RISK OF USING BIDDING STRATEGIES FOR A CONTRACTOR

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ABSTRACT

Construction contractors often procure projects through a competitive bidding process. Every contractor intends to bid competitively while dealing with the associated risks concurrently. Contractors have developed their own bidding strategies to retain their competitive edge. However, these strategies may carry an inherent risk component that is unforeseen leading to what is termed the 'winner's curse'. The aim of this study is to identify the risks entailed in the different bidding strategies and to explore solutions for the purpose of minimising risks. The research employs semi-structured interviews and a questionnaire survey which was administered to quantity surveying professionals with vast experience in the construction tendering process. Content analysis is used to analyse the qualitative data while statistical measures are used to analyse the quantitative data.

The results of the survey reveal that contractors use bidding strategies mainly for survival purposes that ensure continuous and sufficient work. However, in each bidding activity, their primary objective is a target return on the investment. In addition, fifteen bidding strategies are identified with their allied risk factors. These bidding strategies are ranked according to the risk significance which yields 'Bidding for repetitive jobs' as the one carrying the lowest risk while 'Intuitive manipulation' ranks as the one carrying the highest risk. The study offers a conceptual model that lists methods to minimise the risks of each bidding strategy which provides guidance for contractors to select better-suited bidding strategy rather than random or haphazard selection. Moreover, since some contractors may opt for a risk favourable approach in order to get a high return, the study examines the different risk perspectives of contractors so that they may adopt such bidding strategies with full knowledge of the attendant risks and what strategies are available to minimise risk exposure.

Keywords: Bidding Strategies; Contractor; Risk; Risk Management.

1. INTRODUCTION

The construction industry is extremely fragmented and highly competitive in nature (Akintoye and Skitmore, 1992). This makes competitive bidding one of the most critical activities for contractors in the construction industry (Wanous *et al*, 1999). According to Roland (1990), a contractor must formulate an economical approach to secure a steady stream of work which will provide the right volume at profitable prices. Hence, construction contractors develop bidding strategies, either well-considered or haphazard, to guide them in making the right decision in the bid decision-making. According to Passer (2011), the decision-making process entails the conclusive decision of bid/no bid. If the decision is made to bid, strategic adaptations to increase the probability of winning as well as the level of markup should be established. However, Tarek (as cited in Tang, 2004) has pointed out, the risks and uncertainties associated with bid submission can lead to difficulties when deciding on the best-fit bidding strategy against the competition. Often the risk is shared between the parties with contractors coping with the risk and owners paying for the risk (Flanagan and Norman, 1993).

Managing risk in construction projects has been recognised as a key to achieve project objectives in terms of time, cost, quality, safety, and environmental sustainability (Zou *et al*, 2006) with Risk Management (RM) divided into risk classification, risk identification, risk analysis and risk response. Further, risk response has been further sub-divided into four actions: retention, reduction, transfer and avoidance (Flanagan and Norman, 1993). However, it is essential to identify risk in bidding and the risks of bidding strategies when bidding for a project, though a contractor's main aim is to submit a substantially responsive

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bid to win the project by using the appropriate bidding strategies. However, it is important that those strategic decisions do not boomerang on the successful bidder in the form of the 'winner's curse.

According to Ariyarathna (2012), though researches have been conducted on various aspects to the application of bidding strategies used in the construction sector and construction risk, no attempt has been made so far to integrate these studies on risk in bidding strategies. The present study aims at identifying the risks entailed in the different bidding strategies used by contractors and to provide solutions to minimise the identified risks.

To achieve the above aim, it was found necessary to achieve the following objectives:

- To identify the bidding strategies used by contractors;
- To assess the risk of using different bidding strategies;
- To identify RM strategies and their applicability to each bidding strategy;
- To introduce a conceptual model to minimise the risk of bidding strategies.

The rest of the paper is organised as follows. The next section will offer an overview of bidding strategies in construction and ascertain the nature of risk in construction through a literature survey. The following section outlines the research methodology followed by data analysis, which entails the findings of an interview survey and a questionnaire survey in order to demonstrate the type of risks associated with bidding strategies, the magnitude of the risk and the methods of managing the risks associated with bidding strategies. The paper then discusses the results and presents, in conclusion, the conceptual model to manage risk in construction bidding.

2.   BIDDING STRATEGIES

Bidding, in general, means the conversion of numbers in a competitive bid after consideration of market factors and risk (Cooke and Williams, 2004). On the other hand, bidding is explained as an invitation to treat by the client and use bidder's errors to his advantage (Carr, 1977). According to Rodriguez (2013), knowledge of how to bid on construction jobs can make the difference between success and failure of a construction contractor because the bidder in competitive bidding is faced with two seemingly incompatible and contradictory objectives: to bid high enough to make a profit and low enough to get the contract (Tang, 2004). Hence, competitive bidding offers abundant opportunities for the application of strategies. However, the application of different bidding strategies depends on the type of client, type of construction work and the size of construction work (Drew et al, 2001).

