Evaluating the use of risk-identification techniques in the South African construction industry

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ABSTRACT

Purpose of this paper: This paper seeks to investigate the current use of risk-identification techniques in the South African construction industry.

Methodology: An extensive literature search was conducted to collect the secondary data; and these were supplemented by primary data via a questionnaire survey. These were then distributed to contractors, who were conveniently sampled in Gauteng (South Africa). The data were analysed by using the Mean-Item Score (MIS).

Findings: A total of twelve risk-identification techniques were identified, of which checklist, flowchart and brainstorming were rated as the most used risk-identification techniques in construction projects in Gauteng.

Research limitations: This research was conducted only with considered contractors in the Gauteng province. Further research could include an increased target population more representative of the South African construction industry.

Practical implications: Practitioners and researchers are likely to find the study useful; as it discusses the risk-identification techniques used in construction; and in particular, it seeks to report empirically on the techniques mostly applied in identifying risks in construction projects. Valuable information about current risk-identification techniques are provided.

Value of the paper: Risk management in construction has received the extensive attention of researchers; but due to constant changes and development in the area, the paper considered adding value to the body of knowledge in the construction industry in South Africa on the theme of the risk-identification techniques used in the construction industry.

KEYWORDS: Construction, Risk, Risk-Identification Techniques, South Africa

1. INTRODUCTION

Risk management (RM) refers to a way of examining areas of threat in a project's success and cautiously planning how each threat should be handled. It is a tool that aims at disclosing the origins of risk and uncertainty, investigating their effect, and formulating adequate responses (Zhao, Lv, Zuo & Zillante, 2010). The RM process globally has been divided into risk identification, risk analysis, and risk response, as well as monitoring and review (Junior & Carvalho, 2013; Shunmugam & Rwelamila, 2014). An efficacious RM approach would help to comprehend not only the types of

risks encountered, but also how to deal with them throughout the life of a project. Owing to its cumulative significance, RM has been acknowledged as a prerequisite in most sectors today; and various approaches have been proposed to deal with the effects caused by probable risks (Garrido, Ruotolo, Ribeiro & Naked, 2011).

In contrast to other industries, the construction industry (CI) is considered as at or near the top in the annual rate of business failure and the resulting liabilities (Chapman, 2001). This is because of the risky environment in which the industry operates. The industry is plagued with too many uncertainties, which must be properly managed, in order to ensure the successful delivery of projects. Enshassi, Mohamed and Abu Mousa (2008) stated that these uncertainties are from diverse sources.

They further indicated that due to the complexity of its operating environment, the industry is characterised by a variety of stakeholders, who are brought together with a common target of attaining the project objectives in terms of cost, time and quality. This feature introduces more complexity to the whole construction process, which is a collection of time-consuming activities (Zhao et al., 2010). Hence, embarking on effective RM techniques to manage the risks associated with construction projects is of the utmost importance.

Most studies on (RM) in construction have focused on investigating the impact of risk factors on construction project success in terms of cost, time, quality and safety (Junior & Carvalho, 2013; Alshibly, Louzi & Hiassat, 2013; Khodeir & Mohamed, 2015). Some researchers examined RM for construction projects at particular phase of the project, such as the conceptual design phase (Goral, 2007) and the construction phase (Tsai & Yang, 2009; Li, Zhang & Fu, 2013), rather than from the perspective of the project life cycle. Furthermore, other authors have extensively investigated the risk factors associated with the construction projects (Kishan, Bhatt & Bhavsar, 2014; Chileshe & Fianco, 2012).

However, few studies have examined the risk-analysis (RI) techniques employed in handling risks in construction projects. The risk-analysis phase in construction projects globally follows on from risk identification, the initial phase of the risk-management process (RMP). Various analytical techniques are available during this phase to help analyse the identified risks; however, the outcomes of these techniques are not conversant in South Africa yet (Shunmugam & Rwelamila, 2014).

As we acknowledge the importance of the CI, as well as its continual exposure to threats and the criticality of the risk-analysis stage; the objective of this paper is to investigate the frequency of using risk-analysis techniques in the CI. Therefore, in order to identify these techniques, an extensive literature review on risk-analysis techniques was conducted, along with the later application of a research survey among construction professionals. The study was conducted in Gauteng province (South Africa).

