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An exploratory factor analysis of risk management practices: A study among small and medium contractors in Gauteng

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Abstract

Risk management (RM) is acknowledged as a key activity in project management in the pursuit to deliver successful construction projects. However, these projects are associated with various risks, which often jeopardise project performance, especially among small and medium construction enterprises (SMEs). Risk management practices (RMPs) have been developed, in order to curtail project risks. Nevertheless, there is no consensus on the practices that constitute RM for SME projects. Therefore, the main purpose of this research is to determine the RMPs that can be tailored for construction SMEs to manage risk in their projects, in order to achieve project success. An extensive review of relevant literature on RMPs was conducted and used to develop a structured questionnaire posted to construction SMEs who were conveniently sampled in the Gauteng province of South Africa. The empirical findings established nine RMPs that were reliable and valid for managing risk in projects undertaken by construction SMEs, namely organizational environment; defining project objectives; resource requirements; risk measurement; risk identification; risk assessment; communication approach and evaluation; risk response and action planning, as well as monitoring and review. It is important to note that the study was not conducted across South Africa; hence, the findings cannot be generalized. Despite the delimitation, the researchers recommend that these practices are for risk management in construction projects undertaken by SMEs in South Africa.

Keywords: Factor analysis, risk management practices, small and medium enterprises, South Africa

Risikobestuur (RB) word erken as 'n sleutelaktiwiteit in projekbestuur in die strewe om suksesvolle konstruksieprojekte te lewer. Hierdie projekte word egter geassosieer met verskeie risiko's wat projekprestasie dikwels in gevaar stel, veral onder klein en medium konstruksie-ondernemings (KMO's). Risikobestuurspraktyke (RBP) is ontwikkel om projekrisiko's te beperk. Tog is daar geen konsensus oor die praktyke wat RB vir KMO-projekte uitmaak nie. Die hoofdoel van hierdie navorsing is dus om die RBP te bepaal wat aangepas kan word vir konstruksie-KMO's om risiko in hul projekte te bestuur ten einde projeksukses te behaal. 'n Uitgebreide literatuurstudie oor RBP is gedoen en gebruik om 'n gestruktureerde vraelys te ontwikkel wat aan konstruksie-KMO's in die Gauteng provinsie van Suid-Afrika gepos is. Die empiriese bevindinge het nege RBP opgestel wat betroubaar en geldig was vir die bestuur van risikos in projekte wat deur konstruksie-KMO's onderneem is, naamlik organisatoriese omgewing; definisie van projekdoelwitte; hulpbronvereistes; risiko-meting; risiko-identifikasie; risikobepaling; kommunikasiebenadering en evaluering; risikoreaksie en aksiebeplanning, sowel as monitering en hersiening. Dit is belangrik om daarop te let dat die studie nie oor die hele Suid-Afrika uitgevoer is nie; daarom kan die bevindings nie veralgemeen word nie. Ten spyte van die beperking, beveel die navorsers aan dat hierdie praktyke is wat vir risikobestuur in konstruksieprojekte deur KMO's in Suid-Afrika onderneem moet word.

Sleutelwoorde: Faktoranalise, klein en medium ondernemings, risikobestuurs-praktyke, Suid-Afrika

1.   Introduction

The construction industry (CI) is one of the largest employers globally. It employs approximately 7% of the global work force or 180 million people and it is predicted to account for approximately 13% of the Global Domestic Product (GDP) by 2020 (Nieuwenkamp, 2016). In South Africa (SA), the CI employed 1 395 000 people (formal and informal sectors), contributing 3.9% to national GDP (StatsSA, 2017). Despite its economic contribution, a construction project is well acknowledged as the riskiest project to execute because of the complexity of its activities, operating environment, and processes involved prior to and during project execution (Gao, Sung & Zhang, 2013). The complexity of its activities and the risk environment lead to poor project performance, especially among small and medium construction enterprises (SMEs), whose contribution to the economy is substantial. This contribution has been recognised in many countries (Mutezo, 2013: 157; Abor & Quartey, 2010: 223; Ellegaard, 2008: 428) and especially in African countries such as South Africa and Nigeria, where they contribute 51% and 57% to national GDP (Kalane, 2015: 15). In Nigeria, SMEs have contributed approximately 48% of the national GDP in the last five years (Aroloye, 2017). As such, the South African government utilizes SMEs to attain three main objectives, namely poverty alleviation, job creation opportunities,

