

# USING APPROPRIATE TOOLS AND TECHNIQUES FOR RISK IDENTIFICATION IN UK CONSTRUCTION'S SMES

Ali Rostami<sup>1</sup>, James Sommerville, Ing Liang Wong and Cynthia Lee

*School of Engineering and Built Environment, Glasgow Caledonian University, Glasgow G4 0BA, Scotland, UK*

Risk Management (RM) techniques are important for any organisation. Those firms that have implemented a RM process have recognised that there would be a higher probability of failure if appropriate techniques are not carefully employed during the risk identification stage. This requires proportionate selection of techniques that are compatible with the organisations' needs and limited resources. A literature review on RM indicates the inadequacy in a number of empirical studies done on how techniques influence the RM process. This work investigates the efficacy of the techniques of risk identification within Small and Medium Enterprises (SMEs) in the UK construction industry. Results from a questionnaire survey shows the challenges faced by SMEs in undertaking risk identification and highlights the most common techniques adopted among 153 organisations. Documentation review, expert judgment and checklist analysis are seen as the most important techniques within risk identification; which are practiced for their valuable results, uncomplicated processes and easy to understand structure. Conversely, the group-based techniques like brainstorming and Delphi techniques because of SMEs' inadequate level of knowledge and resources are less practised.

Keywords: risk identification, risk management, small and medium enterprises.

## INTRODUCTION

The Global Construction Perspectives and Oxford Economics (2013) forecasted that the construction sector will grow by over 70% by 2025. This significant growth in the global construction industry will create considerable opportunities for the UK construction organisations, but will equally generate demand for adequate reforms in project performance (Mlybari, 2011). In order to improve the performance of the construction industry and take advantage of the new business environment, a number of studies have specified the key role of the RM practice (Tabish and Jha, 2011). Chapman and Ward (2008) explained that implementation and subsequent practise of RM contributes to enhanced project performance. This view is also confirmed by the UK Government through the British Standard focusing on RM (BS 31000:2009). BS (31000) states that the practise of RM in organisational management resulted in the

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<sup>1</sup> ali.rostami@gcu.ac.uk

control of delays and budget overruns, which ultimately promotes the competitive advantage of organisations.

Recent studies in the UK construction industry presented the weak reputation of RM within organisations (Smith *et al.*, 2014; and Lyons and Skitmore, 2004). Kim and Bajaj (2000) and Frimpong *et al.* (2003) investigated that the construction professionals' low level of familiarity with techniques and inability to elicit results of the processes are the most influential factors which impact the adoption of RM in organisations. Chapman (1994) and Couillard (1995) added that, even professionals with frequent use of RM have difficulty to understand the rationale of RM techniques' outputs in new projects. This difficulty is also compounded by SMEs' restricted resources which make both implementation and practice of RM more complicated (Debrah and Ofri, 2006). The take up and practice of RM techniques involves a considerable level of investment which in some cases is unaffordable for SMEs. This investment signifies the high degree of effort required to understand and to learn how to use the techniques at both organisational and personal levels. Review of literature on RM in SMEs implied that the users' knowledge and experience in RM have precedence over organisational constraints (Henschel, 2007). This reinforced the viewpoints of Chileshe and Kikwasi (2013) that lack of awareness and experience in RM tools and techniques are two key innate problems of professionals in construction organisations.

The question of major relevance to SMEs considering the practice of RM is: which tools or techniques can provide the greatest benefits?

## **RISK IDENTIFICATION TOOLS AND TECHNIQUES**

The Risk Identification (RI) process, as the initial step of RM, forms the structure of the whole process (Chapman, 1998; Ward and Chapman, 2003). Failure in the identification of risks can cause inadequacy in the whole process of RM, which can in turn critically affect the organisation's resources. This process assists organisations in RM to: (1) recognise the best and most relevant input data (2) understand the benefits of the process (3) recognise risks and their potential impacts (4) provide information for decision-makers (Simu, 2006; Henschel, 2007; and Wang *et al.* 2007). The RI process or risk information gathering process can be achieved with the aid of different tools and techniques. The most common tools and techniques are: documentation reviews, expert judgment, diagramming techniques, assumption analysis, information gathering, checklists and SWOT technique (Chapman, 1998 and BS, 2010).