2. REVIEW OF THE LITERATURE

2.1 Risk management in construction: Theory and Practice

2.1.1Important definitions

Risk: construction risks are referred to as uncertain, unwanted and unexpected upcoming events; if they materialize it usually results in an additional cost, or delay to a project; hence, the objectives of the project are not met (Barnes, 1983; Perry, 1986). The notion of risk differs among individuals, according to perception, attitudes and experience; contractors, engineers, designers perceive risk from the technical viewpoint; whereas

finance and economics tend to influence the opinions of lenders and developers (KarimiAzari, Mousavi, Mousavi & Hosseini, 2011).

Zou, Zhang and Wang (2007), highlighted more recently that risk could either be a threat or an opportunity. For example, the realization of a saving in cost or time by taking a risk would be considered as the realization of a benefit resulting from taking a risk.

Risk Management: Edwards and Bowen (1998) stated that: "(RM) is a systematic approach to dealing with risk. A RM system should establish an appropriate context, set goals and objectives, identify and analyse the risks, influence risk decision-making and monitor and review risk response''. Some of the better-known approaches to RM include: ISO 31000. This is the standard from the International Organization for Standardization (ISO); RAMP, Risk Analysis and Management for Projects and PMBOK, as articulated in the Project Management Book of Knowledge, which was developed by the Project Management Institute.

A survey of the existing literature (Kishan et al., 2014; Chinenye, Okorocha, Aku, Agwu & Okogbuo, 2015) divulges that the process of RM encompasses at least four steps, namely: risk identification; risk analysis; risk-response planning; and risk control. The key steps are briefly expanded on below:

Risk identification: RI usually foregoes other stages of RMP. And Olamiwale (2012) stated that it is the starting point of the RMP; and it is considered to be crucial; since if risk is not identified, it would be almost impossible to respond to it effectively. The purpose of this stage is to identify and draw a list any probable risks that might prevent the project from achieving its set objectives. To draw up this list, Schatterman, Herroelen, Vonder and Boone (2008), established that it is firstly essential to research the possible source of risk and its unwanted effects, when striving to reach the project objectives.

Risk analysis: Risk analysis follows RI; and it involves assessing the identified risk. Here, the target is an accurate and objective computation of risk, to the extent that if this is possible, it enables the decision-making process to be more certain (Kishan et al., 2014). The essence of this step of the RMP is that it ventures to capture all practicable possibilities and to examine the end result of any decision. To conduct risk analysis, risks must first be quantified in terms of their magnitude/impact and frequency, or the timeframe of each event (Shunmugam & Rwelamila, 2014).

Risks are analysed, either by qualitative methods (expert judgement, experience and intuition), or by quantitative methods (probability analysis, sensitivity analysis, simulation analysis and scenario analysis).

Risk-response planning: This entails formulating a mitigating plan to reduce efficiently the impacts of the identified risks (Aloini, Dulmin, Mininno & Ponticelli, 2012). There are three ways of responding to risk, namely: risk retention – also known as risk acceptance – risk reduction and risk transfer. The first entails acknowledging and managing the risk; the second involves actions that reduce the possibility of the risk arising or the severity of the effect if the risk does arise. The third is about shifting the risk to the party capable of dealing with the identified risk (Schatteman et al., 2008).

Risk control: This is the final step of RM; and it involves putting into action the measures taken to manage risk. All measures that are taken to manage risk must be monitored and reviewed to ensure that they are effective (Kishan et al., 2014). Risk control should become an ongoing process, in which the effect of risk is evaluated and assessed repeatedly. The results of the previous steps are transferred onto a uniform framework, such as a 'risk register', and then transmitted to the project team for action (Chihuri & Pretorius, 2010).

At this stage of the process, RM should become an ongoing process; since the nature of the construction milieu necessitates the constant

documentation of new risks, which spark off the whole process yet again. RM, therefore, does not end until the project draws to a close.