and promoting economic growth (Leboea, 2017: 39). To buttress this statement, Mutezo (2013: 155) stated that SMEs are often regarded as the backbone of the economy and the main driver of economic growth in the country (Falkner & Hiebl, 2015: 131).

Regardless of the noted economic significance, it is estimated that many SMEs in South Africa fail to go past the end of their second year of business establishment (Marcelino, Pérez-Ezcurdia, Echeverría Lazcano & Villanueva, 2014: 332; Cant & Wiid, 2013: 710). Perera (2016) supported this statement by arguing that many SMEs do not survive beyond their first five years of business establishment and that eight out of ten SMEs fail every year. Studies have revealed that many SMEs fail, due to a number of factors, which include, but are not restricted to the lack of access to finance (Boone & Kurtz, 2006; Ramlee & Bernma, 2013; Brown & Lee, 2014) and lack of appropriate management skills (Olawale & Garwe, 2010: 731). However, Rostami, Sommerville, Wong & Lee's (2015: 98) study revealed that 80% of SMEs failures are as a result of management failure. It was indicated that there is a necessity to improve corporate governance and the link to risk management (RM). In performing their activities, SMEs face many risks that are often similar to those of large enterprises. SMEs, however, tend to experience more risks than large enterprises, and the risk of not delivering the project within its set target is higher in SMEs than in large enterprises (Rostami *et al.*, 2015: 98). As a result of high exposure to risk and failure, investors and banks have become hesitant about funding SMEs (Ellegaard, 2008: 429; Kraus, Rigtering, Hughes & Hosman, 2012: 161).

Risk management practices (RMP) have been developed in order to curtail project risks. However, RM is still not widespread among construction SMEs. Even though it is not a new concept, it has lately become a growing priority in any construction project management (Jurgensen, Duijm & Troen, 2010: 1040). RM in construction refers to a process that consists of identifying, assessing, and planning actions to deal with potential risks that may influence the successful achievement of project objectives (Kraus *et al.*, 2012: 161). The inability of SMEs' owners to apply the RM process has contributed in RM becoming one of the factors that leads to lowering the sustainability of SMEs (Falkner *et al.*, 2015:130). RM can help SMEs to efficiently deal with negative occurrences that could jeopardize the successful achievement of project objectives. However, Marcelino-Sádaba *et al.*'s (2014: 332) study reported that many SMEs do not or not adequately apply RMPs, mostly because they cannot afford to rededicate resources due to their constraints. Lack of RM strategies in place also remains to be a common trend among SMEs amidst

many risks, a factor that could be closely linked to the high failure rate (Nunes, Viveiros & Serrasqueiro, 2012: 453). According to Gao *et al*. (2013: 683), knowledge on the risk management strategies applied by SMEs remains scanty, especially in less developed economies. Furthermore, Gunasekaran, Rai & Griffin (2011: 5494) point out that the lack of adoption and implementation of mitigative strategies in SMEs projects have resulted in many projects not achieving set objectives.

Chihuri & Pretorious (2010: 65) postulated that, in South Africa, risk management was also not widely used among both small and large firms and that there was a lack of actual adoption and implementation of RM practices. Yaacob (2015: 496) argues that scientific effort among researchers to investigate issues on RMPs is inadequate and emphasises that research on RMP of SMEs is minimal compared to SMEs' critical contribution to the economy. In order to overcome project failures, Cooke-Davis (2002: 188) established that project success is highly dependent upon the implementation of RMPs. Rounds & Segner (2011: 104) described it as one of the most capable areas and critical procedures that help complete projects successfully. Furthermore, Imbeah & Guikama (2009: 778) argued that RMPs are closely aligned with overall project performance.