In construction bidding, contractors' decision making on pricing has been found to be subject to exogenous and endogenous variables, which vary in response to the context within which they are considered (Shash, 1993). In order to meet specific objectives while taking care of factors that influence the pricing decision, firms have to adopt some sort of pricing strategy. For instance, a construction firm that is targeting a niche market could do this by tendering for such jobs at a low price level (Skitmore and Akintoye, 1990). According to Fellows and Langford (as cited in Skitmore and Akintoye, 1990), firms may adopt low profit-level pricing in times of economic recession in order to maintain market share or to penetrate a new market. According to Skitmore (1989), only bids derived from a detailed cost estimate along with a realistic markup can be regarded as genuinely competitive. In order to maintain genuine competitiveness, bidding strategies can include different markup policies that may be variable or fixed. Upson (1987) has proposed that the following factors should be given consideration with regard to variable markup policies: work in hand, bids in hand, availability of staff, profitability, ability of the architect or other supervising officers, contract conditions, site conditions, construction methods and programme, market conditions and the identity of other bidders.

2.1.   THEORETICAL CLASSIFICATIONS OF BIDDING STRATEGIES

According to Smith (cited in Zoysa, 1997), there are several major types of bidding models: models based on probability theory, regression models and econometric models. Zoysa (1997), moreover, classified them under three major types: mathematical approach, judgmental approach, and artificial intelligence and information technology approach. However, according to the available literature, most of these models cannot be used in actual practice due to the constraints imposed by the real world (Tang, 2004). Therefore, the present study focuses on strategies that have been actually implemented rather than the aforementioned theoretical models which may enjoy currency in academic circles. Among the reasons that function as a deterrence to the utilisation of the models are (i) the overly simplified assumptions on which the models are based which make them impracticable for the purpose of addressing real-world problems; (ii) the unwillingness of most bidders to struggle with sophisticated mathematical models, which makes them rely on their own experience in dealing with problems associated with bidding situations for the purpose of accomplishing organisational objectives" (Tang, 2004). Hence, many of them prefer to rely on their own experience in dealing with bidding situations for the purpose of accomplishing organisational objectives. Boughton (1987) has found out that profit maximisation is the most frequently used bidding objective. Similarly, Friedman's model, which was one of the mathematical approaches to determine bidding strategies, addressed the existence of multiple bidding criteria by listing the objective of profit maximisation as one of the top priorities (Zoysa, 1997). Thus, Friedman's model has been recognised as a practical decision-making model. The discussion above underscores the need for practical approaches in order to bid effectively (Wanous *et al.,* 1999).

2.2.   BIDDING STRATEGIES PRACTICING IN THE CONSTRUCTION INDUSTRY

Following are some of the bidding strategies practicing in construction industry, highlighted in the existing literature.

Bid Unbalancing: 'Mathematically unbalanced bids' and 'materially unbalanced bids' differ on the basis of proportionating/disproportioning the overheads and profits to the final bid (Christodoulou, 2008). Cattel *et al* (2007) has categorised "bid unbalancing" as 'front-end loading', 'back-end loading' and 'individual rate loading' that vary in terms of the allocation of higher rates in the estimate.

Equally Distributed Mark-up: According to Ariyarathna (2012), this is the easiest way to cover the additional risks associated with conceptual estimates since it adds money to the bid price after which it is equally distributed among every item. The inclusion of the same markup for every item is known as equally distributed mark-up.

Winning Price Criteria: Nawarathne (1998) has pointed out that the price of a large job of similar nature is the criterion used to determine the bid price. For example, the rate for the gross floor area of a similar type of building can be used in future when bidding for projects of this nature. Hence, this historical data is used to predict the bid price with a profit.

Planned Mark-Up: A mark-up factor is introduced to earn profits. However, a smart and aggressive competitor could quickly figure out the popular mark-up factor and, thus, technically knock out other firms by constantly beating the mark-up price of its rivals. Zoysa (1997) has therefore recommended a target outcome and the use of a variable mark-up. Hence, Tiered Mark-up is a variation on the planned mark-up strategy.

High-Low Criteria: According to Zoysa (1997), this strategy determines two critical levels based on the corporate objectives and structure of the contracting organisation. Thus, the bid amount can vary within a range between the two specified ends. The contractor first estimates the project cost, after which he uses the high-low criteria. If he has decided to go ahead based on the above, he then uses another strategy to determine the bid price.

