This questionnaire will be discussed in detail in the next chapter.

No	Category (Job related factors)	Categories
1	Type of job	Project Characteristics
2	Size of job	
3	Warranty issues, which might possibly create risks	
4	Design quality	
5	Contractor involvement in the design phase	
6	The amount of changes expected throughout the execution of this project	
7	Qualification requirements	
8	Degree of difficulty considering delays, shortages	
9	Project related contingency	
10	Degree of hazard (safety)	
11	Project duration	
12	Labour requirement	
13	Equipment requirement	
14	Location	
15	Project start time	
16	Number of Subcontractors	
17	Project cash flow	
18	Clarity of the work and specifications	
19	Tendering method (selective, open)	Project Documentation
20	Completeness of the documents	
21	Tendering duration	
22	Owner / Client	Client
23	Size of client	
24	The client's requirements	
25	The project is matching the company strategy and future	Company Situation
26	Need for work	
27	Management of similar size projects in the past	
28	Return of investment	
29	Reliability of company cost estimate	
30	Historic profit	
31	Current work load	
32	Uncertainty in estimate	
33	Availability of other projects	
34	Confidence in workforce	
35	The ratio of your firm's current market share to the expected or aimed share	
36	General overheads	
37	Availability of equipment	
37	Supervisory availability	
39	Policy in production cost savings	
40	Labour environment	
41	Policy in economic use of building resources	
42	Identity of competitors	
43	Strength of the firm	
44	Number of competitors tendering	
45	Tax liability	Economical

No	Category (Job related factors)	Categories
46	Risk of investment	Situation
47	Amount of possible upcoming profitable projects out for tender in near future	
48	Economic condition	
49	Market's direction (whether it is declining, expanding, etc.)	
50	Government regulations	
51	Risk in fluctuation in material prices	
52	Risk in fluctuation in labour prices	
53	Capital requirement	
54	Competition	
55	The current financial capability of the client	Project Finance
56	The history of client's payments in past projects	
57	Project terms of payment (monthly/quarterly)	
58	Degree of difficulties in obtaining bank loan	
59	Contract conditions	Contract
60	Type of contract	

Table 5.2: Practical factors influencing bidding mark up size in Saudi Arabia

5.7.3 Behaviour of contractor in setting factors priority

The third part of the interview concerns the behaviour of the contractor in setting the priority of factors that determine mark up in Saudi Arabia. Interviewees agree that these factors are priorities based on personal judgment and experience. Company strategy and company situation affect their priority as well. Also, they agreed the priority of these factors can be set by a different person in the company through discussion, management meeting, internal company targets and policy. Interviewees (5, 3, and 10) stated:

Interviewee 5 "*This could be from miscommunication. This is a personal judgment and usually top management should be involved and usually there is internal agreement for lower and maximum mark up size. However, in our company, for example, we can submit a bid price for a project that has more than one phase, and one of these phases could have a zero mark up size. When you are dealing with the customer, the customer type can affect the mark up size"*

Interviewee 3 "*This is depends on company strategy, where they can take more orders with less mark up size and generate profits, or their strategy is to take less orders with a higher mark up size to generate the same profit. For example, I cannot go below less than mark up size, but I have to take a minimum number of orders which is a difficult equation to maintain. And there is a different strategy between company strategy and project strategy. Project strategy can be affected by the market and you have to maintain the company's overall strategy*"

Interviewee 3 "*We have a process. The estimation team will calculate the cost of the project taking into consideration the risk. Then after that, the sales team proposes the mark up size based on the market for this project. After that, it comes to me as department manager based on the value of the project. The mark up size should be signed by a department manager or higher level. if the mark up size does not comply with company strategy*"

Interviewee 10 "*No, there is no equation. This is based on experience and mostly this is more personal experience. All of us work in order to win the project to gain money, not to lose. Therefore, study of the project is very important before determining mark up size and we do not build project cost and mark up size based on customer's study. All of these lead to winning the project and a reasonable mark up size and profit*"

Interviewee 5 "True, I worked with both types of company. It depends on the strategy of the company. This is a subjective topic, and I agree with more projects with a lower mark up size to generate volume. But all of these depend on the overall company target and strategy. The company will have a strategy and if it is followed there will be no problem in any one of these approaches"

Interviewee 10 "*This decision is a strategic decision, so no one takes this decision alone. We will have details of the cost analysis and the total cost of this project, which we cannot go below. The regular mark up size x will be increased or decreased after evaluating these factors through a scoring system. Everyone works to win the job and gain money. Also, we evaluate our risk of project delivery and contract terms, and the documentation of project, as well our estimation of the project before we decide our final mark up size*".

Also, they agreed that the priority of factors that influence bidding mark up size could change due to company situation, such as target and current profit and cash flow. In addition, customer type and contractor relationship with the customer affects priority of these factors. Other interviewees introduce risk as a key element affecting their decision in setting the priority of factors that influence the bidding mark up size in Saudi Arabia.

Interviewee 3 "*No, our target is based on order take (volume), revenue (turn over), profit and cash flow, and all of these are link to each other*"

Interviewee 1 "*The current process mostly depends on senior management judgment. However, a procedure to follow and evaluate the bidding mark up size, based on company situation, maybe able to help*"

Interviewee 2 " *That's correct, customer type affects the bidding mark up size. When we deal with a public customer they have fixed terms, while the private sector has flexibility to discuss terms, project execution and project delivery date, while in the public sector these terms cannot be negotiated*"

Interviewee 5 "*If it is a different manager, sure the mark up size will change, because it is based on his experience, his relation with the customer and market. Our market is based on relationships, it is does not matter about your skills, it is about who you know. This is our culture and this how you can sell*"

Interviewee 2 "*All of these are correct. All of these factors can be changed in rank, but their importance are the same. The risk is important here, as well as the size of the project and payment terms*"

5.7.4 Validating the initial though of the concept

The method of understanding all of these factors seems to depend only on management experience and personal judgment. Some interviewees agreed with this approach, while others agreed that some contractors have a systematic approach in evaluating the factors that influence bidding mark up size in Saudi Arabia, which help and support management judgment. Others believe their decision is based on historical data and previous experience of winning bids.

Interviewee 1 "*No mathematical tool in place and most organisations take their decision based on their judgment, and the many other factors that can affect their decision. Some of them have an excel sheet to evaluate this, and some of them, they just take the decision based on their judgment. Each organisation has their own way to make their bidding decision*"

Interviewee 4 "*We do not have a tool but we have historic data for all wining bids for our previous jobs. So we can review our historic bids before we set the bidding price for a new job*"

Interviewee 6 "*We have an excel sheet, but only to calculate the cost, we do not have a weight system*".

The aim of the last part of the interview is to validate the initial concept of the model, and receive comments and feedback from the interviewees towards the improvement of the initial concept. The researcher introduced the concept of the model to the interviewees, and an idea about how it can be used by them to support their bidding mark up size decision. In summary, the initial concept was about identifying common factors that influence bidding mark up size in Saudi Arabia, and by identifying the factors weight, based on contractors' answers for these factors for each project, the proposed mark up size will be determined. After the explanation of the initial concept to interviewees, some comments and feedback have been received. Interviewee (3) comments are stated below.

Interviewee 3 "*It will be interesting, but not sure if I can use it in my entire project. We can try it, but our method can be more accurate that a tool*"

Interviewee 6 "*.... If you create this tool this could help us and we would gladly test it. This tool should be like the factors and we can evaluate these factors, which should be based on company strategy. And this should be make our life easier*".

Most of the interviewees agreed with the initial model, as it follows current practice in Saudi Arabia, determining mark up size by contractor.

Interviewee 8 "*I assume that the best approach to determine the mark up size is that we have a systematic programme containing all costs and all items, in order to have better understanding of the expected mark up size as a support decision tool*"

Interviewee 8 " *Yes, this can help if all factors are added to this software with a point from one to ten. I have an idea regarding what you are talking about and this could help and support the decision*".

Other interviewees stated that it would be very difficult to use the model, or build trust from the first day. In general, most contractors take their bidding mark up size decisions, in Saudi Arabia, based on judgment. As a result they will find it difficult to use the model at the beginning.

Interviewee 3 "*It will be difficult to use the tool to determine mark up size and take this tool to the next level, but you need to make sure this tool is accurate*"

However, the initial concept has been improved based on interviewee comments and feedback details. A proposed model will be discussed in chapter 7.

5.8 Closing thoughts

This chapter begins by identifying the interview structure to achieve the research goal, and answering the questions which arose. Subsequently, it follows with an interview analysis method for the data collected. The interview findings help in understanding the process of setting mark up size in Saudi Arabia. Also, the interview findings discovered factors that influence bidding mark up size from the literature review, which has been confirmed by interviewees.

Exploring the current practice of setting mark up size decisions in Saudi Arabia has been accomplished, and establishing a common understanding of who takes the decision of setting mark up size in Saudi Arabia contractors has been discovered. It is found that this process mostly depends on personal experience and management

judgment. Most contractors do not apply a mathematical approach to determine mark up size. The decision of mark up size is mainly affected by the size of contractor and type of customer.

The factors influencing bidding mark up sized in Saudi Arabia can be categorised into the following groups: Project Characteristics, Project Documentation, Project Finance, Economic Situation, Company Situation, Client and Contract. Fifty eight factors were identified and assigned to these groups. Table 5.2 present factors influencing bidding mark up in Saudi Arabia and its groups.

It is noticeable that some contractors set mark up size based on contractor strategy. The mark up size can be increased or decreased, if contractors want to enter a new market.

As contractor decision of setting mark up size is based on the management judgment of evaluating factors that influence bidding mark up size, the contractor will be required to review the factors that influence bidding mark up size, and set the appropriate level of importance. This practice could take from minutes to days, depending on the contractor's internal procedure. The result of this decision could differ from one manager to another, based on their experience and personal judgment.

The research result found that there is no standard to set up mark up size in Saudi Arabia.The interviewees support the initial concept of the model. A number of the interviewees agreed that the initial concept of the model reflects the current practice of Saudi Arabian contractors, but in a systematic manner. The possible disadvantage of the proposed model relates to implementation, where most contractors do not prefer systematic tools as they are used to traditional methods, i.e. personal

judgment. The model will also explore the reason behind the decision of setting mark up size, where top level management do not usually a give reason for their personal judgment.

The initial concept of the model also received a positive feedback from interviewees. The most positive comments are that the proposed model can help a contractor support their decision in setting mark up size, and reflect current practice.

Chapter 6: Questionnaire Design and Result

6.1 Introduction

This chapter aims to explore the preliminary study of data collection procedure for the questionnaire, scope of the questionnaire, data analysis and results.

The aim of the preliminary study is to confirm the findings of the literature review, as discussed in chapter 2 (Factors influencing bidding mark up size decision in competitive bidding). This was done through qualitative interviews and questionnaire. The aim of the interviews was to identify factors affecting the contractor's decisions in term of determining mark up size. However, the purpose of the questionnaire was to collect data, supporting the need for this study, and identify the level of importance for the identified 60 factors from literature review and interviews. Interviews were used to verify the applicability of factors to the Saudi Arabian environment by consulting experts in the industry, and the questionnaire was used to expand the research sample size.

The first objective of this preliminary study is to review and understand the factors that influence decisions on bidding markup size in Saudi Arabia. Decision analysis has been done through a literature review, and confirms findings in term of factors that influence the bidding mark up size, and to understand how bidding strategy works in real life. The second objective is to help developing a bidding model used contractors' information in order to support their decisions on markup size.

In this chapter, the research scope, required data, sample size and piloting the questionnaire will be discussed, in addition to other topics mentioned at the beginning of this chapter.

6.2 Research Scope and Required Data

The scope of this research is to identify factors influencing bidding mark up size in Saudi Arabia, and to focus on developing a computerised model to help contractors determine bid mark up size.

The required data for preliminary study is the identification of factors that are going to be used in a bidding mark up size model, and their level of importance.

This was done through interviews in order to identify factors listed and consolidate with the literature review. This list of factors was used in questionnaire in order to set level of importance for these factors in Saudi Arabia. This data is an initial step in developing a computerised aid tool for determining bidding mark up size.

6.3 Questionnaire Survey and Data Collection

There is an array of different ways to collect data. Researchers have the possibility to select from alternatives ways such as interviews, questionnaires, case studies, observation, etc.

The questionnaire data has been collected from top management, project managers and bid managers, who are involved in the biding process and determining bid mark up size in a competitive bidding situation in Saudi Arabia. The factors that could influence bidding mark up size were identified from previous literature review, conducted in Saudi Arabia and other countries. These factors were listed in the

questionnaire and respondents asked to evaluate these factors. The questionnaire has been distributed online and through paper copies.

The questionnaire (appendix 3) was designed based on the research of Ahmad and Minkark (1988) and customised to suit Saudi Arabian contractors. The next section will discuss the structure of the questionnaire.

6.3.1 Structure of the Survey

The questionnaire has been designed to suit contractors who operate in Saudi Arabia. Firstly, the questionnaire consisted of ten questions. These questions have been categorised into three sections: respondent profile, research concept framework, and factors that influence bidding mark up decisions.

Section I: This section was to collect information about the respondent (Questions 1-6), which are about respondent profiles. In these questions the following information was gathered: respondent's experience, organisation type, main type of clients, the annual sales of the organisation, and the number of workers in the organisation.

Section II: This section was to collect information about research concept framework. This was to understand bidding mark up decision process in Saudi Arabia. Also the questionnaire was used to evaluate the understanding of organisation concept, or model, used by the respondent in performing decision making in the bidding process.

Section III:

This section was about factors that influence bidding mark up decisions. This question aimed to understand which factors influence the contractor, when making

bidding mark up decisions, and which factor is ranked most important by the contractor.

6.3.2 Sample selection

The sample can be defined as a group of items chosen from the population (Snedecor, 1989). In this research the population are contractors who work in the construction industry in Saudi Arabia.

According to McBurney and White (2004), there are four types of sample population. These types are haphazard, purposive, convenience and random. In haphazard, the selection of a sample from the population is performed by the researcher without any planning, or without having a structure. In purposive, the researcher selects from the population based on his own judgement. In convenience, the selection from a population is based on practical reasons. A random sample is where each unit in the population has a known chance of being selected (McBurney & White, 2004).

In this research purposive sample has been used because the other types, such as haphazard, cause a problem in terms of reliability and validity of data set. There is a list of contractors who work in the construction industry and the random sample cannot be used from this data. However, according to McBurney and White a convenience sample is not suitable for statistical data. Therefore, the purposive sample was used in this research where purposive sample is constructed to serve a very specific need or purpose by have a specific group from population (McBurney & White, 2004).

The total number of contractors in Saudi Arabia, based on The Ministry of Commerce and Industry, are about 11,659. The formula used to calculate the sample size is (Kish 1965):

$n = n' /(1+n'/N)$

Where n = Sample size

N = total population

$n' = S^2/V^2$

V = the standard error of sampling distribution = .05

Where S = the maximum standard deviation in the population elements (Total error = .1 where at confidence level 95%)

P = the proportion of population elements.

By introducing the above values to the formula n = 372

From the provided list of contractors from The Ministry of Commerce and Industry, 1000 purposive contractors have been selected based on their size, annual sales and organization firms. This sample process was suitable for collecting statistical data for this research as other sample process could cause a problem in terms of reliability and validity of data set (McBurney & White, 2004).

From previous studies such as Dulamimi and Shan (2002) and Ahmad and Minkarah (1988) the response rate was between 20% and 35%, so a response rate of 22% was assumed, and a total of 1,000 questionnaires were distributed through the Saudi Engineering Council. A total of 396 were received, giving an actual response rate of 39.6% that is a higher rate than expected.

6.3.3 Piloting the Questionnaire

The questionnaire was distributed to nine practitioners from various industries who work in the area of competitive bidding strategy. These practitioners included bid managers, financial managers, project managers, and those at top management level. The questionnaire was distributed to a number of companies selected from a list provided by the Jeddah Chamber of Commerce and Industry in Saudi Arabia. Two semi-structured interviews were conducted with two professionals from Saudi Arabian industry in order to validate the questionnaires. They provided some recommendations to improve the answerability and accountability of the questionnaire. A review and pilot questionnaire was conducted to refine the questions, before deciding on the format of the actual questionnaire, based on the feedback given.

6.3.4 Questionnaire Distribution Method and Non Response

The questionnaire was distributed by two different methods. The first method used was through paper, that is to say face to face. The response rate for this method was about 85% (20 questionnaires were distributed and 17 returned). This method is sufficient, but it was time consuming and required a relationship with professionals in the field. The advantage of this method is that practitioners can ask questions and collect data personally, which reduces incomplete data and the number of mistakes completing the questionnaire. Also, it helps the researcher to observe how the practitioners deal with the questionnaire.

The second method used was through an online questionnaire. An email was distributed to 1,000 professionals with support of the Saudi Engineering Council. This method reached above 39% as a response rate. The support of the Saudi

Engineering Council helped to achieve a high response rate. The advantage of this method is that the practitioners were interested to share knowledge, because it is part of the Saudi Engineering Council.

6.4 Data Analysis

According to previous research in related topics such as Dulamimi and Shan (2002) and Ahmad and Minkarah (1988), a 39.6% response rate is acceptable as previous studies' response rate was between 20% and 40%. The returned questionnaire has been analysed using Statistical Package for Social Sciences (SPSS).The data has been uploaded, coded and labelled into SPSS in order to analyse the data and prepare all tables, figures and charts, which will be presented in the results section.

6.4.1 Reliability and Validity

Reliability can be defined as the result does not change over time and an accurate representation of the total population. However, if the result of the research can be reproduced if we implement similar methodology then the methods of the research can be considered as reliable (Joppe, 2000).

However, there are three types of reliability of quantitative research identified by Kirk and Miller (1986) these types are: the degree to which a measurement remains the same, the stability of a measurement over time and the similarity of measurements within a given time period (Kirk and Miller,1986).

Nevertheless, According to Patton (2001) validity and reliability are two factors should be considered in any qualitative research during the designing, analysis and judging the study. On the other hand, Lincoln and Guba stated that reliability in qualitative research use "dependability", in qualitative research which closely

corresponds to the notion of "reliability" in quantitative research. In this chapter quantitative survey will be analysed. According to Pallant (2004) Cronbach's alpha coefficient should be above 0.7 to prove the reliability.

In order to perform the reliability test, SPSS Software has been used. The result of Cronbach's alpha coefficient was 0.967 (see Table 6.1) for the 60 factors.

Cronbach's Alpha	N of Items
.967	60

Table 6.1: Reliability Statistics

Table 6.1 Showing Reliability Statistics of Cronbach's alpha coefficient is 0.967, which indicate a high level of consistency.

According to Joppe (2000) validity determines to measure if the research measure truly the research results. In general, validity can be determined by asking questions and verifying the answer with other research (Joppe, 2000).

The validity of the research can be secured through literature review and exploratory interviews, and more importantly, the feedback received from academic and industrial advisors.

6.4.2 Normality

According to Tabachnick and Fidell (2001), normality can be assessed by statistical or graphical means. In order to assess normality using statistical measures the Kolmogorov-Smirnov test, and kurtosis and skewness values should be measured. In general, the value of Kolmogorov-Smirnov should be above 0.05 to represent a non significant result, and the values of kurtosis and skewness should be zero, to indicate normality

The other method to assess normality (Pallant, 2004) is graphical measures that use histogram and normal Q-Q and detrended Q-Q plots. According to Mayhew (2004) the normal distribution has the following characteristics:

- the curve has a single peak;
- it is bell-shaped;
- the mean lies at the centre of the distribution, and the distribution is symmetrical around the mean;
- the two tails of the distribution extend indefinitely and never touch the horizontal axis;
- the shape of the distribution is determined by its Mean (μ) and Standard Deviation (s).

To test the normality, SPSS software has been used for 60 factors. Each factor's group is entered into the dependent list, and independent group factor variables are entered into the factor's list box. This approach allows testing the normality of the distribution among all the dependent and independent variables.

Tests of normality for groups of factors for Project Characteristics against size of organisation (Large or small to Medium contractor) are given in Table 6.2. The explanations of how to categorize size of organization will be discussed in questionnaire discussion.

	Size of Organization	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Type of job	Large	.228	151	.000	.819	151	.000
	Small to Medium	.229	245	.000	.833	245	.000
Size of job	Large	.248	151	.000	.780	151	.000
	Small to Medium	.229	245	.000	.826	245	.000
Warranty issues, which might possibly create risks	Large	.192	151	.000	.894	151	.000
	Small to Medium	.209	245	.000	.873	245	.000

Design quality	Large	.218	151	.000	.830	151	.000
	Small to Medium	.247	245	.000	.874	245	.000
Contractor involvement in the design phase	Large	.201	151	.000	.897	151	.000
	Small to Medium	.161	245	.000	.928	245	.000
The amount of changes expected throughout the execution of this project	Large	.234	151	.000	.874	151	.000
	Small to Medium	.178	245	.000	.908	245	.000
Qualification requirements	Large	.195	151	.000	.863	151	.000
	Small to Medium	.212	245	.000	.889	245	.000
Degree of difficulty considering delays, shortages	Large	.225	151	.000	.873	151	.000
	Small to Medium	.192	245	.000	.901	245	.000
Project related contingency	Large	.186	151	.000	.898	151	.000
	Small to Medium	.180	245	.000	.915	245	.000
Degree of hazard (safety)	Large	.192	151	.000	.897	151	.000
	Small to Medium	.166	245	.000	.922	245	.000
Project duration	Large	.216	151	.000	.839	151	.000
	Small to Medium	.226	245	.000	.845	245	.000
Labour requirement	Large	.188	151	.000	.865	151	.000
	Small to Medium	.225	245	.000	.857	245	.000
Equipment requirement	Large	.203	151	.000	.849	151	.000
	Small to Medium	.216	245	.000	.875	245	.000
Location	Large	.179	151	.000	.888	151	.000
	Small to Medium	.195	245	.000	.897	245	.000
Project start time	Large	.143	151	.000	.920	151	.000
	Small to Medium	.157	245	.000	.929	245	.000
Number of Subcontractors	Large	.138	151	.000	.935	151	.000
	Small to Medium	.150	245	.000	.936	245	.000
Clarity of the work and specifications	Large	.226	151	.000	.829	151	.000
	Small to Medium	.242	245	.000	.815	245	.000
Project cash flow	Large	.224	151	.000	.823	151	.000
	Small to Medium	.233	245	.000	.827	245	.000

Table 6.2: Tests of Normality

Results from table 6.2 show that variables scored less than 0.05, which means that the distribution of the data is non normal. However, according to Pallant (2004) this is common in large samples. Also, figures 6.1 and 6.2 show the Q-Q and detrended Q-Q plots that suggest non-normal distribution for type of job.

Normal Q-Q Plot of Type of job

Detrended Normal Q-Q Plot of Type of job
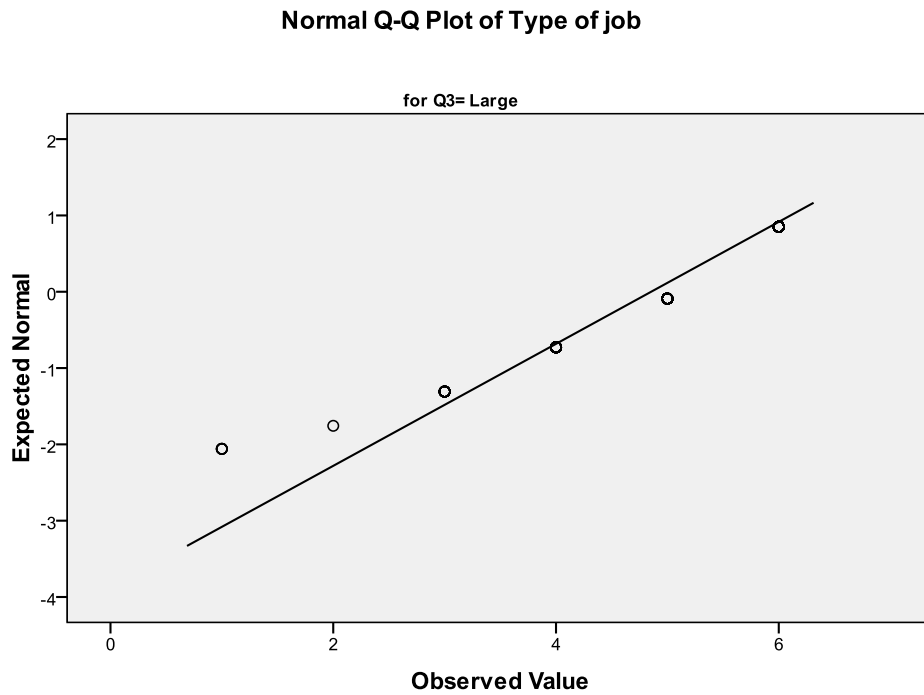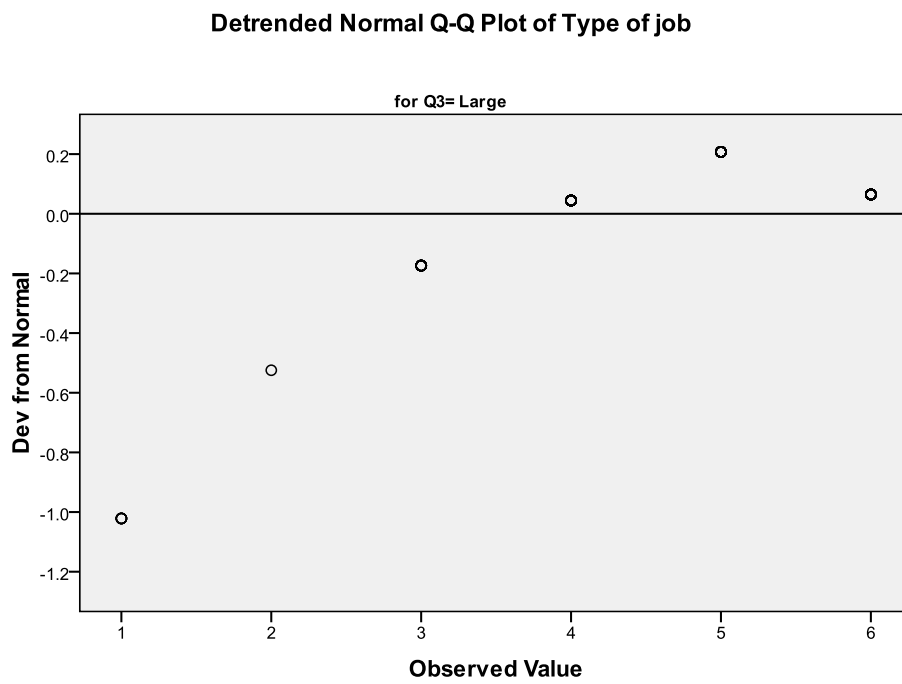
Figure 6.1 Normal Q-Q plot suggest non normal distribution

Detrended Normal Q-Q Plot of Type of job
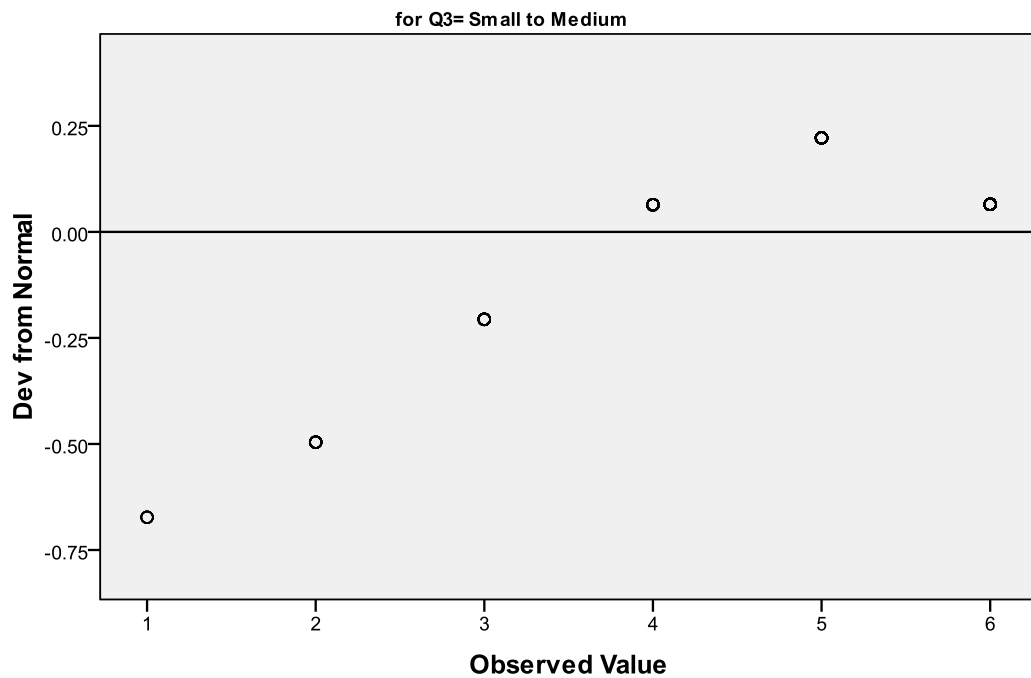
Figure 6.2 Detrended Normal Q-Q plot suggest not normal distribution

However, it is difficult to present tables and figures for all normality tests generated from SPSS, as it generates more than 100 pages of tables and figures, but the present table and figure illustrate the distribution of the data is non normal. However, according to Pallant (2004) this is common in large samples. The data is common to be non normal in large samples (Pallant,2004) and Data may not be normally distributed because it actually comes from more than one process, for example in our case from general manager and project managers that can affect the normality of the data. However, this mean statistical Analysis tools for non normal distribution are required to analyse this data.