The scarcity of scientific research on RMPs and poor project perfor-mance highlight, the need to determine RMPs that construction SMEs can use to improve their project performance. Furthermore, although many studies have been conducted on RM among SMEs, the plethora of studies lack consensus of the RMPs to be used by construction SMEs. The purpose of this study is, therefore, to determine the reliable and valid RM practices tailored for construction SMEs projects, using exploratory factor analysis.

2.   Risk management in SMEs

A study conducted by Gao *et al*. (2013: 684) indicated that formal RM frameworks are designed for large enterprises, and that the frameworks are too complicated and pricey for SMEs to adopt. According to Blanc-Alquier & Lagasse-Tignol (2006: 18) and Gao *et al*. (2013: 684), SMEs lack RM knowledge, skills and capability. SMEs' owner managers are so knowledgeable about their ventures and are commonly not able to identify all the risk elements that have an impact on their business activities (Smit & Watkins, 2012: 6326). These statements are supported by Sullivan-Taylor & Branicki (2011: 5565) and Gunasekaran *et al*. (2011: 5498) who believe that implementing formal RM process is not feasible because of SMEs' restricted resources.

Contrarily, Corvellec (2009: 288) argued that organizations might implicitly implement RM. RM is embedded in daily management activities and business processes. Organizations do not openly state that they are addressing risks and implementing RM. Nevertheless, they are addressing risks encountered by their organizations in an effective manner. Poba-Nzaou, Raymond & Fabi (2014: 488) concurred with the study. They revealed that SMEs' RM practices are informal, unstructured, and instinctive. However, they still effectively address management risks. Poba-Nzaou, Raymond & Fabi (2014: 488) interpret this as SMEs demonstrating RM capability.

Establishing risk initiatives for construction SMEs is critical to the success of their projects. SMEs' failure is often due to high levels of non-application of RM processes, unmanaged risks and worst-case scenarios, and the inability to manage risks. However, Ekwere (2016: 32) notes that the objective of RM is not to prevent risk-taking, but to ascertain that risk is taken with a clear understanding and knowledge to enable its measurement and mitigation with an organization. SMEs are also found to have backward-looking perspectives as opposed to a transformed and forward-looking approach that promotes continuous improvement (Ching & Colombo, 2014: 77). According to Watt (2007: 26), SME senior managers should consider the following steps in their RM processes: establish the SMEs' risk strategy; determine the risk appetite; identify and assess the risk, and prioritize and manage the risk.

Having an understanding of the RM process surrounding the organization is useless if inadequate RM initiatives are applied. Owners and managers of construction SMEs need to take RM as a process that utilizes internal controls as measures to mitigate and control risk pertaining to their organizations. Hence, owners and managers in SMEs need to be conversant with risk identification and analysis, in order to manage risks from a diverse range of sources (Schultz, 2001). Schultz's statement is complemented by Smit & Watkins (2012: 6328) who stipulate that SMEs that incorporate RM are better equipped to exploit resources pertaining to their organizations, thus enabling SMEs to convert an expenditure activity into an activity that can yield a positive return (Hsu, Lien & Chen, 2013). According to Napp (2011: 34), risk occurrence can be a danger to SMEs in continuity; it is of paramount importance that SMEs focus and try to implement comprehensive RM. The main outcome of RM is to reduce the number of threats that materialize into problems and to minimize the effect of those that do occur (Hillson, 2009). Taking the above into consideration, it is clear that RM is of paramount importance. If RM is

managed effectively and efficiently, it can help businesses become more cost effective.

