

ATTITUDES, PERCEPTIONS AND PRACTICES OF CONTRACTORS TOWARDS QUALITY RELATED RISKS IN SOUTH AUSTRALIA

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ABSTRACT

This study addresses the process of pricing quality related risk at the bidding stage in the competitive method of procurement. While some studies have been undertaken in other states of Australia, they are limited studies dealing with contractor's perception about quality while considering risks and during bidding stage in the South Australia region. The aim of this study is to ascertain the attitudes, perceptions and identify the general practices of contractors in pricing risks and secondly to find out their practices towards quality related risks during the tendering stage. The data was elicited using a survey sample of a cross-section of 23 construction contractors registered with the Master Builders Association of South Australian (MBASA), and the results were analysed using frequency distribution. The results show that the majority of the contractors do not use any risk management processes. Usage was dependent on experience and judgement of the decision makers. Three prominent practices established were consideration for adding only high ranked risks with the base cost, additional of a percentage in the overall cost, and pricing high ranked risks independently and then adding additional lump sum for the residual risk. The identification of these practices could benefit the contractor's in pricing risks more effectively and negate the conflicts arising through the dissatisfaction from the non-performance and quality related issues.

Keywords: Risk management, practices, quality, tendering, construction industry, Australia

INTRODUCTION

No construction project is free of risks. The situation becomes worse for the contractors due to the competitive environment of the construction sector. These risks can affect schedule, costs and quality objectives. It can also be argued that risk can be an element of omnipresence in every sector of construction and the importance of risk management and associated pricing has got utter attention both by the clients, contractors and researchers practicing in the industry. But as the competition in the construction industry is prevailing and risk attitudes also varies contractor to contractor, the price consideration and associated prices also vary. As a result, negative impacts are found on clients' and contractors corporate or personal objectives. Even the situations worsen when client dissatisfactions with the quality increases and contractors reputation decrease further resulting in reduced competitive advantage.

Jha and Iyer (2006) contended that in order to achieve the schedule and cost objectives project quality objectives are sometimes overlooked and half-hearted attempts are made to achieve those objectives in the sites. Consequently, although contractors consider risks while they bid, Love and Edwards (2004) argued that quality deviations and poor safety issues are becoming almost 'perennial' in Australian construction industry. Love and Sohal (2003) contended that overall lack of attention is the main reason behind this situation and very few Australian construction organisations measure their quality costs, although Love et al., (2004a) argued that Contractor's tender price also sometimes may allow for some degree of rework in the form of contingency. The concept regarding risk can also become a cause of defects (Josephson and Hammarlund, 1999). Latham (1994) cited in Barber et al. (2000) found that contractors need to reduce construction cost up to 30 per cent if they wanted to be competitive in UK construction industry. Whereas, according to the estimation of CIRIA (1995) wasteful companies can be at a 10% disadvantage in tendering for new work.

The remainder of the paper is structured as follows. The following section gives an overview of the state of the construction industry in South Australia. A review of the literature on quality related risks with emphasis on attitudes, perceptions and practices follows after the overview. The next section explains methodological approach adopted and

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the analyses of results. This is followed by the results and discussion of the findings. The implications and conclusions drawn are in the last section.

AN OVERVIEW OF THE SOUTH AUSTRALIAN CONSTRUCTION INDUSTRY

The South Australian construction market is relatively smaller than other states, (RCBCI 2003) and as a result, opportunity for employment is fairly limited (RCBCI 2003). During 2001-02 South Australia ranked fifth among the states and represented only 5.9% of the value of the national construction industry (RCBCI 2003). This scenario has not almost been changed since then when comparing the present value of work done prepared by ABS (2010). Though construction activities can be observed in other regional areas of South Australia, but fairly, most construction activities are centred on Adelaide (RCBCI 2003). There are small numbers of major builders and contractors are operating in the state. As the market is small, most of the participants know each other, and any kind of industrial disruption can have adverse effect on the construction industry (RCBCI 2003).