Intuitive Manipulation: According to Nawarathne (1998), this method covers many orthodox strategies ranging from critical decision-making to random guessing of bid price. Here strategic decisions are made

based on perceptions or the use of informal information sources. It carries the risk however of corporate collapse due to incorrect decision-making.

Giving Discount after Tender Submission: According to Illukkumbura (1998), the highest bidder can offer a discount and come to the position of the lowest bidder in order to win the bid.

Miscellaneous Section: Some organisations have a separate miscellaneous section in the case of small construction projects where it is not profitable to allocate high overhead (Zoysa, 1997). Hence, the miscellaneous section remains a separate section which can, at the conclusion of the project be added to the company's overall profit where possible.

Diversifying the Jobs in Bidding: Here, the contractor diversifies his bidding in the marketplace (from public to residential to commercial) depending on what he thinks is the most desirable at any given point in time (Nawarathne, 1998).

Bidding for Repetitive Jobs: Some clients tend to give repetitive projects like housing schemes to the same contractor rather than going for competitive tendering and selecting another contractor (Zoysa, 1997). Bidding for such projects thus poses an advantage to the contractor.

Labour Resource Management: This strategy assumes that all contractors can obtain material at the same prices which makes labour costs the only difference between competitors. The strategy is to closely manage workers to minimise labour costs without reducing the fee or unit costs (Nawarathne, 1998).

Standard Fee in Bidding: According to Barr (1990), the contractor has a standard fee below which he is not willing to go. If the contractor feels that he is unable to win the bid with the standard fee, then he decides not to bid. This makes the contractor less competitive.

3.   RISKS IN CONSTRUCTION

The construction industry is widely associated with a high degree of risk and uncertainty due to the nature of its operations. The construction industry has furthermore changed rapidly over the past decade with companies now faced with more risk and uncertainty than before (Enshassi *et al*, 2008). Contractors also have to be more competitive in bidding while dealing with the risks connected with bid submission. A project, by definition, is trying to introduce a change, a new production system or way of working, or a new building (Burtonshaw-Gunn, 2009), in which the change entails uncertainty, which in turn introduces a high likelihood of projects being 'blown off course' by a potential future event. Thus, several studies have been conducted to date on the topic amidst growing concern regarding how to manage risk in construction projects (Mak and Wong, 1997). Risk Management (RM) is a management tool that aims at identifying the sources of risk and uncertainty, determining their impact, and developing appropriate responses (Uher, 2003). A systematic approach to RM in the construction industry consists of three main stages: risk identification, risk analysis, and evaluation of and response to risk (Wang *et al*, 2004; Raftery, 2003). Moreover, according to Flanagan and Norman (1993), classification of and attitude to risk are additional steps in the process of RM.

The objectives of risk identification are to identify and categorise risks that could affect the project (Anon., n.d.). Risk classification, in turn, can be categorised under strategic and operational or generic and specific considerations (Kaplan Financial Limited [KFL], 2010). The next step in the process focuses on risk analysis of estimates which allows for the inherent uncertainty of the costs of individual activities or elements within a project when assessing the final cost of the bid (Mak and Wong, 1997). Moreover, though the preceding steps have been carefully considered in the RM process, the decision may vary from one project to another depending on risk attitude. In simple terms, there are three types of organisations: risk favourable, risk averse and risk neutral (KFL, 2010). The RM process concludes with a proposal for risk responses. According to Burtonshaw-Gunn (2009), the options available to respond to risk will be based on one or more of the risk response actions, also known as the '4Ts': Treat, Tolerate, Transfer and Terminate. KFL (2010) has come up with a risk map which takes into consideration the impact of risk and the probability of its occurrence which sums up the RM strategy as available in the literature so far. Risks Associated with Bidding Strategies

According to Illukkumbura (1998), there are three types of risks associated with bidding, namely, risk of losing the bid, risk of under-pricing, and risk of choosing an inappropriate job. Though formal and analytical risk models are available that prescribe how risk should be incorporated into construction bids, Ahmed *et al.* (cited in Laryea and Hughes, 2011) have pointed out that contractors use experience-based mechanisms in approaching risk that are not systematic in nature which, in turn, may result in ineffective RM. According to Laryea and Hughes (2011), it is also the case that risk incorporated in the bid may be excluded at the end to enhance the competitiveness of the bid as the price must reflect other micro-economic factors. Thus, instead of pricing contingencies, it is possible that risk is priced mostly through contractual arrangements to reflect commercial imperatives.

Generally, those who make the lowest bid end up paying more than what the contract is worth in actual fact where the value estimates of rivals remain relatively low. This prospect was initially known as the "winner's curse" (Wilson, 1969). Contrary to this situation, a well-known adage, according to Drew, Lo and Skitmore (2001), goes that the bidder who makes the most mistakes wins the most number of contracts. Such mistakes may be regarded as random occurrences resulting in either unnecessary additions or omissions that produce high or low bids respectively. Since these types of scenarios too lead to "winner's curse", contractors should identify the risks that may lead to 'winner's curse' as well as other risks associated with bidding.