6.5 Result of the Survey

The results of this questionnaire will be presented in a similar order to that of the questionnaire structure. The following section will present the results of respondent profile, research concept framework, and factors that influence bidding mark up decisions.

6.5.1 Respondent Profiles

This section contains the results of five questions describing the respondent profiles.

This result is based on questions 1-6, which are about respondent profiles. In these questions the following information has been gathered: respondent's experience, organisation type, the annual sales of the organisation, the number of workers in the organisation, and the percentage of work which the organisation obtains through competitive bidding.

One thousand questionnaires were sent out and 396 questionnaires were returned. The response rate was therefore, about 39.6%. The results showed that the questionnaire had been filled out by respondents from various different organisational sectors, and a majority of respondents had more than five years experience in bidding strategy.

Q1. This question was to assess the respondent's work experience in bidding strategy. This was asked to investigate the differences between respondents, in terms of their experience, and ensure that most have the appropriate experience to answer the questionnaire. The questions presented are shown below:

Figure 6.3 Q1 of the questionnaire

The result in term of respondents experience is as follows:

work experience in years	Respondent percentage
< 1 Year	8.84%
1 -3 Years	19.44%
3-5 Years	12.88%
>5 Years	53.03%
None	5.81%

Table 6.3: Respondents' work experience
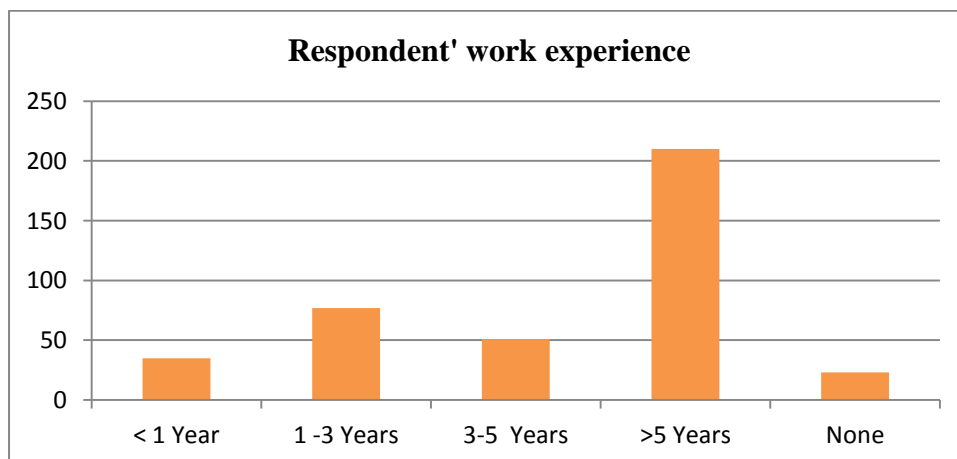
Figure 6.4 Q1 Number of respondent for each work experience group

From the output shown above, table 6.3 and figure 6.4, 53.03% of respondents have more than five years experience in bidding strategy, 12.88% have between three and five years experience, 19.44% have between one and three years experience, and 8.84% have less than one years experience. This indicates that the majority of respondents have appropriate experience in the research topic.

Q2 This question assessed the type of organisation. This was asked to understand the respondents' type of business, in terms of industry sector. The questions presented are shown below:

Figure 6.5 Q2 of the questionnaire

The result in term of organization's main business is as follows:

organization's main business	Respondent percentage
Building	21.21%
Engineering	38.89%
Industrial	10.10%
Services	2.78%
Others	27.02%

Table 6.4: Respondents' organization's main business
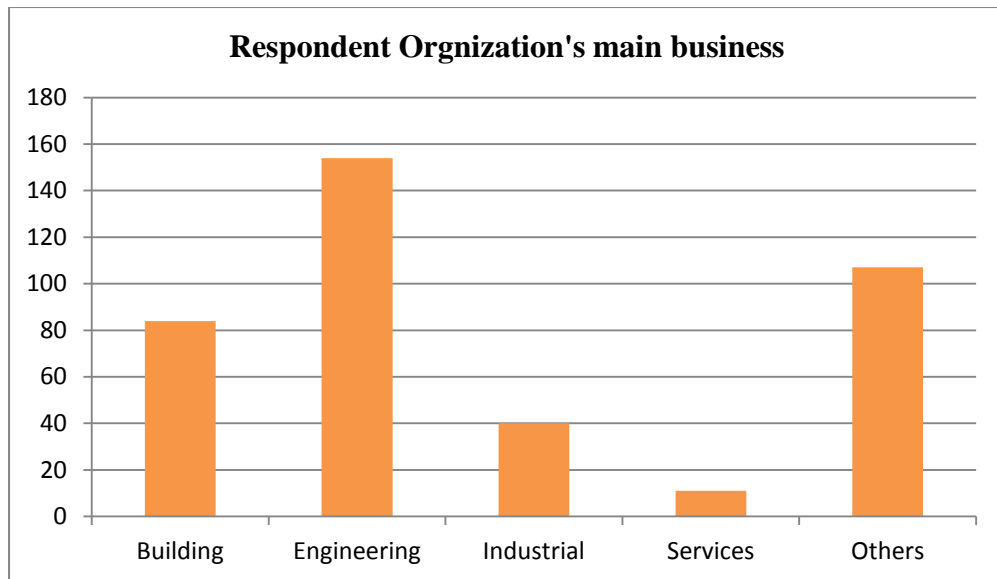
Figure 6.6 Q2 Number of respondent according to organisation's main business

From the output shown above, table 6.4 and figure 6.5, 21.21% of respondents work mainly in building, 38.89% mainly in engineering, 10.10% in industrial and 2.78% work mainly in services. Other respondents (27.02%) work in different types of business or in construction.

Q3 This question was to assess respondent's main client type. This was asked in order to understand how customer type can influence respondent decision. The questions presented are shown below:

Figure 6.7 Q3 of the questionnaire

The result in term of organization's main clients is as following:

organization's main clients	Respondent percentage
Public sector	17.17%
Private sector	16.41%
Both Sectors	66.41%

Table 6.5: Respondents' organisation's main clients

Figure 6.8 Q3 Number of respondent according to organisation's main clients

From the output shown above, table 6.5 and figure 6.8, 17.17% of respondents work mainly with the public sector, 16.41% work mainly with the private sector, and the remaining 66.41% work with both sectors.

Q4 This question was to determine respondent's organisation size by assessing the annual sales of the respondent's organisation. This question was asked with the next question in order to understand the organisation size. The questions presented are shown below:

Figure 6.9 Q4 of the questionnaire

The result in term of organisation's main business is as follows:

organization's annual Sales in millions	Respondent percentage
Under 5	16.92%
5-25	25.51%
26-100	18.69%
101-500	18.43%
over 500	20.45%

Table6.6: Respondent organisation's annual sales

Figure 6.10 Q4 Number of respondents according to organisation's annual sales

From the output shown above, table 6.6 and figure 6.10, 16.92 % of the respondent organisation's annual sales are below 5 million SAR, 25.51% are between 5 and 24 million SAR, 18.69% are between 26 and 100 million SAR, 18.43% are between 101 and 500 million SAR, and the remaining 20.45% are above 500 million SAR.

Q5 This question was to assess the respondent's organisation size by number of employees. This question was asked with the previous question, in order to understand the organisation size. The questions presented are shown below:
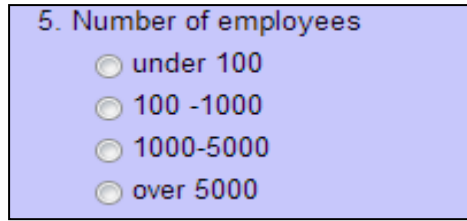
Figure 6.11 Q5 of the questionnaire

The result in term of organisation's main business is as follows:

Organization's employees size	Respondent percentage
Under 100	36.11%
100-1000	34.34%
1000-5000	15.40%
over 5000	14.14%

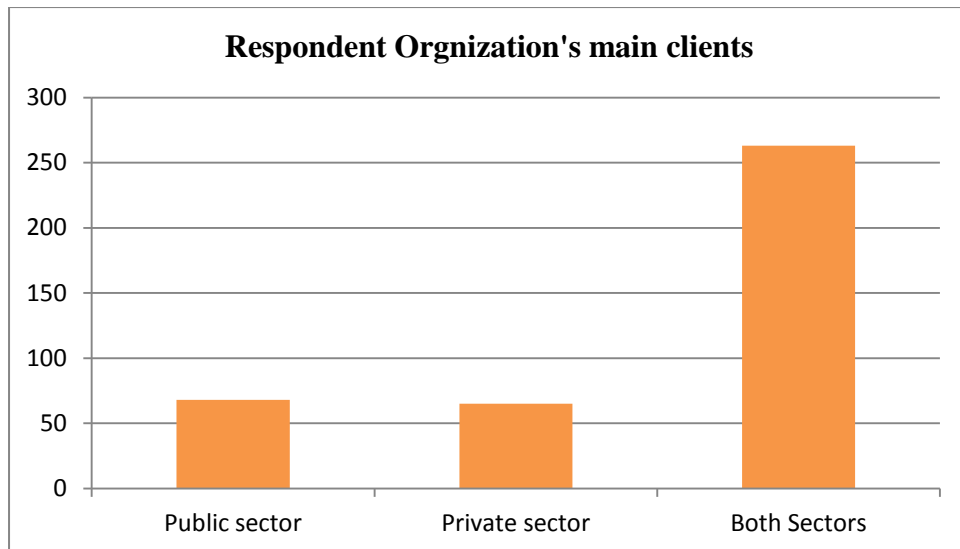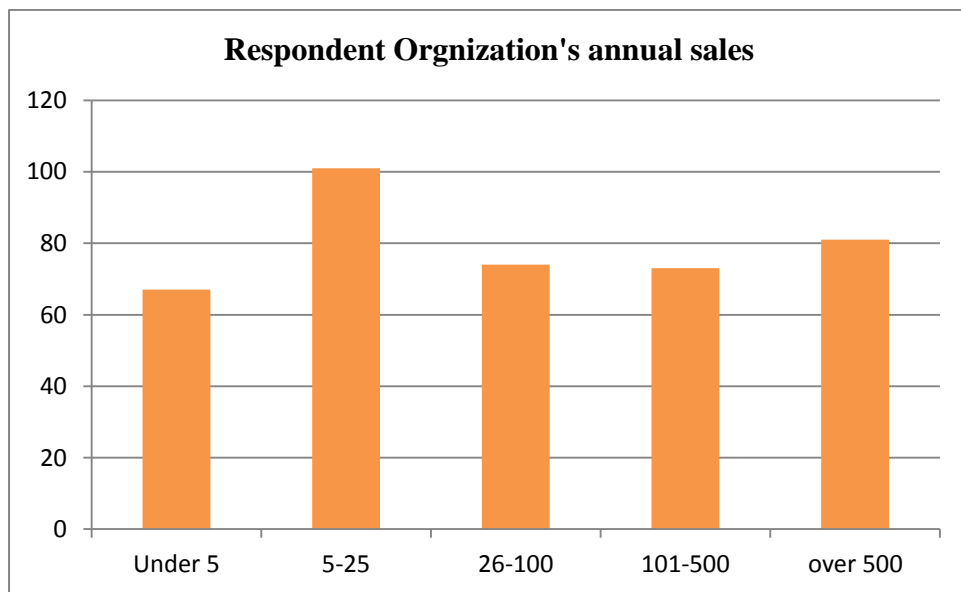**Table 6.7**: Respondents' organisation's employee size
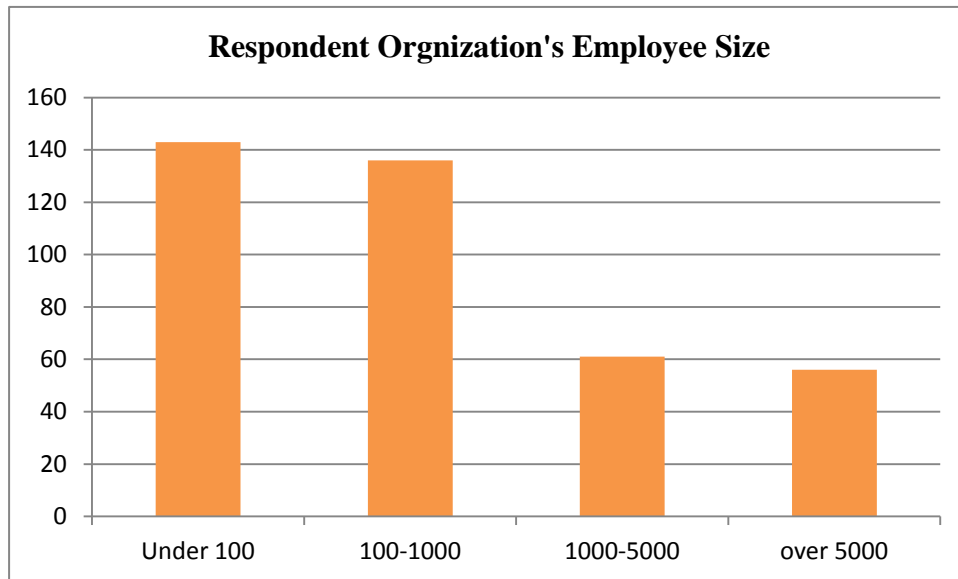
Figure 6.12 Q5 Number of respondent according to organisation's employee size

From the output shown above, table 6.7 and figure 6.12, 36.11 % of respondent's organisations have fewer than 100 employees, 34.34% have between 100 and 1,000 employees, 15.40% have between 1,000 and 5,000, and the remaining 14.14% have more than 5,000 employees.

From the results shown for questions 4 and 5, an organisation's size is considered large if it has above 100 employees and annual sales above 100 million SAR. The result of large organisation's size is 38.8%, with 61.2 % of the population in small to medium size organisations.

6.5.2 Organisations' Bidding Characteristics

This section will discuss the results of questions 6 and 7, which are about organisation bidding characteristics. In these questions the following information was gathered: percentage of work obtained through competitive bidding, and how organisations evaluate the mark up size decision to determine mark up size.

Q6 This question assessed the percentage of work obtained through competitive bidding. The questions presented are shown below:

6. Percentage of work obtained through competitive bidding
- under 25%
- 25% -50%
- 50%-75%
- over 75%

Figure 6.13 Q6 of the questionnaire

The result in term of organisation's percentage of work obtained through competitive bidding is as following:

organization's work obtains through competitive bidding	Respondent percentage
Under 25%	39.14%
25% - 50%	36.11%
51% -75	12.63%
over 75%	12.12%

Table 6.8: Organisation's percentage of work obtained through competitive bidding
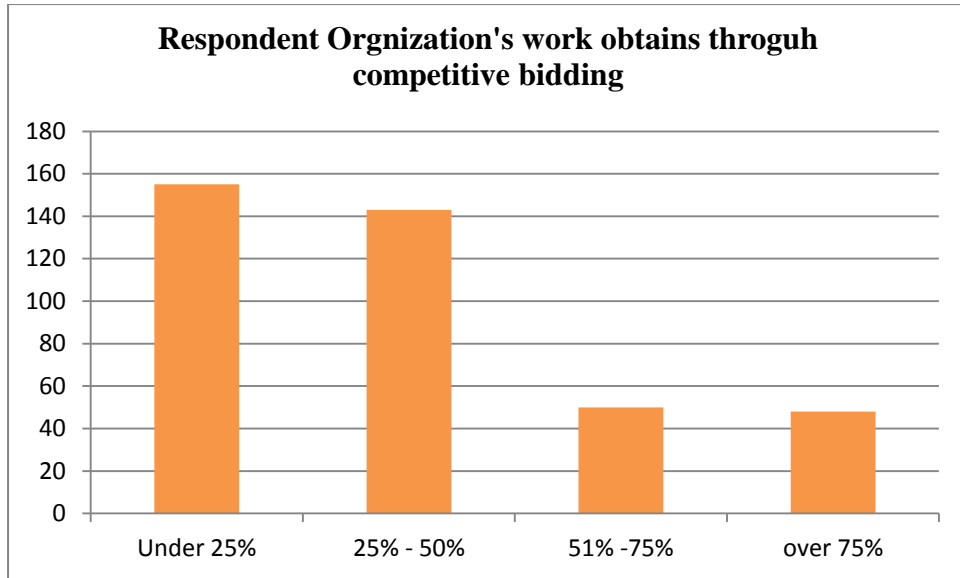
Figure 6.14 Q6 Number of respondents whose organisation obtained work through competitive bidding

From the output shown above, table 6.8 and figure 6.14, 39.14 % of organisations obtained less than 25% of their work though competitive bidding, 36.11% obtained between 25% to 50% of their work through competitive bidding, 12.63% obtained between 51% to 75% of their work though competitive bidding, and 12.12% of organisations obtained more that 75% of their work through competitive bidding. This indicates that obtaining work through competitive bidding is one of the major methods of obtaining work in Saudi Arabia.

Q7 this question assessed how organisations determine mark up size. Three options were available for respondents (by using a model/decision support framework, by negotiation with in-house experts, by using historical data). Also, the possibility to add other methods was provided to respondents. The questions presented are shown below:

Figure 6.15 Q7 of the questionnaire

The result, in term of an organisation's different methods, of determining mark up size bidding is as follows:

organization's method use to determine mark up size	Respondent percentage
By using a model/ decision support framework	22.22%
By negotiation in house experts	50.51%
By using historical data	60.10%
Others	4.04%

Table 6.9: Respondents' organisation's percentage of work obtained through competitive bidding
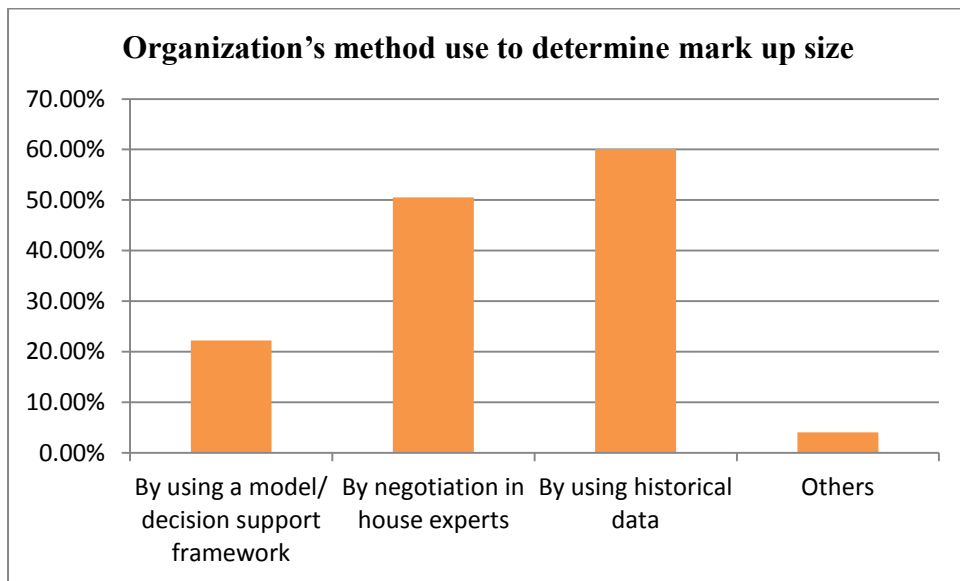
Figure 6.16 Q7 Number of respondents, according to the organisation's percentage of obtaining works through competitive bidding

135

From the output shown above, table 6.9 and figure 6.16, 39.14 % of respondent

organisations use a model/decision support framework, 50.51% use negotiation with

in-house experts, 60.10% use historical data, and 4.04% use other methods, such as

lower cost methods. This indicates that determining mark up size through experience

and personal judgment is the most used method in Saudi Arabia. To test if the

response differs between contractor types, the data has been tested using chi-squared

tests for independence in the form of the contingency coefficient because the

variables are categorical and not at the ordinal scale.

Chi-Square Tests

Method used to determine mark up size vs. client type	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.807[a]	8	.213
Likelihood Ratio	10.428	8	.236
Linear-by-Linear Association	.997	1	.318
N of Valid Cases	396		

a. 2 cells (13.3%) have expected count less than 5. The minimum expected
count is 1.31.

Table 6.10: Chi-Square test for method used to determine mark up size vs. client
type

From table 6.10 the contingency coefficient .213 shows that there is no statistically

significant association between the method used to determine mark up size and the

main client for contractors.

Chi-Square Tests

method used to determine mark up size vs. contractors size	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.640[a]	4	.006
Likelihood Ratio	15.272	4	.004
Linear-by-Linear Association	.163	1	.686
N of Valid Cases	396		

a. 2 cells (20.0%) have expected count less than 5. The minimum expected count is 3.05.

Table 6.11: Chi-Square test for method used to determine mark up size vs. contractors size

From table 6.11 the contingency coefficient 0.006 shows that there is a statistically significant association between the method used to determine mark up size and size of contractor.

The previous section, 6.5.3, discussed factors that influence bidding mark up decisions and their level of importance in Saudi Arabia. The result was that all 60 factors can be considered as important influences in bidding mark up size for contractors.

From section 6.5.1 and 6.5.2, the results of the questionnaire confirm the need for the research, and provide a justification in order to carry out this research. Competitive bidding is one of main methods used to obtain work in Saudi Arabia, and still the majority of organisations determine their mark up size through judgment.

6.5.3 Ranking of factors influencing bidding mark up size

The section was about factors that influence bidding mark up decisions. This question aimed to understand which factors influence an organisation's decision when making bidding mark up decisions, and which one of these factors is ranked as

most important by the organisation. The result of this identifies the importance level of these factors. The respondents are requested to assess the level of importance of 60 factors, which in their judgment relate to bidding mark up size. The rating scale used is 0 to 6, where 0 indicates the lowest level of importance and 6 indicates the highest level of importance.

The importance index used in this research is:

Importance index = $\sum$ ax * 100/6

where a is the weight given to each response.

Average score = (Importance index/ 6) %

Table 6.12 below presents the importance of factors, and their respective rank, in terms of their influence on setting a proper mark up size on bidding decisions.

No.	Factors ranking up to important index formula	important index	No.	Factors ranking up to important index formula	important index
1	Size of job	82.74%	31	Location	72.43%
2	Clarity of the work and specifications	82.24%	32	Identity of competitors	72.31%
3	Project cash flow	80.35%	33	Availability of equipment	72.22%
4	Type of job	80.26%	34	Confidence in workforce	72.10%
5	The history of client's payments in past projects	79.59%	35	Historic profit	72.01%
6	Project duration	79.38%	36	Number of competitors tendering	71.89%
7	Reliability of company cost estimate	79.00%	37	Government regulations	71.76%
8	The current financial capability of the client	78.49%	38	Risk in fluctuation in labour prices	71.55%
9	Project terms of payment (monthly/quarterly)	78.32%	39	Project related contingency	70.92%
10	The client's requirements	78.20%	40	Management of similar size projects in the past	70.75%
11	Owner / Client	77.57%	41	Policy in production cost savings	70.41%
12	Design quality	77.44%	42	General overheads	70.29%
13	Strength of the firm	77.06%	43	Supervisory availability	70.03%
14	Competition	76.98%	44	Degree of hazard (safety)	69.95%
15	Labour requirement	76.81%	45	Market's direction (whether it is declining, expanding, etc.)	69.11%
16	Risk in fluctuation in material prices	76.68%	46	Availability of other projects	68.48%
17	Return of investment	76.56%	47	Uncertainty in estimate	68.01%
18	Contract conditions	75.93%	48	Tendering method (selective, open)	67.85%
19	Equipment requirement	75.67%	49	Labour environment	67.00%
20	Qualification requirements	75.51%	50	Risk of investment	66.84%
21	Size of client	75.25%	51	Completeness of the documents	66.62%
22	The project is matching the company strategy and future	75.25%	52	The ratio of your firm's current market share to the expected or aimed share	66.50%
23	Capital requirement	75.00%	53	Amount of possible upcoming profitable projects out for tender in near future	65.24%
24	Need for work	74.87%	54	Tendering duration	65.15%
25	Degree of difficulty considering delays, shortages	74.41%	55	Contractor involvement in the design phase	64.69%
26	Warranty issues, which might possibly create risks	74.37%	56	Degree of difficulties in obtaining bank loan	64.69%
27	Type of contract	73.44%	57	Policy in economic use of building resources	62.71%
28	Economic condition	73.15%	58	Project start time	61.41%
29	Current work load	72.60%	59	Number of Subcontractors	58.63%
30	The amount of changes expected throughout the execution of this project	72.43%	60	Tax liability	57.03%

Table 6.12: The factors' ranking order

From the results of table 6.12, it appears that size of job, clarity of the work and specifications, project cash flow, type of job and the history of client payment in past projects, are the five highest ranked factors in term of influencing bidding mark up size. The lowest ranked factors are degree of difficulties in obtaining bank loan, policy in economic use of building resources, project start time, number of sub-contractors and tax liability. The highest ranked factor is 82.74% and the lowest ranked factor is 57.03%. This indicates that all 60 factors are considered relevant, because both highest and lowest ranked are nearly from the mid importance point to the highest importance point.

As discussed before, these factors were categorised into the following groups: project characteristics, project documentation, client characteristics, company situation, economic situation, project finance and contract. These groups have been scored using the following formula:

Group score =   = $\sum Ib_{fg} / N_{fg}$

Where $\sum Ib_{fg}$ Sum of the listed factors ranking inside the group

N_{fg} total sum of listed factors inside the group

Group	Group Score
Client characteristic	77.01%
Project finance	75.27%
Contract	74.69%
Project characteristics	73.87%
Company situation	71.5%
Economical situation	70.33%
Project documentation	66.54%

Table 6.13: Groups' ranking order

From table 6.13 client characteristic and project finance are the most important groups. The first group confirms the result of interviewees; the importance of who the client is on determining mark up size decision for projects in Saudi Arabia. On other hand, economic situation and project documentation are the lowest ranked group. However, from the group score it is clear these entire groups are important, as all of them score near to each other.