In the construction industry, both the public and private sector play important role. The South Australian Government is a major client of the industry providing up to 50% of the building works in the state (RCBCI 2003). Civil Engineering is the largest sector (more than 50%) followed by the building sector (representing around one third) of the state's construction activities (RCBCI 2003). The smallest sector is the residential construction, represents nearly 10% of the whole works done. The following figure shows the value of work done in the building and construction industry in South Australia 2001-02 which was \$2421 million (RCBCI 2003).

LITERATURE SURVEY

Risk management and quality management: awareness and usage

Though the importance of risk management has been proliferated emphasising on project schedule and cost objectives, Kent (2004) argued that risk management starts and ends with quality, while Arrigo and Casale (2010) extended the idea that quality management can be used as a risk management tool to eliminate loss costs and improve safety, quality and efficiency at construction sites. The study of Karim et al., (2005) which examined the experiences and perceptions of Australian construction firms in using quality management systems, particularly those based on ISO 9000 found that more than 79% of respondents see ISO 9000 series quality system as tool for better risk management. According to Kent (2004) the core of risk management needs to focus on quality by providing the product as it was designed and ensuring performance of the product as anticipated with eliminated or zero defects and reduced liability.

The usage of risk assessment and management practices is closely aligned to the awareness. Burchett et al. (1999) cited in Francis and Skitmore, (2005) found that degree of utilisation of risk management to be dependent on 'managers' concerns and time involvement, human / organisational resistance and understanding of quantitative techniques. The study by Aje et al., (2009) in Nigeria also found contractor' management capability to have a significant impact on cost and time performance of building projects. Ahmed et al., (2007) identified retention of organisational knowledge and provision of a competitive advantage among the benefits of usage of risk assessment principles. Mills (2001) also observed that systematic risk management helps the quantification of uncertainty.

According to Mok et al. (1997), risk management should be considered at the inception of the project. Bajaj (2001) argued that use of risk management at the tendering stage is very important as it can influence profitability from the project and company as a whole. Unlike the client side contractor usually get less time to prepare the bid. Mok et al. (1997) argued that the use of risk management processes in estimation stage allows more systematic and rational way deciding contingencies for the risks. Furthermore, Al-tatabi and Diekman (1992) stated that identification of risks depends on historic data, experience and insight; whereas Toakley and Ling (1991) contended that in order to be beneficial these data have to be detailed. Bajaj (2001) extended the idea that in order to be competitive; decisions should be supported by historic data and detailed planning. The rationale being that bidding is normally undertaken by contractors during the inception and planning stages.

Risk pricing: practices and processes

According to Gules (1992) cited in Love et al. (2004b), and DIST (1998), the common practice by the contractors is to price from Bill of Quantities (BoQs) and design documents along with some contingencies. Previous studies have shown that the pricing adopted by the contractors eventually affect the productivity of the construction industry. This inevitably affects the level of quality achievement which sometimes is even questioned by the clients when the quality is not satisfactory. So the main intention behind this question is to understand clients give emphasis on which factors of

a project and why. If they consider other factors over quality then what they expect in terms of quality. Some studies have also explored the price mechanisms (Tah et al., 1994; Bajaj, 2001; Ahcom et al., 2006; Laryea and Hughes, 2008). For example, Tah et al. (1994) in their study of current practices and attitudes of estimating the indirect costs involved in tendering, identified that contractors normally opted for quantification and allocation of general overheads, risk contingencies and profit in a tender. Other alternatives identified in the same study was the consideration by contractors of a lump sum for the total cost, and only high ranked itemised risks and add a percentage for that risk. However, recent studies such as Laryea and Hughes (2008) have argued that due to the nature of competition, contractors cannot consider to price all kinds of risks, so their bidding decisions are influenced by the amount of risks they can assume. Furthermore they may also try to shift some of the risks on the sub-contractors (Laryea and Hughes 2008). Moreover trust and relationship is getting more importance in the construction industry, hence risk sharing is considered as an important medium in reducing risks. Some practices and processes of pricing risk are separate and parallel especially when considering the safety issues. This practice reflects the alignment of the argument made by Ahcom et al. (2006) that cost estimation department and safety department has a strong link. Numerous studies have also been conducted on the techniques for lowering risk costs. These have ranged from mitigating through the adoption of a risk avoidance (Akintoye and MacLeod, 1997; Mills, 2001; and Hallowell & Gambatese, 2009) to risk transfer (Casey, 1979; Kuesel, 1979 and Lam et al., 2006).