3.1. RESEARCH GAP EXPLORATION

This research attempts to bridge the gap that separates research on application of bidding strategies and the research on risk. Although much research exists on the application of bidding strategies and risk as separate phenomena, there is little that explores the risk entailed in bidding strategies and its management. Our study brings together the significant bidding strategies that exist in the industry as mentioned in the literature and identifies their inherent risk component. But risk identification is only the first step in the RM process. It is equally important to identify the risk responsive strategies. Therefore, our study aims to identify the risks inherent in using different bidding strategies and to provide solutions to minimise risk.

However, the scope of the research is limited to identifying and resolving risks related to bidding strategies in the pre-contract stage. Hence, the risks related to bidding strategies during the post-contract stage have not been accounted for in this study. In order to view the topic under study from a wider spectrum and from different angles, the study gathered data from C1-C6 contractors.

4. METHODOLOGY

The study focuses on a topic, i.e., risks inherent in bidding strategies, which constitutes a lacuna in the field of studies related to risk in construction. Hence, much background study was undertaken via an extensive literature survey in order to find a viable research problem and a specific focus for this study.

4.1. DATA COLLECTION

For the purposes of data collection, the study adopted the survey research approach. Semi-structured interviews and a questionnaire survey were conducted among quantity-surveying professionals who have vast experience in the construction tendering process. The semi-structured interviews attempted to identify the risks entailed in bidding strategies and the methods in use to manage. The results of the interview survey were used to formulate the close-ended questions in the questionnaire. The questionnaire survey carried Likert responses to identify the objectives of using bidding strategies, the importance of using bidding strategies, and the extent of using the strategies and their attendant risks in terms of consequences and probability of occurrence. The questionnaire allowed respondents to rate Likelihood and Consequence in 5-number scales. The magnitude of the risk was calculated by multiplying them.

The non-probability sampling technique was used in the data collection. Among the non-probability sampling techniques, 'Convenience Sampling', is the most convenient and immediately available sampling method, which was used to select the respondents for the survey. Consequently, the sample size was selected as thirty considering the availability of resources, the aim of the study, the statistical quality required for the study, and the fit between the ideas of the researchers and those of experts in this field. The sample therefore consisted of quantity surveyors from various organisations who are involved in the tendering process.

4.2. DATA ANALYSIS

The qualitative data gathered through semi-structured interviews were analysed using the content analysis technique. The QSR NVivo 2008 computer software was used to simplify the work relating to content analysis. The quantitative data collected through the questionnaire survey were subjected to a statistical analysis using Mean Weighted Rating (MWR), Relative Importance Index (RII) and the One Sample T-test. The formulas for calculating them are given as follows. Moreover, the central tendency assessment was done using statistical tools such as mean, mode and frequency.

The RII technique has been widely used in construction research for measuring attitudes with respect to surveyed variables. Likert scaling was used for ranking questions that have an agreement level. The respondents were required to rate the importance of each factor on a 5-point Likert scale using 1 for not important, 2 for of little importance, 3 for somewhat important, 4 for important and 5 for very important. Then, the relative importance index was computed using the following equation

$$RII = [(W.n) \text{ x } 100] / A.N \tag{Eq: 01}$$

Where, W = Constant expressing the weighting given to each response, A = The highest weighting, n = The frequency of responses, N = Total number in the responses.

$$MWR = \sum (V_i \text{ x } F_i) / n \tag{Eq: 02}$$

Where, V_i = Rating of each Factor, F_i = Frequency of Responses, n = Total number of responses

$$t = (\mu_{sample} - \mu_0) / (s / \sqrt{n}) \tag{Eq: 03}$$

Where, μ_{sample} = sample mean, μ_{o} = population mean, s = sample standard deviation, n = sample size

This "t" value was calculated using the IBM SPSS computer software.

However, the methodological limitations were existed in conducting the study. The sample size for the interview survey is not a representative distribution of the population which is limited to five experts. Yet, experts have been selected more specifically in the tendering field with more than 12 years of experience in order to eliminate the probable limitations. Furthermore, the time constraint had narrowed down the data collection to assess the possible risk management strategies. The model assumes that the identified risk factors are mutually exclusive. Although the definitions of risk encompass welcome 'up-side' as well as unwelcome 'down-side' effects, for the purposes of this research, the risk is defined as the 'down-side' consequences of the exposure to economic or financial loss, physical damage, or injury, or delay.