Chapman (1998), through the behavioural scientists' framework which was developed by Handy (1993), conducted an empirical research on the effectiveness of risk identification and assessment techniques in construction projects. The research divided risk identification tools/techniques into three main categories by the degrees of involvement of people, comprising: identification by expert; one-to-one interview; and working group led by analysts. The result cited that the brainstorming technique which involves the analyst leading a working group is the most widely used risk identification technique in large organisations.

Further, Lyons and Skitmore (2004) sought the frequency of use of risk management techniques in the construction engineering industry. Project managers from 44 enterprises highlighted that the checklists, brainstorming, case-based approach and scenario building were the most frequently used tools and techniques for identifying

risks. They indicated that the success rate of their projects was highly influenced by the association of techniques.

In organisations, a series of factors are involved in the practice of techniques in risk identification (Raz and Michael, 2001). These factors affect the effectiveness of techniques in achieving their objectives, and include: given, intervening and output factors (Chapman, 1998). The givens embrace the organisation's existing factors which impact outputs. The main given factors comprise resources, leader knowledge and skills, and tools and technologies. The intervening factors are temporary factors which are adopted to improve the productivity or user satisfaction such as leadership and procedure. Finally, the output factors cover the satisfaction and user-expected results in terms of their objectives.

In the context of SMEs, restrictions imposed by organisational given factors, such as finance and technology; force SMEs to adopt cost-effective and time-effective techniques (Welsh and White, 1981). Hence, working group techniques like brainstorming for risk identification which was highlighted by Chapman (1998) and Lyons and Skitmore (2004), are not appropriate for most SMEs. This paper attempts to identify the most common tools and techniques in the risk identification process, and assesses their efficacy in SMEs in the UK construction industry.

## RESEARCH METHODOLOGY

This research was part of a mixed method study which aimed to identify key tools and techniques in the RI process in SMEs in the UK construction industry that can be applied to the development of a Scaling Risk Management process for SMEs. As a whole, the study was based on a sequential explanatory mixed method and included quantitative and qualitative studies. This paper embraced the quantitative part of the study with literature review that assisted to conduct semi-structured interviews for further qualitative study.

The data for the study was obtained by means of a postal questionnaire. Organisations which participated in this study employed more than 10 people but less than 250 employees. Database for the study was obtained from the Office of National Statistics (ONS), the Small Business Gateway, the Financial Analysis Made Easy (FAME) and the Scottish Centre for the Built Environment (SCBE). The period of the study was from the 15<sup>th</sup> of February to the 31<sup>st</sup> of May 2013. 113 small and 40 medium-sized enterprises participated in this study (Table 1). Attempts were placed to have samples across architecture, engineering and construction organisations.

*Table 1: Organisation distribution which participated in the study*

Organisation	Architecture	Engineers	Contractors	Total
Small	26	25	62	113
Medium	16	10	14	40
<b>Total</b>	42	35	76	153

The questionnaire comprised of three sections. Section 1 explored general information about the participants. Section 2 collated general risk and RM information, and asked respondents to indicate the most important difficulties in terms of their impact on the implementation of RM. Section 3 evaluated the risk identification and risk analysis tools and techniques, and investigated their efficacy regarding the organisational characteristics.