RESEARCH METHODOLOGY

To investigate the perceptions associated with the attitudes and the general practices of contractors in pricing risks, the following research methodology is employed.

Instrument

The questionnaire was divided into four sections as follows: (1) general demographics of the respondents; (2) usage of risk management and risk pricing processes; (3) quality management related issues; and (4) impact of quality related-risk factors on pricing. The results discussed and presented here relate only to the first, second and third sections of the questionnaire, as this study is extracted from a research project that also examined the significant impact of quality related risks on pricing in the overall risk margin and the overall management cost. It is beyond the scope of this paper to report on all the issues that were covered within that research project.

The results of the survey were then analysed in this paper to

1. To investigate the general perceptions and practices of contractors towards risks while pricing them for the competitive bidding.
2. To evaluate the attitudes and perceptions of the contractors on quality and related costing during the bidding stage.

The questionnaire listed the 8 reasons for lack of usage of statistical or quantitative models during the pricing of risk; 4 pricing mechanisms and 5 techniques; 6 techniques for lowering risk costs and 14 quality definitions, and respondents were then invited to indicate their preferences on a 'yes' and 'no' basis.

Survey administration

The questionnaire survey was conducted by two means; firstly, through the email, and secondly, by post. For the internet, 'Survey Monkey' (a well-known web site for conducting survey) was used. In the first stage, 30 questionnaires were sent by post and 100 emails, requesting to participate in the survey, were sent to different organisations. In the later time, more 120 questionnaires were sent by post expecting to get more responses (including the above 100 organisations to whom emails were sent). In both means, an information sheet about the research was attached, and the prospective respondents were requested to adopt only one method (either 'Survey Monkey' or the printed copy of the questionnaire).

The South Australian construction industry has been chosen as a setting for this study, based on the ease of data collection though it can be hold significant for all over Australia, as there is not so much difference between the state wise practices. Due to insufficient time and being smaller firm, two respondent sent emails regarding their incapability to participate in the survey. Apart from those two, 7 responses were collected by 'Survey Monkey'. While for postal response, the rate was more than double. 18 responses were collected but 2 of them were identified as invalid due to vastly incomplete answers. This left a total of 23 usable responses representing a valid response rate of 15.3%. Though the response rate is low, but similar kind of responses are found in other studies. Response rate for Karim et al., (2005) was 26.6% and argued that it is possible to get lower response in construction. Other studies that have had lower response rates are as follows: Ofori et al. (2002), 15%; Tower and Bacarini (2008), 15.8%; Wang and Yuan (2011),

21%. The low response rate from the electronic questionnaire is justifiable. As observed by (Sekaran, 2003), one of the disadvantages of electronic questionnaires is that the respondents must be willing to complete the survey

Analysis of results

The primary focus of the study presented in this paper was to establish and evaluate the general perceptions, attitudes and practices of South Australian contractors regarding quality risks and pricing techniques. As the main intention was exploratory, the main statistics used in the data analysis were the method of descriptive statistics and frequencies. This is the recommended approach to use where no previous research has been conducted (Luk 2006; Karim et al. 2005; Tower and Bacarini, 2008). For example, Luk (2006) and Tower and Bacarini (2008) used the descriptive method as no previous research has been conducted on the quality risk pricing by the contractors and practicing contracting organisations. Overall, it followed the research structure of Tower and Bacarini (2008) as it also tried to emphasis on qualitative and quantitative methods.