From the above result, the findings of literature review have been confirmed; these factors influence bidding mark up size decisions in Saudi Arabia. In order to achieve the research goals, further analysis will be conducted to explore the most important factors influencing bidding mark up decision in Saudi Arabia. This would help to reduce the possible set of principle components, in order to develop a simple and user friendly tool helping contractors determine their mark up size.

6.6 Contractors' Main Variables

From analysis of the first section in this questionnaire, the contractors' type is reached through three main variables. These variables are shown in figure 6.17:

- Size of contractor

- Main clients

- Contractors Business work
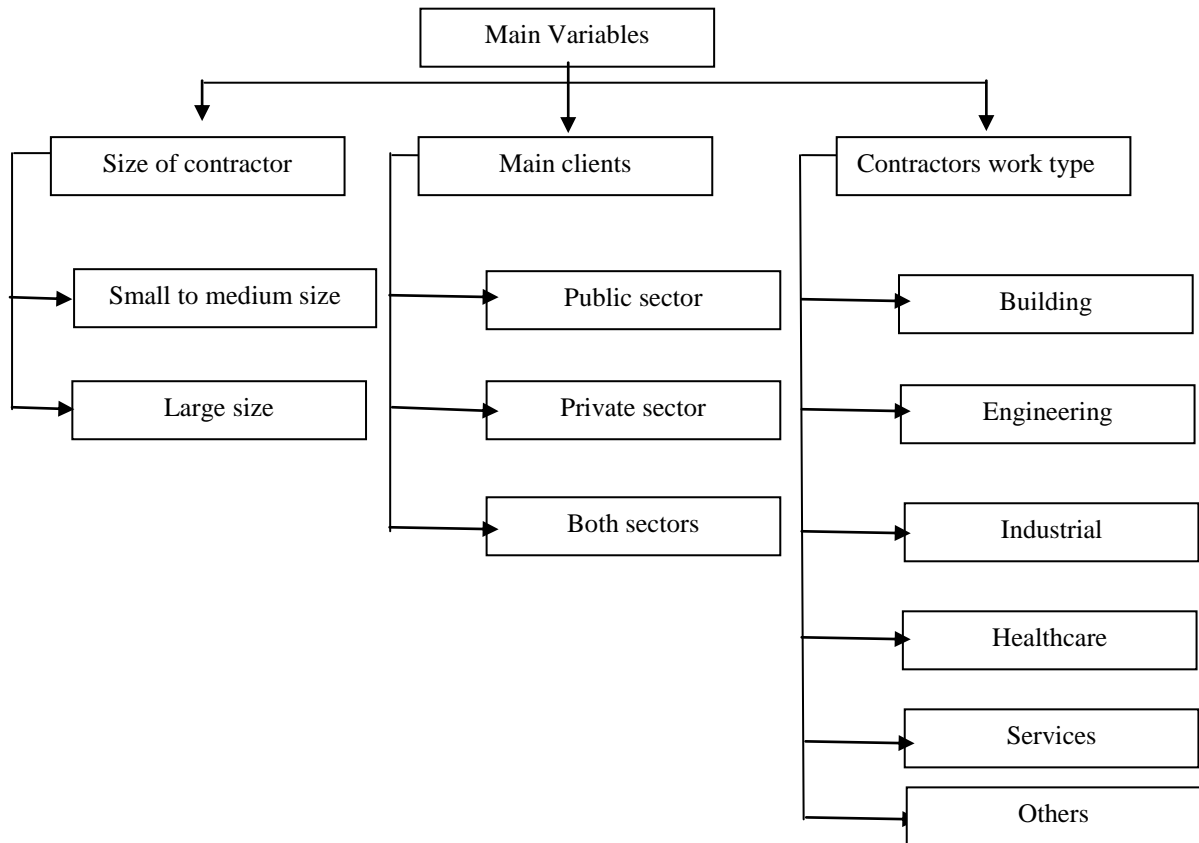
Figure 6.17 Organization's main variables

The numbers of each variable from figure 6.17 above are illustrated as a result of the questionnaire in section I. These variables are: size of contractors, Main clients and contractors work type. However, after considering these three variables and possibility of their values, it was found that there are 36 contractor types and some contractors' work type (Industrial, healthcare, services and other) do not have sufficient number of respondents compared to other contractor types. Therefore, to increase the number of respondents in each category of contractor type, the two main variables (contractor size and main client type) have been used to identify contractor types (as shown in table 6.14).

Contractors' types	No. of respondents
Small to medium size and public sector	48
Small to medium size and private sector	43
Small to medium size and both sectors	151
Large size and public sector	20
Large size and private sector	22
Large size and both sectors	112

Table 6.14: Contractor types (based on contractor' size and main client type)

Based on contractor size and main client type, 6 contractor types has been identified (table 6.14) and the respondent of each contract type has been analysed to explore the difference in response to each of these two main variables (Main clients and size of contractors). Also, principal factors analysis has been used based on the factor's group, in order to select the most relevant factors in each group, and reduce the number of factors to be used in the proposed bidding model.

The difference in response of contractor types, based on contractor size and main client type, is considered to establish a relationship between the main two variables (Main clients and size of contractors). This relationship will be considered during development of the support bidding model to determine bidding mark up size for contractors.

Based on the main variables of contractors (contractor size and main client type), the respondent of each contract type has been analysed to explore the difference in importance of these factors for each contractor type. A one way Anova test has been conducted on the 60 factors as an independent list, with the main clients as the categorical variable in order to find the significant factors that considered as statistically significant among a contractor's main client.

No	Factor	Sig.
1	Type of job	0.022
2	Warranty issues, which might possibly create risks	0.002
3	Design quality	0.023
4	Degree of hazard (safety)	0.005
5	Owner / Client	0.04
6	Return of investment	0.039
7	The current financial capability of the client	0.018
8	The history of client's payments in past projects	0.02
9	Contract conditions	0.003
10	Type of contract	0.029
11	Clarity of the work and specifications	0.005
12	Competition	0.01
13	Identity of competitors	0.008
14	Strength of the firm	0.001

Table 6.15: Contractor's main client vs. 60 factors

Table 6.15 shows the 14 factors that can be considered as statistically significant among a contractor's main client. All of these factors Sig. scored less than 0.05. This means contractors" main client public response are differ from contractors" main client private or both.

Regarding the main variable size of contractor, there are significant differences in the answers of respondents to the level of importance for four factors among the 60 factors listed. These four factors scored less than 0.05. The result in table 6.16 shows that the response of small to medium contractors differs in comparison to large contractors.

	Factor	Sig.
1	Contractor involvement in the design phase	0
2	The project is matching the company strategy and future	0.016
3	Return of investment	0.041
4	Market's direction (whether it is declining, expanding, etc.)	0.012

Table 6.16: Size of contractor vs. 60 factors

The results from tables 6.15 and 6.16 support the view that contractors answer differently on level of importance based on contractor characteristics. This indicates that the level of importance attached to each factor influencing biding mark up size differs with regard to contract characteristics Factors Analysis.

To select the most important factors, in terms of determining bidding mark up size decisions, a factors analysis has been attempted. The Principal Components Analysis (PCA) has been used to analyse the 60 factors and reduce the number of variables in the dataset.

According to Ferguson and Cox (1993), the procedure to perform Principal Components Analysis has three steps:

1. Check suitability of the dataset by two methods:

   - Kaiser-Meyer-Olkin Measure of sample adequacy (should be above 0.05).

   - Barlett's Test of Sphericity significance should be zero.

2. Use eigenvalues of the indicator to identify the number of components to be retained.

3. Choose factors that will be discarded.

After following this procedure, factors with communalities of lower than 0.6 will be discarded. Then the components are examined for the remaining factors. For factors within the same components, only those with high level of importance and one with the highest communalities remained.

The test for the 60 factors give a value of 0.940 for Kaiser-Meyer-Olkin Measure of sample adequacy, and for Barlett's Test of Sphericity significance equals 0.000 (as shown in table 6.17). Therefore, analysis can be performed on this set

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.940
Bartlett's Test of Sphericity	Approx. Chi-Square	14610.848
	Df	1770
	Sig.	.000

Table 6.17: KMO and Bartlett's Test

Table 6.18 shows that 12 components have eigenvalues greater than 1. This means 12 components will be retained.

Compo nent	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	20.757	34.594	34.594	20.757	34.594	34.594
2	2.836	4.727	39.322	2.836	4.727	39.322
3	2.412	4.020	43.342	2.412	4.020	43.342
4	2.016	3.360	46.702	2.016	3.360	46.702
5	1.867	3.111	49.813	1.867	3.111	49.813
6	1.672	2.787	52.600	1.672	2.787	52.600
7	1.485	2.475	55.074	1.485	2.475	55.074
8	1.465	2.442	57.516	1.465	2.442	57.516
9	1.233	2.056	59.572	1.233	2.056	59.572
10	1.152	1.920	61.492	1.152	1.920	61.492
11	1.085	1.808	63.300	1.085	1.808	63.300
12	1.061	1.769	65.068	1.061	1.769	65.068
13	.995	1.658	66.726			

Extraction Method: Principal Component Analysis.

Table 6.18: Total Variance Explained

From figure 6.18 there are 12 factors has an eigenvalues below one

Scree Plot
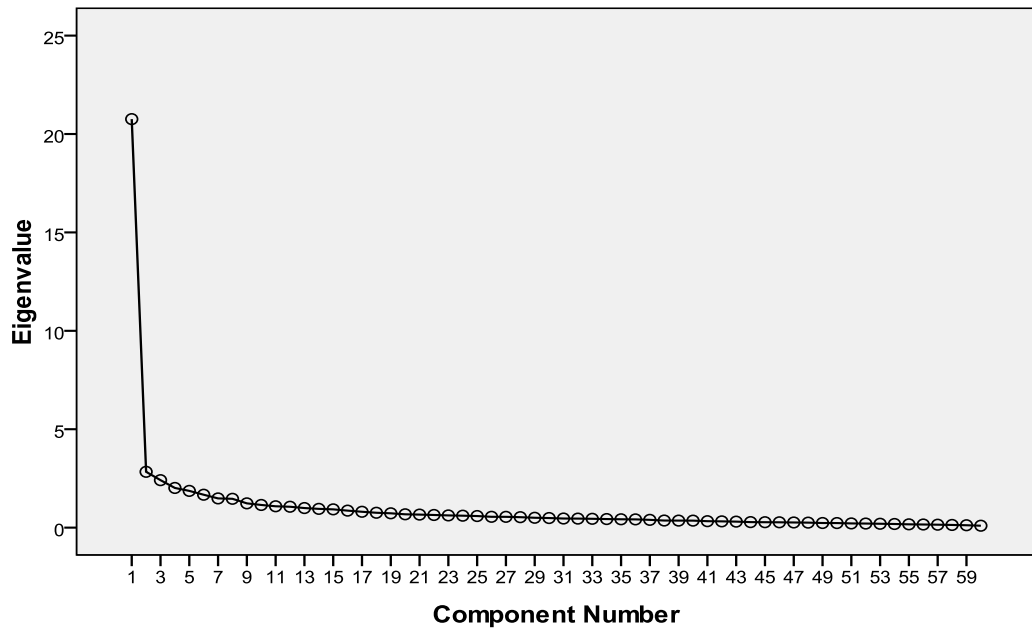
Figure 6.18 Scree plot

From table 6.18 factors below communalities score of 0.6 will be discarded.

	Initial	Extraction
Type of job	1.000	.603
Size of job	1.000	.641
Warranty issues, which might possibly create risks	1.000	.586
Design quality	1.000	.613
Contractor involvement in the design phase	1.000	.517
The amount of changes expected throughout the execution of this project	1.000	.533
Qualification requirements	1.000	.669
Degree of difficulty considering delays, shortages	1.000	.594
Project related contingency	1.000	.603
Degree of hazard (safety)	1.000	.542
Project duration	1.000	.605
Labour requirement	1.000	.728
Equipment requirement	1.000	.766
Location	1.000	.650
Project start time	1.000	.624

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Number of Subcontractors	1.000	.628
Tendering method (selective, open)	1.000	.641
Completeness of the documents	1.000	.668
Tendering duration	1.000	.625
Owner / Client	1.000	.703
Size of client	1.000	.701
The client's requirements	1.000	.604
The project is matching the company strategy and future	1.000	.525
Need for work	1.000	.569
Management of similar size projects in the past	1.000	.622
Return of investment	1.000	.647
Reliability of company cost estimate	1.000	.645
Historic profit	1.000	.544
Current work load	1.000	.624
Uncertainty in estimate	1.000	.579
Availability of other projects	1.000	.694
Confidence in workforce	1.000	.653
The ratio of your firm's current market share to the expected or aimed share	1.000	.622
General overheads	1.000	.511
Availability of equipment	1.000	.717
Supervisory availability	1.000	.751
Policy in production cost savings	1.000	.679
Labour environment	1.000	.644
Policy in economic use of building resources	1.000	.703
Tax liability	1.000	.673
Risk of investment	1.000	.726
Amount of possible upcoming profitable projects out for tender in near future	1.000	.620
Economic condition	1.000	.708
Market's direction (whether it is declining,expanding, etc.)	1.000	.612
Government regulations	1.000	.617
Risk in fluctuation in material prices	1.000	.563
Risk in fluctuation in labour prices	1.000	.619
Capital requirement	1.000	.676
Project cash flow	1.000	.717
The current financial capability of the client	1.000	.748

The history of client's payments in past projects	1.000	.650
Project terms of payment (monthly/quarterly)	1.000	.694
Degree of difficulties in obtaining bank loan	1.000	.636
Contract conditions	1.000	.808
Type of contract	1.000	.774
Clarity of the work and specifications	1.000	.601
Competition	1.000	.761
Identity of competitors	1.000	.794
Strength of the firm	1.000	.743
Number of competitors tendering	1.000	.729

Extraction Method: Principal Component Analysis.

Table 6.19: Communalities

From Table 6.18, the following factors: warranty issues (which might possibly create risks); contractor involvement in the design phase; the number of changes expected throughout the execution of this project; degree of difficulty considering delays; degree of hazard (safety); whether the project matches the company strategy and future; the need for work; historic profit; uncertainty in estimates; general overheads; and risk in fluctuation of material prices, were discarded as their communalities score was below 0.6. The remaining factors, which maintained the highest communalities, remained.

After discarding these factors, a new Principal Component Analysis was conducted and the Kaiser-Meyer-Olkin measure of sample adequacy was 0.940 and Barlett's test of sphericity significance equalled 0.000. Therefore, analysis could be performed on this set and a rotated-component matrix was produced. Table 6.20 identifies the indicator inside each component.

	Component											
	1	2	3	4	5	6	7	8	9	10	11	12
Equipment requirement	0.76											
Availability of equipment	0.74											
Labour requirement	0.73											
Supervisory availability	0.67											
Policy in production cost savings												
General overheads												
The current financial capability of the client		0.7										
Project terms of payment ((monthly/quarterly		0.69										
Project cash flow		0.66										
The history of client's payments in past projects		0.63										
Capital requirement		0.53										
Degree of difficulties in obtaining bank loan												
Size of client			0.7									
Owner / Client			0.7									
The client's requirements			0.61									
Completeness of the documents			0.6									
Tendering duration			0.57									
The project is matching the company strategy and future												
Project start time												
Project related contingency				0.65								
Design quality				0.6								

Warranty issues, which might possibly create risks				0.6								
Degree of difficulty considering delays, shortages			0.59									
Qualification requirements			0.52									
The amount of changes expected throughout the this execution of project												
Type of job												
Degree of hazard ((safety)												
Contractor involvement in the design phase												
Tax liability				0.77								
Risk of investment				0.68								
Policy in economic use of building resources				0.65								
Labour environment												
Availability of other projects					0.72							
The ratio of your firm's current market share to the expected or aimed share					0.6							
Current work load					0.59							
Uncertainty in estimate					0.57							
Confidence in workforce					0.52							
Identity of competitors						0.86						
Competition						0.81						
Number of competitors tendering						0.77						
Strength of the firm						0.74						
Contract conditions							0.72					

	1	2	3	4	5	6	7	8	9	10	11	12
Type of contract								0.69				
Government regulations								0.52				
Clarity of the work and specifications												
Return of investment									0.61			
Management of similar size projects in the past									0.54			
Need for work									0.51			
Reliability of company cost estimate									0.5			
Historic profit												
Economic condition										0.62		
Market's direction (whether it is declining, expanding, etc)										0.53		
Amount of possible upcoming profitable projects out for tender in near future												
Risk in fluctuation in labour prices												
Risk in fluctuation in material prices												
Number of Subcontractors											0.55	
Tendering method ((selective, open											0.53	
Location												0.57
Size of job												
Project duration												

Table 6.20: Rotated Component Matrix

From Table 6.20, it can be seen that the indicator inside each component was examined and only one indicator with highest communalities remained. However,

Also, factors that identified from interviews remained. As well, 'Size of Client' and 'Owner / Client' are remained as this two factors used as the main indicator including for the model and to determine contractors level of important for each factors.

6.7 Summary

This chapter aims to achieve one of the research objectives; that is to review and understand the factors that influence decisions on bidding mark-up size in Saudi Arabia. As a result of this questionnaire's findings, factors influencing bidding mark-up size in Saudi Arabia have been identified and can be used in the proposed developed model. Also, the information gathered from this questionnaire confirmed that contractors deal with a large number of factors which may influence their decisions.

As a response to one of research objectives to design and develop a bidding strategy model using contractors' information in order to support their decisions on mark-up size, contractor's characteristics (contractors' size, main clients) were explored and investigated. The difference in response between contractor types, based on contractor size and main client type investigated if there was a relationship between these main variables that can help to develop the proposed model.

Regarding the contractors' size, the results show that there are significant differences in the response of the level of importance for some factors that influence bidding mark-up size in Saudi Arabia. As a result, the response of small to medium contractors differs in comparison to large contractors.

Regarding the contractors' main clients, it shows that contractors' main client/ public customers' response differs from contractors' main client/ private customers'. A significant difference in response is the level of importance of factors influencing bidding mark-up size in Saudi Arabia among a contractor's main clients.

Table 6.21 presents the summary of total original factors that present in Table 5.2 for practical factors influencing bidding mark up size in Saudi Arabia for each group and summary of total retained from each group. Also, Table 6.22 shows the retained factors with level of importance.

Group	Original No. of Factors	Factors Retained
Client characteristic	3	3
Project finance	4	2
Contract	2	1
Project characteristics	18	7
Company situation	20	8
Economic situation	10	4
Project documentation	3	0

Table 6.21: Factors Retained for each Group

No.	Factors ranking up to important index formula	important index	No.	Factors ranking up to important index formula	important index
1	The current financial capability of the client	78.49%	14	Identity of competitors	72.31%
2	The client's requirements	78.20%	15	Project related contingency	70.92%
3	Owner / Client	77.57%	16	Management of similar size projects in the past	70.75%
4	Return of investment	76.56%	17	Policy in production cost savings	70.41%
5	Contract conditions	75.93%	18	Market's direction (whether it is declining, expanding, etc.)	69.11%
6	Equipment requirement	75.67%	19	Availability of other projects	68.48%
7	Qualification requirements	75.51%	20	The ratio of your firm's current market share to the expected or aimed share	66.50%
8	Size of client	75.25%	21	Amount of possible upcoming profitable projects out for tender in near future	65.24%
9	The project matches the company strategy and future	75.25%	22	Degree of difficulties in obtaining bank loan	64.69%
10	Degree of difficulty considering delays, shortages	74.41%	23	Policy in economic use of building resources	62.71%
11	Economic condition	73.15%	24	Number of Subcontractors	58.63%
12	The amount of changes expected throughout the execution of this project	72.43%	25	Tax liability	57.03%
13	Location	72.43%			

Table 6.22: The level of importance for retained factors

Finding from this chapter has been used in developing the proposed model in the next chapter.

Chapter 7: Development of the Model

7.1 Introduction

The factors influencing bidding mark-up size in Saudi Arabia have been identified in the previous two chapters and the process of how contractors determine the bidding mark-up size have been explored through research interviews.

This chapter is to introduce the proposed developed model, including the modelling procedure, based on findings and recommendations from the previous chapters.

Many researchers explored the bidding mark-up size decision and developed a bidding decision model to determine mark-up size. Some of these models were by: Friedman (1950s), Gates (1959, 1966), Stark (1968, 1972, 1974), Teicholz and Ashley (1978), Diekmann et al. (1982), Vickrey (1961), Cattell (1987), and Tong & Lu (1992). These models were not clear to contractors and they did not explore how the contractors' characteristics can affect the model.

 All developed models introduced a general model without a specification for contractors' characteristics. In addition, previous models did not introduce user-friendly computer-based models that helped contractors to enter the situation without exploring the mathematical equation.

Based on the above, the aim was to build a model that considered the bidding mark-up size decision and to develop a user-friendly computerized tool to support contractors to determine mark-up size in Saudi Arabia.

The proposed model will consider the following:

- Identification of contractor size and client types

- A method that provides information about project characteristics, project documentation, clients, the company situation, economic situation, project finance and contracts.

- Establishing the importance level of factors influencing bidding mark-up size with flexibility to modify it as appropriate.

- Establishing a method where contractors can explore their assessment of factors which influence bidding mark-up size.

In summary, this chapter presents the development process of the model that will help contractors to determine mark-up size and the process of developing a computer-based tool has been explored in this chapter.

7.2 The Model Methodology

The methodology used in developing the proposed model is illustrated as follows:

1. Identification of factors that influence the bidding mark-up size decision in Saudi Arabia:

   - A literature review has been conducted to identify factors that influence bidding mark-up size.

   - Qualitative interviews have been conducted to explore factors that influence bidding mark-up size decisions in Saudi Arabian industry.

- A quantitative questionnaire has been used to identify factors that influence bidding mark-up size and confirms the findings of interviews.

- A quantitative questionnaire has been used identify the level of importance for each factor influencing bidding mark-up size in Saudi Arabia.

2. Exploring the current bidding mark-up size decision process in Saudi Arabia:

   - Qualitative interviews have been conducted to explore the current process in how contractors determine mark-up size in Saudi Arabia.

   - Understanding how contractors set priorities in their factors that influence the bidding mark-up size decision.

   - Understanding how contractor size and client types affect factors influencing the bidding mark-up size decisions in Saudi Arabia.

3. Development of the proposed model:

   - Development of a method that allows contractors to assess factors which influence the bidding mark-up size decision, based on contractor characteristics.

   - Development of a method that allows contractors to illustrate the factors that influence bidding mark-up size decisions in Saudi Arabia.

- Development of a mathematical method to produce the proposed mark-up size percentage in competitive bidding situations, based on contractors' answers.

- Development of the above proposed model in a computer-based tool.

- Development a set of rules to ensure that the contractors' inputs are correct and to ensure that the computer-based tools are user friendly.

7.3 Development of the Model

The development of the proposed model is based on qualitative interviews and is the result of a questionnaire conducted during this study. The model was developed based on factors that influence bidding mark-up size in Saudi Arabia that were identified through interviews and a literature review. Based on suggestions and findings from the literature review, interviews and the questionnaire, the level of importance for these factors was calculated and the model was developed.

The general structure of the model can be divided into four phases. First phase identified the contractor size and client type (based on contractor characteristics). In the second phase, contractors considered the identification of level of importance for each of the factors, based on contractors and project situations. Phase three considered the identification of the contractor strategy in terms of the minimum and highest mark-up sizes to match company strategy to achieve their target in this bidding situation. The final phase presented the recommendations and mark-up size, based on the contractors' input (Figure 7.1).
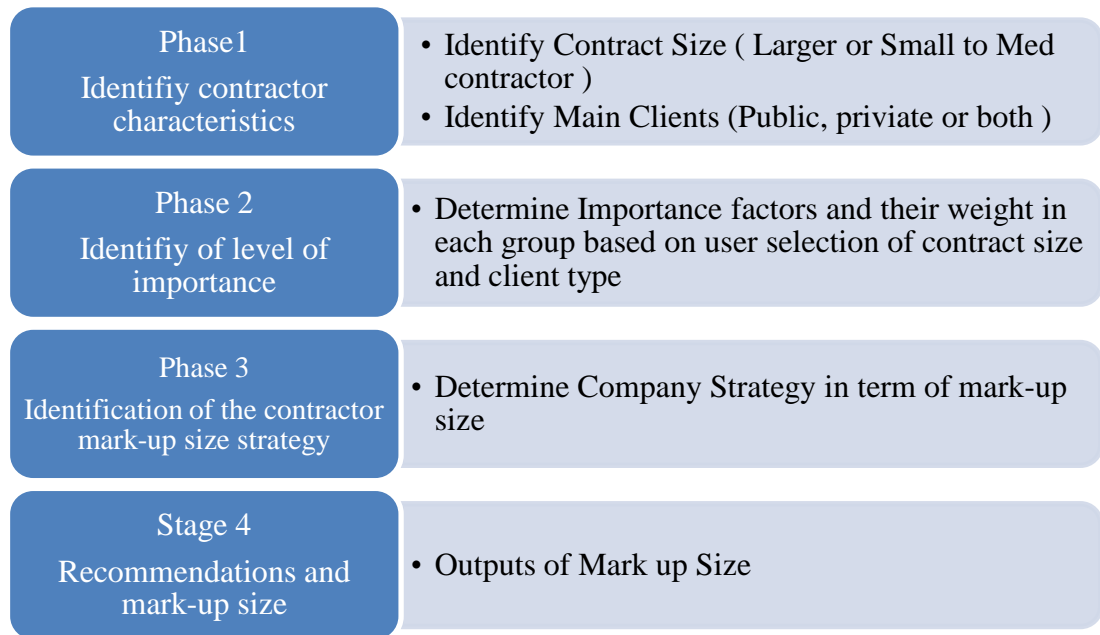
Phase 1 Identifiy contractor characteristics	• Identify Contract Size (Larger or Small to Med contractor) • Identify Main Clients (Public, priviate or both)
Phase 2 Identifiy of level of importance	• Determine Importance factors and their weight in each group based on user selection of contract size and client type
Phase 3 Identification of the contractor mark-up size strategy	• Determine Company Strategy in term of mark-up size
Stage 4 Recommendations and mark-up size	• Outputs of Mark up Size

Figure 7.1: Structure of the proposed model

All information entered by contractors and resulting recommendations will be stored in the application and it will be available for a contractor whenever he wishes to retrieve it. The developed bidding strategy model constructed a computer-based application that facilitates the process of determining mark-up size as one of the research objectives. The Active Server language was used to develop a dynamic website that can be accessed remotely by contractors in order to test and validate the model.

A details explanation of how to apply the proposed processes of the developed model within the constructed computer based application is included in the following section. The final application is designed using a computer scripting language called

ASP (Active Server Pages). ASP is Microsoft's server-side script engine for dynamically generated web pages. The researcher decided to use it mainly because the developed application will be easy to access to all contractors through internet.