5. DATA ANALYSIS

5.1. RESULTS OF EXPERT INTERVIEW SURVEY

Risk Associated in Bidding Strategies

Since the existing literature was not satisfied in the identification of risks associated with prevalent bidding strategies, semi-structured interviews were conducted among five experts who have more than 12 years of experience in the tendering field to elicit more understanding of risks associated with bidding strategies in Sri Lanka. The empirical data that were subsequently gathered via semi-structured interviews are discussed in this section and presented in Table 1.

Table 1: Risks Associated with Bidding Strategies

Bidding Strategy	Risks
Front-End Loading	• Rejection of bid on the basis of 'imbalance' • Unexpected increments in quantity • Increase in performance bond by the client

Bidding Strategy	Risks
	• Request by consultant for rate breakdowns • Requirement for reduction in rates by contractor • Difficulty in maintaining positive cash flow at a latter stage • Possibility of deletion of loaded item • Price fluctuations and lower rates, leading to loss of latter items
Back-End Loading	• Unexpected quantity increments • Price fluctuation affecting end rates • Possibility of omitting loaded items • Possibility of disputes at the end of the project • Possibility of the client giving up or abandoning the project • Impact on cash flow at the initial stage of the project
Individual Rate Loading	• Possibility of lower priced items being increased in quantity • Possibility of higher priced items being decreased in quantity • Incorrect predictions on quantity increments • Possibility of loaded items being omitted due to design changes
Equally Distributed Mark-up	• Possibility of yielding a low profit when a number of sub-contractors are working • Occurrence of cash flow problems • Possibility of actual quantities far exceeding the estimated quantities
Winning Price Criteria	• Non-adjustment of price • Low productivity of labour and equipment than anticipated • Non-availability of projects of similar nature for comparison • Differences between the projects compared
Planned Mark-up	• Non-consideration of value of the project and its duration • Non-adjustment of mark-up to suit the project requirements • Possibility of competitors following the bid pattern
High-Low Criteria	• Possibility of losing jobs that is beyond the two levels • Incorrect estimation of low criteria by contractor • Possibility of going through periods when contractor has no jobs • Possibility of contractor not sticking to market price
Giving Discount after Tender Submission	• Possibility of giving discounts beyond the cost • Possibility of giving discount for under-quoted items • Possibility of damage to reputation due to unethical practices
Miscellaneous Section	• Possibility of mother company taking over and finishing the project • The possibility of project failure and blame is placed on the mother company
Diversifying Jobs in Bidding	• Possibility of occurrence of pricing errors • Possibility of decrease in selected market • Mismatch with pre-qualification criteria • Incurring of additional cost of recruiting expertise and for purchasing of machinery
Bidding for Repetitive Jobs	• Possibility of losing more profitable jobs • Expectation on the part of clients of a higher standard than in the first project • Expectation of discounts by clients and low markups for up-coming projects
Labour Resource Management	• Losses due to low productivity of labour and equipment • Increase in demand for labour while the project is going on • Possibility of in-house labour gang becoming a burden • Inclusion of labour cost without proper plan
Standard Fee in Bidding	• High value of standard fee • Unrecoverable losses • Difficulty in competing or surviving in atmosphere of competition • Reduction in competitiveness
Bidding based on Sub-contractor's Bid	• High price of subcontractors' price and difficulty in winning the bid Errors in sub-contractor pricing

Bidding Strategy	Risks
Intuitive Manipulation	• Probability of failure due to differences in the rates in different places • Post-contract management difficulties due to not keeping contemporary records • Losses due to quantity changes and unforeseeable design, development issues

5.2. RESULTS OF QUESTIONNAIRE SURVEY

The questionnaire survey aimed to identify the objectives of using bidding strategies, the extent to which the identified bidding strategies are being used by contractors and the risks associated with each bidding strategy as a quantitative value. 41 questionnaires were distributed while 32 of them were collected in time. Of these, two were rejected due to incompleteness. Therefore, the response rate was 76.9%, which is a satisfactory rate for a survey. The sample represented 63% of main contractors, 27% of sub-contractors and 10% of property developers. Under the ICTAD contractor classification, 40% were classified under C1 or C2, 27% under C3 or C4, 23% as C5 and C6 while the remainder comprised C6 graded contractors.

Objectives of Using Bidding Strategies

Firstly, the objectives of using a bidding strategy were assessed. The participants were allowed to respond according to a 5 rated respondent's scale which ranged from very low (1) to very high (5). The MWR for each factor was computed to deliver an indication of the importance of the factor. Mode was used to identify the most frequent Likert response by the respondents. RII was used to determine the relative ranking of objectives.