RESULTS AND DISCUSSION

The analysis of the data collected and the results obtained are presented and discussed as follows:

Demographics

From the previous studies, it was found that final bid price is decided by top level management such as Proprietors, Directors or Managing Directors including the estimators. The profile of the respondents according to the position is shown in Table 1.

Position of the respondents	Frequency	%	Cumulative
Estimator	5	21.7	21.7
Senior estimator	3	13.0	34.7
Chief estimator	1	4.3	39.0
Director	6	26.1	65.1
Managing director	5	21.7	86.8
Other (proprietor)	1	4.3	91.1
Other (project manager)	1	4.3	95.4
Other (state manager)	1	4.3	100.0
Total	23	100.0	

As can be seen from Table 1 that from a functional background viewpoint, Result of the responses shows that it aligns with the previous researches. Proprietor (1 response), Director (6 response) and Managing director (5 response) represent 52% of the total response. While almost 40% represent estimators of different ranks. The importance of having respondents from different professionals and sectors is that, as project drivers for public and private sectors are different (Wang et al., 2010), so there can be some discrepancy in their views. Another important aspect is that through the experience one can acquire required skills to perform any task (Schmidt, Hunter and Outerbridge, 1986) and can give judgement on particular activity. Experience and judgement is particularly established method in construction sector and also evident in previous literatures.

Organisation size by number of employees

The profile of respondents according to the number of employees in their firm is shown in Table 2. As can be observed, the majority 8 (8%) of the respondents were small firms with less than 10 employees. This was followed by six (26.1%) responses organisations having less than 20 employees. 3 responses were collected from each organisations comprised of 21-49, 50-99, 100 - 500 employees. Karim et al. (2005) defined small firms as having less than 50 employees and medium organisations comprised of less than 150 employees.

Table 2. Organisation size (number of employees) of respondents

Number of employees	Frequency	%	Cumulative
Under 10	8	34.8	34.8
10-20	6	26.1	60.9
21-49	3	13.0	73.9
50-99	3	13.0	86.9
100-500	3	13.0	100.0
Total	23	100.0	

Although not shown the demographics part of the questionnaire also sought information about the respondent's turnover. This [annual turnover] was reflected by the sales of the respondent contractors in South Australia, expressed in millions of dollars. The results indicated that, the annual turnover size of under A\$5 million was the most frequent, reported by almost half of the contractors surveyed, and annual turnover of sales of A\$5 – 20 million was reported by about one fifth of the contractors surveyed. Though there was no respondent having the annual turnover of more than 500 million dollars, there were still three large firms based on the number of employees. These represented 13% of the total response number

Extent of usage of risk management processes

As observed earlier, the usage of risk assessment and management practices is closely aligned to the awareness. In order to ascertain that, the second section of the questionnaire sought the respondent's extent of usage of risk management processes and the processes for risk pricing mechanism. Respondents were asked whether they followed any standard risk management process (e.g. AS/NZS 4360:2004) while bidding. The purpose of this question was to identify whether contractors go through any risk management process while they consider to bid and in which extent they follow the processes.

The majority, 15 (65.21%) of the respondents indicated that, they did not follow any kind of standard risk management process. On the other hand, only a minority, about one third (8) of the contractors considered using risk management processes while bidding. The results suggest that this might be due to the fact that the contractors get less time to prepare and submit the bid and they consider only design and other documents to identify the costs. Also they only may consider the major risk issues related to safety requirements.

Totality of usage of risk management processes

As a follow up to the extent of usage, the respondents were further asked the totality of the usage, whether they carried out the whole steps or the used the risk management processes partially such as limited to identifying risks and opportunities, due to the tight schedule to prepare the base estimate. Out of the 15 respondents who indicated not following any standard risk management processes, 2 (13.33%) stated that they used risk management partially or segmented, whereas the majority 13 (86.66%) stated that it wasn't relevant. Out of the 8 who considered using standard risk management processes, 2 (25%) stated that they used the whole process whereas the remainder 6 (75%) of the respondents indicated that they followed partial or segmented processes. These partial processes can be limited to identifying and analysing the consequences the risk and can be limited to identifying the major risks and opportunities.