2.1.2Empirical research

Building on the perceptions detailed earlier, the trends from some other parts of the world on RM practices are summarized below:

United Kingdom: Rostami, Sommerville, Wong and Lee (2015), investigated the efficacy of different tools and techniques of RI in SMEs in the UK CI. It was established that the complexity of detecting the appropriate tools and techniques in organizations are the key barriers that obstruct the practice of RM. The results highlight: Documentary review; expert judgment; checklist and information gathering – as the most significant techniques within RI. These are executed for their valuable results, simple processes and easy-to-comprehend factors of the structure. In opposition, brainstorming and Delphi, owing to SMEs' insufficient knowledge and resources are less practised. However, RI was considered to be significant for projects' success; and it was established that it has a positive effect on the key parameters (Rostami et al., 2015).

USA: In a study entitled "risk identification and assessment for international construction projects'', Walewski, Gibson and Vines (2006), found that the participants valued the identification and management of overarching project risks; and they recognised the dangers of exclusive attention to those risks within their area of influence. Although the need for comprehensive risk identification, assessment and management was acknowledged by all; it was nevertheless practised by few.

Singapore: A survey conducted in 2001 found that projects had poor RM implementation: "lack of time"; "lack of budget"; "low-profit margin"; and "not economical" were the most-recurrent hindrances to RM implementation (Hwang, Zhao & Toh, 2013). Yet, RM was identified to be crucial for project success (Hwang et al., 2013).

Hong Kong: A study that was carried out in Hong Kong found that formal RM processes were used minimally (Tummala, Leung, Mok, Burchett & Leung, 1997). Deterministic and subjective methods were found to be used more frequently than quantitative methods. The time required and the difficulty in interpreting the results of RM processes; the lack of RM skill and resistance to change, were found to be the major barriers of RM implementation; yet the majority of the participants believed that RM could positively contribute to project success (Tummala et al., 1997).

Swaziland: In a survey carried out in 2014 in Swaziland, to evaluate the RM practices, the respondents were required to rate the time spent by their organisation on the use of the following RM processes in handling risk: Risk identification; risk assessment; risk allocation and risk responses. The results revealed that both companies (86.27% indigenous and 95.65% multinationals) spend considerable time in identifying risk prior to its occurrence and assessing the prospective effect thereof on the project; whereas risk allocation and responses demonstrated the lowest percentages (Olamiwale, 2014). Furthermore, the documentation review and the brainstorming methods were perceived as the most used in construction (Olamiwale, 2014). The Delphi technique was perceived as less used; while others were not used in the Swaziland CI.

It is thus palpable that these industries spend considerable time on the early identification of risks that could impede projects' objectives. This is so; since RI always initiates the RMP; and it allows for early recognition of the inherent risks in construction projects, which in turn assist management in taking swift and adequate measures against the identified risk.

A review of the previous studies by South African researchers on RM in the CI corroborates the results from the global studies. Makombo (2011)

carried out a study to identify the RM frameworks in the CI of SA. He stated that the obstacles related to RM were found to be the skills gap amongst the professionals in dealing with such issues, poor scope management and a lack of focus on RM in the project-initiation phase; hence, RM is almost always a 'crisis-management' endeavour. Most of the respondents stated that they had not planned RM activities; and there was no formal RM structure in place; and consequently intuition and experience were used for risk decision-making.

Similarly, a study conducted by Boubala (2011) revealed that most construction companies use 'Customer Complaints' as a technique to identify risks. While others claim to employ 'Incidents Registers', Audit Reports' the 'Brainstorming' technique, and the 'SWOT Analysis'. However, a percentage of 53.4% indicated the inability of owners to mention the tools and activities used to determine their businesses 'Risk Appetite', which is a crucial point of any business to decide when to resort to risk-prevention techniques.

The conclusions of a study carried out by Visser and Joubert (2008) revealed that over half of the South African organisations surveyed, lacked formal RM policies and procedures; and there was a lack of RM training (Visser & Joubert, 2008). The most significant risks that plague the industry were found to be the shortage of critical resources, poor business and project-risk management, risk exposure during the tendering process, and the government-interference risk (Visser & Joubert, 2008). These findings were also identified by Mbachu and Nkado (2007) in their earlier study.