Subsequently, 11 objectives were considered in the analysis. Of those, 8 factors were assigned MWR values that were higher than the neutral point 3. It revealed that those 8 factors are either high or are very highly relevant. The 11 factors selected for the analysis were ranked using the RII value. Among those, the highest RII of 84% was held by 'Pursuing a target return on investment'. These results were validated by the central tendency of the data, obtaining the mode value of 4 and 5. Next to the pursuit of a return on investment, 'Continuing the operation of company', 'Ensuring sufficient number of projects in hand', and 'Meeting the expectations of clients and the industry' were the other top five important objectives. However, most of the bidders have given low importance to 'providing a barrier to entry by other firms' which obtained the least RII of 44% and the least MWR value of 2.20.

Degree of Importance of Bidding Strategies

In order to determine the degree of importance of bidding strategies, the 5-rated Likert scale, which ranged from very low importance (1) to very high importance (5), was included in the questionnaire. The above-mentioned statistical tools were used for the same function of analysis. 15 bidding strategies extracted from the literature survey were considered in the analysis. Nine bidding strategies out of the 15 were assigned MWR values higher than the neutral point 3. The highest RII of 74% was gained by 'Bidding for repetitive jobs' while the least RII of 36% was gained by 'Back-end loading'. Similarly, the MWR results were endorsed by the mode values, obtaining the weightage of 4 and 1 for the highest and lowest ranked strategies respectively. Moreover, 'High-Low Criteria' and 'Sub-contractors' bid-based bidding' received equal importance at 69.33% and were ranked as the second most important strategy.

Extent of Using Bidding Strategies

The questionnaire survey was further extended to identify the extent to which bidding strategies are used in the Sri Lankan construction industry. Responses were coded according to the 5-rated Likert scale which ranged from very low used (1) to very high used (5). The 'Equally distributed mark-up' strategy ranked as the most extensively used strategy gaining an RII value of 76.67%. Similarly, by obtaining the mode value of responses as 5, it became the application most used in Sri Lankan bidding practice. 'Front- end loading' and 'individual rate loading' ranked as a close second and third by gaining the RII value of 74% and 70.67% respectively. On the other hand, 6 bidding strategies were assigned MWR values lower than the neutral point 3. They are 'Winning price criteria', 'Diversifying jobs in bidding', 'Miscellaneous section', 'Intuitive manipulation', 'Labour resource management' and 'Back-end loading,' which appear to be used less in Sri Lankan practice.

Risk of Using Bidding Strategies

The Likert respondent's scale which ranges from improbable (1) to very likely (5) was used to gather data on the prevalence of the various bidding strategies among contractors in Sri Lanka. Similarly, consequences were rated on the scale ranging from Negligible (1) to Disastrous (5). Consequently, risk was quantified by multiplying likelihood and consequence. Since more than one risk is involved in a particular bidding strategy, the mean value was computed to derive the value of various risks associated with the bidding strategy because the mean of all risk factors is a much better value than the summation of the risks. Further, T-statistics were calculated using IBM SPSS software for the purpose of comparison of the different statistical measures.

A slight difference is noticed in ranks calculated with respect to the mean and T-statistic where riskiness is the lowest for 'Miscellaneous section' under the mean value ranking and 'Bidding for repetitive jobs' under the T-statistic ranking. However, both measures reveal the highest risk to be 'Intuitive manipulation'. 'Equally distributed mark-up', 'Front-end loading' and 'High-low criteria', on the other hand, are identified as low-risk strategies accordingly. In contrast, 'Back-end loading', 'Labour resource management' and 'Individual rate loading' are the other high-risk bidding strategies as Table 2 shows.

Table 2: Risk Values of Bidding Strategies

Bidding Strategy	Mean	Rank	t-statistic	Rank	
Intuitive manipulation	17.77	1	20.394	1	High Risk
Back end loading	15.89	4	9.348	2	
Labour resource management	16.57	2	8.403	3	
Individual rate loading	15.99	3	5.361	4	
Winning price criteria	14.45	5	3.972	5	
Planned mark-up	14.24	6	3.497	6	
Discount after tender submission	14.14	7	1.821	7	
Standard fee in bidding	12.33	8	-1.697	8	
Subcontractors' bids based	9.42	10	-6.003	9	
Diversify the jobs in bidding	10.27	9	-9.264	10	
Miscellaneous section	6.60	15	-12.469	11	Low Risk
High-low criteria	8.86	12	-15.275	12	
Front end loading	9.24	11	-15.802	13	
Equally distributed mark-up	7.67	14	-21.677	14	
Bid for repetitive jobs	7.69	13	-24.364	15	

Methods of Managing Risk

The RM process ends with the conveyance of the RM strategies. The results derived from the open ended questions in questionnaire survey are tabulated in Table 3.