The website (http://bidmarkup.net/) has been sent to potential contractors with login user names and passwords, in order to access the computer-based application. The first interface (Figure 7.2) of the application is as shown below presents the login page to the application:

Figure 7.2: Login page to the model

Figure 7.3 shows that contractors can continue to test the model or click the help link to read the concept and instructions for using the computer-based model.
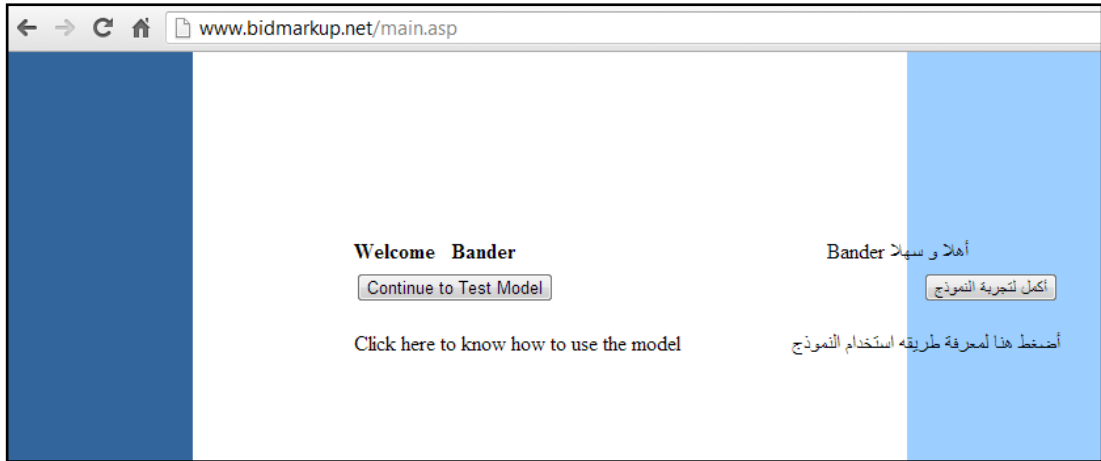
Figure 7.3: Test model screen

In the first phase of the developed model, contractors identified their size and client type. This is an important procedure in the model as this will affect the level of importance of the factors which influence bidding mark-up size in Saudi Arabia. From previous chapters, one of the main findings confirmed that the level of importance significantly differed based on contractor's size and type of client. Figure 7.4 shows the question presented to contractors in order to identify the contractor's size and type of client. Meanings for these categories were explained to contractors in the help and instruction section.
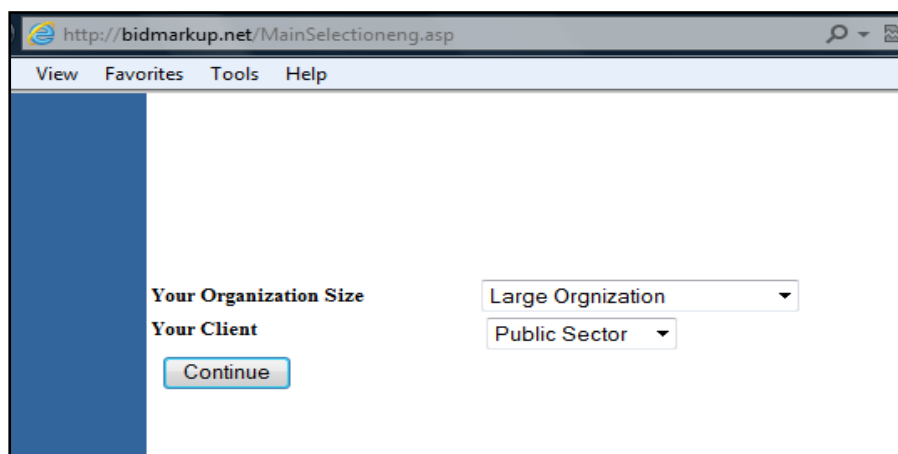

Figure 7.4: Contractors login page to the model

The level of importance of factors influencing the bidding mark-up size in Saudi Arabia differs according to the contractor size, as presented in Table 6.12. Six contractor types were based on contractor size and main client type for these factors. From the results of the questionnaire, Table 7.1 presents the level of importance for factors influencing the bidding mark-up size in Saudi Arabia, based on contractor size and main client type that will be used in this model.

Factors	Small to medium size and public sector	Small to medium size and private sector	Small to medium size and both sectors	Large size and public sector	Large size and private sector	Large size and both sectors
The current financial capability of the client	71.88%	77.13%	80.57%	70.83%	85.61%	79.02%
The client's requirements	77.08%	79.07%	77.04%	73.33%	85.61%	79.32%
Owner / Client	73.96%	77.13%	77.70%	65.00%	81.82%	80.51%
Return of investment	69.79%	75.19%	76.60%	73.33%	81.06%	79.61%
Contract conditions	70.14%	74.42%	77.04%	65.00%	72.73%	80.06%
Equipment requirement	76.04%	75.58%	73.95%	75.83%	78.03%	77.38%
Qualification requirements	75.69%	75.19%	74.61%	70.83%	81.06%	76.49%
Size of client	72.22%	76.74%	73.51%	69.17%	81.06%	78.27%
The project matches the company strategy and future	66.32%	71.71%	75.06%	76.67%	82.58%	79.02%
Degree of difficulty considering delays, shortages	72.57%	71.71%	73.73%	73.33%	75.76%	77.08%
Economic condition	68.40%	73.26%	74.50%	65.83%	72.73%	74.70%
The amount of changes expected throughout the execution of this project	72.22%	66.67%	72.08%	68.33%	71.21%	76.19%
Location	77.08%	71.71%	71.74%	64.17%	71.21%	73.36%
Identity of competitors	70.14%	64.34%	75.72%	62.50%	70.45%	73.81%
Project related contingency	67.36%	70.54%	71.52%	67.50%	68.18%	72.92%
Management of similar size projects in the past	72.22%	72.48%	74.28%	75.00%	77.27%	77.23%
Policy in production of cost savings	64.58%	68.22%	70.75%	64.17%	75.76%	73.36%

Factors	Small to medium size and public sector	Small to medium size and private sector	Small to medium size and both sectors	Large size and public sector	Large size and private sector	Large size and both sectors
Market's direction (whether it is declining, expanding, etc.)	63.19%	68.60%	67.22%	70.00%	71.97%	73.66%
Availability of other projects	64.93%	64.73%	68.10%	65.83%	78.03%	70.54%
The ratio of your firm's current market share to the expected or aimed share	63.19%	65.50%	64.90%	66.67%	69.70%	69.79%
Amount of possible upcoming profitable projects out for tender in near future	61.81%	62.79%	66.00%	64.17%	68.94%	66.07%
Degree of difficulties in obtaining bank loan	68.40%	62.79%	64.46%	56.67%	65.15%	65.48%
Policy in economic use of building resources	56.25%	63.57%	64.79%	56.67%	60.61%	63.84%
Number of Subcontractors	53.47%	57.36%	58.06%	55.00%	60.61%	62.35%
Tax liability	52.08%	58.53%	57.95%	51.67%	55.30%	58.63%

Table 7.1: Level of importance of factors for different contractor types

7.4 The Input of the Model

The developed model required contractors to confirm the identification of the level of importance for each of the factors, based on the contractor type selected. However, the contractor had the possibility to amend the level of importance for each factor considered in this model, based on the contractor's situation.

The contractor was asked to provide an answer for each factor in this model in order to identify the contractor's situation in this project.

The input in this phase was based on the contractors' response for each of the factors identified in this model. These factors were grouped as: project characteristics, client characteristics, company characteristics, economic situation, project finance and contract. The contractor selected the most appropriate choice that illustrated the contract situation for this factor, based on the project situation. As a result, Table 7.2 presents the factors which influence bidding mark-up size in Saudi Arabia with their choices that were used in developing this model:

Factors	How the factors were presented	The input data / the choices available
The current financial capability of the client	The preferable client financial capability	High risk to low risk
The client's requirements	The clarity of client requirements	Clear Partly clear Not clear
Owner / client	This main criteria in the beginning of the model	This question is from the beginning of the model
Return of investment	The risk or return of investment	High risk to low risk
Contract conditions	The clarity of contract condition	Not clear to clear (5 levels)
Equipment requirement	The availability of equipment requirement	From easy to get it, to very difficult to get it (5 levels)
Qualification requirements	The satisfaction of the organization with project qualifications required	High qualification required Average qualification required No qualification required
Size of client	The level of preferable size of client matched with company strategy	Small client / large client this is from beginning of the model
The project matches the company strategy and future	The preferable project match with company strategy	Total match to unmatched
Degree of difficulty considering delays, shortages		
Economic condition	The general economic condition in the area	Going up, stable, going down
The number of changes expected throughout the execution of this project	Preferable project design quality that matches the objectives	Expect major changes Expect minor changes No changes
Location	The preferable location for the project	Many projects in the same location Single projects in the same location Another project near the location No project near from the location First time in this location

Factors	How the factors were presented	The input data / the choices available
Identity of competitors	The identity of competitors in this project	Know and have better chance to win Know and has lower chance to win Unknown
Project-related contingency	The degree of risk for project-related contingency	High risk to low risk (5 levels)
Management of similar size projects in the past	The experience of managing similar projects	No experience in similar projects Fair experience Experience in similar projects
Policy in production of cost savings	The requirement of policy in production cost saving	No policy There is a policy but it is not required Required
Market's direction (whether it is declining, expanding, etc.)	The level of market direction	Declining, no change, expanding
Availability of other projects	The level of availability of other projects	Many other available to no other project available
The ratio of your firm's current market share to the expected or aimed share	The level of market share	From below company strategy to above company strategy
Amount of possible upcoming profitable projects out for tender in the near future	The number of possible upcoming profitable projects out for tender in the near future	Many projects to no projects (3 or 5 levels)
Degree of difficulties in obtaining bank loans	The degree of requests for loans from banks for projects	Very difficult to easy
Policy in economic use of building resources	The requirement of policy in economic use of building resources	Required, no policy, not required
Number of subcontractors	Number of competitors	Many subcontractor available Few subcontractors available No subcontractors available
Tax liability	The level of tax	No tax , fair tax, high tax

Table 7.2: Factors considered with their input

The contractor was asked to answer these questions, based on input provided, in order to illustrate the contractor's situation in this project for the factors which influence bidding mark-up size in Saudi Arabia considered in the developed model.

Figure 7.5 presents the computer-based screen model which allows contractors to confirm the level of importance for each of the factors considered in this model and gives the possibility to change the level of importance, based on contractor's situation. Figure 7.5 also shows all the input required data to be entered by the contractor.

Include	Question	Weight	Answer
✓	The amount of changes expected throughout the execution of this project	0.7121	Expect Major changes ▼
✓	Qualification requirements	0.8106	High qualification Required ▼
✓	Degree of difficulty considering delays shortages	0.7576	Expect Major Delay ▼
✓	Project related contingency	0.6818	Very High Risk ▼
✓	Equipment requirement	0.7803	Easy to find the required equipment ▼
✓	Location	0.7121	Many project in the same location ▼
✓	Number of Subcontractors	0.6061	Many Subcontractor avilable ▼
✓	The clients requirements	0.8561	Clear ▼
✓	The project is matching the company strategy and future	0.8258	Overall Project match with Company strategy ▼
✓	Management of similar size	0.7727	No experience in similar project ▼

Figure 7.5: Presented factors with input choices

The contractor entered the input value in this stage, and all entered information was saved in the computer-based application for retrieval later. In order to ensure that the contractor completed the required input for each factor considered in this model, the following rules were in place:

- Contractor cannot proceed to the next phase until all required data is entered and validated.

- Contractor has the possibility to modify the level of importance for one or some factors considered in this model. In this case, the level of importance of factors obtained from the questionnaire result will be neglected.

- Entered value by contractor for level of importance for factors considered in this model is validated.

- Contractor has the possibility to neglect one or more factors if it is required in his situation by removing the tick for the factor.

After contractors completed the answers for each factor considered in this model, the contractor inputs were considered in the calculation to assess mark-up size for this project.

However, contractors were asked to enter the company strategy in terms of minimum and maximum mark-up size required, in order to gain a profit from this project, and whether this matched the company's strategy overall.

Figure 7.6 presents the question for minimum and maximum mark-up size that was considered for this project.

Figure 7.6: Presented factors with input choices

Figure 7.7 shows a sample of the result screen. However, once the contractor completed this stage, the computer-based model will show the contractor all his input with the recommended mark-up size for this project. This information can be printed out in order to review it or for it to be distributed to other decision maker for review. The result include the project mark which include the minimum mark calculated based o factors weight and mark assign for each factors while the maximum mark is the same factors weigh when the highest grade assigned for each factors based on contractors input. The Project Mark is calculated based on actual customer input and each input has a specify grade for each factor.

Welcome to Result

Project Number	{431E0341–5DC3–4980–A3DE–C95929CF18C3}
Contractor Min. Mark up size Strategy	23.0 %
Contractor Max. Mark up size Strategy	50.00 %
Project Mark	39.4663
Project Min. Mark	15.3333
Project Max Mark	49.2
Recommendation Mark up size	23%

Figure 7.7: Sample Result Screen

7.5 The Mathematical Equations

The developed model for bidding mark-up size began with the development of a mathematical method to determine mark-up size recommended to contractors, based on the contractor's situation and input for this project. A utility theory method was used to design the developed model in order to determine mark-up. This method was used by Ahmad & Minkarah, (1988). Each input had a utility function which was then combined with a level of importance for each factor to form a single utility curve. Below:

$$u(x) = \sum_{i=1}^{n} k_i u_i(x_i) + k \sum_{i=1, j>i}^{n} k_i k_j u_i(x_i) u_j(x_j)$$
$$+ k^2 \sum_{i=1, j>i, l>j}^{n} k_i k_j k_l u_i(x_i) u_j(x_j) u_l(x_l)$$

$$+ \dots + k^{n-1} k_1 k_2 \dots k_n u_1(x_1) u_2(x_2) \dots u_n(x_n)$$

Where u is normalized between 0 and 1, ui(xi) is a normalized single attribute utility function, k_i is the scaling constant for the single attribute utility function, and K is a scaling constant that is the solution to $1 + K = \prod_{i=1}^{n} (1 + K k_i)$

The project mark is calculated based on contractors' input for each factor. Each factors has level of important and each factors input has specific grade. When customer completes the inputs for all factors, the total project mark will be the total sum of each factor level of importance multiply by grade of input of this factor. While the minimum mark calculated based o factors weight multiply by minimum grade can be assigned for each factor and the maximum mark is the similar by

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calculating the sum of total factors weigh multiply by maximum grade can be assigned for each factor.

7.6 The Output of the Model

The final stage of this model is the output result. The computer-based model is designed to deliver the report that contains all contractors' inputs and company strategies in terms of minimum and maximum mark-up size for the project and the results of the recommendations of mark-up size that can help the contractor to take the decision in terms of what mark-up size to use for the project. The report covers three aspects of evaluation, which are the following:

- Input from the contractor for each factor with level of importance

- Company strategy in terms of mark-up size range for this project

- Bidding mark-up size recommendations based on contractor input

The report shows the final recommendation decisions on the mark-up size for this project. The contractor can take his final decision by judgment and the result of this computer-based model. Figure 7.8 presents an example of the recommendation report.

Welcome to Result

Project Number	{431E0341–5DC3–4980–A3DE–C95929CF18C3}
Contractor Min. Mark up size Strategy	23.0 %
Contractor Max. Mark up size Strategy	50.00 %
Project Mark	39.4663
Project Min. Mark	15.3333
Project Max Mark	49.2
Recommendation Mark up size	23%

Factors	Answer	Weight	Grade
The amount of changes expected throughout the execution of this project	Expect Major changes	0.6833	2.0499
Qualification requirements	High qualification Required	0.7083	2.1249
Degree of difficulty considering delays shortages	Expect Major Delay	0.7333	2.1999
Project related contingency	Very High Risk	0.675	3.375
Equipment requirement	Easy to find the required equipment	0.7583	0.7583
Location	Many project in the same location	0.6417	0.6417

Figure 7.8: Sample of output screen

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Chapter 8: Testing and Validation

8.1 Introduction

This chapter aims to report the testing and validation of the developed computer-based bidding model that help contractors to determine mark up sizes in Saudi Arabia. Testing and ensuring the accuracy of the proposed developed model is essential for using the output of this research in practice in industry, and to ensure that the developed model is not limited to use in an academic environment.

The sensitivity and confidentiality of the contractor data affects the pay in from the contractor when it comes to testing and validating the model. However, in order to overcome this difficulty, the following method has been used in order to test and validate the computer-based model:

- Test the workability of the computer-based model
- Testing and validation through the use of individual contractors

8.2 Testing and Validation of the Developed Model

In order to test the computer-based model for use by individual contractors, the model has been tested to ensure it works properly and to meet the model's requirements. The following tasks have been tested by two students to ensure the workability of the model:

- Ensuring the input validation.

- Amending the level of importance of the influence for a number of factors when bidding for the mark up size

- Ensuring that no errors occurred during the process of completing the assessment of the factors

- Ensuring the correctness of the model's outputs resulting from the mathematical equations used.

In testing the workability of the computer-based model, all errors and issues have been corrected in order to ensure that the computer-based model is ready to be tested by Saudi Arabian contractors.

However, based on the feedback and comments, the computer-based model works as designed, which means that testing and validation can be proceed to the next stage using individual contractors.

8.3 Validation and Testing Results using Contractors

The testing and validation of computer based model has been performed by Saudi Arabia contractors. All contractors who participate in previous questionnaire and provide their contacts in order to test the model have been contact at this stage.

Each one of them has been provided with user name and password to access the website through the internet and given two weeks to test and validate the model.

The testing of computer based model by participant can be monitored through the application, in order to check if participant test the model and inputs their comments and feedback.

Nine participants tested the model and provided their feedback and comments through the application and through email

Interview Number	Job Title of Interviewee	Company Size	Main Client	No. of Tested Projects
1	Project Manager	Large	Public	9
2	Project Manager	Large	Both	2
3	Project Manager	Large	Private	5
4	Owner	Large	Public	2
5	Project Manager	Large	Both	1
6	Project Manager	Small to medium	Private	5
7	Project Manager	Small to medium	Both	6
8	Project Manager	Small to medium	Both	2
9	Project Manager	Small to medium	Private	3

Table 8.1: Profiles of participants

From the participants' feedback, we can see that they are in agreement with the recommendations for the bid mark up size, and agree that this could help them in their day to day job.

Also, it was found that some participants had removed the tick from 'considerable factor' in the model and had changed the level of importance for some factors based on their individual situation.

In term of general comments from the contractors who participated in testing and validating the model, it is clear that they are interested in having a computer-based model, and they responded positively. However, in the following sections we will consider both the strengths and weaknesses identified by the contractors in terms of the computer-based model.

8.3.1 Strengths

The strong points of the computer-based model can be summarized in the following list created from the responses of those who participated in the testing and validating process:

- It is an excellent model that could save 75% of the time needed for bid mark up preparation

- It needs greater customization to be used in day to day work

- It will help the contractor to save time

- The model's results can help the discussion involved in determining the mark up for the project

- The contractor can arrive at a decision quickly.

The feedback from the contractors and the identified strong points support the value of the developed computer-based model as a tool which can help contractors to determine the mark up size for projects in Saudi Arabia. In terms of the identified strong points, the aim of the research to develop a computer-based model that helps

contractor to arrive at mark up decisions and support their judgment, has been achieved.

The model show that it can save contractors' time in terms of arriving at decision with regard to the bidding mark up. Also, it was found that the model can be customized to the individual contractor's needs to better aid them to arrive at a decision as part of the bidding mark up process.

8.3.2 Weaknesses

The weak points of the computer-based model can be summarized as in the following list:

- It requires many inputs and is difficult to follow

- The user needs more detail about how to use the model

- There is a need to enhance the Arabic terminology in this model

- Some factors are not listed in the input. However, the participants state that it is important to have a weighting for these factors in the decision making process.

- It is very difficult to use this model.

The feedback from the contractors in terms of the weak points is useful with regard to improving the model. These aspects should be taken into consideration in order to understand the barriers involved in using the computer-based model.

The above-mentioned weak points are very important. For example, with regard to the point about the need to enhance the Arabic terminology in this model, a greater understanding of the contractors' culture and terminology is required in order to customize the Arabic model for them and to make it easy to use.

However, regarding the other point that some factors are not listed in the input, while the participants assume it is important to have a weighting for these factors in his decision making, the factors considered in this research were based on the questionnaire study. However, there is a need for a degree of flexibility for the individual contractor allowing him to add or remove factors and to set the level of importance. Consequently, the best way in which to deal with these factors would be to study each contractor separately to customize the model to fit his particular situation.

Nevertheless, other points such as difficulty in using the model or that the model requires many inputs before the contractor can determine the mark up size seems to be points which are common when any new tool or model is introduced, and it will take some time before the contractor becomes used to working with the model.

In general, a better explanation and the provision of training with a detailed user manual for the model will be necessary. These, and each factors and examples being attended to, will lead to the provision of a better computer-based model that will lead the contractor to better decisions in term of determining the mark up size.

The suggestion for the improvement of the model in term of enhancing the Arabization is a valid one. Suitable training and a better explanation of the model could be considered to ensure the optimum use of the model in practice by the contractors.

8.4 Summary

The testing and validation of the proposed computer-based model has been conducted using two different methods due to the need for confidentiality in terms of

the contractors' data. These methods are testing the workability of the model and for individual contractors to test and validate the model. The first method aimed at checking the workability of the model is to ensure that the developed model works as designed, without users finding errors and by confirming that the output result is as designed by the mathematical equation. This was a prerequisite to proceed with the testing and validation involving individual contractors.

The testing and validation through individual contractors was to validate the computer-based model using contractors' actual projects and data. Nine contractors participated in this validation process and provided their comments in terms of the model's strengths and weaknesses.

It was found that the contractors who participated in testing and validation had an interest in using the model to aid them in arriving at a suitable bidding mark up size in order to contribute to the practical performance of the contractor. Also, it established a mechanism for recording the contractors' project evaluation in terms of the bidding mark up size and sharing contractor's project evaluation mechanisms with the decision making team.

Some participants identified the same weaknesses in the model, such as the need for a more extensive explanation of the model and a user manual, plus the difficulty of use. These points could be taken into consideration in enhancing the proposed model, in order to ensure that the user obtains maximum advantage from the use of the model in actual practice.

In general, in order to promote the model as a tool which can aid contractors, top management level should promote, increase the level of awareness and knowledge inside the company about the value of using the developed model, and should ensure

that proper training is given for everyone who participates in the bidding mark up

process.

Chapter 9: Conclusion

9.1 Introduction

This chapter aims to detail the conclusions from the research; its achieved aim; limitation; recommendations for further work; and contribution to knowledge. The previous chapters explored the development model to determine the size of the mark-up and carried out the testing and validation of the model.

The importance of the research's aim and objectives were confirmed through literature reviews. This research explored, through literature reviews, the factors which affected the bidding mark-up in Saudi Arabia. These factors were identified by conducting a preliminary study through interviewing Saudi Arabian contractors from. By using a questionnaire, distributed to Saudi Arabia contractors, these factors were weighted and ranked according to their level of importance.

Based on the contractors' size and their main clients, the factors, which influenced the bidding mark-up in Saudi Arabia, were studied and explored. With regards to the contractors' sizes, it was found, from their responses about the importance of some factors, that there were significant differences, about some factors which influenced the size of the bidding mark-up size in Saudi Arabia. Therefore, the responses, from small to medium sized contractors, differed in comparison to large contractors.

On the other hand, it was found that, based on their main types of clients, contractors responded differently. It was found that, amongst a contractor's main clients, there was a significant difference in their responses in terms of the level of importance of the factors influencing the size of bidding mark-up in Saudi Arabia.

At the end, twenty five factors were identified as the main factors which influenced the size of the bidding mark- up in Saudi Arabia. These were used to develop the proposed model.

However, literatures reviews were carried out, also, in order to explore the Saudi Arabian contractors' behaviours in determining the process of the size of the bidding mark- up. Interviews were conducted with contractors to explore their behaviours and processes. Many contractors agreed that judgment and experience played a major role in determining the size of the bidding mark-up and research found that some other Saudi Arabian contractors were using techniques to determine the size of mark-up . However, in general, it was found that judgment and experience were the most common methods used to determine the size of mark- up size in Saudi Arabia and many Saudi Arabian contractors did not follow any process to determine the size of the mark-up . Nevertheless, in order to achieve the research aim, a bidding strategy model was developed to enhance the business outcomes and to help Saudi Arabian organisations to determine their sizes of bidding mark-ups. The interviews, conducted in this research, were considered in order to find answers to how these factors could be used to develop a competitive bidding model which could help contractors to determine the size of mark- up.

The literature reviews explored several bidding models which helped contractors to determine the size of the mark-up for their projects. In practice, most of these models were not used because it was found that the model was complex and did not match with the Saudi Arabian market. However, based on literature reviews, a direction was identified for this research; this helped to develop proposed a model to determine the size of mark-up. Interviews and a questionnaire helped to understand

and develop the proposed model to assist Saudi Arabian contractors in determining the size of the mark-up.

In order to achieve this research's objectives and to progress this model successfully to practical use, the model was constructed as a computer-based application which, as defined in proposed model, facilitated the process of determining the size of the mark-up.

However, after developing the model, Saudi Arabian contractors were asked to examine the proposed model in order to ensure that it worked, as designed, and to ensure that, in practice, they could use the model simply Saudi. In the following section, the proposed model and its validation methods are explored in order to ensure that, as designed, the developed model works.

9.2 Model Development and Validation

Based on the above findings from literature reviews and interviews, the factors, influencing the size of the bidding mark-up, in Saudi Arabia, were identified and the country's existing process, of determining the size of the bidding mark-up, was explored in order to develop the proposed bidding model. Next, a computer based model was developed using Active Server Pages. The built model took account of the following items:

- Identification of contractor size and client types.
- Provision of information about project characteristics; project documentation; clients; the company situation; economic situation project finance; and contracts.

- Based on contractor size and client types, contractors set up the level of importance of factors influencing the size of the bidding mark-up.

- Contractors could explore their assessment of factors which influenced the size of the bidding mark-up.

Different methods were used to test the computer-based model to ensure that it worked properly and fulfilled its requirements.

The first method was used to ensure that the model worked properly. Students used different approaches to test and ensure the input validation; to amend the level of importance of the influence of a number of factors; to ensure that no errors occurred during the process of completing the assessment; and to ensure the correctness of the model's outputs.

It was found that the model worked properly and was ready to be validated by Saudi Arabian contractors.

Nine participants, from Saudi Arabian contractors used the other method to validate the computer based model. These participants tested the model and provided their feedback and comments through the application and through written emails.

It was found that the proposed model could help contractors, in their day to day activities, and save them time in determining the size of mark-up. Also, it was established clearly, from the participated contractors' positive responses, that they were interested in having a computer-based model.

9.3 Meeting the Aim and Objective of the Research

This research aimed to develop a bidding strategy model to enhance the business outcomes in order to help Saudi Arabian organisations, determine their sizes of bidding mark-ups. The aim was achieved through developing the proposed model based on the literature reviews; the preliminary study's findings; interviews; and a questionnaire.

The factors, which, for Saudi Arabia contractors, influenced the size of the bidding mark-up, were identified and, then, their level of importance was obtained. Also, there was recognition of the contractors' behaviours in determining the size of mark-up. The multi criteria approach was used to develop the purpose of the model and the final computer based model was designed using Active Server Pages.

This research's overall aim (chapter 1 section 1.3) was implemented. The following explain the implementation process of the research objectives.

Objective One was to define the characteristics of bidding models through a literature review and empirical research.

The research began with the literature review which defined the characteristics of the bidding models. It was found that the characteristics, of bidding models for type of Saudi Arabian contractors and their main clients, affected the setting of the priority of the factors influencing the size of mark-up.

Objective Two was to review and understand the factors which influenced decisions, in Saudi Arabia, on the size of the bidding mark-up.