The answered questionnaires were analysed by using the Statistical Package for the Social Sciences (SPSS) version 19. The data collected through the questionnaires was based on the key identified tools and techniques from the literature review which were subjected to Principal Component Analysis (PCA) to determine their scale of importance in relation to risk identification. To evaluate the suitability of factor analysis in the preliminary test, the Kaiser-Meyer-Olkin (KMO) value was found to be 0.847 (significant value = 0.6) (Tabachnick and Fidell, 2007), Bartlett's test of the Sphericity (Bartlett, 1954),  $\rho = .00$  (significant value  $\rho < .05$ ). (Table 2)

Table 2: Kaiser-Meyer-Olkin (KMO) and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.847
Bartlett's Test of Sphericity	Approx. Chi-Square	726.354
	df	21
	Sig.	.000

The Kaiser's criterion (Kaiser, 1960) was conducted to determine the smallest number of factors that are required for factor analysis. In Kaiser's criterion, the values above 1 in the Total Variance Explained table in column Initial Eigenvalues (Table 3) highlight the number of required factors which include 4.424 and 1.034. These two factors define a total of 77.98% of the variance (Table 3, Cumulative % column). Therefore, two-factor solution for the factor analysis method was considered to extract the key tools/techniques in the RI process.

Table 3: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadingsa
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	4.424	63.205	63.205	4.424	63.205	63.205	4.141
2	1.034	14.772	77.977	1.034	14.772	77.977	2.817
3	.463	6.612	84.589				
4	.396	5.653	90.242				
5	.353	5.041	95.283				
6	.205	2.924	98.208				
7	.125	1.792	100.000				

To aid the interpretation of these two components, *Oblimin Rotation* (Costello and Osborne, 2005) was performed. This process indicated the highest loading tools and techniques which contain: documentation review; expert judgment; checklist analysis and information gathering techniques.

## TOOLS AND TECHNIQUES: EMPIRICAL FINDINGS

Chapman and Ward (2008) stated that the techniques in risk identification call for thinking and imagination about unthinkable which fosters creativity and assists to seek the experience of the personnel. In practice, an adequate set of techniques improves: information capturing; communication; quality of risk analysis; and prioritising of activities and resources. There is a wide range of techniques in the risk identification phase and each of them is appropriate for a particular task (Raz and Michael, 2001). Techniques are mostly adopted in organisations based upon the degree of the practitioners' familiarity with and ability in understanding the benefits of them (Brassard, 1989). This study adopted the BS 31010 (2010) tools and techniques to

identify the most common techniques among construction SMEs for the risk identification process.

In section 3, the first question in the risk identification part of the research questionnaire pointed out the SMEs' familiarity with techniques, and subsequently, the usage rate of them was assessed through the second question. The results indicated that the top four tools and techniques were: documentation review, expert judgment, checklist analysis and information gathering.

### 1. Documentation Review

The respondents outlined various tools and techniques that they practiced in their role within their organisations to identify risks (Figure 1). The first tool that emerged was the documentation review. 142 out of 153 companies were familiar with this tool and 81% of them considered the tool as the first preferred tool to identify risks in organisation. Collecting data by reviewing existing documents is known as the documentation review technique. This review covers documents of the previous business plans, strategies, activities, contracts and other stored information in either hard copy or electronic formats. The technique is used to collect background information to understand and identify new business probabilities and uncertainties. This review assists to recognise the strengths and weaknesses of the organisation and understand the history and philosophy of the business. SMEs highlighted that the technique helped them to develop the risk identification process by assessing the organisation's existing documents to set up focus groups or devise an observation framework.