Table 3: Methods of Managing Risks of Bidding Strategies

Bidding Strategy	Method of Managing Risk
Front-End Loading	• Only the items above an overall justifiable level should be front-loaded • Deciding on an optimum range of loading that is not identified in the Perato Curve • Proper management of the cash received initially
Back-End Loading	• Avoiding back-loading in any way
Individual Rate Loading	• Re-checking the estimated quantities before setting the rates. Depending not only on the tender drawings, but also on specifications, contractor's own method statement, details gathered during the site visits, soil report, previous experience, etc.
Equally Distributed Mark-up	• Mark-up is HOH, SOH and profit. SOH are often given in the preliminary bill. Hence, calculating carefully and holistically the head office contribution of the total project for the total duration • Use of different mark-ups where necessary

Bidding Strategy	Method of Managing Risk
Winning Price Criteria	• Calculating the basic cost accurately • Taking into consideration location and economical, technical, commercial, etc., factors and making necessary price adjustments for a rational bid decision.
Planned Mark-up	• Considering location, economic, technical, commercial, etc., factors and making necessary price adjustments for a rational bid decision. • Deducting the portion of SOH covered by preliminaries related to each project from the planned mark-up
High-Low Criteria	• Considering location, and economic, technical, commercial, etc., factors and making necessary price adjustments for a rational bid decision • Being flexible in changing the limits to get profitable jobs beyond the two levels
Giving Discount after Tender Submission	• Revisiting the pricing strategy and seeing how far the contractor can go down in terms of the amount he would lose in the anticipated profit
Miscellaneous Section	• Monitoring the subsidiary company's activities • Checking whether the miscellaneous section can handle the job before taking the decision as any failure would harm the goodwill or reputation of the company.
Diversifying Jobs in Bidding	• Balanced allocation of working capital after considering every sector
Bidding for Repetitive Jobs	• Maintaining good relations with clients • Making sure that there are appropriate provisions for rate adjustments in the case of future projects
Labour Resource Management	• Considering other factors as well, such as materials, plant and tools as a contractor's technical approach would differ from site to site
Standard Fee in Bidding	• Matching standard fee with the project requirements and selecting only appropriate jobs for bidding as this would not be applicable to all projects
Bidding based on Sub-contractor's Bid	• Obtaining quotations from one or two reliable sub-contractors • Checking sub-contractor's prices for accuracy and appropriateness before using them. • Going for back to back agreements • Obtaining a high-performance bond • Transferring full liquidated damages (LD) to the sub-contractor
Intuitive Manipulation	• Making sure of an estimated net cost • Using past experience and the analytical mind in decision making