2.1 Identified risk management practices

There was no particular study with similar factors and the measures that deemed to influence project outcome. The extensive literature review suggested nine theoretical RM practices that SMEs could use to manage their projects in order to achieve successful project delivery. These practices are discussed in detail in this section.

2.1.1 Organizational environment

According to the Institute of Risk Management (IRM, 2002), the internal environment influences an organization in adopting a comprehensive and collaborative approach to risk and, therefore, impacts positively on the outcome of the project. In addition, it influences management decision-making to achieve the right balance of risk and opportunity. Likewise, the external environment evaluates the strategic alignment of an organization's RM and its external operating environment (IRM, 2002). Smit (2012: 67) indicated that understanding the organizational environment of risk ensures that all organizational stakeholders understand their responsibilities and accountabilities, as well as identify possible weak areas that may influence the project from achieving its objectives. As stakeholders play a crucial role in the success of any project, scholars studying the construction sector (Olander & Landin, 2005: 323; El-Gohary, Osman & Ei-Diraby, 2006: 597; Bosher, Dainty, Carrillo, Glass & Price, 2007: 165; Momeni, Hamidizade & Nouraei, 2015: 416) established that stakeholder involvement has undeniable impacts on project outcomes. Furthermore, in exploring the effect of organizational environment, top management involvement, and stakeholder's involvement on the success of a project, Basu, Hartono, Lederer & Sethi (2002: 516) observed that these factors were considerably related to project success. From the discussion, it can be suggested that understanding the organizational environment is an important practice of RM and project success.

2.1.2 Defining project objectives

According to Goetz (2010), unclearly defined objectives lead the project into overruns, personality clashes, unhappy clients, and missed milestones. Defining project objectives aids in aligning the organization whereby the project objectives are clearly visible and understood, hence positive and negative risks in achieving the objectives are identified and understood, and risk responses

are aligned (Boubala, 2010: 14). In support of this statement, Goetz (2010) and Beleiu, Crisan & Nistor (2015: 64) added that keeping project objectives in the vanguard of every project assures that the project and the team are in sync during the course of the project's life cycle. They deduced that clearly defined objectives will enable the project's successful result. It can thus be suggested that defining project objectives is imperative practice for RM.

2.1.3   Resource requirements

RM resources are important in a project, as they enable RM performance of the project to be achieved (Oztas & Okmen, 2005: 1246; El-Sayeh, 2008: 435). Muthuramalingam (2008: 5) established that availability of resources was a good predictor of RM performance, thus contributing to a successful completion of the project. Haughey (2014: 2-3) concluded that RM resources influenced project success. Scheid (2011) stated that a project's resources need to be considered, in order to keep on track with successful outcomes. Manfredi & Auletta (2013) concurred with Scheid (2011) who indicated that the availability of resources had an impact on the decrease of cost overruns in projects.

2.1.4   Risk measurement

Smit (2012: 71-72) indicated that defining and documenting the risk measurement of a project was crucial to its success. He observed that risk measurement influences the outcome of the project in defining the risk measurement criteria to be used (*e.g.*, classification system of high, medium, or low); defining risk materiality (when risk is important), and determining the level of acceptable risk and risk time frame applicable to risk impact and risk probability (*i.e.*, when risk is expected to occur, *e.g.*, next month, next year, and so on). Phoya (2012: 28) declared that, in order to successfully achieve project objectives, a project team has to define a classification rule set (risk measurement) for each impact type that is relevant. The author further stipulated that risk measurement can detect the key influences on project outcome and allow the effects of uncertainty to be determined. Karimi, Mousavi, Mousavi & Hosseini (2010: 9108) indicated that, when risk measurement is used, it reduces risk impact on the project regarding schedule, budget, and quality. Goossens & Van-Gelder (2002) demonstrated that risk measurement, being one of the activities of RM, influenced project success and project performance.