From the foregoing review of the literature, it is apparent that project success is extremely reliant on the aptitude of the project team to deal with risks. Nonetheless, there is a dominant issue of insufficient skills, inadequate training in risk management, lack of risk-management knowledge, evident lack of understanding of and regard for the RMP.

2.2 Risk-identification techniques

Wang, Walker and Redmond (2007) indicated that companies are exposed to and confronted with different risks, depending mostly on their size and type of organisation. These exposures may possibly be due to business failures, financial losses on projects, construction accidents on site, disputes, and the defaults of business associates and organisational risks. Risks need to be identified early, in order to develop strategies that would assist the organisation in formulating efficient decisions about retaining the identified risks or shifting them to the party well equipped to reduce any negative features that they may encounter.

At this stage, the origin, causes and impacts of risk are determined. Once risk is identified, it may be apparent that the problems associated with the said risk are half-solved already; because it is almost impossible to access or respond to an unidentified risk. The result of RI is a risk register, which records all the major risks encountered; potential risks and forecasts of unfavourable events and consequences. A risk register shows a short and brief description of each type of risk; these risks are then grouped according to their provenance. Subsequently, the adverse event that produced the risk must be exposed, in order to establish and allocate a risk-response action to it. Additionally, it is indispensable that the team responsible for the identified risks be allocated to each risk (Canon, 2010).

In order to identify all probable risks, which might impact on a particular project, several techniques are employed. It is always indispensable to employ the technique that is conversant with the project team and lucrative to the project itself. The following serves as the most common risk-identification techniques used in construction (Kishan et al., 2014; and Lester, 2007):

Brainstorming: This is one of the most-known RI techniques. According to PMI (2013), this technique is usually performed with a multidisciplinary set of experts, but not on the team. The goal being to obtain a comprehensive list of project risks. Here, there is only one facilitator, who is briefing on the different characteristics of the participants. This technique appears to be a well-organized RI technique; since it involves an open discussion, which is attended by the project team and other project participants. Therefore, it creates an opportunity to discuss the existence of risks, as well as the potential impacts thereof.

Nevertheless, it is predisposed to be influenced by stronger parties, if not monitored (Khalafallah, 2002).

Interviews/Expert opinion: Experts or interviewing experienced participants in a project can be a huge help in avoiding or resolving alike problems on several occasions. In this technique, all project members or the appropriate persons can be interviewed to identify the factors leading to risk (PMI, 2013).

Questionnaires: The risk-identification questionnaire technique can be employed to spot possible risks in a project. The questions are well-formulated; and they are handed out to team members by the project manager. This procedure allows for consistency and short response periods, as well as open disclosure of risks. The major disadvantage is that the final results are based on the ideas of individuals (PMI, 2013).

Delphi technique: This method is identical to brainstorming; but here the projects' participants are not familiar with each other; and they operate at different places. The identification of factors is carried out without consulting the other project participants. As in brainstorming, the facilitator sums up the identified factors (PMI, 2013). This method may be appropriate to the identification of risks; but it is more suitable for attaching the possibility of occurrence and the potential impacts of previously identified risk events (Jayasudha & Vidivelli, 2014).

Expert systems: This technique is conducted by using the past experiences of experts to identify any potential risks in a construction project. The disadvantage of this technique is that it tends to ignore outright any risk that was previously omitted; and it relies solely on knowledge (Khalafallah, 2002).

Past Experience: Here, the analogy is performed to identify potential risks, usually from similar projects. When relating the features of projects, it must provide insight on the recurrent factors (Gajewska & Repel, 2011).

Checklist: This technique can be quick and straightforward; it is impossible to build comprehensive ones. A checklist can be developed, based on historical information and knowledge that has been accumulated from preceding similar projects and other sources of information (Gajewskaa & Repel, 2011). Serious attention should be taken to exploring items that do not appear on the checklist. Further, it should be re-examined during project closure, in order to improve it for future projects.

Documentary review: A planned and detailed documentary review needs to be performed regularly, considering all the assumptions, plans and previous project files, which could be used as indicators that reveal any entrenched risks in the project (PMI, 2013).