Type of data utilised in the usage of risk management processes

This question sought to establish the type of data utilized in the usage of risk management processes. The three options availed to the respondents were as follows: (1) usage of historical data from previous projects; (2) independent usage or (3) combination of both for the independent use with some historical data. The majority (13) of the respondents stated that they used some kind of historic data while considering any risk management process, but with a varying degree. On the other hand, the minority, 1 (8%) of the respondents argued for independent use of the project data. However, 15% of the respondent totally depends on repeatable non repeatable historic data. These results are similar to the findings of Bajaj et al. (1997) that risk identification and considerations depend on historical data and any previous experience of the person/ company involved in the similar projects.

The conclusions to be drawn from the above findings are that, in pricing risks historic data is used by most contractors who follow partial or full extent of risk management processes. Historic data is used to complement particular project characteristics (e.g. site condition in a geographical condition, past experience from similar kind of projects and problems, lesson learned). This practice is observed in the survey irrespective of firm size and project type. But in the

case of small firms and particularly in residential and building type projects some firms totally use totally repeatable/non repeatable historic data and some time they don't compare historic data if the project is new for them.

Factors influencing the process of risk assessing and pricing

This question sought to establish how the overall process of risk assessment and pricing was conducted. The two options available to the respondents were as follows: (1) experience and judgement of the decision maker; and (2) using various analytical and statistical analysis models such as the Monte Carlo simulation. The majority of the respondents (22) agreed that the overall process of risk assessment depends on the experience and judgment of the decision maker. While 1 stated that they used analytical and statistical method in pricing risk. The following Table 3.0 shows the frequency of answers by the respondents regarding risk assessment process and consequent pricing.

Table 3.0 Frequency of respondents on risk assessment process and pricing.

Methods	Frequency	%	Cumulative	Ranking
Experience and judgement	22	95.65	95.65	1
Using analytical and statistical methods	1	4.35	100.00	2
Total	23	100		

This result is similar to the previous research such as Tower and Baccarini (2008). Though it is true, in present time, sophisticated programs for analyzing and simulating risks are available, even for micro-computers (Thompson and Perry, 1992), still contractors depends on experience and judgment for their final decision. The findings are similar to the research conducted by Fayek et al. (1998) that there is no particular difference between small and medium sized organizations in assessing risks.

According to all respondents overall process of risk assessment and pricing depends on experience and judgment, except one who also uses analytic software in assessing risk. But it contradictory to previous researches that only large firms use this kind of process while they bid for large projects. Major reasons for not using analytic or statistical software packages were requirement of extra cost, specialist skills, time. While due to the complicated interface and not consideration market condition a substantial part of the respondent do not use this kind of process. In general, for small firms cost and specialist skill requirement are major reason, while for large and medium size organisations the causes are varied.

Reasons for lack of statistical or quantitative model applications

Table 4 summarises the reasons according to the frequency of respondents for the lack of usage of the statistical or quantitative models during the pricing of risk. Only one respondent out of 23 did not answer this question. Though six reasons were provided in the questionnaire, two respondents mentioned two more causes for not using any statistical or quantitative method.

Table 4. Reasons for not using any statistical or quantitative models

Reasons	Frequency	%	Ranking
Specialist skill required	10	43.49	1
Incur extra cost	10	43.49	1
Time consuming	9	39.13	3
Complicated interface	9	39.13	3
Do not consider competition attributes	7	30.43	5
Do not consider market practices	5	21.74	6
Time required to train	1	4.35	8
Not suitable for too small projects	1	4.35	8

According to one respondent time is required to train employees and another participant mentioned that these kind of methods are not suitable for small projects. From the above table 4, it is found that requirement of special skills (e.g.

software skills, analytic risk calculation skill depending on Monte Carlo Simulation etc.) and extra cost are major causes of not adopting analytic method (having 10 responses). The complicated interfaces of the software's and time required to analyse were also considered major issue by 9 respondents. While according to 7 participant these software's do not consider market competition attributes and 5 respondents' reason was these do not consider market practices. Two other participants mentioned extra two causes which has been mentioned above.