2.1.5   Risk identification

The results of Al-Shibly, Louzi & Hiassat (2013: 22) indicated that risk identification influenced project success. Similarly, Ewer & Mustafa (2008: 1-6) observed that some authors (Martins, 2006: 56; De Bakker, Boonstra & Wortmann, 2011: 78; Grote & Moss, 2008: 88-89) inferred that, when management involvement increases in risk identification, the risk of unclear or misunderstood scope seems to lessen and improve project performance and, hence, influence positively a project's outcome. A study conducted by De Bakker *et al*. (2011: 78) stipulates that risk identification contributes to project success. They also inferred that the interaction through discussion between project members during risk identification has a positive impact on the perceived success of the project.

2.1.6   Risk assessment

Roque & De Carvalho (2013: 102) established that risk assessment activity makes a greater significant impact on the success of the project. The results indicated that adopting risk assessment has a substantial positive impact on the project success, as project staff are able to take actions to mitigate the occurrence of risks to a greater extent. Al-Shibly *et al*. (2013: 34) tested the relationship between risk assessment and planned budget. The authors established that there was an impact of risk assessment on project planned budget. Furthermore, Smit (2012: 83), Zeng & Smith (2007: 594), El-Sayegh (2008: 433) and Abu Mousa (2005: 18-19) affirmed the influence of risk assessment on the successful completion of a project. They reported that assessing uncertainties during the project, making use of the RM strategies, and understanding the business environment, significantly impact on project outcome.

By assessing risk, managers can distinguish between acceptable and unacceptable risk events, thus enabling them to capture and process information to assist them in the development of a risk management strategy (Oztas & Okmen, 2005: 1248; Nieto-Morote & Ruz, 2011: 226; Karimi *et al*., 2010: 9107). Likewise, Naidoo (2012: 24), indicated that risk assessment once performed, improved project objectives, accurate schedule, improved communication between relevant parties, and hence increased the likelihood of project success.

2.1.7   Risk response and action planning

Al-Rousan, Sulaiman & Salam (2010: 6-7) argued that there is no such thing as a project without risks and problems. The authors added that, if a project is successful, then it is not successful, because

there were no risks and problems, but because appropriate responses were developed which led to successful completion of the project. Kutsch & Hall's (2005: 596) studies established that project performance can be improved by developing mitigating measures that positively influence risk response for project success. Gajewska & Ropel (2011: 32) and Alberto & Timur (2013: 72) stated that risk response and action planning influence project success. The latter authors established that, when conducted, risk response will change the risk profile through the project life cycle, and risk exposure will diminish. Omphile (2011: 52) and Aimable (2015: 9-10) established that risk response activities are strongly linked to the success of construction projects. Omphile (2011: 52) further indicated that the impact of responding to a risk may make sense in the short term by saving design costs, allowing the team to meet schedule. Moreover, Baccarini, Salm & Love (2004: 288) indicated that one of the documented keys to project success is mitigating the influence of potential project risks to improve the chance of project success.

2.1.8   Communication

Aulich (2013: 96) indicated that communication between project head and management is crucial to the success of construction projects. This is generally influenced by the principal agent relationship between the parties and the contract type chosen (Kelkar, 2011: 112). Naidoo (2012: 29) showed that a balance between formal and informal communication between project manager and other stakeholders reduces mistrust and conflict of interest. Likewise, Zulch (2012: 54) opined that communication influenced project success. The author further established that managers spend approximately 90% of their working time engaged in some form of communication, be it meetings, writing emails, reading reports, or talking to project stakeholders. Therefore, communication in construction provides a positive contribution to projects, by improving the motivation of project members and the effectiveness of the performance (Aulich, 2013: 96). De Bakker *et al.* (2011: 83) stipulated that, in situations where risks are not shared openly, the positively communicative effect may not occur, hence, stifling the success of a project.

2.1.9   Monitoring, review and continuous improvement

A study by Prabhakar (2008: 8-9) pointed out that monitoring, review and continuous improvement influenced project success. Likewise, Papke-Shields, Beise & Quan (2010: 659) also asserted that the likelihood of achieving project success seemed to be enhanced by other factors, by regularly monitoring the project progress.