SWOT(Strengths-Weaknesses-Opportunities-Threats): A SWOT Analysis is a planning tool often utilised to identify the internal strengths and weaknesses, as well as the external opportunities and threats of an organisation. The practice of this tool is usually illustrated in a quadrant charter, outlining the four elements in the form of strengths, weaknesses, opportunities and threats (Morano, Martins & Ferreira, 2006).

Cause-and-Effect Diagrams: These are also known as fishbone or Ishikawa diagrams; and they show how numerous elements can relate to probable problems or effects (PMI, 2013). They are generated by recording the problems on the right side and the sources on the left side. Each effect is attributed to a particular class; and the principal causes must be assembled in congruity with these classes (Morano et al., 2006).

Flowchart: This is a graphical tool that illustrates the stages of a process to be executed. A flowchart is used to gain a better comprehension of the risks, or the elements interrelated therewith (Morano et al., 2006).

Influence Diagram: This technique is a graphical depiction comprising nodes depicting the decision variables of a problem. Three different types of nodes form this technique, namely: Utility; decision; and chance; and by two types of relationship: causal and informational. The causal arises between utility and chance nodes; and it characterises a probabilistic dependence. While the informational arises between decision nodes; and they characterise time precedence (Morano et al., 2006).

Regardless of the significant number of risk-identification techniques above, we verified that: Checklist, Flow Chart, Brainstorming, Interview/Expert opinion, Delphi Technique and Questionnaire, were the six (6) techniques most cited in the literature. Similarly, these techniques are the most used in the construction industry (Grote & Moss, 2008).

3. RESEARCH METHODOLOGY

3.1 Population and data collection

The targeted population for this study included large building contractors, who have a valid registration with the Construction Industry Development Board (CIDB). The three highest gradings (7-9) were considered large and were selected from the contractor's list published by CIDB. The respondents included top management (mostly project managers, construction managers, and quantity surveyors) who were willing to participate in the study. Based on their positions, education, work experience and professional background, the authors inferred that the respondents had satisfactory knowledge of RM, as well as the activities associated with construction.

Both secondary and primary data were used to investigate the RI techniques mostly used in the Gauteng province. The secondary data were gathered through a comprehensive related literature review. Various sources were consulted, including accredited academic sources and journals, books, the internet, theses, and dissertations. The primary data, on the other hand, were obtained from a well-structured questionnaire, which was pilot-tested before being distributed to the respondents, in order to ensure simplicity, suitability, readability, understanding and the time taken in answering the questions. Ratings on the impact of risk factors in construction projects were consequently needed from the top management of these enterprises. The drop-off and collect strategy was adopted to increase the response rates, as used by Agumba (2013), and Okoro (2015).

3.2 Sample and sampling procedure

Based on a positivistic (quantitative) approach of simple random sampling, all the contractors in CIDB grade 7-9 in Gauteng had an equivalent chance to be drawn and to participate in the study. Out of 50 questionnaires sent out, 44 were returned and used, representing a 88% response rate, which was satisfactory for this study. The study used probability-sampling procedures to get the sample for the research. Probability sampling with the process of stratified sampling was used. The probability sampling is preferable to non-probability sampling; as it ensures accurate results (Mutezo, 2005).

This technique was selected because of the various categories of contractors. This method ensured a better representation of the population. The data presentation and analysis utilised frequency distributions and the percentages of all the respondents. The study was undertaken between the months of June to August 2014.

3.3 Questionnaire design

The questionnaires consisted of four sections: i) Background information to obtain information on the respondent and the company itself; ii) the risk factors identified by the literature; iii) management methods, which can be used to manage risks; and iv) the risk-analysis strategies that can be used to analyse and estimate the impact of the risk factors.

Either the respondents or the interviewers employed a close-ended questionnaire for its advantages; as it is easy to ask and quick to answer; because they require no writing. The use of closed-ended questions considers the possible unavailability of respondents. This method allows the researcher to acquire responses promptly.

3.4 Data analysis

The study was quantitative in nature; risk identification techniques were identified, as a result of conducting an in-depth literature search. A five-point Likert scale was used to determine the relative use of each risk-identification technique. The adopted scale was: 1- Never, 2-Rarely, 3-Sometimes, 4-Often, and 5-Always.