Risk pricing mechanisms

Table 5 summarises the reasons according to the frequency of respondents for the risk pricing mechanisms and preparation of base estimate. The respondents were asked to select the appropriate processes for pricing risks and preparation of base estimate while preparing the tender. As shown in Table 5, the use of integrating both processes and simultaneously when pricing risks and preparation of the base estimate is found to be the most popular. This implies that contractors price the base estimate by trade by trade basis and at parallel they check that whether those items have any risk. If the item has any major risk they consider it then and decide whether they should consider the risk price.

Table 5. Processes for risk pricing and preparation of base estimate

Pricing mechanism	Frequency	%	Cumulative	Ranking
Both processes are integrated and simultaneous	13	59.10	100.00	1
Separate but not parallel	6	27.27	36.36	2
Separate and parallel	2	9.09	9.09	3
Parallel but risks pricing are extended	1	4.54	49.99	4
Total	22	100.0		

The second ranked pricing mechanism was that of regarding the whole process as separate but not parallel. This suggests that contractors preferred undertaking the risk identification and pricing decision upon completion of the estimation process. On the other hand, a minority 2 (9.09%) of the respondents considered the whole processes of estimation and risk pricing separate and conducted at parallel time. Only one responded mentioned that these processes are parallel but the risk identification and pricing process extends beyond the estimation process to identify risk other than the items/trades of the projects.

These findings are consistent with literature (Tah et al., 1994; Bajaj, 2001; Ahcom et al., 2006; and Laryea and Hughes, 2008). For example, Bajaj (2001) observed that contractors tendency was to put high contingency has been changed and therefore, are reluctant to put high contingency in their bids and if the situation demands the share with sub-contractors and transfers risks to insurances.

The inference that can be drawn from the above findings is that, the majority of the respondents prefer the integrated approach during the bidding process. This involves the consideration of the risk simultaneously. Whenever they identify any major risk they assess and, if required, price the risk. For contractors, cost estimation and risk identification and assessment are an integrated process. But according to one fourth of the respondents risk identification and analysis phase starts when the estimation is finished. But for very few firms these processes are separate and parallel. When considering the firm size it was revealed that in the large firm's estimation and risk pricing processes are separate. In these large firms these processes are either parallel or starts after estimation is complete. The reason behind these practices of large firms can be due to the fact that they have separate departments for estimation, quality control, safety, planning department. Each of the department can work separately and parallel. Before deciding the final bid they accumulate all assessment and decide the final risk price. But in the case of small and medium sized firms the usual practice is estimating and risk pricing are simultaneous and are integrated. The reason behind this can they have limited manpower to look after all these issues separately

Risk pricing techniques of contractors

The risk pricing techniques adopted by the contractors have an impact on the overall productivity of the construction industry as the final costing for undertaking the works might either be lowered or higher. In order to ascertain the various risk pricing methods adopted by the contractors, the various methods identified in literature were collected and the respondents were asked to select the appropriate method that they used for pricing risks within the bid price from a selection of six options. The frequency of the options selected by the contractors were summarised and ranked. The results are presented in Table 6.

Table 6. Risk pricing techniques by the contractors

Pricing techniques	Frequency	%	Ranking
Only high ranked risks are priced independently and added to base cost	9	40.91	1
A percentage in the overall estimated cost	6	27.27	2
High ranked risks are priced independently and adding lump sum for the residual risks	4	18.18	3
A lump sum in the total profit margin	2	9.09	4
A percentage in the total profit margin	1	4.55	5
Total	22	100.0	

The results presented in Table 6 shows that the least preferred method of risk pricing technique was that of including ‘a percentage in the total profit margin’. The most preferred option adopted by the contractors was one of considering only highly ranked risks for pricing independently and then added to base cost. As can be observed, the majority 9 (40.91%) of the respondents preferred this option. This view aligns with the argument made by Laryea and Hughes (2008) that contractors cannot price for all the risks due to the competition. Based on the frequency of responses, the adding of ‘a percentage in the overall estimated cost’ was the second most highly placed risk pricing technique with almost one fourth (27.27%) of the respondent selecting it.