In addition, Hwang & Lim (2013: 209) and Kamau & Mohamed (2015: 84) established that project monitoring and review allow management to verify that the control actions that were applied are efficacious in order to achieve project success. If control actions are found to be ineffective, these should be revised, or new control actions be implemented, thus enabling continuous improvement in future projects (DEAT, 2006: 8). Rezakhani (2012: 19) indicated that project monitoring and continuous improvement is even more critical than planning in achieving project success. Likewise, many researchers (Spikin, 2013: 104-105; Chin, 2012: 42 indicated that one of the elements of the project management methodology whose main aim is to achieve project success is monitoring project progress.

3.   Research

The purpose of this research was to determine the RMPs that can be tailored for construction SMEs to manage risk in their projects, in order to achieve project success. A quantitative research design was adopted. This type of design allows for the use of structured questionnaire surveys, enabling researchers to generalise their findings from a sample of a population (Creswell, 1994). In the questionnaire, nine risk management practices (constructs), consisting of 42 measures, were extracted and set as the variables of risk management practices SMEs should follow (Netemeyer, Bearden & Sharma, 2003). Exploratory factor analysis (EFA) was used to assess these measured variables in terms of their validity and reliability. EFA is a type of technique that analyses the unidimensionality (characteristics) of each of the defined risk management practices (original variables), in order to reduce it to a common score (smaller number of factors) by examining relationships among these quantitative factors (Pallant, 2013: 192; Rossoni, Engelbert & Bellegard, 2016: 200). Several factor analysis methods are available, but principle component analysis (PCA) was used, because the Eigenvalues could be extracted, which explains whether the factors tested had or had not a noticeable effect on people's responses to the variables in the original test (analysed construct) (Rossoni *et al.*, 2016: 201; Yang, Shen & Ho, 2009: 163-164; Pallant, 2013: 192).

3.1   Sampling method and size

A list obtained from the CIDB register of contractors containing 548 addresses of SMEs forms the population for the study. A total of 225 participants registered with the CIDB, but located in the city of Johannesburg Metropolitan Municipality, city of Tshwane

Metropolitan Municipality, Ekurhuleni Metropolitan Municipality, and the West Rand District Municipality, was conveniently sampled from this list, because they were easiest to access (Etikan, Musa & Alkassim, 2016: 2). The sample size used the general Rule of Thumb method. Van Voorhis & Morgan (2007: 34) recommend 10 participants per measurement; 20 participants should be added for each independent variable. With nine factors (constructs), the sample size was 9 x 20 = 180, but 45 additional participants were added, resulting in a total sample of 180 + 45 = 225. The sample size table by Krejcie & Morgan (1970: 608) recommends a sample size for a population of 500 as 217. This recommendation validates the sample size of 225 as efficient for the population of 548.

3.2   Response rate

From the 225 original questionnaires, 181 completed ones were returned, resulting in a high response rate of 96%. According to Moyo & Crafford (2010: 68), contemporary built-environment survey response rates range from 7% to 40%, in general.

3.3   Data collection

A structured questionnaire survey was distributed to 187 SMEs in South Africa, using the drop-and-collect method and electronic email from July to September 2016. Topics on risk management practices used in the questionnaire were extracted from reviews of the literature, resulting in the formulation of a questionnaire divided into two sections. Section one on respondent's profile obtained personal information on current position and years of experience in business, gender, education qualification, risk management responsibility. It also obtained the company profile information, which included location of the business and type of contractor. Section two sets questions on nine risk management practices consisting of 42 measures. The respondents were required to indicate their level of agreement, in practice, with these measures defining the risk management practices. The data from these measurements forms the variables used in the EFA, which tested the validity and reliability of the factors. To reduce the respondent's bias, closed-ended questions were preferred for section two (Akintoye & Main, 2007: 601).