The data collected were analysed statistically using the Mean-Item Score (MIS) method of descriptive analysis. The indices were used to determine the relative use and ranking of each item. The ranking made it possible to cross-compare the relative use of the items, as perceived by the respondents. A similar approach has been used by Le-Hoai, Lee and Lee (2008), in order to analyse the data gathered from questionnaire survey.

The MIS was computed from the total of all weighted responses, and then linking it to the total responses on a specific aspect. The respondents' scores on all the chosen criteria, considered together, are the empirically determined indices of relative importance. The index of MIS of a specific aspect is the sum of the respondents' actual scores (on the 5-point scale) given by all the respondents' as a proportion of the sum of all maximum possible scores on the 5-point scale that all the respondents could give to that criterion. Weighting was allocated to each of the responses from a scale of one to five for the responses of 'Never' to 'Always.

The mean item score (MIS) was calculated for each item as follows;

$$\mathbf{MIS=}\ \frac{\mathbf{1n_1 + 2n_2 + 3n_3 + 4n_4 + 5n_5}}{\mathbf{\sum N}} \quad \text{..... Equation 1.0}$$

Where: n_1 = Number of respondents for 'Never', n_2 = Number of respondents for 'Rarely', n_3 = Number of respondents for 'Sometimes', n_4 = Number of respondents for 'Often', n_5 = Number of respondents for 'Always', N = Total number of respondents. After mathematical computations, the criteria were then ranked in descending order of their mean-item score. The next section presents the findings and a discussion on the survey.

4. FINDINGS

4.1 Demographic results

The questionnaires were completed by top management in the organizations (Table 1). A total of 50 questionnaires were sent out; 44 were returned and used, which represents 88% the overall sample. These formed the basis of this study. Table 2 below presents the responses from the participants, as well as their position. It is shown that of the 44 responses, the majority of the respondents were construction managers, i.e. 15 (34.1%); 11 (25%) were

quantity surveyors; 9 (20.5%) were project managers; 4 (9.1%) were named as others; while 3 (6.8%) were directors; and 2 (4.5%) were architects.

Table 1 Position of the respondent

Position of the Respondents	Frequency	Percentage %
Director	3	6.8
Project Manager	9	20.5
Construction Manager	15	34.1
Architect	2	4.5
Quantity Surveyor	11	25.0
Other	4	9.1
Total	44	100

Figure 1 illustrates the working experience of the respondents in the industry. It was shown that 48% had working experience that ranged from 1-5 years; 25% had working experience that ranged from 6-10 years; 14% had working experience that ranged between 11-15 years; and only 5% had experience that ranged from 16-20 years; while 8% had more than 20 years of working experience. On the basis of their function, education, work experience and professional background, it may be concluded that the respondents have sufficient knowledge of construction activities.

The response rate for completed questionnaires is shown in Figure 1 below.

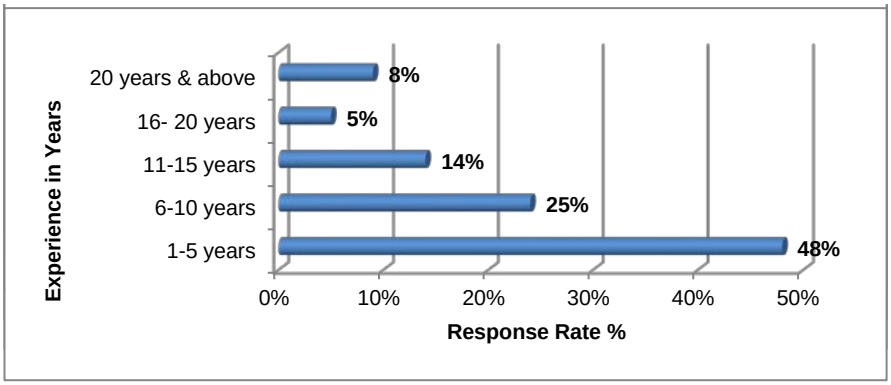

Figure 1 Experience of the organisation in construction (years)

4.2 Frequency of use of risk identification techniques

The twelve (12) risk-identification techniques quoted in the literature formed part of the questionnaire, in order to investigate their frequency of application. Hence, Checklist, Flow Charts, Brainstorming, Interviews/Expert opinion and Delphi Techniques were the five (5) most used techniques in the CI in Gauteng (South Africa). Table 2 shows the frequency distribution of each technique, according to its ranking and mean item score (MIS). It is shown that Checklist was the most used technique with a score of MIS=4.55; followed by Flow Charts (MIS=4.52). Brainstorming came third, with a score of MIS=3.91; followed by Interviews/Expert opinion (2.86) and Delphi Technique with MIS=2.52.