At this stage, a literature review was carried out to identify the factors, which influenced the size of the bidding mark- up in Saudi Arabia; and interviews were conducted in order to identify the Saudi Arabian factors which influenced the size of the bidding mark-up. It was found that, in Saudi Arabia, there were twenty five factors which influenced the size of the bidding mark-up; these could be considered in developing the proposed bidding model. Also, in the responses about a contractor's main clients and the contractor' size, it was found that there were significant differences regarding the level of importance of some factors which influenced the size of the bidding mark-up in Saudi Arabia.

Objective Three was to investigate and examine the use of a multi-criteria approach or other decision-making methods in developing a bidding strategy model.

At this stage, a literature review was carried out to explore the previous models and to investigate different decision-making methods. Also, interviews, with Saudi Arabia contractors, were conducted in order to understand their current processes and the decision-making methods used to determine, in a competitive bidding situation, the sizes of their mark-ups. It was found that most contractors used judgment and experience to determine the size of their mark- ups. Also, they were interested in having a systematic method to help in making decisions about the size of the mark-up.

Objective Four was to design and develop a bidding strategy model which could be used for contractors' information in supporting their decisions on the size of mark-ups.

In developing a bidding strategy model, based on the interviews; the findings from the questionnaire; and according to the contractors' information, the contractors' size

and main clients were used to identify the contractors' characteristics. The level of importance was applied and assigned based on the contractors' two main characteristics from the considered factors identified in objective two.

Objective Five was to construct a computer-based application which facilitated the process of determining the size of mark-up as defined in Objective Four.

At this stage, we used Active Server Pages to construct a computer-based application of a database to establish the recording and evaluation of contractors' based levels of importance for considered factors which were based on contractors' characteristics. Contractors identified their strategies, in terms of the minimum and maximum size of the mark-up, to match, in competitive bidding situations, their company strategies.

Objective Six was to examine the proposed strategy model with organisations in Saudi Arabia which obtained their work or a percentage of it through competitive bidding.

At this stage, we used different examination methods, of the proposed model, to test its workability and to examine if it worked properly in a contractor's competitive situation. It was found that contractors were interested in establishing a mechanism for recording their project evaluations in terms of the size of the bidding mark- up and, as a tool, in helping them to share project evaluation mechanisms and in determining the size of the mark- up.

9.4 Research Limitation

This research's aim was to develop a bidding model which could help contractors to determine the size of the mark-up. As explored in the literature review, in the

previous chapters, it was difficult to aim to develop a perfect bidding model. Developing this model involved a process; the factors influencing the decision; contractor's characteristics; and output requirements. Therefore, the final proposed model, presented in this research, had the following limitation:

- The model considered only two contractor's characteristics; namely specifying the user when it was both analysed and developed (contractor's size and main clients). From the questionnaire, other contractor characteristics, which could be used in the model, were such as the percentage of work obtained through bidding.

- There was no investigation as to the accuracy of the assessment of the contractor's situation for the factors which were considered in influencing the size of the bidding mark-up size. It was based on user input.

- The proposed model was developed based on data collected from Saudi Arabia contractors Therefore, the considered factors and their level of importance were suitable for Saudi Arabia contractors.

- The proposed model was examined by nine contractors; further testing and enrolment of the model, in practice, was required to prove its validity.

9.5 Recommendation for Further Research

As a result of this research, there were a numbers of areas which could benefit from further research. These are as follows:

- Considering the impact of other contractors' characteristics when specifying the user model and studying and analysing the relationship between other contractors' characteristics which could be involved in designing the model and considering the factors influencing the size of the bidding mark-up.

- Enhancing the model to integrate with contractors systems in order to assess the factors considered in influencing bidding mark-up decisions and in determining contractors' mark-up strategies.

- Examining the model for gulf countries and checking their suitability since they have similar environments to Saudi Arabia.

- Using the existing model as recording mechanism for contractors' project evaluations in terms of the sizes of the bidding mark- up size and using the data with different methods to determine the size of the mark-up.

- Studying the different contractor's behaviours, in determining the mark-up process, before and after using the systematic proposed model.

9.6 Contribution to knowledge

This research's main contribution was the development of computer based model which could help contractors to determine, in competitive situations and in day to day job activities, the sizes of their mark-ups. Compared to the previous models, the proposed model improved the considerations in deciding on the factors which that determined the size of the mark-up. These improvements were:

- In bidding, the model, with minimum input, could help contractors when making decisions about the size of the mark-up.

- The model considered the contractor's strategy for the size of the mark-up.

- The model considered contractors' two main characteristics (contractor's size and main clients).

- The model did not require mathematical skill or historical data.

- The model could help inexperienced contractors to determine the size of the mark-up.

- In bidding, the model could help contractors to establish a mechanism for recording the contractor's project evaluation in terms of the size of the mark-up.

- The model could help contractors to establish knowledge sharing of a contractor's project evaluation mechanisms and, as a tool, could help the sharing of information, between a contractor's team when determining the size of the mark-up.

In terms of the first question: "What were the factors which affected bidding mark-up in Saudi Arabia?" The research findings and conclusion answered the research questions. From the literature review, the interview findings; and the results of a questionnaire, the research was able to explore and identify the factors which influenced the size of the bidding mark-up in Saudi Arabia and established a relationship between these factors and contractor's characteristics.

In terms of second question "How did contractors behave when setting the priority for these factors in Saudi Arabia?" It was discovered that contractors' behaviours were based on their judgment and experience in determining the size of the bid mark-up. However, it was found, also, for Saudi Arabia contractors, that the contractor's characteristics affected the setting of the priorities for factors which were considered to influence the size of the bidding mark-up.

In terms of the third question "How could these factors be used to develop a competitive bidding model in order to help improve the performance of contractors?" the answer was based on contractors' feedback after examining the model. It was found that contractors were interested in using the model in order to determine the size of the mark- up and to save time in their daily activates. However, the model's main contribution to the contractors was to enhance the performance of contractors in terms of saving contract time in their daily activates. Also, it established a mechanism for recording the contractors' project evaluation in terms of the size of the bidding mark- up sharing, within an organization, contractor's project evaluation mechanisms.

The developed model could be generalised for Saudi Arabia contractors since it was developed based on the data collected from Saudi Arabia contractors, Also, the model was flexible in adapting to the considered factors and their level of importance. Therefore, in competitive situations, the model could be generalized to help to determine the size of the mark-up.

9.7 Reflection on Learning

Personal interest, in the research, was the rationale for selecting the research topic. Investigating decisions about the size of the bidding mark-up provided the research with an opportunity to explore and understand how Saudi Arabian contractors behaved when determining in competitive situations, the size of the mark-up. Also, performing this research provided the researcher with knowledge to conduct academic research including a range of knowledge about carrying out a related literature review; selecting proper research methodology; collecting and analysing data; developing a structured document; and more.

The thesis was a useful journey and valuable to the researcher. It provided him with much knowledge which was characterised by depth and richness. During this journey, the researcher published, at international conferences, three papers and two posters.

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APPENDIX 1

Interviews Questions Form

Bidding Interview

Person and Company profiles

Person Name	
Position	
Experience	
Company sector	
Company Size	
Project size	
Bidding Type	

Q1

Talk about Bidding Process and how organization determines mark up size?

Q2

Discuss about factors influencing bidding markup size decision.

Q3

How your organization determine markup size decision in bidding process?

Q4

Is they using any tool or mathematical tool / is they need any tool?

Q5

How the process can be improved? Any suggestion , Recommendation ?

APPENDIX 2

Interview Transcript

Interview 1

Interviewer: First of all let me introduce myself to you. My name is Bander Nourah and I am a PhD student at The University of Manchester. I am conducting research regarding the bidding mark up size, and factors that influence contractors to set their mark up size in order to win the contract or bid.

Before I start talking about the subject, kindly let me know your experience in detail, if possible.

Interviewee: Thank you for inviting me for this interview. My name is Mansur Almourai. I have worked for an oil and gas company for more than 8 years as a project manager with 300 employees. In our bidding process we only deal with an approved vendor list, and I am responsible for around 8 million SAR budget, for purchasing through the bidding process.

Interviewer: Can you explain to me about bidding, and how the bidding process is conducted in your company?

Interviewee: The bidding process in our company is not much different than any other company. We start by sending a request for proposal from our selected vendor list. When vendors send their responses in a sealed bid, our vendor management team opens the sealed bid and selects the lowest price.

Interviewer: From your experience, and relationship with vendors, what factors do you believe influence the bidding decision and bidding mark up size, from vendor point of view.

Interviewee: From vendor point of view, the top factors affecting their decision could be: criticality of job, resource availability, organisation standard profit margin, owner, payment history, requirement design and the other factors, such as government enforcement. However, there are other factors where people guess it is very important where it is not, such as the possibility of a change request is not an important factor in bidding decisions.

Also, there are factors that help to have a better decision, such as site visit and job explanation.

Interviewer: How do they make a decision in the bidding process? Bid or no bid, and mark up size?

Interviewee: In this stage of bidding process I do not have the practical experience, but I assume that will mostly be based on experience and judgment.

Interviewer: Anyway, do they use any tool, or mathematical tool, or do they need any tool?

Interviewee: No mathematical tool in place and most organisations take their decision based on their judgment, and the many other factors that can affect their decision. Some of them have an excel sheet to evaluate this, and some of them, they just take the decision based on their judgment. Each organisation has their own way to make their bidding decision.

The company usually thinks about driving price for profit with good relations and other factors is fine, but profit and margin increase is the first choice to make money.

Interviewer: How the processes can be improved?

Interviewee: The current process mostly depends on senior management judgment. However, a procedure to follow and evaluate the bidding mark up size, based on company situation, maybe able to help

Interviewer: Thank you Mansur. Before we end the interview, would you like to add anything more regarding the process of setting bidding mark up size?

Interviewee: Thank you it was nice to meet you. Nothing more to be added.

Interview 2

Interviewer: First of all let me introduce myself to you. My name is Bander Nourah and I am a PhD student at The University of Manchester. I am conducting research regarding the bidding mark up size, and factors that influence the contractor to set their mark up size in order to win the contract or bid.

Before I start talking about the subject, kindly let me know your experience in detail, if possible.

Interviewee: Majed Kohaj, I have ten years experience in bidding processes as a sales engineer with 1,000 employees in the power industry. We participate in a sealed bid where the lowest price wins the bid. Our annual average winning bid is about 1 billion SAR

Interviewer: Can you explain to me about bidding and how the bidding process is conducted in your company?

Interviewer: Regarding the factors that influence bidding mark up size, from your point of view, which are the factors that can affect bidding mark up size from the 60 factors provided?

Interviewee: All these factors are very important when we participate in bidding. All of them have similar weight in our decision. However, some other factors are more important, such as customer payment history, scope of work and number of contracts. To explain more for you, sometimes before we participate in the bid we check who the competitor is, because sometimes we have already used one competitor as a subcontractor in our bid price. So we have to understand this very well and maybe it could affect our total price and some competitors, as they do not have overhead costs. Other factors such as type of job, area "Tadrees" , Competitor strategy based on my current work, Number of Competitor. Type of Competitor, Overhead, and competitor overhead. Qualification required, people buy document, some time buy the document and do not want to subscribe, required time for project.

Low profit based on resource overhead, payment history of client and his availability of cash.

As well, project start date is a very critical factor where this affects availability of resources, labour, availability of equipment, and number of projects in the same region. For example, last month we got a project and they required it to start one week after the winning the bid. This could affect everything, such as the whole delivery time, due to a short time to allocate resources and equipment. Where we prefer the project start time, it should be based when the customer gives us access to the site.

Interviewer: As you know there are different types of customer, such as public and private customers. Do you deal with them in a similar way, in terms of bidding mark up size, or differently?

Interviewee: That's correct, customer type affects the bidding mark up size. When we deal with a public customer they have fixed terms, while the private sector has flexibility to discuss terms, project execution and project delivery date, while in the public sector these terms cannot be negotiated.

Interviewer: Does this mean that only terms and condition are the main factors in dealing differently with these types of customers?

Interviewee: These are the main factors in dealing with differing mark up sizes. Other factors have the same importance as these factors. However, sometimes if we have had a bad history with previous customers, we do not participate in his bidding the next time

Interviewer: Do you have any other important factors that you would like to add to the bidding mark up size decision?

Interviewee: The 60 factors provided, almost cover the most important factors in bidding in industry in Saudi Arabia.

Interviewer: If we categorised these factors into groups, which groups are more important, such as clients, project documentation, contract terms and scope, company situation, economic situation, competitors and project characteristics? How do you rank these groups of factors in terms of affecting the company decision in setting mark up size, and how does your strategy affect that?.

Interviewee: All of these groups are important. You cannot rank it, but let us say that the important one scope of work which mean project characteristics because without know project characteristics you can not evaluate the mark up size, then who is the competitors. As well the company situation and it is work need.

Interviewee: Also, I am looking to know who is going to fund the project, and who is going to pay the payment? For example, it could be a public project, but it can be funded by the private sector.

Interviewer: How does the company set the mark up size?

Interviewee: The team estimator calculates the project cost and the department manager judges the mark up size based on the situation.

Interviewer: How does the department manager set the mark up size? Does he have any tool or does he rank factors and evaluate the risk and changes in price and labour cost? Can you explain more?

Interviewee: All of these are correct. All of these factors can be changed in rank, but their importance are the same. The risk is important here, as well as the size of the project and payment terms.

Interviewer: Last question, do you think if we develop a tool to help contractors set their mark up size, based on these factors, this could help add benefits for contractors based on company mark up size strategy?

Interviewee: Yes, it is a good idea. For sure.

Interviewer: Most probably, if I develop this tool I will send a link for you to test.

Interviewee: Okay. No problem.

Interviewer: Last thing, do you have anyone you can recommend, so I can conduct the same interview with him?

Interviewee: From our company or another company? I will think and come back to you via email.

Interviewer: Thank you.

Interviewee: Thank you.

Interview 3

Greeting

Interviewer: First of all, let me introduce myself to you. My name is Bander Nourah and I am a PhD student at The University of Manchester. I am conducting research regarding the bidding mark up size, and factors that influence contractors to set their mark up size in order to win the contract or bid. In Saudi Arabia most contractors participate in the bid in order to win contracts.

Before I start talking about the subject, kindly let me know your experience in detail, if possible.

Interviewee: Ahmad Hwswi, department manager with more than 11 years experience.

You are talking about mark up size. In our company the mark up size is decided by top management level.

Interviewer: What are the factors influencing bidding mark up size? Is it company strategy or top management judgment, or there are other factors?

Interviewee: Yes, all of these could be correct, or you can add there is a target agreement internally. For example, management have internal agreements for mark up size with headquarters. If you can participate in this project, and at the same time you can manage to maintain the internal target agreement, you can participate in the bid. But if the project has a strategic approach or entrance into a new market in this case the mark up size could be changed. All of these depend on sector, and change from one sector to another. There are major projects in this sector but we have to compare our bid price from region to region, and from one country to another.

Interviewer: Does that mean if you have projects in a specific region, you can reduce your mark up size in this region for future projects in the same region?

Interviewee: Yes, sure, it also affects the absolute value, where the volume is driven with volume you can generate growth

Interviewer: Can I know what affects your decision in setting mark up size? Does client type affect your decision?

Interviewee: It is not usually true, this does not always affect the bidding mark up size, but the important factors are the competition and the internal target agreement, where the company does not accept below x% as mark up size for any project. Therefore, I cannot participate in bidding less than the internal agreement. Our internal agreement strategy is based on the market and this can change yearly.

Interviewer: Can you identify the top factors that influence your decision on bidding mark up size, and elaborate on your internal mark up size agreement?

Interviewee: First of all, the market price level, which includes competition. Secondly, existing integration based on the new project or system. The customer, I cannot say is critical, but it should be added, but not as significant. Also, the market entrance, if you would like to invest there in order to win other projects in that area. Other factors are internal management approval. For example, shareholders of the company can say that they do not want to sign a contract less than x% as mark up size, but let us say that this one of the major factors.

Interviewer: Does that mean you do not care about winning more projects, if you win strategic projects?

Interviewee: No, our target is based on order take (volume), revenue (turn over), profit and cash flow, and all of these are link to each other.

Interviewer: Last year one of contractors won more projects than your company, but gained less profit than your company.

Interviewee: This is depends on company strategy, where they can take more orders with less mark up size and generate profits, or their strategy is to take less orders with a higher mark up size to generate the same profit. For example, I cannot go below less than mark up size, but I have to take a minimum number of orders which is a difficult equation to maintain. And there is a different strategy between company strategy and project strategy. Project strategy can be affected by the market and you have to maintain the company's overall strategy.

Interviewer: You told me that the client is not very important for you because you deal only with approved customers.

Interviewee: Actually, we know our customers, and we know the sectors we are dealing with and our end users.

Interviewer: Is there any history with your customer in terms of payment, scope of work, do these affect your bidding mark up size decision?

Interviewee: Sure, but this is not based on the risk analysis such as payment delay, which means a final cost will be added. We identify our risk evolution and bid mark up size separately, to make sure that you are very clear when you work in the project, you should not exceed the risk evolution during the excisions of the project. And the mark up size will be very clear. If I do not use the risk during the project, it will be added to the mark up size by the end of the project

Interviewer: This is very new and important information. Can you explain how you calculate this in your biding price?

Interviewee: The risk factors will be part of cost, not in mark up size, and this how we believe we should the calculate the bidding price.

Interviewer: What about contract and project documentation, how important are these for you?

Interviewee: These are very critical factors. We maintain the mark up size based on our internal agreement and the terms of the project.

Interviewer: Can you explain to me the process of how you determine the project mark up size, after your team calculates the project cost? Is that correct, and how do you actually determine the mark up size and is it the final mark up size?

Interviewee: We have a process. The estimation team will calculate the cost of the project taking into consideration the risk. Then after that, the sales team proposes the mark up size based on the market for this project. After that, it comes to me as department manager based on the value of the project. The mark up size should be signed by a department manager or higher level. if the mark up size does not comply with company strategy.

Interviewer: Okay, the important thing for me is how to set mark up size, not the approval process. For example, in your talk you said that the sales team proposed the mark up size based on the market. How do they determine the mark up size?

Interviewee: It depends, let us be clear. It depends if it is an extension project or a new project and what option he has, and as well he knows that we cannot go below the mark up size. And after that, we discuss the project, if it is strategic project, and I judge that we need to lower the mark up size, based on the strategy of the department and company to justify it.

Interviewer: If we talk about the same project, the cost and documentation of it, and instead of going to sales manager X it went to sales manager Y, would both of them determine the same mark up size systematically, or could each one of them determine a different mark up size?

Interviewee: It depends, from person to person for sure, with the same project documentation and project cost. But we have a limit in that everyone would like to gain more profit, but everyone cannot exceed the mark up size. You have to limit the lower mark up size and there is no maximum limit.

Interviewer: Currently I am working on a bidding model from your practice, do you assume there is any room for improvement in terms of determining the mark up size?

Interviewee: Yes, market transparency, competition level, if you talk how we can do it systematically, or determine mark up size, it is a very wide range and we cannot make one judgment for estimation.

Interviewer: If there is a model ready to use through a website, are you interested in using it? Or could this tool help you in your work?

Interviewee: It will be interesting, but not sure if I can use it in my entire project. We can try it, but our method can be more accurate that a tool. It will be difficult to use the tool to determine mark up size and take this tool to the next level, but you need to make sure this tool is accurate.

Interviewer: The tool will not be the final market decision. As you know the sales manager proposes mark up size and you are able to change it. This can be in the tool as well, the tool will be an aid for the decision.

Interviewee: We have something similar to this tool and we used to get special approval if we did not maintain the internal agreement. In this tool it would be like a questionnaire, which we fill in, if the customer deals with us for the first time; do we have experience, documentation, liabilities, etc? This will evaluate the risk of the project and somehow will be applied to the process.

Interviewer: In the real market, not all companies follow a system and your tools are not shared by all other markets. When we have the same tool tested by your company, as a generic tool, that will add a credit for the tool itself.

Interviewer: Do you have another recommended person to perform the interview with?

Interviewee: Yes, you can contact Naif. Thank you for your invitation.

Interviewer: Thank you.

Interviewee: Thank you.

Interview 4

Greeting

Interviewer: First of all let me introduce myself to you. My name is Bander Nourah and I am a PhD student at The University of Manchester. I am conducting research regarding the bidding mark up size, and factors that influence contractors to set their mark up size in order to win the contract or bid. In Saudi Arabia most contractors participate in the bid in order to win contracts.

Before I start talking about the subject, kindly let me know your experience in detail, if possible.

Interviewee: Eng. Naif, I have 12 years experience seven of it in the engineering field, and five of them in the sales department. Currently I am the GM of the company. I can give you a brief about the company. We are a dealer of many vendors. We have three divisions, one for project, service and the last one for parts. We sell only for major customers in Saudi Arabia and also we deal with contractors and sub-contractors. My area is related to sales with low risk, because I used to work in the parts document with very low mark up size, where in the project they can reach 50%, 60% or 70% as mark up size.

Interviewer: You raised a point. In a project they deter a high mark up size due to risk. My question here, are you adding your risk to cost, or mark up size?

Interviewee: Okay, we add all our risk factors in the mark up size based on our judgment, and we try to reduce this risk by our relationship with customer and vendors. We reduce the risk also by entrance on the project where there is almost is a minimum risk. Usually, when we forecast the item of project, we add the risk value in mark up size.

Interviewer: What about your mark up strategy, do you have internal agreement for mark up size?

Interviewee: Actually, we do not reach this point. We have a target in terms of money, then during the year we distribute this overall to future projects during the year. But also, this depends on the competition and sometimes customers create the competition to reduce the bid price. And in this case, sometimes we know the competitor and agree with them regarding the minimum mark up size.

Interviewer: How do you set your mark up size?

Interviewee: First of all, we calculate our cost and we have to cost approach, one with delivery and the other one without delivery, then we add the mark up size. And customers do both calculations to compare which is cost effective for him. Also, there are other factors that affect mark up size. When we offer a price with delivery, we increase the mark up size in order for the customer to select the price without delivery. This helps us to avoid any additional work and overhead.

Interviewer: If we have different categories for the factors that affect the mark up size, such as project documentation, contract, project finance, company situation, economic situation and clients, from your point of view what are the top three groups?

Interviewee: Okay, do you want us to go through all factors, it is better for me and I would like to add comments for each factor. Let us talk about the type of work. This affects the mark up size, and based on company strategy and the required type of work, it will affect the mark up size. Also, regarding the value of contract or job, when the value of contract increases the mark up size it will be very low, and this is usually what happens in work and it could be only 1%. We have different mark up sizes based on the scale of the value of project. The warranty after the delivery, this does not affect our company because we do not give any local warranty, but there will be a warranty by external parties with no extra cost to the customer. Also, some

other factors are not applicable to us, such as the designing phase or participation in the design phase. This is only when a customer requires a design based on his requirement, and the customer will have usually proposed the design with the required quality. In this area the mark up size will be high, because it requires knowledge and know-how skills. The customer usually involves the top contractor in writing the proposal for the project, before participating in the opening bid.

Interviewer: How does client payment history and strength of the customer determine mark up size?

Interviewee: Yes, sure the customer payment history is very important. Also customer name and number of projects per year will affect the mark up size for his project, in order to be one of his approved list contractors. And as the customer usually has a mega project, we will try hard to win his contract with a very low mark up size, to enter his contractor list and win him as customer. Also, if I would like to enter a new market I would do the same.

Interviewer: Regarding contract condition, type of contract and clarity of work. How does this affect you?

Interviewee: This could happen rarely. Not all customers are the same. Some customers are not sure what the best fit for his requirements are. This needs a discussion with the customer to understand his needs, and make sure that we can fit his requirements. This could lead to increasing the mark up size in order to avoid miscommunication later on, and to maintain the risk if we have a different understanding.

Interviewer: How does the economic situation around you affect the decision of mark up size?

Interviewee: Actually, in Saudi Arabia now, we are booming and for sure it is slowing down with the current global economic situation, but all of these are recovering fast. So, it was only a slowdown period, but as usual, at the end of the year, all customers request us to participate in the budget for next year. And this cannot be the same behaviour for next year, and we cannot plan for this to happen each year. We do not feel that the economic situation can affect our decision on mark up size.

But also, rumours affect our mark up size decision, because if we hear that the government could stop spending we try to make sure we win a contract by reducing mark up size. But if we know there are many projects in the market, we can increase our mark up size because there will be a shortage of resources in the market.

Interviewer: In practice, what is the process to determine mark up size x before submitting your bid price?

Interviewee: We calculate our finance cost including materials, shipment, insurance and all other items, and this will be as a percentage. Here, when we come to the mark up size, the customer type and customer history affects the bidding mark up size, and this could be a fixed mark up size based on customer history and customer type. Sometimes we have special requirements, which can increase the mark up size due to customer need and there is no competition in this area. This could be changed by the risk. We can talk and we try to avoid any risk through agreement between us and the

customers. all of these if we do not have history of winning price before it will be more assumption with taking care of these assumption.

Interviewer: Are you using a systematic tool or software for determining mark up size ?

Interviewee: We do not have a tool but we have historic data for all wining bids for our previous jobs. So we can review our historic bids before we set the bidding price for a new job.

Interviewer: This is one way of determining mark up size. The main objective from this interview is to develop a tool that can evaluate these factors, in order to estimate the mark up size for the project and can work in wide range of projects. This can be used as support tool for the decision maker.

Interviewee: Right, this can help if it can win the target value of the bid for the company.

Interviewer: Thank you for your time. It was long interview with you. Appreciate your time and effort.

Interviewee: I was glad to support you. Thank you.

Interview 5

Greeting

Interviewer: First of all let me introduce myself to you. My name is Bander Nourah and I am a PhD student at The University of Manchester. I am conducting research regarding the bidding mark up size, and factors that influence contractors to set their mark up size in order to win the contract or bid. In Saudi Arabia most contractors participate in the bid in order to win contracts.

Before I start talking about the subject, kindly let me know your experience in detail, if possible.

Interviewee: Ahmad worked in sales and the execution department for projects and MRO, for about five years. Usually our customer request for quotation is prepared by our sales department, then it is moved to our engineering department to calculate the material required, time of work and overhead, and to add the mark up size to the quotation.

Interviewer: My question is how do you add your mark up size?

Interviewee: This depends on the scope of work, client type, the client's history and previous quotation history with them.

Interviewer: Is your mark up size fixed in all projects?

Interviewee: No, for example, the percentage could be the same but the value will be different for example 10% of 100,000 SAR is not equal 10% of one million. This depends on the scope of work, clients and labour, so it is all depends on cost, quality and many other factors. The mark up size decision is affected by all of these factors in general.

Interviewer: For example, if you have two projects for a big client and they have a similar scope of work, are your going to have same mark up size?

Interviewee: Actually, it depends on the cost of project, the percentage of mark up size could change the value of the job. If you increase your mark up size above the market , the customer will easily find another competitor who can do the same job with a lower price.

Interviewer: What is your competition in the market and how do you set your mark up size with the competition?

Interviewee: From the history in the market I can estimate the competitor bid price.

Interviewer: How you can compete "against"?? these competitors?

Interviewee: I can lower my price in order to win the bid. Actually, I calculate my cost and overhead, so this is the price which I cannot go below. This price will allow me to continue in the market without profit, but build an entrance into the market.

Interviewer: Do you decide the mark up size systematically, or just use your own judgment?

Interviewee: We calculate our cost based on material, labour and then we add a percentage as overhead, then we have another percentage as mark up size.

Interviewer: My question, how do you determine your mark up size?