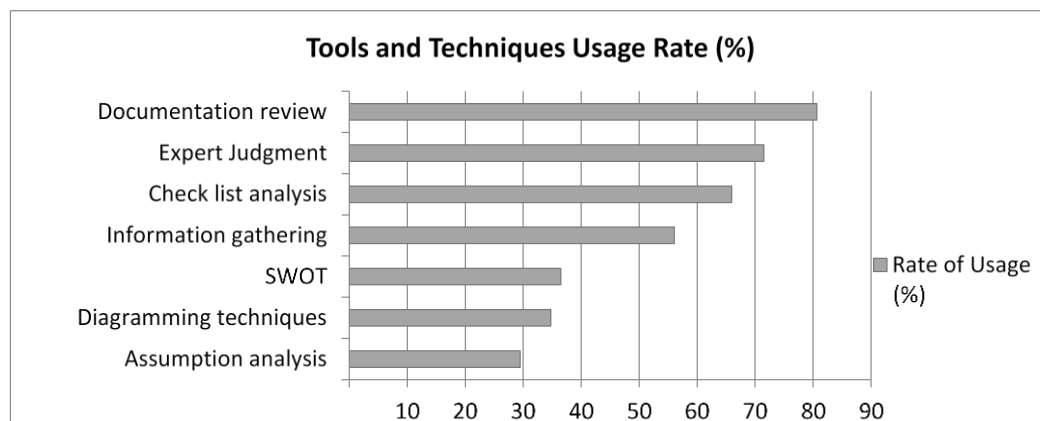


Figure 1: Percentage of Tools and Techniques Usage among SMEs

The participants explained that this technique contained the assessment of the existing documents at the start of the process which was to find out what types of information were available and which part of them were required for further review. The assessment step is followed by the compiling process which specifies the limit of the review for answering the evaluation questions. Then the accuracy of the compiled information needs to be checked by the management team. In this step, the usable part of the information is critically analysed to derive the key information from documents (Witkin and Altschuld, 1995).

### 2. Expert Judgment

The second risk identification tool/technique that emerged from 129 questionnaires with 71% usage rate among SMEs was the expert judgment. The expert judgment tool is widely practiced in different stages of businesses and potentially covers both internal

and external risks. The SMEs stated that the expert judgment is implemented and practiced because of: its affordable required resources in terms of time and budget; valuable results and outcomes; uncomplicated process to set up and quick to produce results. They noted that the outcomes of this technique can be as accurate as other costly tools and techniques like the diagramming techniques.

The expert judgement is a process which is founded on the knowledge and experience of individuals or groups. The people with specialised knowledge whether part of the organisation or involved in a specific activity of the business, are known as the experts of the business (Otway and Winterfeldt, 1992). The research revealed that the expert judgment in SMEs highly relies on the experience and skills of the SMEs' owners and managers. 87 companies indicated that they used their management experience due to their familiarity with the business activities instead of the costly advice of consultants. Few companies argued that if the firm could hire a part-time consultant with relevant expertise, knowledge and skills, they would do so to afford the business with more success probability (fewer risks). They believed that utilising the services of an expert is more beneficial and operational than business management analysis. A business manager from a medium-sized company highlighted that the efficacy of the expert judgement technique highly depends on both internal and external experience. The identified risks by the management team should be reviewed by a consultant with relevant experience of similar business areas to achieve the best possible outcomes.

### *3. Checklist analysis*

The third emerging technique was a checklist analysis which was familiar to 127 organisations out of 153. 66% of organisations stated that this technique was currently being practiced by their business management. This technique is known as a basic method of risk identification in which pre-identified threats and opportunities are investigated for signs of potential risk situations (Duncan, 1996; Kumamoto and Henley, 1996). Checklists within organisation are developed over time through functional experts' contributions and collective experience (Ward 1999, and Chapman and Ward, 2008).

A number of organisations named the checklist as the starter of the risk identification which gradually forms the structure of the process. Checklist helps to speed up the whole process and stops organisation from forgetting the critical steps caused by disruptions. A medium-sized company presented the checklist as the source of the Risk Breakdown Structure (RBS) which supports the team in better understanding of the risks involved. This company analogised the RBS with the Work Breakdown Structure (WBS) in mapping the details of activities. More than 25% of participants noted that lack of investment in training and technology were the main barriers to replacing alternative (new) methods with old-fashioned techniques such as checklist analysis.

### *4. Information Gathering*

The fourth common set of techniques which was practiced in more than 56% of SMEs was information gathering. 115 out of 153 organisations were familiar with the information gathering techniques. They indicated that the process of information gathering helped to enhance the organisation's memory, develop effective management and save resources. The most important techniques in this method include interviewing, brainstorming, Delphi technique and root cause analysis. 27 participants named the interviewing and brainstorming techniques as the most used information gathering techniques in risk identification.

Risk identification through the interviewing technique can be an individual assessment or involve a group of people (Chapman, 2001). This technique is categorised as a resource-intensive technique due to its dependence on the organisational resources and time. The collected information through this technique is used to provide a ground for further risk identification. Chapman and Ward (2008) believed that the individual straightforward approaches such as the pondering approach which is based on individual identification assessment could be more beneficial for organisations than that of costly interviews.