As a matter of fact, the techniques cited in the literature as the most used in the CI were the following: Checklist, Flow Chart, Brainstorming, Interview/Expert opinion, Delphi Technique and Questionnaire (Grote & Moss, 2008; Rostami *et al*., 2015). However, Questionnaire, Document review and Expert systems did not appear in the study among the most used techniques. This finding endorses the finding of past research conducted by

Olamiwale (2014), who reported on the questionnaire, expert systems and document review as least used in construction. Thus, these findings are in agreement with the literature to the extent that two of them (Checklist and Flow Charts) appeared among the six (6) most-used techniques that presented the highest frequency of application, where Checklist techniques were identified as the most-used techniques in the CI.

Table 2 Frequency distribution of use of risk identification techniques

Risk-Identification Techniques	Rank	MIS
Checklist	1	4.55
Flow Charts	2	4.52
Brainstorming	3	3.91
Interviews/Expert Opinion	4	2.86
Delphi Technique	5	2.52
Questionnaire	6	2.48
Influence Diagram	7	2.02
Expert systems	8	1.95
Past Experience	9	1.68
Document Review	10	1.25
SWOT Analysis	11	1.22
Cause-and-effect diagrams	12	1.19

5. CONCLUSION

The study revealed that checklist was the most frequently practised, followed by flowchart. The findings concur with those identified in the literature as the most-practised ones in Construction. Nevertheless, it is remarkable to observe the absence of Delphi technique, brainstorming, interview/ expert opinion and questionnaire among the techniques most commonly used; since literature also mentions these as the most common, although the first three had a score greater that the average (MIS>2.5).

Another remarkable point to notice is that the questionnaire was observed by the current study, as one of the least-practised (MIS=2.48); whereas in literature it is commonly cited.

Furthermore, it is evident that among contractor respondents, there is a lack of general awareness of the techniques available, as disclosed in the literature to be used to identify any risks. This situation undoubtedly has an influence on the practice of these techniques. However, it is comprehensible that the understanding of these techniques does not assure one that they will be used by the organizations, which will employ the technique they believe to be the most conversant and trustworthy.

This paper presents a variety of remarkable contributions to RI in both theory and practice; nevertheless, numerous shortcomings of the study need to be recognised. The study addressed the South African CI; hence, the results may not directly apply to other industries, or to similar organisation operating in other countries. A further restraint is related to the approach employed in conducting this study, which is based on the quantitative approach. For instance, a qualitative approach with more exhaustive questions could provide dissimilar outcomes by addressing various class sections.

Practitioners and researchers are likely to find the study useful; as it discusses risk-identification techniques used in construction; and in particular, it reports empirically on the techniques mostly applied in

identifying risks in construction projects. Valuable information on current risk-identification techniques are provided.

In conclusion, although we can find various studies on RM in South Africa, the number of studies in the field of construction remains unsatisfactory.

6. RECOMMENDATIONS

Following the findings and conclusions of this study, the following recommendations are made:

1. The results of this study recommend contractors to select the optimal risk-identification technique to identify potential risks, and to determine the appropriate preventive techniques to respond to risk effectively at the outset of a construction project.
2. Proactive measures in RM should be inculcated early enough into the project life cycle, in order to mitigate risks.
3. RM should become a part of the prospectus of construction-related courses at undergraduate level; as this would assist in eradicating the level of unawareness concerning risks in the CI.
4. Training sessions on RM should be organised regularly; and participation should be obligatory for all the stakeholders in the CI. This would assist in creating better awareness among stakeholders in the industry.
5. Common practices of RM that would allow for reliability in the management of risks; and these practices should be introduced into the industry.

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