Interviewee: This mark up size is based on company strategy, but also the market factors can increase or decrease the mark up size.

Interviewer: Okay, how do you set your mark up size percentage between minimumand maximum mark up size?

Interviewee: When we talk about percentage of mark up size, the percentage itself it will be different based on the volume of work. Also, the scope of work is very important to determine the mark up size. Sometimes the customer says that we cannot accept a price above this limit. So we can understand the market. Depending on the market we can increase or decrease the bid mark up size based on internal agreement and discussion.

Interviewer: If the manager decides to have x percentage mark up, and the manager changes before submitting the project price, can the other manager assume a different bid price?

Interviewee: This could be from miscommunication. This is a personal judgment and usually top management should be involved and usually there is internal agreement for lower and maximum mark up size. However, in our company, for example, we can submit a bid price for a project that has more than one phase, and one of these

phases could have a zero mark up size. When you are dealing with the customer, the customer type can affect the mark up size.

Interviewer: The factors can be categorized into groups, from your point of view which groups are more important for you to determine mark up size?

Interviewee: Here financial cost is not as important as in Europe. In our approach we add all our risk for materials; labour will be added to the cost itself, so, if risk happens in the project it will not take from the mark up size, so the safety factors can be changed to benefit at the end of the project, if they were not used.

Interviewer: How do the terms of the contract affect your mark up size decision?

Interviewee: There are some conditions that can affect the cost and calculation of the cost. What happens if costs increase due to terms of the contract? This could decrease the percentage of mark up size, because you have already added to the cost.

Interviewer: When do you set the percentage of mark up size, at the end of the evaluation or from an early stage?

Interviewee: No, this will be at the end of the evaluation. It is also depends on the target.

Interviewer: How does the company situation and economic situation, market and other group can affect the decision of mark up size?

Interviewee: External factors affect more than internal factors, because they are more controllable than external factors. Also, the terms of conditions of the customers.

Interviewer: I would like to know the ranking of factors which are important, as you said competition is very important.

Interviewee: The second is project details. As well, the region of the project could affect the cost, which leads to lower the mark up size in order to win the job.

Interviewer: Does that mean your costs can be higher than other competitor costs, when you go to a different region?

Interviewee: Yes, that is correct but I can add more benefits to the project such as warranty.

Interviewer: Last question, mark up size depends on different factors and managers sometime decide by judgment or excel sheet. Do you guess if we had a tool that could help a manager to decide the mark up size?

Interviewee: No, because this tool will not be linked to external factors, so the tool will not be aware of the situation in the market and it will be waste of time. Material and labour price can change all the time, and company strategy can change at any time. This tool can work in the USA or Europe but in not our region. Their culture accepts a systematic tool, but in Saudi Arabia or the Gulf this may not work.

Interviewer: Thank you for your time and accepting the interview with short notice.

Interviewee: Thank you.

Interview 6

Greeting

Interviewer: First of all, let me introduce myself to you. My name is Bander Nourah and I am a PhD student at The University of Manchester. I am conducting research regarding the bidding mark up size, and factors that influence contractors to set their mark up size in order to win the contract or bid. In Saudi Arabia most contractors participate in the bid in order to win contracts.

Before I start talking about the subject, kindly let me know your experience in detail, if possible.

Interviewee: I am Abdulrahman, working on a project related to an IT service bidding project.

Interviewer: Can I know how you add your mark up size in this project, after you calculate your cost?

Interviewee: Each project has a different process. For example, is it our specialism and there are many other factors such as size of customers, new market entrance, or is it a repeat project?

Interviewer: If we talk about the seven groups of factors that affect bidding mark up size, such as project documentation, economic situation, etc.

Interviewee: Each group you talk about affects the mark up size, and there is no clear way how these affect the mark up size. However, setting mark up size differs from one company to another. From my practical experience there is a judgment and internal agreement inside the company about the percentage of mark up size. This is the way to set the mark up size, but there is no clear approach to set the mark up size taking into consideration the competition. After we calculate the cost we can add the percentage of mark up size, and sometimes after we do all of that, we re-evaluate the whole project and find this price is acceptable to win the job

Interviewer: During your setting mark up size, there are other risk factors, are you adding your risk cost in bidding mark up size or in the cost?

Interviewee: We add these risk factors in the cost as a contingency plan and this will be part of the cost.

Interviewer: Do you have any strategy in the company that defines the lowest and highest mark up size for any project?

Interviewee Oh… , in sales no, we do not have this. Usually we have a target and we set our mark up size based on the target. So if we can reach our target by increasing the mark up size, and it is still below the competition we will do.

Interviewer: When you review the project document and cost, before setting the mark up size, do you have in your mind a specific mark up size? Or do you do some evaluation?

Interviewee: Usually, I can add 20% as mark up of the project, but after that I have to think about if this bidding price can compete the others, and can I win the job, but this is what we usually do.

Interviewer: What is better for you, to win more projects with less mark up size, or win less projects with higher mark up size? Which is best?

Interviewee: True, I worked with both types of company. It depends on the strategy of the company. This is a subjective topic, and I agree with more projects with a lower mark up size to generate volume. But all of these depend on the overall company target and strategy. The company will have a strategy and if it is followed there will be no problem in any one of these approaches.

Interviewer: In setting mark up size is there any tool or excel sheet? And what is the context of it, how do you use it ?

Interviewee : We have an excel sheet, but only to calculate the cost, we do not have a weight system. If you create this tool this could help us and we would gladly test it. This tool should be like the factors and we can evaluate these factors, which should be based on company strategy. And this should be make our life easier.

Interviewer: How does the manager decide if this is the correct mark up size or not? Is it affected if it is a different manager?

Interviewee: If it is a different manager, sure the mark up size will change, because it is based on his experience, his relation with the customer and market. Our market is based on relationships, it is does not matter about your skills, it is about who you know. This is our culture and this how you can sell.

Interviewer: From your point of view, what are the top five factors affecting the mark up size decision, and what is your recommendation to improve or speed up the process of deciding mark up size?

Interviewee: For the factors question, it is customer type and customer size ... and my ability to do the work and … you need the factors that affect the mark up size decision ... sure, the competitors are very important. However, regarding setting the mark up size, it is not systematic, so a systemic approach is needed and a system to calculate the mark up size. And also we can set a limitation for mark up size.

Interviewer: We found that there is no standard to set up mark up size in Saudi Arabia, and we are trying to build a systematic approach, utilising factors to evaluate the situation to set mark up size for your project, and based on your mark up size decision.

Interviewee: We appreciate your work and if we like the tool we can improve it.

Interviewer: Thank you for your support. Appreciate your time and effort.

Interviewee: If you need anything else let us know and we can help.

Interviewer: Thanks.

Interview 7

Greeting

Interviewer: First of all, let me introduce myself to you. My name is Bander Nourah and I am a PhD student at The University of Manchester. I am conducting research regarding the bidding mark up size, and factors that influence contractors to set their mark up size in order to win the contract or bid. In Saudi Arabia most contractors participate in the bid in order to win contracts.

Before I start talking about the subject, kindly let me know your experience in detail, if possible.

Interviewee: Zyad from Ticko company. In our company we work as sub-contractors, that is we work under the contractor to avoid a representative in Saudi Arabia, and also to get benefit from the contract relation. For more than 11 years in the field.

Interviewer: When you provide a bidding price for your contract, how do you add your mark up size?

Interviewee: Ok this could has but but, for example, when the customer requests the bidding price from the contractor, the contractor will send the request to us. For example, if it is less than $50,000 we will tell our contractor that you have a commission of these amounts, and in our sales department and we have a factory that produces the product required by customer. Each factory sells internally to the sales department based on product and country. When the price is received by the sales department, that already has a factory mark up size. We will add mark up size based on company strategy and based on product when there is no competition. When there is competition, we reduce our mark up size.

Interviewer: You said that you have two main clients for your business. Do you deal with them in same way, or there is a different way when you set the mark up size?

Interviewee: both type of clients we are deal with and most of our customers will get the same price. When they get a similar contract with our required customised engineering. And our clients usually required to customized product with consultancy and factory include our mark up size. And in Mega project our customers required budget re-quotation as Engineering department So, in this case, the mark up size at this stage, you have to add a higher mark up size for clarification, time factors, and price change. When questions arise, the general quotation will become clear, and in this case the scope will be agreed between us and the customer. Then the customer can send the office purchasing order and our contractor will get a percentage from our subcontract bidding price.

Interviewer: As you are working internationally, factors can affect mark up size are the change in exchange rate, labour cost etc… are you add this risk as different factor or you add all of these changes to mark up size?

Interviewee: No, all of these add to mark up size. We do not feel risk with dollars but we feel risk with euro. Sometimes we request to get the quotation from the factory in dollars.

Interviewer: Is there any reason to increase your mark up size or decrease your up size?

Interviewee: First of all competition, and after that entrance in a new market. Sometimes I will have 0% mark up in order to enter a new market.

Interviewer: Does the market direction affect your mark up size?

Interviewee: If there is a boom in business this could lead to increase the mark up size, but it all depends on competition. And we have to know which project to enter and which project not.

Interviewer: Next question, I would like to know how you set your sales mark up size, based on competition, entering a new market etc., is there is a formula?

Interviewee: Actually, this is ready from our main branch on an excel sheet we cannot change. If we need to decrease the mark up size then we have to get top management approval.

Interviewer: what is the excel sheet include?

Interviewee: it is having fixed factory price, packing material, delivery point cost, documentation of paper.

Interviewer: All of these are costs, but until now I cannot see your mark up size? How do you set it?

Interviewee: Based on the factors we discussed. Actually, someone calculates the cost and we know that some products are expensive so we reduce mark up size, and this decision is taken by senior management who base their decision by considering the competition.

Interviewer: We discussed many factors and about the bidding mark up process and how management take their decision. Do you think if there was a tool to help these managers take their decision on mark up size? Such as a weight system?

Interviewee: If you talk about the Saudi market it is different than other markets, including the Gulf countries. Competition here in Saudi Arabia is high, but if you talk about an alert system then that may help management and employee. But when "you"?? talk about zero mark up size we discuss internally with our top management.

Interviewer: It was nice talking to you. Thank you.

Interview 8

Greeting

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mark up size in order to win the contract or bid. In Saudi Arabia most contractors participate in the bid in order to win contracts.

Thank you for accepting the interview.

Before I start talking about the subject, kindly let me know your experience in detail, if possible.

Interviewee: Eng. Zaid I am from the sales team, and it is the department manager and I who set the mark up size and we have a systematic way to calculate the cost and the mark up size. We calculate our cost on material, labour, overhead, and we input all of these in software, then after that we add a mark up size based on the project size and the scope of the work.

Interviewer: My question here, Are you adding a risk to the cost before the mark up size?

Interviewee: We add our risk cost as a separate cost under the risk of the project.

Interviewer: You already have the software to calculate the cost but how you determine the mark up size?

Interviewee: It depends; the main factor influencing the mark up size is the size of the project itself. The percentage of mark up size will be based on each item in the project, so we do not add an overall mark up size for the whole project. I can provide you with a template to calculate the project cost and how to set mark up size.

Interviewer: You said that your main factor to determine the mark up size, is the size of the project, is that everything?

Interviewee: No, there are many other factors such as competition, project start date, project duration, region of the project and especially the size of the project. Also it depends if it is a private project or public project.

Interviewer: How do you determine these projects and link it to your decision?

Interviewee: Actually, I add these factors as overhead or additional cost in my cost calculation. But in no project will all of the factors affect the bid mark up size.

Interviewer: Do you think that software, containing these factors and evaluating factors related to the project, can support the decision in setting mark up size?

Interviewee: Yes, this can help if all factors are added to this software with a point from one to ten. I have an idea regarding what you are talking about and this could help and support the decision.

Interviewer: Are you doing the same for both types of client?

Interviewee: Actually, we look to gain profit and we never have 0% mark up size.

Interviewer: From your experience, what do you feel can help a company determine the mark up size?

Interviewee: I assume that the best approach to determine the mark up size is that we have a systematic programme containing all costs and all items, in order to have better understanding of the expected mark up size as a support decision tool.

Interviewer: There are two ways of setting the mark up size (overall project or for each item), what is your approach?

Interviewee: We put our mark up size based on each item.

Interviewer: From your experience, what could be done to improve the process of determining the mark up size in the company?

Interviewee: As I told you I have two ideas. First of all, software to calculate the cost, and the second one is software to calculate the mark up size based on the evaluation of factors we discussed before.

Interviewer: Do you have an internal agreement for mark up size from the beginning of the year?

Interviewee: Yes, the construction management from the beginning of the year have a target profit, and based on it we can determine our mark up size later on.

Interviewer: Do you have a sub-contractor from your contract, and how does it affect your mark up size?

Interviewee: We know from the beginning that we will have a sub-contractor, so we add a small mark up size for the sub-contractor job.

Interviewer: Thank you Eng. Zaid I appreciate your time.

Interviewee: Thank you. We are glad to answer your questions.

Interview 9

Greeting

Interviewer: First of all let me introduce myself to you. My name is Bander Nourah and I am a PhD student at The University of Manchester. I am conducting research regarding the bidding mark up size, and factors that influence contractors to set their mark up size in order to win the contract or bid. In Saudi Arabia most contractors participate in the bid in order to win contracts.

Thank you for accepting the interview.

Before I start talking about the subject kindly, let me know your experience in detail, if possible.

Interviewee: Mr. Salah. In general, I work in construction and building.

Interviewer: I would like to know, in more detail, how you determine the mark up size for the project.

Interviewee: Usually we set up mark up size based on couples of points experience, top management decision , additional overhead. Also, we set the mark up size, not in a systematic approach, but based on the judgment from a decision maker.

Interviewer: I have a question here, you set the mark up size based on your experience and you set x for specific project, how do you set this x from your experience?

Interviewee: I am from a medium size company, so the x percentage is decided based on my competition. The x percentage depends on other factors, such as our labour, the region of the project. We do not have expertise requiring additional cost.

Interviewer: I can figure from your talk that you determine mark up size based on your experience, but from your talk you raise several factors that affect your decision, and these factors can change from one project to another.

Interviewee: Yeah, that's correct.

Interviewer: Is your mark up size affected if you deal with different types of customers?

Interviewee: Yes, that's correct. For example, a private client may not pay the final payment, so I will increase the mark up size.

Interviewer: In my research we trying to build a model that utilises the factors that can support determining the mark up size, such as project size and region of work. Do you guess this can work?

Interviewee: Can you repeat your question, what do you mean exactly?

Interviewer: To explain it more.

Interviewee: I will help you. I have two bidding situations, the first one I add a 20% mark up size, whereas the another one was 35%, and this is mainly due to the different region of the project.

Interviewer: Do you have any recommendations that can support the decision of determining mark up size, in order to avoid the different opinions in setting mark up size?

Interviewee: We have cases where the project scope, size and region are similar but we set different mark up sizes, all of this depends on the customer's profile and history. The customer affects the mark up size, not the type of customer but his history. From one customer to another we have different mark up sizes.

Interviewer: From your experience, how we can improve the process of determining mark up size and make it more systematic?

Interviewee: Do you have an option here?

Interviewer: Actually, if you have two managers you will find each one determines the mark up size differently than the another one. How do they determine the mark up size?

Interviewee: Okay, the mark up size is affected by our need of work.

Interviewer: Do you guess if there was software that could evaluate these factors in order to determine mark up size, do you assume this could help the company?

Interviewee: Yes, that can help. This is not available here and sure it will help.

Interviewer: Last question for you. You said that determining mark up size has different approaches and ways, do you mean that this is like a game?

Interviewee: Yes, it is game. For example, we determine a very high mark up size for one project because we know the competitor set a very high mark up size and we won the contract.

Interviewer: I am in a process of developing a software support company to determine their mark up size based on the evaluation of factors.

Interviewee: I forget to tell you that the important factors for setting mark up size is the scope of work and strength of the competitor. And we will not go to bid where we cannot beat the competitor. And if there is company, which has high overheads I will participate in the bid. And also, we ask about our competitor in order to know how they can bid and set their bidding price.

Interviewer: This concept is true and we can call it game theory. Thank you Eng. Salah.

Interviewee: We thank you. We are very interested in your research.

Interview 10

Greeting

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Thank you for accepting the interview.

Before I start talking about the subject, kindly let me know your experience in detail, if possible.

Interviewee: Mr. Adnan, with 36 years experience in the field.

Interviewer: I would like to know more from your practical experience how you determine mark up size.

Interviewee: There are many factors that affect how we determine our mark up size. First of all there are internal company factors, secondly, the project itself, and thirdly, the owner of project, all of these factors affect the mark up size. For example, when the company won many project and there is a shortage in resources then we increase the mark up size, and when the project is important for the company we reduce the

mark up size. Also, when the owner of the project has a good customer payment history the mark up size will be lower than other customers who usually delay the payment. This how we control our risk. Also, there are other factors that affect the mark up size, which is the competition in the bid. Are they the same size or are have they overheads or not, so we can decide how we can determine our mark up size.

Interviewer: When a project comes to your company, how do you determine the mark up size, considering all these factors. Is it through a system or meeting?

Interviewee: This decision is a strategic decision, so no one takes this decision alone. We will have details of the cost analysis and the total cost of this project, which we cannot go below. The regular mark up size x will be increased or decreased after evaluating these factors through a scoring system. Everyone works to win the job and gain money. Also, we evaluate our risk of project delivery and contract terms, and the documentation of project, as well our estimation of the project before we decide our final mark up size.

Interviewer: Does that mean for each project you will have a team who sit together to determine mark up size?

Interviewee: Yes, for each project a team will sit and opinions will be shared and discussed with a team leader. This discussion can take more than one meeting before we decide on which mark up size. We have a system we follow in order to determine mark up size.

Interviewer: Are you looking for information, who is the competitor and market direction before determining mark up size?

Interviewee: Yes, for sure, we discuss the main factors, but there are many other factors. In construction, project material and labour also play a major role in mark up size, because material prices change from time to time during the project execution.

Interviewer: Is your risk added to the cost or to the mark up size?

Interviewee: Actually, we add our risk to the cost of material.

Interviewer: When you set your cost do you put it for each item, or overall for the whole project?

Interviewee: We set our mark up size for the whole project including the finance cost. Then we add our mark up size.

Interviewer: From your experience, how we can improve the process of determining mark up size decision?

Interviewee: When the market is easy with no competition, it will be easy to determine mark up size, but when there is competition a lot of research is required before determining mark up size. Also, this includes the economic situation.

Interviewer: You told us that you evaluate the factors based on score. Do you have any model or equation?

Interviewee: No, there is no equation. This is based on experience and mostly this is more personal experience. All of us work in order to win the project to gain money,

not to lose. Therefore, study of the project is very important before determining mark up size and we do not build project cost and mark up size based on customer's study. All of these lead to winning the project and a reasonable mark up size and profit.

Interviewer: It seems that the company has a more systematic approach. It was nice to meet you and thank you for sharing information.

Interviewee: Thank you.

Interview 11

Greeting

Interviewer: First of all let me introduce myself to you. My name is Bander Nourah and I am a PhD student at The University of Manchester. I am conducting research regarding the bidding mark up size, and factors that influence contractors to set their mark up size in order to win the contract or bid. In Saudi Arabia most contractors participate in the bid in order to win contracts.

Thank you for accepting the interview.

Before I start talking about the subject, kindly let me know your experience in detail, if possible.

Interviewee: Eng. Hamza.

Interviewer: Can you let me know more about what factors can affect bidding mark up size?

Interviewee: Project duration, project place and the quality required for the project.

Interviewer: There are many factors that affect bidding mark up size. How do you determine your mark up size based on these factors?

Interviewee: Yes, there is a list of these factors that are important for us, for example, type of clients. From experience, first of all, we have to decide if we can do this project or not. Then we evaluate some factors in an excel sheet, such as customer type and other factors, and then it will be decided by top management. The mark up size also will depend on the competition. Also, there will be a company strategy for a lower mark up size. For example, in a project where there are many competitors we determine a lower mark up size. Where there is no competition, we can have higher.

Interviewer: How we can improve the determining mark up size decision process?

Interviewee: The important thing is to have a standard requirement and we can change the requirement of the customer, so the cost and delivery time will not affect it.

Interviewer: Is the goal of determining these factors. finding a systematic way to evaluate these factors in order to determine mark up size? How do you see this approach and can this help the company determine the mark up size?

Interviewee: Here, all of this is added as part of the cost and we do not evaluate it as mark up size. Mostly we have a fixed mark up size. After calculating the cost the mark up size will be added. But, for example, based on type of customers, you can add a different mark up size.

Interviewer: Thank you Eng. Hamza.

Interviewee: Thanks. If you have any other questions, we would be glad to answer them at anytime.

Interview 12

Greeting

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Thank you for accepting the interview.

Before I start talking about the subject, kindly let me know your experience in detail, if possible.

Interviewee: Good morning Eng. Bander.

Interviewer: Good morning Eng. Hani. Thank you for accepting the interview and participating in the questionnaire. The research topic is towards an effective bidding model and the study investigates the factors that can affect the bidding mark up size.

Interviewee: First of all, we are contractors who participate in most bidding projects. We can answer you from a practical point of view. We participate in most governmental bidding projects and can support you in understanding the bidding model process.

Interviewer: Can I know how you participate in these bidding projects and how you calculate the cost and determine bidding mark up size?

Interviewee: First of all, we search for a project that will be available for bidding, then we read the terms and conditions and visit the project location with our engineers, in order to check the location and cost of resources in this location. We get a price for the material required from the same location, and we ensure which material is approved in this project.

After that, engineers will determine the price of each element required in this project, including material, labour cost, etc. Based on that, we can calculate the dry cost for the project. After that we determine the mark up size by 10% or 15% or 20%.

Interviewer: My question here, how do you determine this percentage for this specific project?

Interviewee: The dry cost, which we calculate, covers all costs apart from overhead, and usually the average contractor adds 25% as mark up size. Sometimes during the bidding process we can send a letter stating that we can reduce the bidding price with a specific percentage. And the important fact here, you have to know how much the dry cost for this project is, and the percentage above the dry cost (mark up size) depends on the contractor.

Interviewer: Who from the contractor, decides this mark up size?

Interviewee: Usually the owner determines the mark up size, or the portfolio project manager. And the important cost for us is the dry cost, because the mark up can be low in order to win the contract.

Interviewer: The portfolio project manager, who takes the decision of mark up size, does he take a long time to decide or a short time?

Interviewee: Yeah, actually, it is a simple process and it can be done in short discussion. It is a simple decision.

Interviewer: If there is a project and the dry cost is one million and the portfolio project manager decides to have a 15 % mark up size, and before submitting the bidding price a new portfolio project manager joins the company, could this mark up size decision change?

Interviewee: Yes, if we have more than one project manager each one will have a different opinion and each has a different mark up size. All of them they would like to win and try to determine the mark up size limit, to win the bid with the highest profit. There is a rule we follow; it is better to lose ten bids, instead of winning one bid, and lose money on that bid.

Interviewer: You could be right. Last year x company won more than ten bids last year, but in total they are losing money in these entire bids. My question now: how do these different project managers decide different mark up sizes for the same project?

Interviewee: Experience plays a major role here. Then the study of the project itself.

Interviewer: Is there anyway all of these managers can have the same decision?

Interviewee: What we do, we meet these managers together, and brief them about the details of cost and project elements. After that, they could decide and agree on the same percentage of mark up size.

Interviewer: Is there anyway to improve the process of mark up size?

Interviewee: Each project needs the required details studied in order to determine the mark up size, and each project has a competitor and the project duration is a critical point of any project.

Interviewer: Does the project duration affect the mark up size, especially if you know this project could be delayed?

Interviewee: You cannot consider this from the beginning, because if you increase the mark up size there is a possibility of losing the bid, and the important thing for us is to do a study for each project, before we decide the bidding price for it.

Interviewer: Thank you Eng. Hani for your time and the information you provided for us in this research.

Interviewee: Thank you.

APPENDIX 3

Questionnaire

Bidding Model Questionnaire

Dear Sir / Madam,

This questionnaire is a part of PhD research programme in The University of Manchester which aims to build an effective bidding model using game theory approach.

This questionnaire aims to design a bidding strategy model in order to help businesses have a higher probability of winning bids by understanding how businesses bid and analysing bidding factors and game theory elements. The information supplied by participants will be treated as confidential and kept in secure storage until the completion of the project; after a period of time it will be destroyed.

All participators who provide a valid email address in the questionnaire will be receive the result of the survey when it publish.

W e would appreciate your help in this research by completing the questionnaire and returning it to Bander Nourah by email or by Post to the below address.

If you are unable to complete the questionnaire due to lack if knowledge of the issues involved, we would be grateful if you would pass it to another person who will be able to answer the questions.

We thank you in advance for your assistance.

Bander Nourah, PhD Student
Dr Margaret Emsley, PhD Project Supervisor
School of Mechanical, Aerospace and Civil Engineering
The University of Manchester
P O Box 88
Manchester
M60 1QD
Email address: Bander.Nourah@postgrad.manchester.ac.uk

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Insert a Question ⬆ | **Edit** this Question | **Copy** this Question | **Delete** this Question

About Your Organization

1. Your working experience in bidding (please tick one box)

- ○ < 1 Year
- ○ 1 - 3 Years
- ○ 3- 5 Years
- ○ > 5 Years
- ○ None

Move Question ⬇

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2. Your type of organization firms (please tick one box)

- ○ Building
- ○ Engineering
- ○ Industrial
- ○ Healthcare
- ○ Services
- ○ Other (Please Specify):
  [   ]

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3. Your main Clients is

- ○ Public sector
- ○ Private sector
- ○ Both sectors

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4. Annual sales/ turnover (millions)

- ○ under 5
- ○ 5 -25
- ○ 26-100
- ○ 101-500
- ○ over 500

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5. Number of employees

- ○ under 100
- ○ 100 -1000
- ○ 1000-5000
- ○ over 5000

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6. Percentage of work obtained through competitive bidding

- ○ under 25%
- ○ 25% -50%
- ○ 50%-75%
- ○ over 75%

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7. How do you evaluate the mark up size for your project
- ☐ By using a model/decision support framework
- ☐ By negotiations with in-house experts
- ☐ By using your historical data

Others...Please specify

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8. Personal Details (Optional)
Your Name and Orgnization Name

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9. Your email address (Optional)

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10. Your orgnization is in
- ○ Saudi Arabia
- ○ United Kindgom
- ○ Other (Please Specify):

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11. I would like to present a framework which can help your organization to determine mark up size for a coming project. Would you like me to present this work to you? If yes please specify contact number.