6.   CONCEPTUAL MODEL OF MINIMISING RISKS OF BIDDING STRATEGIES

Finally, a conceptual model was developed summarising all the survey findings in a single illustration as shown in Figure 1. The web illustration of different risks and responses associated with bidding strategies allows users to act rationally in the bidding process in order to gain competitive advantage over rivals.
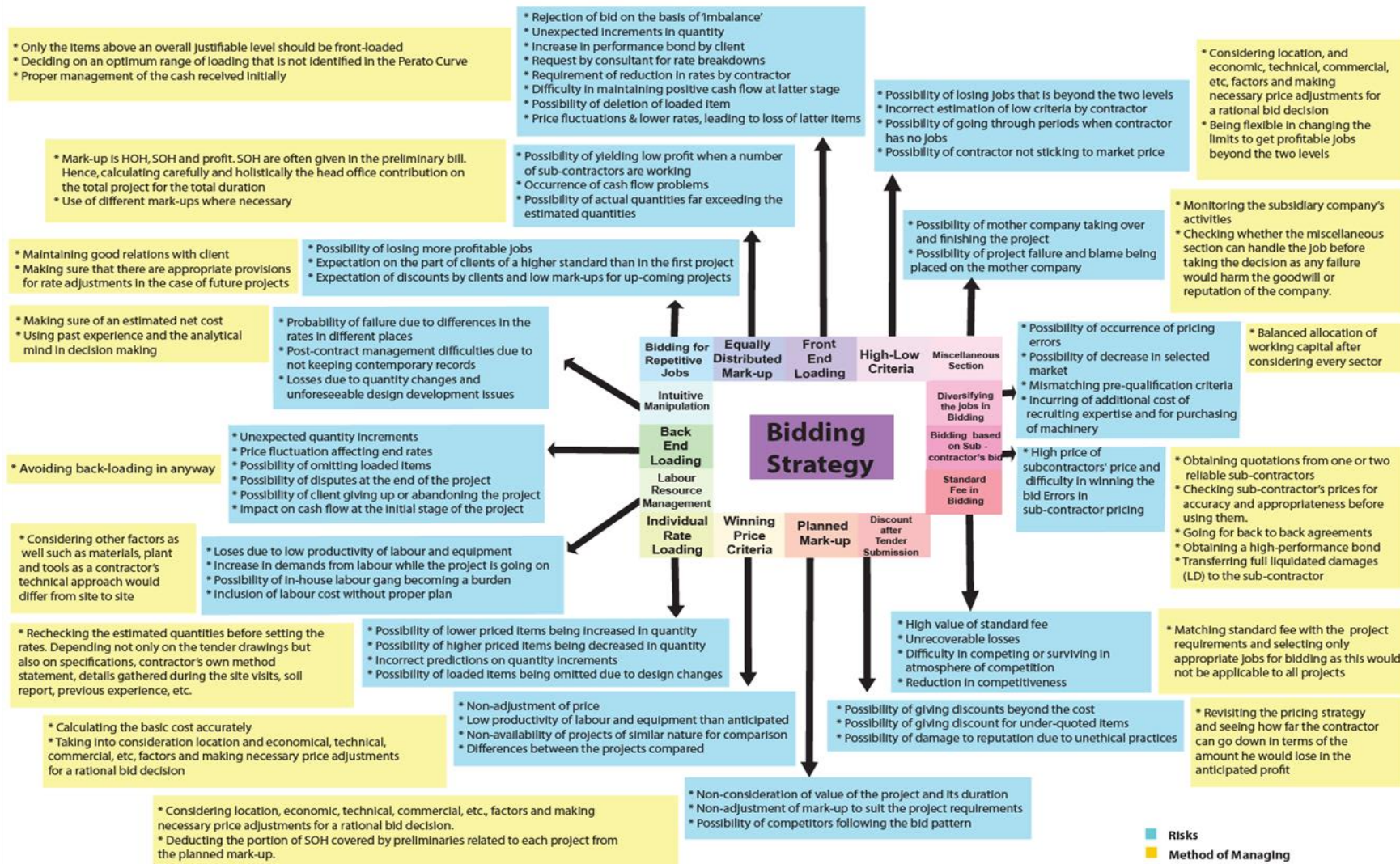
Figure 1: Conceptual Model of Minimising Risks of Bidding Strategies

7.   CONCLUSIONS

The complexity and dynamic nature of the construction industry has made construction-bidding complicated and competitive. Thus, contractors have come to use their own strategies to ensure their survival and development. While having to bid competitively, contractors, at the same time, deal with risks and uncertainties associated with bidding which they find difficult to foresee. The present study aimed at identifying the risks associated with the different bidding strategies used by contractors in Sri Lanka and providing solutions to minimise such risks.

A larger number of bidding strategies were identified in the literature of which 15 bidding strategies were extracted. They are front-end loading, back-end loading, individual rate loading, equally distributed mark-up, planned mark-up, standard fee in bidding, high-low criteria, giving discount after tender submission, bidding for repetitive jobs, winning price criteria, diversifying the jobs in bidding, miscellaneous section, labour resource management, bidding based on subcontractors' bids and intuitive manipulation.

Table 1 tabulates the different risk factors of each bidding strategy that have been identified through the semi-structured interviews. The results of the questionnaire revealed that contractors use bidding strategies mainly to accomplish the objective of getting a target return on investment. Additionally, contractors aim at the continuation of the operation and ensuring a sufficient number of projects in hand. The bidding strategies were also ranked according to their importance which showed the "Equally distributed mark-up strategy" to rank as the topmost strategy used extensively by contractors. "Front-end loading" and "Individual rate loading "ranked second and third. In contrast, "Winning price criteria", "Diversifying jobs in bidding", "Miscellaneous section", "Intuitive manipulation", "Labour resource management" and "Back-end loading "are not as much used among Sri Lankan contractors. The questionnaire survey also attempted at quantifying the risks. It showed the "Bidding for repetitive jobs", "Equally distributed mark-up", and "Front-end loading" to be low-risk bidding strategies while "Intuitive manipulation", "Back-end loading" and "Labour resource management" as high-risk bidding strategies. The next crucial objective was RM. Table 3 has identified and tabulated the ways of managing the risks of each bidding strategy. Moreover, a conceptual model has summarised all the survey findings in a single illustration including different risks and responses associated with bidding strategies.

The present study provides a guide for construction contractors to select the best suited bidding strategy bearing in mind the inherent risk component of each strategy. Further, the research is is sensitive to the different risk attitudes of the bidders. If a bidder is risk averse, he is then directed to low-risk bidding strategies. On the other hand, if a bidder is risk favourable, such a person can use high risk strategies in full knowledge of the inherent risk component as well as the risk responsive strategies. Finally, the study recommends the investigation of the risk of using bidding strategies from the client's perspective for the purpose of delivering the best value for money to the client.

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