Brainstorming is the second common technique in the information gathering process among construction SMEs. The aim of this technique is to provide a comprehensive list of risks with the aid of business team and multidisciplinary specialists. Osborn (1963) introduced the brainstorming as a problem solving method that provides a considerable range of ideas in less time. This technique contains identifying problems, creating ideas, introducing and developing solution sub-processes (Chapman, 1998). The results of the study revealed that the medium-sized participating firms were more likely to implement this technique for the reason of being familiar to them and its time effectiveness character. Two of those companies indicated that they used semi-structured interviews for the ground phase of the risk identification and used its generated information as the identified problems in the brainstorming technique.

## **CHALLENGES FOR RISK IDENTIFICATION TOOLS AND TECHNIQUES**

There are many barriers associated with RM process within organisations such as the adaption of risk management with business plans, identification of the most appropriate RM tools and techniques (Carter, 1972), the importance of adequate resources (Hull, 1980) and need for cultural improvement in organisations (Leopoulos *et al.*, 2006). One of the key important barriers highlighted by the majority of SMEs in this study was the identification of appropriate techniques in RM. The organisations indicated that the techniques that support the data collection in the risk identification stage perform the key fundamental role in the whole process of RM. In large construction projects, the judgments attained from the project core team outlined that the most effective risk identification techniques belonged to the group work techniques (i.e. brainstorming and Delphi techniques) (Chapman, 1998). In line with the Chapman study, Raz and Michael (2001) stated that the checklists, brainstorming, risk documentation form and periodic risk reporting were the most common risk identification techniques in the software and high-tech industries which were frequently practiced among large organisations. However, the current study within SMEs in the UK construction industry revealed a different set of techniques which included documentation review, expert judgment and checklist analysis.

The results indicated that employing a technique in a process is influenced by the characteristics of the organisation which affect the effectiveness of the process. These characteristics are defined by three distinct classifications: (1) individuals, (2) organisation and (3) environment (Handy, 1993). In small to medium-sized companies, due to their low degree of complexity and high level of centralisation in management (Ghobadian and Gallea, 1997), the individuals' factors such as personality, aptitude, experience, knowledge, leadership etc. have more impact than those of the organisation (i.e. group work and relationships). In addition, restrictions imposed by organisational factors, such as resources and technology, force SMEs to adopt cost-effective and time-effective techniques. Therefore, the techniques like

brainstorming which was highlighted by Chapman (1998) and Raz and Michael (2001) are not appropriate for most SMEs' due to their noted barriers.

The participants named: uncomplicated process to set up and practise; easy to understand for practitioners; time and cost effectiveness; valuable results and outcomes; being familiar to other management processes; dependence on old-fashioned methods (unwillingness to learn and practise new methods); lack of investment in training to learn alternative methods, and low degree of budget to replace new methods (Software-Technology) as the most important issues in the adoption of techniques.

The results of the research indicated that among all risk identification techniques the documentation review was the most cost and time effective technique because of its independent character and uncomplicated process. This technique can be implemented independent of other resources, and obtaining information through it is completely affordable. However, the quality of information being gathered is not controllable and needs to be assessed together with the outcomes of other information collecting techniques such as interviews, questionnaires and checklists.

## CONCLUSION

On the basis of a survey with the UK construction enterprises having adequate knowledge and experience of construction management, 3 key tools and techniques were identified on an assessment of their likelihood of usage and degree of efficacy in risk identification. The documentation review, expert judgment and checklist analysis were highlighted to have significant impacts on the efficiency of risk identification. The attempt to evaluate these key tools and techniques from the perspective of organisational characteristics indicated that valuable results and outcomes; time and cost effectiveness; and uncomplicated processes are the main reasons of their practice within small and medium sized enterprises. Conversely, the group-based techniques like brainstorming because of SMEs' inadequate level of knowledge and resources are less practised.

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