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12. Bidding characteristics and factors to increase the probability of wining the bid
Please answer each question by marking in the appropriate number according to your perception: (1 = low importance , 6 = high importance) for the following Bidding characteristics and factors **in order to make decision for setting Mark up size**

	1	2	3	4	5	6
Type of job	○	○	○	○	○	○
Size of job	○	○	○	○	○	○
Warranty issues, which might possibly create risks	○	○	○	○	○	○
Design quality	○	○	○	○	○	○
Contractor involvement in the design phase	○	○	○	○	○	○
The amount of changes expected throughout the execution of this project	○	○	○	○	○	○
Qualification requirements	○	○	○	○	○	○
Degree of difficulty considering delays, shortages	○	○	○	○	○	○
Project related contingency	○	○	○	○	○	○
Degree of hazard (safety)	○	○	○	○	○	○
Project duration	○	○	○	○	○	○
Labour requirement	○	○	○	○	○	○
Equipment requirement	○	○	○	○	○	○
Location	○	○	○	○	○	○
Project start time	○	○	○	○	○	○
Number of Subcontractors	○	○	○	○	○	○
Tendering method (selective, open)	○	○	○	○	○	○
Completeness of the documents	○	○	○	○	○	○
Tendering duration	○	○	○	○	○	○
Owner / Client	○	○	○	○	○	○
Size of client	○	○	○	○	○	○
The client's requirements	○	○	○	○	○	○
The project is matching the company strategy and future	○	○	○	○	○	○
Need for work	○	○	○	○	○	○
Management of similar size projects in the past	○	○	○	○	○	○
Return of investment	○	○	○	○	○	○
Reliability of company cost estimate	○	○	○	○	○	○
Historic profit	○	○	○	○	○	○
Current work load	○	○	○	○	○	○

⬆
Move Question

Uncertainty in estimate	○	○	○	○	○	○
Availability of other projects	○	○	○	○	○	○
Confidence in workforce	○	○	○	○	○	○
The ratio of your firm's current market share to the expected or aimed share	○	○	○	○	○	○
General overheads	○	○	○	○	○	○
Availability of equipment	○	○	○	○	○	○
Supervisory availability	○	○	○	○	○	○
Policy in production cost savings	○	○	○	○	○	○
Labour environment	○	○	○	○	○	○
Policy in economic use of building resources	○	○	○	○	○	○
Tax liability	○	○	○	○	○	○
Risk of investment	○	○	○	○	○	○
Amount of possible upcoming profitable projects out for tender in near future	○	○	○	○	○	○
Economic condition	○	○	○	○	○	○
Market's direction (whether it is declining, expanding, etc.)	○	○	○	○	○	○
Government regulations	○	○	○	○	○	○
Risk in fluctuation in material prices	○	○	○	○	○	○
Risk in fluctuation in labour prices	○	○	○	○	○	○
Capital requirement	○	○	○	○	○	○
Project cash flow	○	○	○	○	○	○
The current financial capability of the client	○	○	○	○	○	○
The history of client's payments in past projects	○	○	○	○	○	○
Project terms of payment (monthly/quarterly)	○	○	○	○	○	○
Degree of difficulties in obtaining bank loan	○	○	○	○	○	○
Contract conditions	○	○	○	○	○	○
Type of contract	○	○	○	○	○	○
Clarity of the work and specifications	○	○	○	○	○	○
Competition	○	○	○	○	○	○
Identity of competitors	○	○	○	○	○	○
Strength of the firm	○	○	○	○	○	○
Number of competitors tendering	○	○	○	○	○	○

أخي العزيز ....أختي العزيزة

السلام عليكم و رحمة الله وبركاته

يعتبر هذا الاستبيان جزء من بحث لرسالة دكتوراه في جامعه مانشستر – بريطانيا لغرض بناء نموذج فعال لتسعير المناقصات التجارية.

يهدف هذا الاستبيان إلي تصميم و بناء نظريات استراتجيه تزيد من مكاسب الشركات و فرص فوزها بالعقود و المناقصات.

جميع البيانات المتعلقة بهذا الاستبيان ستعامل بسريه تامة و سوف تستخدم فقط في إغراض البحث.

يسعدنا مشاركتكم في هذا البحث و نرجو التكرم بإعادته إلي بندر نوره عن طريق البريد الإلكتروني أو عن طريق البريد على العنوان الوارد أدناه.

إذا كنت غير قادر على إكمال هذا الاستبيان نظراً لاختلاف التخصص أو التعامل في القضايا المعنية قد نكون ممتنين لو تكرمتم بتسليمها إلى شخص آخر لديه القدرة على الإجابة على الأسئلة.

نشكركم على مساعدتكم

بندر نوره – طالب دكتوراه

د / ماريحيت ايمسلي – مشرفه البحث

كليه الهندسه

جامعه مانشستر

ص ب 88

مانشستر

M60 1QD

Bander.Nourah@postgrad.manchester.ac.uk

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معلومات عن الشركة
هل لديك خبرة في تقديم المناقصات ؟

Move
Question
⬇

- ○ أقل من سنة
- ○ 1 -3 سنوات
- ○ 3- 5 سنوات
- ○ أكثر من خمس سنوات
- ○ لا يوجد

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ماهو مجال الشركة

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- ○ البناء
- ○ المشاريع الهندسيه
- ○ المشاريع الصناعيه
- ○ الرعاية الصحية
- ○ الخدمات
- ○ أخرى حدد

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عملائك هم

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- ○ القطاع العام
- ○ القطاع الخاص
- ○ كل القطاعات

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ما حجم المبيعات السنوية

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Question
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- ○ أقل من خمسة مليون
- ○ 5-25 مليون
- ○ 26-100 مليون
- ○ 101-500 مليون
- ○ أكثر من 500 مليون

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عدد الموظفين

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Question
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- ○ أقل من 100
- ○ 100-1000
- ○ 1001-5000
- ○ أكثر من 5000

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ما النسبة المئوية التي يتم الحصول عليها للعمل من خلال المناقصات

○ أقل من 25%
○ 25%-50%
○ 50%-75%
○ أكثر من 75%

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كيف تقوم بتحديد هامش الربح لمشاريعك

☐ باستخدام برنامج او نظام مساعد
☐ استشاره الخبراء في الشركه
☐ باستخدام بيانات المشاريع السابقة

أخري حدد

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معلومات شخصية
ألاسم
الشركه

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موقع الشركه

○ المملكة العربية السعودية
○ بريطانيا
○ أخري حدد

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لو رغبت في تقديم نموذج يساعدكم في اتخاذ قرار هامش الربح لمشاريعكم؟
هل يمكنني الاتصال بكم ؟ في حاله الموافقة الرجاء تسجيل رقم خاص بالاتصال بكم

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هناك العديد من العوامل التي تؤثروتضع هامش الربح في المناقصات
الرجاء اختيار التقييم المناسب لكل عامل حيث أن 1 يعني اقل أهميه بينما 6 تعني أكثر أهميه

	1	2	3	4	5	6
نوع العمل	◯	◯	◯	◯	◯	◯
حجم العمل	◯	◯	◯	◯	◯	◯
الضمان للمشروع و ما قد ينتج عنها من مخاطر	◯	◯	◯	◯	◯	◯
جودة التصميم	◯	◯	◯	◯	◯	◯
مشاركة المقاول في عملية تصميم المشروع	◯	◯	◯	◯	◯	◯
كمية التغييرات المتوقعة أثناء سير المشروع	◯	◯	◯	◯	◯	◯
المهارات المطلوبة / التأهيل الهندسي المطلوب	◯	◯	◯	◯	◯	◯
درجة الصعوبة في العمل	◯	◯	◯	◯	◯	◯
المخاطر المترتبة على المشروع	◯	◯	◯	◯	◯	◯
درجة السلامة المطلوبة في المشروع	◯	◯	◯	◯	◯	◯
مدة المشروع	◯	◯	◯	◯	◯	◯
توفر العمالة	◯	◯	◯	◯	◯	◯
توفر المعدات	◯	◯	◯	◯	◯	◯
موقع المشروع	◯	◯	◯	◯	◯	◯
وقت بدء المشروع	◯	◯	◯	◯	◯	◯
عدد المقاولين الفرعيين	◯	◯	◯	◯	◯	◯
نوع المناقصة (مفتوحة ، محدده حسب تصنيف معين)	◯	◯	◯	◯	◯	◯
اكتمال الأوراق الخاصة بالمناقصة	◯	◯	◯	◯	◯	◯
مدة المناقصة	◯	◯	◯	◯	◯	◯
العميل / صاحب المشروع	◯	◯	◯	◯	◯	◯
حجم العميل	◯	◯	◯	◯	◯	◯
المواصفات الخاصة بالعميل	◯	◯	◯	◯	◯	◯
تطابق المشروع مع استراتجيات الشركه	◯	◯	◯	◯	◯	◯
الحاجة للعمل	◯	◯	◯	◯	◯	◯
إدارة مشروع سابق بنفس الحجم	◯	◯	◯	◯	◯	◯
العائد من الاستثمار	◯	◯	◯	◯	◯	◯
الثقة في صحة تقدير الشركة لتكلفة المشروع	◯	◯	◯	◯	◯	◯
التاريخ الربحي في المناقصات السابقة	◯	◯	◯	◯	◯	◯

كمية العمل الحالية	⊙	⊙	⊙	⊙	⊙	⊙
عدم التأكد من صحة التقدير	⊙	⊙	⊙	⊙	⊙	⊙
توفر مشاريع أخرى	⊙	⊙	⊙	⊙	⊙	⊙
الثقة في القوه العاملة	⊙	⊙	⊙	⊙	⊙	⊙
نسبة مشاركتك في السوق مقارنة بالمتوقع	⊙	⊙	⊙	⊙	⊙	⊙
النفقات العامة للشركه	⊙	⊙	⊙	⊙	⊙	⊙
توفر المعدات	⊙	⊙	⊙	⊙	⊙	⊙
توفر المشرفين	⊙	⊙	⊙	⊙	⊙	⊙
سياسة توفير تكاليف الانتاج	⊙	⊙	⊙	⊙	⊙	⊙
بيئة العمل	⊙	⊙	⊙	⊙	⊙	⊙
وجود أنظمة للبناء الاقتصادي	⊙	⊙	⊙	⊙	⊙	⊙
الضرائب	⊙	⊙	⊙	⊙	⊙	⊙
مخاطر الاستثمار	⊙	⊙	⊙	⊙	⊙	⊙
كمية المشاريع المتوقع طرحها للمناقصات في المستقبل	⊙	⊙	⊙	⊙	⊙	⊙
الوضع الاقتصادي العام	⊙	⊙	⊙	⊙	⊙	⊙
اتجاه السوق تصاعدي او تنازلي	⊙	⊙	⊙	⊙	⊙	⊙
النظام الحكومي	⊙	⊙	⊙	⊙	⊙	⊙
مخاطر ارتفاع أسعار المواد	⊙	⊙	⊙	⊙	⊙	⊙
مخاطر ارتفاع أسعار العمالة	⊙	⊙	⊙	⊙	⊙	⊙
رأس مال المشروع	⊙	⊙	⊙	⊙	⊙	⊙
التدفق النقدي للمشروع	⊙	⊙	⊙	⊙	⊙	⊙
القدرة المالية للعميل في الفترة الحالية	⊙	⊙	⊙	⊙	⊙	⊙
التاريخ المالي للعميل في المشاريع السابقة	⊙	⊙	⊙	⊙	⊙	⊙
(طريقة الدفع في المشروع (شهرية، كل 3 أشهر	⊙	⊙	⊙	⊙	⊙	⊙
صعوبة الحصول على قرض لتمويل المشروع	⊙	⊙	⊙	⊙	⊙	⊙
شروط العقد	⊙	⊙	⊙	⊙	⊙	⊙
نوع العقد	⊙	⊙	⊙	⊙	⊙	⊙
وضوح مواصفات العمل المطلوب	⊙	⊙	⊙	⊙	⊙	⊙
المنافسين	⊙	⊙	⊙	⊙	⊙	⊙
هوية المنافسين	⊙	⊙	⊙	⊙	⊙	⊙
قوة الشركة بالنسبة للمنافسين	⊙	⊙	⊙	⊙	⊙	⊙
عدد المنافسين	⊙	⊙	⊙	⊙	⊙	⊙

Move
Question

APPENDIX 4

Poster Published for the PGRMACE10 Conference

The University of Manchester 2010

Factors Influencing Bidding Mark Up Size

Bander Nourah* and Dr. Margaret Emsley

Management of Projects

Introduction

Identifying the proper mark up size in competitive bidding is a challenging job because there are many factors that influence this decision. A proper mark up is defined as one which is low enough to maximise an organization's chance of winning the bid but high enough to ensure that winning the bid will be profitable. The aim of this paper is to identify the factors that influence the mark up size decision in competitive bidding.

Factors influencing bidding mark up size decision

A review of the following literature found 58 common factors that could influence bidding mark up size decision: Ahmad and Minkarah (1988), Shash (1993), Fayek (1998) and Egemen and Mohamed (2007). These 58 factors were categorized into five main groups as follows: project characteristics, project documentation, internal company factors, bidding situation and economical situation.

Research Methodology

The present study's objective was to identify the various factors that influence the bidding mark up size decision. The required data were collected using an online questionnaire. The questionnaire was divided into two sections. The first section was introductory, covering organization and respondent profiles. The second section presented the 58 factors that can potentially influence the mark up size decision in competitive bidding.

Result

One hundred and fifty questionnaires were sent out and 25 questionnaires were returned. The response rate was therefore 16.66%. The results showed that the questionnaire had been filled out by respondents from various different organization sectors.

Organization Sectors

Figure1: Respondents' organization sector

The results of the questionnaire show that project characteristics are the factors that have the most significant influence on the bidding decision. Also, project documentation and bidding situation have a significant influence on bidding mark up size. The top factors identified by organizations are type of job, contract conditions, the current financial capability of the client, owner/client, and size of job. Table 2 below presents the top importance of factors and their respective ranks in terms of their influence on setting a proper mark up size in bidding decisions.

Rank	Factors	Category (job related factors)	Average score
1	Type of job	Project characteristics.	88.67%
2	Contract conditions	Project documentation	81.33%
3	The current financial capability of the client	Bidding situation	80.67%
4	Owner/Client	Project characteristics.	78.67%
5	Size of job	Project characteristics.	78.67%
6	Competition	Project characteristics.	78.00%
7	Need for work	Internal company factors	78.00%
8	Type of contract	Project documentation	77.33%
9	Identity of competitors	Bidding situation	77.33%
10	The history of client's payments for past projects (considering delays, shortages)	Bidding situation	76.67%

Table 1: Importance of factors that influence bidding mark up size

Conclusion

The study has found that there are some factors that do not have a significant influence on the mark up size decision, such as return of investment and risk of investment. However, the study highlights the factors that do influence mark up size decision. It is advised that organizations give due attention to these factors in order to set a proper mark up size and increase their chances of winning bids.

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School of Mechanical, Aerospace & Civil Engineering

Postgraduate Research Conference, PGR-MACE10

APPENDIX 5

Paper Published for the 4th Saudi International

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Factors Influencing Bidding Mark Up Size

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Abstract

Competitive bidding is a common practice in business. The main objective of this paper is to identify the factors that influence an organization's decision in setting a proper mark up size in a competitive bidding scenario.

From a literature review, 58 factors that affect the mark up size decision have been identified and are presented in this study. These factors are categorized into five main groups: internal company factors, bidding situation, economical situation, project documentation and project characteristics. A questionnaire was emailed to 150 organizations in the United Kingdom and Saudi Arabia in order to identify how these factors influence their decision on mark up size.

The study found that return of investment and risk of investment are not the most important factors for an organization when setting the mark up size. Type of job, contract conditions, the current financial capability of the client, owner/client and size of job are actually the top factors influencing

the mark up size decision. Therefore, organizations are advised to give attention to these factors which affect their own and their competitors' mark up size.

Introduction

Identifying the proper mark up size in competitive bidding is a challenging job because there are many factors that influence this decision. A proper mark up is defined as one which is low enough to maximise an organization's chance of winning the bid but high enough to ensure that winning the bid will be profitable. The aim of this paper is to identify the factors that influence the mark up size decision in competitive bidding.

Factors influencing bidding mark up size decision

A review of the following literature found 58 common factors that could influence bidding mark up size decision: Ahmad and Minkarah (1988), Shash (1993), Fayek (1998) and Egemen and Mohamed (2007). These 58 factors were categorized into five main groups as follows: project characteristics, project documentation, internal company factors, bidding situation and economical situation.

Research Methodology

The present study's objective was to identify the various factors that influence the bidding mark up size decision. The required data weres collected using an online questionnaire. From a literature review, using Ahmad and Minkarah (1988), Shash (1993), Fayek (1998), and Egemen and Mohamed (2007) as a starting point, the questionnaire was developed. The questionnaire was divided into two sections. The first section was introductory, covering organization and respondent profiles. The second section presented the 58 factors that can potentially influence the mark up size decision in competitive bidding. These factors were rated on a scale of 1 to 6 so as to measure the effectiveness of

these factors when setting the mark up size. In the scale 1 meant a low level of importance and 6 meant the highest level of importance. The questionnaire was emailed to 150 bidding experts in the United Kingdom and Saudi Arabia.

Data Analysis

The data collected from the questionnaire were processed using Statistical Package for Social Sciences (SPSS). The level of importance and rank of factors were calculated using an importance index. The importance index used in this research is:

Importance index = $\sum$ ax * 100/6

where a is the weight given to each response.

Average score = (Importance index/ 6) %

Result

One hundred and fifty	Respondent
Building	16%
Engineering	20%
Industrial	4%
Services	36%
Others	24%

Table 1: Respondents' organization sector

No. of years	Respondent
< 1 Year	0%
1 -3 Years	8%
3-6 Years	12%
>5 Years	80%

Table 2: Respondents' experience in bidding

All of the organizations who were involved in the questionnaire obtain a percentage of their work through competitive bidding. Table 3 shows the percentage of work obtained through competitive bidding by the respondents' organizations, and Table 4 presents their annual turnover/sales in millions of pounds.

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Percentage of work obtained through competitive bidding	Respondent percentage
Under 25%	24%
25-50%	24%
51-75%	24%
Over 75%	28%

Table 3: Work obtained through competitive bidding

Annual turnover/sales	Respondent percentage
Under 5	8%
5- 25	20%
26- 100	16%
101 -500	20%
Over 500	36%

Table 4: Annual sales (millions of pounds)

The results of the questionnaire show that project characteristics are the factors that have the most significant influence on the bidding decision. Also, project documentation and bidding situation have a significant influence on bidding mark up size. The top factors identified by organizations are type of job, contract conditions, the current financial capability of the client, owner/client, and size of job. Table 5 below presents the importance of factors and their respective ranks in terms of their influence on setting a proper mark up size in bidding decisions.

No	Category (job related factors)	Rank	Average score
	Project characteristics.		
1	Type of job	1	88.67%
2	Owner/Client	4	78.67%
3	Size of job	5	78.67%
4	Competition	6	78.00%
5	Design quality	14	75.33%
6	Warranty issues, which might possibly create risks	15	75.33%
7	Project cash flow	18	74.67%
8	The amount of changes expected throughout the execution of the project	19	74.67%
9	Project terms of payment (monthly/quarterly)	21	74.00%
10	Degree of difficulty	29	70.00%
11	Project duration	30	70.00%

12	Project related contingency	32	69.33%
13	Degree of hazard (safety)	33	68.67%
14	Labour requirement	36	66.00%
15	Equipment requirement	42	64.67%
16	Location	44	63.33%
17	Contractor involvement in the design phase	47	62.67%
18	Project start time	53	60.67%
19	Subcontractors	56	60.00%
20	Subcontracted amount	57	60.00%
	Project documentation		
21	Contract conditions	2	81.33%
22	Type of contract	8	77.33%
23	Completeness of the documents	11	76.00%
24	Risk of fluctuation in material prices	45	63.33%
25	Risk of fluctuation in labour prices	52	62.00%
	Internal company factors		
26	Need for work	7	78.00%
27	Management of similar sized projects in the past	13	75.67%
28	Strength of the firm	16	75.33%
29	Reliability of company cost estimate	22	74.00%
30	Return of investment	23	73.33%
31	Historic profit	25	72.00%
32	Capital requirement	26	70.67%
33	Current work load	27	70.67%
34	Project linkage with portfolio management of the	28	70.67%
35	Uncertainty in estimate	31	70.00%
36	Availability of other projects	35	67.33%
37	Confidence in workforce	37	66.00%
38	General overhead	38	66.00%
39	The ratio of your firm's current market share to the expected or aimed share	39	66.00%
40	Supervisory availability	46	63.33%
41	Policy on production cost savings	48	62.67%
42	Policy on economic use of building resources	49	62.67%
43	Availability of equipment	50	62.67%
44	Amount of possible upcoming profitable projects out for tender in near future	54	60.67%
45	Labour environment	55	60.67%
46	Consideration delay or shortage	34	68.67%
	Bidding situation		
47	The current financial capability of the client	3	80.67%
48	Identity of competitors	9	77.33%
49	The history of client's payments for past projects (considering delays, shortages)	10	76.67%
50	Tendering method (selective, open)	12	76.00%
51	Number of competitors tendering	20	74.67%
52	Qualification requirements	24	73.33%
53	Tendering duration	51	62.67%

	Economical situation		
54	Risk of investment	17	75.33%
55	Economic condition	40	66.00%
56	Market's direction (whether it is declining, expanding,	41	66.00%
57	Government regulations	43	64.67%
58	Tax liability	58	55.33%

Table 5: Importance of factors that influence bidding mark up size

Conclusion

The study has found that there are some factors that do not have a significant influence on the mark up size decision, such as return of investment and risk of investment. However, the study highlights the factors that do influence mark up size decision. It is advised that organizations give due attention to these factors in order to set a proper mark up size and increase their chances of winning bids.

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APPENDIX 6

Poster Published for the 4th Saudi International

Conference Host by University of Manchester 2010

Won Silver Poster Price

Factors Influencing Bidding Mark Up Size

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Introduction

Identifying the proper mark up size in competitive bidding is a challenging job because there are many factors that influence this decision. A proper mark up is defined as one which is low enough to maximise an organization's chance of winning the bid but high enough to ensure that winning the bid will be profitable. The aim of this paper is to identify the factors that influence the mark up size decision in competitive bidding.

Factors influencing bidding mark up size decision

A review of the following literature found 58 common factors that could influence bidding mark up size decision : Ahmad and Minkarah (1988), Shash (1993), Fayek (1998) and Egemen and Mohamed (2007). These 58 factors were categorized into five main groups as follows: project characteristics, project documentation, internal company factors, bidding situation and economical situation.

Research Methodology

The present study's objective was to identify the various factors that influence the bidding mark up size decision. The required data were collected using an online questionnaire. The questionnaire was divided into two sections. The first section was introductory, covering organization and respondent profiles. The second section presented the 58 factors that can potentially influence the mark up size decision in competitive bidding.

Result

One hundred and fifty questionnaires were sent out and 25 questionnaires were returned. The response rate was therefore 16.66%. The results showed that the questionnaire had been filled out by respondents from various different organization sectors.

Organization Sectors

Figure 1: Respondents' organization sector

The results of the questionnaire show that project characteristics are the factors that have the most significant influence on the bidding decision. Also, project documentation and bidding situation have a significant influence on bidding mark up size. The top factors identified by organizations are type of job, contract conditions, the current financial capability of the client, owner/client, and size of job. Table 2 below presents the top importance of factors and their respective ranks in terms of their influence on setting a proper mark up size in bidding decisions.

Rank	Factors	Category (job related factors)	Average score
1	Type of job	Project characteristics.	89.67%
2	Contract conditions	Project documentation	81.33%
3	The current financial capability of the client	Bidding situation	80.67%
4	Owner/Client	Project characteristics.	78.67%
5	Size of job	Project characteristics.	78.67%
6	Competition	Project characteristics.	78.00%
7	Need for work	Internal company factors	78.00%
8	Type of contract	Project documentation	77.33%
9	Identity of competitors	Bidding situation	77.33%
10	The history of client's payments for past projects (considering delays, shortages)	Bidding situation	76.67%

Table 1: Importance of factors that influence bidding mark up size

Conclusion

The study has found that there are some factors that do not have a significant influence on the mark up size decision, such as return of investment and risk of investment. However, the study highlights the factors that do influence mark up size decision. It is advised that organizations give due attention to these factors in order to set a proper mark up size and increase their chances of winning bids.

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APPENDIX 7

Paper Published for the 5th Saudi International

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This paper won the 2nd prize for Engineering field

Factors influencing bidding mark up size in Saudi Arabia construction contractors

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Abstract

The majority of revenues generated by construction contractors come from bidding projects. Identifying the proper mark up size in competitive bidding is a challenge because there are many factors influence this decision. The aim of this research is to investigate how bid mark up size decisions is influenced by different characteristics of contractors. Various factors have been identified and analysed in order to identify the weight and ranking order of each factor in terms of its influence on the bid mark up size. Questionnaire has been used to identify each factor's level of importance. The findings have been used to establish a ranking order of factors in terms of their influence on bidding decisions based on contractors' characteristics. An important discovery is that the level of importance and rank of factors that influence bid mark up size differ based on contractors' characteristics.

Keywords: Bidding factors, decision making, mark up size

Introduction

The majority of revenues generated by construction contractors come from open bidding projects (Wanous, Boussabaine, & Lewis, 2000). In a competitive bidding situation, to have a successful bid a contractor needs to set a mark up high enough to gain a reasonable profit and low enough to win the contract. Competitive bidding is an area in which application of a strategy should be implemented. Bidding strategy success is based on management judgment more than any other single factor. It has been proven that many businesses fail because of poor management judgment and poor business strategy (Park & Chapin, 1992).

Improving the bidding process in terms of determining bidding mark up size requires identification of factors that influence the decision of determining mark up size. The decision of determining bidding mark up size is important in the bidding process (Ahmad, 1990).

Previous research identifying factors that influence bid mark up size decisions in different construction industries has mostly relied on the prominent study conducted by Ahmad and Minkarah (1988). However, there are some factors presented in some studies that are not presented in others. Moreover, the level of importance given to factors differs from one study to other. This has given an opportunity to re-explore these factors in order to establish an importance index for factors that influence bidding mark up size decisions in Saudi Arabia's construction environment. The aim is to explore factors that influence bid mark up size and establish a ranking order based on the level of importance of these factors, which is influenced by the characteristics of contractors.

Literature review

According to Wanous et al. (2000), bidding strategy can be defined as a contractor's long term objectives and goals in terms of selecting which projects to bid for, determining mark up size, and preparing bidding documents. This research focuses on contractors' bidding strategy aimed at determining the proper mark up size in a competitive bidding situation, and to understand how proper mark up size is set, an investigation into the factors influencing bidding mark up size is conducted.

Ahmad and Minkarah (1988) tried to answer the question 'how are bid decisions made?'. In their research they argued that input from the construction sector was important in order to have a meaningful bidding decision model. However, a comprehensive answer to this question was not easily found because bid decisions are made based on experience, judgment and perception. Therefore,

researchers undertaking a project in order to explore factors that affect the bidding decision process must do so by looking at two aspects: the bid / no bid decision, and the bid mark up size decision.

The initial part of Ahmad and Minkarah's research (1988) involved conducting a questionnaire in order to get information about the firm, evaluate the level of importance of 31 factors that could affect the bidding decision, and question the policy and practice of the firm that affects the bidding process. The research came up with some important findings, which can be summarized as follows:

1. Competition and profitability are not the only factors that are important when making bidding process decisions.
2. Experience, judgment and subjective assessment are used by contractors in the bidding decision process. However, statistical or mathematical tools are not utilized.
3. The level of importance of factors differ when it comes to bid / no bid decisions and bid mark up size decisions.

These findings provided the researchers with new information for identifying the factors that affect the bidding decision process. This new information helped them to develop a system to help contractors in making bid decisions. The system was based on a multi attribute utility model, whereby the bidder provides judgment input to the system in order to help contractors to have better decision in bidding process (Ahmad & Minkarah, 1988).

Another study conducted in Saudi Arabia was that of Abdulrahman Bageis and Chris Fortune in 2008. Their study's objective was to identify factors that affect the bid / no bid decision in order to develop a bid decision aid tool that would help contractors make their bid / no bid decision. The main finding of this research was that the level of importance of these factors is affected by the characteristics of the contractor and their main clients. Due to this, the model proposed in their research for making bid / no bid decisions considered the contract type and main client in order to determine the level of importance of factors that affect bid / no bid decisions (Bageis, 2008).