This practice is also common and has been shown in various studies, though the amounts of added percentages are varied study to study. The risk pricing technique where the high ranked risks are priced independently and then a lump sum for the residual risk is added was the third ranked option. 4 (18.18%) of respondents preferred this option. This finding is also consistent with literature on pricing of risk as various studies contend that risk and profits are closely related and in general situation, occurrence of risk may lead to contractors losing profit. On the contrary, only a minority 1 (4.55%) of the respondents considered the technique of risk price as percentage of total profit margin. This can be due to the fact contractor wants to price as low as possible and assume many of the risk. So if any risk demands, he/she may lose some profit, but got some new experience and market. 2 respondents also have the similar view of the previously mentioned contractor. But the difference is that they consider risk price as a lump sum of the profit.

Techniques for lowering risk cost considered by the contractors

To investigate the techniques adopted by the contractors for lowering risk costs, the six techniques identified in literature were used. The respondents were then asked to select as many techniques or factors that they considered as appropriate for lowering risk costs. The frequency of the techniques for lowering risk costs as selected by the contractors were summarised and ranked. The results are presented in Table 7.

The results presented in Table 6 shows that the highly placed technique for lowering risk costs by the contractors was that of transferability of risk to the sub-contractor. As can be observed from Table 7, the majority 14(60.87%) of the respondents mentioned that transferring risks on the sub-contractors can be a major factor in lowering the bid price in terms of lowering the risk cost. The second highly placed technique was shared by those of ‘risks that can be assumed’ and ‘risks that can be negotiated to be transferred to the client’ such as during the contract period. Both these techniques were selected by 10(43.48%) of the respondents. The technique for ‘opportunities that can be had’ was third placed with 9(39.13%) of the respondents suggesting that opportunities in the project also help them in lower bid price.

Table 7. Techniques for lowering risk costs

Techniques	Frequency	%	Ranking
Risks that can be transferred to the sub-contractor	14	60.87	1
Risks that can be assumed	10	43.48	2
Risks that can be negotiated to be transferred to the client	10	43.48	2
Opportunities that can be had	9	39.13	4
Risks that can be shared with the sub-contractor	6	26.09	5
Risks that can be negotiated to be shared with the client	5	21.74	6

Interestingly, though sharing risks is seen as a good practice in risk management and is gaining importance, from the survey data it is revealed that still this practice is not considered among the South Australian contractors surveyed comparing to other techniques of mitigating and lowering the risk cost, because sharing risks with client and subcontractor are considered by only 6 and 5 respondents respectively. This finding contradicts that of Bajaj (2001) which established and found that, the tendency for risks sharing with sub-contractors were increased when compared to his previous study. But in the present research risk transferring is prevalent than the risk sharing. But in terms of negotiating about the risks with clients are similar to the findings of Bajaj (2001).

Quality and its associated costs

Table 8 summarises the respondent's perception of quality. The respondents were the following question: Although quality is defined as 'customer satisfaction', how do you perceive quality while preparing the bid? They were requested to select as many definitions as they thought appropriate from a range of options (see Table 8). As can be seen from Table 8, although it was anticipated that for contractors' quality view on quality definition in the bidding stage will be to conforming to specification and standards (as was identified in the interview and other literatures), only 13 and 12 respondents selected these criteria in defining quality.