Yng Ling and Lie (2005) identified the factors affecting mark up decisions of a profitable contractor in Singapore. They investigated 52 factors and found that 21of these factors were significant in terms of their influence on the bidding mark up decision (Yng Ling & Liu, 2005).

The finding from literature review resulted in 60 potential factors influencing contractors bidding mark up size decisions.

Data Collection

The data were collected from construction contractors in Saudi Arabia with the support from Saudi Council of Engineers. The respondents were a project managers and managers who are involved in bidding decision mark up size. Online questionnaire method was used to collect all required information. From a literature review, using Ahmad and Minkarah (1988), Shash (1993), Fayek (1998), and Egemen and Mohamed (2007), the questionnaire was developed. The questionnaire was divided into two sections. The first section was introductory, covering organization and respondent profiles. The second section presented the 60 factors that can potentially influence the mark up size decision in competitive bidding. These factors were rated on a scale of 1 to 6 so as to measure the effectiveness of these factors when setting the mark up size. In the scale 1 meant a low level of importance and 6 meant the highest level of importance.

Data Analsis and result

The total number of questionnaire requested to be filled was 1000, 396 questionnaires were returned. The response rate was 39.6%. In the first section of the questionnaire the contractors was asked to answer questions in order to identify their characteristics (Size of contractors, contractor's main client type, contractor's main type of work, contractor's percentage of work obtained through competitive bidding). 61% of respondent was from medium and small size contractors where the rest was from large contractors. 17% of respondent was work only with public sector, 16% from the respondent was work only with private sector and 66% of them was work with both sectors.

This second part of the questionnaire aimed to understand which factors influence contractor's decision when making bidding mark up decisions.

The data collected from the questionnaire were processed using statistical tool. The level of importance and rank of factors were calculated using an importance index. The importance index used in this research is:

$$\text{Importance index} = \sum ax * 100/6$$

where a is the weight given to each response given to each response and x is n/N with n is the frequency of the response and N the total number of responses. Table 1 present the important index and rank order for factors for small/ medium and larger contractors.

	Large		Medium/Small	
	Important Index	Rank	Important Index	Rank
Type of job	80.84%	4	79.89%	4
Size of job	84.42%	1	81.68%	2
Warranty issues, which might possibly create risks	72.84%	35	75.34%	18
Design quality	79.00%	11	76.45%	15
Contractor involvement in the design phase	71.32%	43	60.47%	57
The amount of changes expected throughout the execution of this project	74.46%	26	71.14%	36
Qualification requirements	76.41%	21	74.93%	21
Degree of difficulty considering delays, shortages	76.41%	22	73.14%	25
Project related contingency	71.54%	42	70.52%	39
Degree of hazard (safety)	72.19%	37	68.53%	44
Project duration	79.44%	9	79.34%	6
Labour requirement	75.43%	23	77.69%	10
Equipment requirement	77.27%	16	74.66%	22
Location	71.86%	40	72.80%	27
Project start time	63.64%	57	59.99%	58
Number of Subcontractors	61.15%	59	57.02%	59
Tendering method (selective, open)	70.02%	48	66.46%	48
Completeness of the documents	66.99%	53	66.39%	49
Tendering duration	65.69%	55	64.81%	53

Owner / Client	78.68%	13	76.86%	14
Size of client	77.49%	14	73.83%	23
The client's requirements	79.44%	8	77.41%	12
The project is matching the company strategy and future	79.22%	10	72.73%	28
Need for work	73.92%	29	68.73%	43
Management of similar size projects in the past	76.95%	19	73.55%	24
Return of investment	79.52%	7	75.00%	20
Reliability of company cost estimate	81.39%	3	77.48%	11
Historic profit	73.92%	30	70.80%	38
Current work load	74.24%	27	71.56%	34
Uncertainty in estimate	71.10%	45	66.05%	50
Availability of other projects	71.00%	46	66.87%	45
Confidence in workforce	72.08%	38	72.11%	33
The ratio of your firm's current market share to the expected or aimed share	69.37%	50	64.67%	54
General overheads	71.65%	41	69.42%	41
Availability of equipment	73.48%	31	71.42%	35
Supervisory availability	70.56%	47	69.70%	40
Policy in production cost savings	72.51%	36	69.08%	42
Labour environment	67.86%	52	66.46%	47
Policy in economic use of building resources	62.45%	58	62.88%	56
Tax liability	57.25%	60	56.89%	60

Risk of investment	68.83%	51	65.56%	51
Amount of possible upcoming profitable projects out for tender in near future	66.23%	54	64.60%	55
Economic condition	73.27%	33	73.07%	26
Market's direction (whether it is declining, expanding, etc.)	72.94%	34	66.67%	46
Government regulations	73.38%	32	71.02%	37
Risk in fluctuation in material prices	77.38%	15	76.24%	16
Risk in fluctuation in labour prices	69.91%	49	72.59%	30
Capital requirement	74.13%	28	75.55%	17
Project cash flow	79.65%	6	80.79%	3
The current financial capability of the client	78.90%	12	78.24%	9
The history of client's payments in past projects	80.74%	5	78.86%	7
Project terms of payment (monthly/quarterly)	76.62%	20	79.41%	5
Degree of difficulties in obtaining bank loan	64.29%	56	64.94%	52
Contract conditions	77.06%	17	75.21%	19
Type of contract	75.11%	24	72.38%	31
Clarity of the work and specifications	81.39%	2	82.78%	1
Competition	75.00%	25	78.24%	8
Identity of competitors	71.86%	39	72.59%	29
Strength of the firm	77.06%	18	77.07%	13
Number of competitors tendering	71.32%	44	72.25%	32

Table 1: Important index and rank order of factors for large and medium/small contractors

The result of table 1 present that the 60 factors which are influencing bidding mark up size can be consider as an important factors for Saudi Arabia contractors. However, regarding the investigation of contractor's size if there is a significant different between larger and medium / small contractors in importance of factors influencing bidding mark up size. A one way ANOVA test has been conducted and it found that there is a significant different in 7 factors from 60 factors. The factors scored less than .05 has been presented in Table 2. This result shows that medium / small contractors are response differently comparing to large contractors.

Factors	Sig.
Contractor involvement in the design phase	.000
The project is matching the company strategy and future	.006
Market's direction (whether it is declining, expanding, etc.)	.011
Need for work	.030
Uncertainty in estimate	.035
The ratio of your firm's current market share to the expected or aimed share	.035
Return of investment	.040

Table 2: Contractor's Size vs 60 factors ANOVA Test

Conclusions

The result establishes a benefits for Saudi Arabia contractors from recognizing and understanding the factors that influencing bidding mark up size in Saudi Arabia environment. Also, the research determines the ranking order for factors influencing bidding mark up size and their level of importance. The research proves that the levels of importance of factors are affected by the size of the contractors. Also, this research shows indication that the levels of importance of factors are affected by characteristics of contractors and it should be consider when build a bidding mark up size model.

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APPENDIX 8

Poster Published for the 5th Saudi International

Conference

Host by Warwick University 2011

Factors Influencing Bidding Mark Up Size

Bander Nourah* and Dr. Margaret Emsley

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Introduction

Identifying the proper mark up size in competitive bidding is a challenging job because there are many factors that influence this decision. A proper mark up is defined as one which is low enough to maximise an organization's chance of winning the bid but high enough to ensure that winning the bid will be profitable. The aim of this paper is to identify the factors that influence the mark up size decision in competitive bidding.

Factors Influencing bidding mark up size decision

A review of the following literature found 58 common factors that could influence bidding mark up size decision: Ahmad and Minkarah (1988), Shash (1993), Fayek (1998) and Egemen and Mohamed (2007). These 58 factors were categorized into five main groups as follows: project characteristics, project documentation, internal company factors, bidding situation and economical situation.

Research Methodology

The present study's objective was to identify the various factors that influence the bidding mark up size decision. The required data were collected using an online questionnaire. The questionnaire was divided into two sections. The first section was introductory, covering organization and respondent profiles. The second section presented the 58 factors that can potentially influence the mark up size decision in competitive bidding.

Result

One hundred and fifty questionnaires were sent out and 25 questionnaires were returned. The response rate was therefore 16.66%. The results showed that the questionnaire had been filled out by respondents from various different organization sectors.

Figure1: Respondents' organization sector

The results of the questionnaire show that project characteristics are the factors that have the most significant influence on the bidding decision. Also, project documentation and bidding situation have a significant influence on bidding mark up size. The top factors identified by organizations are type of job, contract conditions, the current financial capability of the client, owner/client, and size of job. Table 2 below presents the top importance of factors and their respective ranks in terms of their influence on setting a proper mark up size in bidding decisions.

Rank	Factors	Category (job related factors)	Average score
1	Type of job	Project characteristics.	88.67%
2	Contract conditions	Project documentation	81.33%
3	The current financial capability of the client	Bidding situation	80.67%
4	Owner/Client	Project characteristics.	78.67%
5	Size of Job	Project characteristics.	78.67%
6	Competition	Project characteristics.	78.00%
7	Need for work	Internal company factors	78.00%
8	Type of contract	Project documentation	77.33%
9	Identity of competitors	Bidding situation	77.33%
10	The history of client's payments for past projects (considering delays, shortages)	Bidding situation	76.67%

Table 1: Importance of factors that influence bidding mark up size

Conclusion

The study has found that there are some factors that do not have a significant influence on the mark up size decision, such as return of investment and risk of investment. However, the study highlights the factors that do influence mark up size decision. It is advised that organizations give due attention to these factors in order to set a proper mark up size and increase their chances of winning bids.

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APPENDIX 9

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CONFERENCE

INFLUENCE OF CONTRACTORS' CHARACTERISTICS IN THEIR BIDDING MARK UP SIZE DECISION

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Competitive bidding is a common practice in business, especially in Saudi Arabia where the majority of revenues generated by contractors come from projects obtained through a bidding process. The aim of this research is to investigate how contractors' characteristics affect the bidding mark up size decision in competitive situation. Contractors' characteristics considered in this research include their size, main client type, percentage of work obtained through competitive bidding and main type of work. Data have been collected through semi-structured interviews and questionnaires. The findings (based on 396 responses) have been used to establish a ranking order of factors in terms of their influence on bidding decisions, based on contractors' characteristics. The results of the research have lead to the important discovery that a contractor's characteristics influence the factors they consider when determining their bid mark up and so contractors do not behave homogeneously when determining bidding mark up size in competitive bidding.

Keywords: Bidding factors, decision making, mark up size.

Introduction

The majority of revenues generated by construction contractors come from open bidding projects (Wanous et al, 2000). To be successful in a competitive bidding

situation, a contractor needs to set a mark up high enough to gain a reasonable profit and low enough to win the contract. When bidding, bidding efficiency is the key to success. Bidding efficiency can be defined as the ratio of actual profits to the amount which can be gained by maximising potential profit when defeating all of the competition at the lowest competitor's price. Although competitive bidding is an area in which application of a strategy should be implemented, bidding strategy success is based on management judgment more than any other single factor. It has been proven that many businesses fail because of poor management judgment and poor business strategy (Park and Chapin, 1992).

Improving the bidding process in terms of determining bidding mark up size requires identification of factors that influence the decision of determining mark up size. The decision of determining bidding mark up size is important in the bidding process, as well as the decision to bid or not to bid, because these decisions affect both day to day operations and long term organization performance (Ahmad, 1990).

Previous research identifying factors that influence bid mark up size decisions in different construction industries has mostly relied on the prominent study conducted by Ahmad and Minkarah (1988). However, there are some factors presented in some studies that are not presented in others. Moreover, the level of importance given to factors differs from one study to another. This has given an opportunity to the present researcher to re-explore and re-examine these factors in order to establish an

importance index for factors that influence bidding mark up size decisions in Saudi Arabia's construction environment.

The aim is to explore factors that influence bid mark up size and establish a ranking order based on the level of importance of these factors, which is influenced by the characteristics of contractors.

LITERATURE REVIEW

According to Wanous et al. (2000), bidding strategy can be defined as a contractor's long term objectives and goals in terms of selecting which projects to bid for, determining mark up size, and preparing bidding documents. This research focuses on contractors' bidding strategy aimed at determining the proper mark up size in a competitive bidding situation, and, in order to understand how proper mark up size is set, an investigation into the factors influencing bidding mark up size has been conducted.

Ahmad and Minkarah (1988) tried to answer the question 'How are bid decisions made?'. In their research they argued that input from the construction sector was important in order to develop a meaningful bidding decision model. However, a comprehensive answer to this question was not easily found because bid decisions are made based on experience, judgment and perception. Therefore, researchers

undertaking a project to explore factors that affect the bidding decision process must do so by looking at two aspects: the bid / no bid decision, and the bid mark up size decision.

The initial part of Ahmad and Minkarah's research (1988) involved implementing a questionnaire in order to evaluate the level of importance of 31 factors that could affect the bidding decision, and question the policies and practices of firms that affect the bidding process. The important findings of the research can be summarized as follows:

1.   Competition and profitability are not the only factors that are important when making bidding process decisions.

2.   Experience, judgment and subjective assessment are used by contractors in the bidding decision process. However, statistical or mathematical tools are not utilized.

3.   The level of importance of factors differ when it comes to bid / no bid decisions and bid mark up size decisions.

Their study fount that degree of hazard, degree of difficulty and type of job are the most important factors that influencing bidding mark up size decision. These findings provided the researchers with new information for identifying the factors that affect the bidding decision process, which helped them to develop a system to help contractors in making bid decisions. The system was based on a multi attribute utility model, whereby the bidder provides judgement input to the system in order to make better decisions in the bidding process (Ahmad & Minkarah, 1988).

In 1993 a further study to identify factors that affect bid / no bid decisions and bid mark up size decisions was conducted in the UK by Ali Shash. The research also used a questionnaire method in order to collect data. The questionnaire was similar to the questionnaire used by Ahmad and Minkarah in 1988. However, 55 factors were presented. The findings of this research can be summarized as follows:

1.   Top contractors based on annual turnover rely on their judgement and perception when making bidding decisions.

2.   The use of statistical or mathematical models is not common among top contractors.

3.   Top contractors are comfortable with their way of making bidding decisions.

Most of these findings are in agreement with the findings of Ahmad and Minkarah (1988) with the most important factors that influence bidding mark up size decision being the need for work, number of competitors tendering and experience in such projects. Nevertheless, the findings of the research provide a foundation for other researchers wanting to develop realistic bidding models (Shash, 1993).

Regarding factors influencing bidding decisions in Saudi Arabia, a study was conducted by Ali Shash and Nader Abdel Hadi in order to determine the factors that affect bidding mark up size in the bidding process and to test if the level of importance of these factors differed according to the size of the contractor. The

research identified 37 factors, classified into 5 groups. These groups were project characteristics, project documents, company characteristics, bidding situation and economic situation. The study used a questionnaire method in the form of a modified version of the questionnaire used by Ahmad and Minkarah in 1988. The study highlighted the factors that affect mark up size decisions in the bidding process in the Saudi Arabian environment and laid the foundation for other researchers to develop an expert system to help contractors determine the right mark up size in their bidding process (Shash and Abdel Hadi, 1993).

Another study conducted in Saudi Arabia was that of Abdulrahman Bageis in 2008. Their study's objective was to identify factors that affect the bid / no bid decision in order to develop a bid decision aid tool that would help contractors make their bid / no bid decision. The main finding of this research was that the level of importance of these factors is affected by the characteristics of the contractor and their main clients. Due to this, the model proposed in their research for making bid / no bid decisions considered the contract type and the characteristics of the main client in order to determine the level of importance of factors that affect bid / no bid decisions (Bageis, 2008).

Other studies have been conducted in different regions of the world, such as the study conducted by Dulaimi and Shan. Their study covered the construction industry in Singapore. Based on the literature review, they were able to identify 40 common factors that influence bidding mark up size. They found that these factors differed between medium and large size contractors. Also, they found that large size

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contractors were more concerned about degree of difficulty, availability of work and identity of competitors, whereas medium size contractors were more concerned about the availability of work, need for work and establishing long relationship with client. Their study can be seen as a starting point for developing a bidding strategy model (Dulaimi and Shan, 2002).

Aminah Fayek (1998) carried out a study which identified 90 factors that influence the bidding decision in terms of setting mark up size which Fayek referred to as margin size. The study used fuzzy set theory to develop a competitive bidding strategy model which improved the quality of the decision making process used in setting margins (Fayek, 1998).

Yng Ling and Liu (2005) identified the factors affecting mark up decisions of a profitable contractor in Singapore. They investigated 52 factors and found that 21of these factors were significant in terms of their influence on the bidding mark up decision (Yng Ling and Liu, 2005).

Egemena and Mohamed (2007) identified key factors which helped a contracting organization reach the correct bid or no bid decision, as well as mark up size decision. The study confirmed that factors relating to strategic consideration had a significant role in both these decisions. Also, in their study they found that small size contractors were more concerned about the possible number of competitors passing the eligibility requirement, risk due to the inflation rate of tender currency and

payment conditions of the project creating risk during project execution, whereas medium size contractors were more concerned about the possible number of competitors passing the eligibility requirement, current workload, availability of other projects in the market and risk due to the inflation rate of tender currency. The study provided a framework for development of a knowledge based system model (Egemena and Mohamed, 2007).

DATA COLLECTION

The data were collected from construction contractors in Saudi Arabia with the support from Saudi Council of Engineers, using an online questionnaire. The respondents were project managers and other managers who are involved in determining bidding decision mark up size. The questionnaire was developed from the results of eight semi-structured interviews with project managers, general managers and owners , with questions focusing on key factors influencing bidding decision in term of setting mark up size, supplemented by those factors obtained from the literature review, specifically the factors used by Ahmad and Minkarah (1988), Shash (1993), Fayek (1998), and Egemen and Mohamed (2007), resulting in a total of 60 factors that can potentially influence the mark up size decision in competitive bidding. The questionnaire was divided into two sections. The first section was introductory, covering organization and respondent profiles. The second section presented the 60 factors and asked respondents to rate each factor on a scale of 1 to 6, where 1 represented the lowest level of importance and 6 represented the highest level of importance.

DATA ANALySIS AND RESULTS

Research Methods

The total number of questionnaire distributed was 1000 and 396 questionnaires were returned, giving a response rate of approximately 40%. In the first section of the questionnaire the contractors were asked to answer questions in order to identify their characteristics (size of contractor, contractor's main client type, contractor's main type of work, contractor's percentage of work obtained through competitive bidding). The size of contractor was based on the annual turnover and number of employees. Figure 1 summarizes the characteristics of the contractors who responded to the questionnaire.

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┌─────────────────────────────────────────────────────────────────────────────┐
│                          Contractors'                                         │
│                          Characteristics                                      │
│                                                                               │
│   Contractor's      Contractor's      Contractor's      Contractor's          │
│   Size              Client            Type of Work      Work through           │
│                                                         Bidding                │
│                                                                               │
│                     Public           Building          Under 25%              │
│                     Sector 17%       21%               (39%)                  │
│       Small and                                                               │
│       Medium        Priviate         Engineering       25% -50%               │
│       Size 61%      Sector 16%       39%               (36%)                  │
│                                                                               │
│       Large Size    Both             Other 40%         50%-75%                │
│       39%           Sectors                            (13%)                  │
│                     67%                                                        │
│                                                        Over 75%               │
│                                                        (12%)                  │
└─────────────────────────────────────────────────────────────────────────────┘
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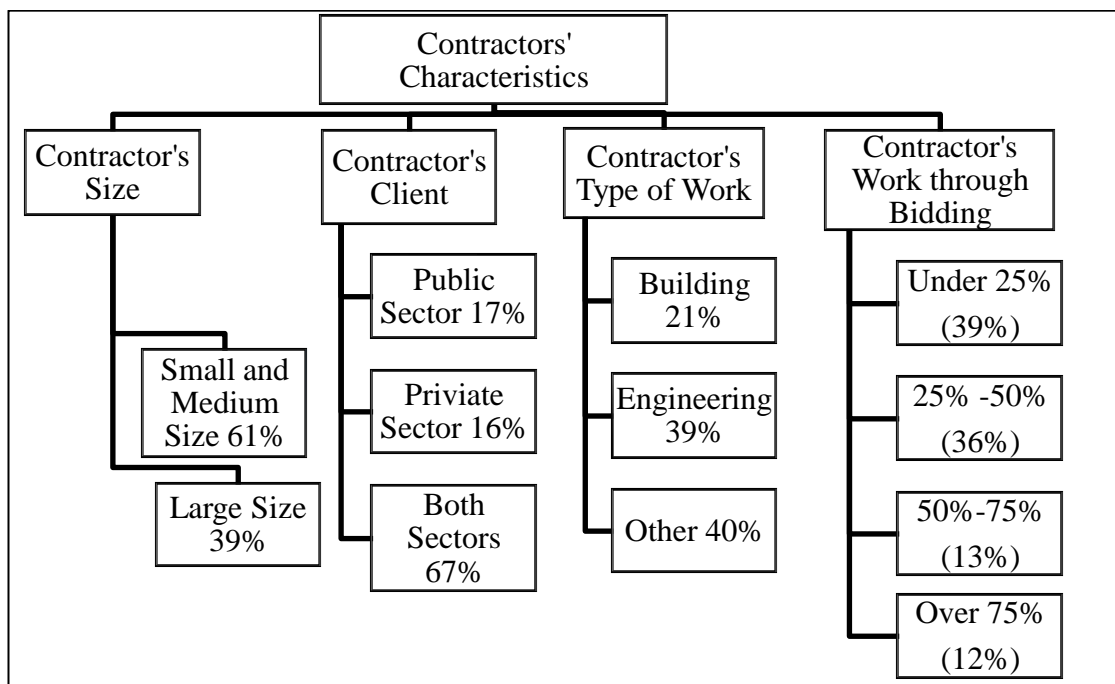
Figure 1 Contractor Respondents' Characteristics

The second part of the questionnaire aimed to understand which factors influence contractors' bidding mark up decisions. The level of importance of those factors that

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influence bidding mark up decisions has been identified using the scores given by contractors for each factor. The data collected from the questionnaire were processed to give the level of importance and hence rank of each factor. The importance index used in this research is defined as:

$$\text{Importance index} = \sum ax * 100/6$$

Where a is the weight given to each response and x is n/N where n is the frequency of the response and N is the total number of responses.

Results

The main focus of the questionnaire was to ensure that the findings of previous literature reviews of factors that influence bidding mark up size is similar in the Saudi Arabia construction industry and to explore if these factors are influenced by the characteristics of contractors. In this research the size of contractors has been examined as one of characteristics of contractors that can influence the bidding mark up size decisions, so the questionnaire aimed to explore if there is a significant difference between factors that influence large contractors and small / medium contractors.

Table 1: Top twenty factors' ranking order for large contractors

Large Contractor

Factors	Importance Index	Rank
Size of job	84.42%	1
Clarity of the work and specifications	81.39%	2
Reliability of company cost estimate	81.39%	3
Type of job	80.84%	4
The history of client's payments in past projects	80.74%	5
Project cash flow	79.65%	6
Return of investment	79.52%	7
The client's requirements	79.44%	8
Project duration	79.44%	9
The project is matching the company strategy and future	79.22%	10
Design quality	79.00%	11
The current financial capability of the client	78.90%	12
Owner / Client	78.68%	13
Size of client	77.49%	14
Risk in fluctuation in material prices	77.38%	15
Equipment requirement	77.27%	16
Contract conditions	77.06%	17
Strength of the firm	77.06%	18
Management of similar size projects in the past	76.95%	19
Project terms of payment (monthly/quarterly)	76.62%	20

Table 1 shows the ranking of the first twenty factors which influence bidding mark up size for large contractors and which can be considered as important factors for large Saudi Arabian contractors. The results also show that return of investment is considered as one of top factors that influences the bidding mark up size decision in Saudi Arabia, whereas in many other previous study (such as Ahmad and Minkarah's 1988 study) it is not one of the highest importance factors.

Table 2: First twenty factors' ranking order for small/medium contractors

Small / Medium Contractor

Factors	Importance Index	Rank
Clarity of the work and specifications	82.78%	1
Size of job	81.68%	2
Project cash flow	80.79%	3
Type of job	79.89%	4
Project terms of payment (monthly/quarterly)	79.41%	5
Project duration	79.34%	6
The history of client's payments in past projects	78.86%	7
Competition	78.24%	8
The current financial capability of the client	78.24%	9
Labour requirement	77.69%	10
Reliability of company cost estimate	77.48%	11
The client's requirements	77.41%	12
Strength of the firm	77.07%	13
Owner / Client	76.86%	14
Design quality	76.45%	15
Risk in fluctuation in material prices	76.24%	16
Capital requirement	75.55%	17
Warranty issues, which might possibly create risks	75.34%	18
Contract conditions	75.21%	19
Return of investment	75.00%	20

The results of Table 2 present the first twenty factors' ranking order which influence bidding mark up size for small / medium contractors and so which can be considered as important factors for small / medium Saudi Arabian contractors. Table 1 and Table 2 show that project is matching the company strategy and return of investment are considered as important factors influencing the bidding mark up size decision for large contactors in Saudi Arabia, which are of less importance for small / medium contractors in Saudi Arabia.

The result of questionnaire validates the finding of literature review; there are common importance factors between previous studies and the findings of this research, demonstrated by the importance of the factors presented in Table 1 for larger contractors and Table 2 for small / medium contractors in Saudi Arabia. At the same time, the level of importance given to these factors in this research differ that found in other research. Also, the results of the questionnaire emphasise the importance of these factors for Saudi Arabian contractors.

The results have shown that there is a different level of importance in factors that influence bidding mark up size between large and small / medium contractors. However, in order to investigate if the difference is significant, a one way ANOVA test has been conducted and it was found that there is a significant difference for 7 of the 60 factors; those 7 factors (which scored less than .05) are shown in Table 3.

Table 3: Factors which are significantly different between different size contractors

ANOVA		Small / Medium	Large Contractor
	Sig.	Rank	Rank
Contractor involvement in the design phase	.000	57	43
The project is matching the company strategy and future	.006	28	10
Market's direction (whether it is declining, expanding, etc.)	.011	46	34
Need for work	.030	29	43
Uncertainty in estimate	.035	50	45
The ratio of your firm's current market share to the expected or aimed share	.035	54	50
Return of investment	.040	20	7

This result shows that small / medium contractors respond differently compared to large contractors. The main factors that are significantly different are the involvement in the design phase, project matching company strategy and market direction. Larger contractors in Saudi Arabia consider these factors are more highly ranked in influencing their bidding mark up size decision, compared to small / medium contractors in Saudi Arabia.

Conclusions

Factors influencing bidding mark up size decision is an attractive topic for researchers, but the area of utilizing these factors to develop a bidding decision model to determine the proper mark up size in competitive situation has not been well researched. Further empirical research is needed to develop a bidding mark up size model for Saudi contractors, utilizing the findings of this research.

The results of the analysis of the questionnaire have established that there are benefits for Saudi Arabian contractors from recognizing and understanding the factors that influence bidding mark up size in the Saudi Arabian environment. Also, the research determines the ranking order for factors influencing bidding mark up size and their level of importance. The research proves that the levels of importance of factors are affected by the size of the contractors and this should be considered when building a bidding mark up size model.

Most of the findings of this research are in agreement with the findings of other previous study such as Ahmad & Minkarah (1988) and Shash (1993). However, the level of importance of factors influencing the bidding mark up size are different from other studies and this is in line with the finding of other previous study. However, there are common factors between this study and previous research but also there are factors introduced in this study as top importance factors that influence bidding mark up size for Saudi Arabian contractors.

Finally, an examination of other contractors' characteristics, such as main client type, main type of work and percentage of work obtained through competitive bidding is needed in order to understand if other contractors' characteristics are affecting a contractor's bidding mark up size decision.

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