Table 8. Perceptions regarding quality during the bidding stage

Quality definitions	Frequency of responses	% response	Ranking
Do it right first time / zero mistake	17	73.91	1
Workmanship	14	60.87	2
Conformance to the specification	13	56.52	3
Conformance to the standards	12	52.17	4
Zero/ least defects on handover and during the operating life-cycle of the project	10	43.48	5
Safe work environment and procedures	10	43.48	5
Zero rework	8	34.78	7
Zero rectification	7	30.43	8
Functionality / fitness for purpose	6	26.09	9
Minimum wastage	5	21.74	10
Zero deviation	2	8.70	11
Structural integrity	1	4.35	14
Least defect during defect liability period	1	4.35	14
Within budget	1	4.35	14

Rather, the greater responses in defining quality were for doing right at the first time which is closely related to zero mistakes (17 responses), followed by workmanship (14 responses). Safety and least defect are also seen by 10 respondents as important measure of quality. While zero rework, zero rectification and fitness of purpose are considered by at least 50% less than the highest responded factors, having responses 8, 7 and 6 responses respectively. Though wastage is seen as loss for contractor in terms of time and money, only 5 respondents consider this criterion related to quality. The least ranked definitions of quality were those for 'zero deviation' which elicited 2(8.70%) response and 'structural integrity', 'least defect during liability period', and 'within budget' all having 1(4.35%) response. The reason behind this can be contractors by themselves cannot deviate from any contract conditions (including time, cost and scope), hence are not considered while bidding.

CONCLUSIONS

The principal aim of this study was to identify the attitudes, perceptions and practices of construction contractors towards quality risks and their pricing. The data collection techniques were used to find out firstly how they price risks, and then it sought the perception towards quality in the bidding stage followed by considerations regarding quality costing. Finally it explored which factors are considered risky in relation to quality of construction projects and how

they incorporate these in the bid price. Though some contractors follow risk management processes while bidding, majority of the contractors do not follow. The use of risk management practice in its full extent is almost sporadic as only few follow the steps of risk management. But the practices of risk management is limited only in identifying and analysing the major risk and practiced by a substantial number of contractors. In the main, the following findings emerged from the survey results:

- Though advocates of risk management emphasises on risk management at the inception of the project, by considering the bidding stage as a inception stage, majority of the respondent in the survey do not use follow any RMP (risk management process). Though some use RMP partially and this is limited to identifying and analysing major risks only. This group, consisted of all firm sizes, uses historic data in pricing risks along with some respondents who do not use any RMP. Some firms also depends on totally historic data, this can be due to the fact they are involved in similar kinds of projects and in limited area.
- In terms of risk assessment and pricing all of the respondents depend on experience and judgment of the decision maker. Though, usage of computer software in analysing risks was considered by 1 respondent, maximum stated that due to implications related to costs, time, complicated interface and necessary skill requirements do not use this process. Maximum number of respondents mentioned that for them risk identification, pricing are integrated with preparing the base estimate while some other conduct risk pricing after the estimation is finished. Very few respondents said that these processes are separate and parallel. There is also discrepancy between different sizes firms' practices. Majority of the small and medium size follow the first method mentioned above, while for all of the large firms of the study do it separately. It can be due the fact they have independent departments for handling individual issues related to project.
- Three prominent practices were found in pricing risk. (1) Consideration for adding only high ranked risk with the base cost; (2) adding a percentage in the overall cost; and (3) pricing high ranked risk independently and then adding lump sum for the residual risks. The least ranked pricing techniques were those of including a percentage in the total profit margin, and consideration of a lump sum of the profit or as a percentage.
- Relative to techniques for lowering risk costs, the three most prevalent were risks that could be (1) transferred to the sub-contractors; (2) negotiated for transfer to clients; and (3) level of risks they can assume, or the potentials and opportunities they can have from the project. Risk sharing in reducing risk price is also considered but by very few in compared to other options.

Implications for the construction industry & future research

The findings of this study will help the contractors in pricing risks more efficiently as most of the conflicts arise from the dissatisfaction from the non-performance issues and quality related issues though the project delivered in due time and within budget, resulting in much client satisfactions which can be helpful for them to sustain in the competitive market. It will also help the client group in identifying the base reasons which in turn can become a risk and eventual costly event for them. Because, in general, clients' perceptions are that all quality risks are originated from contractors' side. While the detailed levels of perceptions and practices between small firms and large firms are not reported in this study, future research could explore these differences in the pricing risk techniques among the small and large firms' practices.

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