3.4   Data analysis and interpretation of findings

The Statistical Package for Social Science (SPSS) version 23 was used to determine the factor analysability of the risk management practices, using inferential statistics (Pallant, 2013).

To rank which of the nine risk management practices consisting of 42 measures were practice, the measures were rated on a five-point Likert scale. Likert-type or frequency scales use fixed choice response formats and are designed to measure attitudes or opinions (Bowling, 1997). The following scale measurement was used regarding mean scores, where 1 = Strongly disagree ($\geq 1.00 \leq$ and <1.80), 2 = Disagree (≥ 1.81 and ≤ 2.60), 3 = Neutral (≥ 2.61 and ≤ 3.40), 4 = Agree (≥ 3.41 and ≤ 4.20), and 5 = Strongly agree (≥ 4.21 and ≤ 5.00).

For analysis of the internal reliability of the factors in the questions on risk management practices, Cronbach's *alpha* values were tested (Kolbehdori & Sobhiyah, 2014: 347; Wahab, Ayodele & Moody, 2010: 67). Tavakol & Dennick (2011: 54-55) and Yount (2006) suggested that the acceptable values of Cronbach's *alpha* would range from 0.70 to 0.95. In the current study, a cut-off value of 0.70 was adopted. Furthermore, the optimal inter-item correlations mean (factor loadings) should range from 0.2 to 0.4, in order for the factor to be reliable (Pallant, 2013: 134). However, in this study, a value of 0.3 and above was adopted.

To confirm whether the data from the measurements was sufficient for factor analysis (test the validity), the Kaiser-Meyer-Olkin (KMO) test (Lorenzo-Seva, Timmerman & Kiers, 2011) and the Bartlett's sphericity test (Hair, Black, Babin, Andersen & Taham, 2006: 110) were performed. In the KMO test, as the values of the test vary from 0 to 1, values above 0.7 are recommended as being desirable for applying EFA (Hair *et al.,* 2006) and a statistically significant Bartlett test ($p < 0.05$) indicates that sufficient correlations exist between the variables to continue with the analysis (Hair *et al.*, 2006: 110; Pallant, 2013: 190).

For factor extraction, Principal Components Analysis (PCA) was used to summarise most of the information into a minimum number of factors, by concentrating the explanatory power on the first factor (find the principal components of data) (Rossoni *et al.*, 2016: 102). In PCA, when the number of variables (measures) is between 20 and 50, it is more reliable to use Eigenvalues to extract factors, as it makes interpretation simpler (Johnson & Wichern, 2007). The highest Eigenvalues in the data is, therefore, the principal components in the

data, which are retained to form a set of few new variables (less than the original variables started with in the analysis).

3.5   Limitation(s) of the study

It is important to note that the study was not conducted across South Africa; hence, the findings cannot be generalised.

4.   Results

4.1   Respondents' profile

The first part of the questionnaire comprised questions relative to the demographic profile of the respondents, the people in the best position to indicate their level of agreement in practice with the measures defining the risk management practices. Table 1 shows the professions of the respondents. These include owner, owner-manager, manager, and project manager. It is obvious that the majority (87.6%) of the respondents were either owners or managers of their enterprise, male (81.8%), and had either Matriculation (22.7%) or a Certificate (20.4%); 43.1% of respondents had 10 years' or less experience in construction.

Table 1:   Respondents' profile

Position	Frequency	Percentage (%)
Owner	56	30.9
Owner-manager	40	22.1
Manager	28	15.5
Project manager	31	17.1
Other	26	14.4
	181	**100.0**
Gender	Frequency	Percentage
Male	148	81.8
Female	33	18.2
	181	**100.0**

Risk management responsibility	Frequency	Percentage (%)
Top management	108	59.6
Operation manager	15	8.3
Organization collective effort	11	6.1
Project manager	13	7.2
Owner	29	16.0
The risk task team	5	2.8
	181	**100.0**
Highest education qualification	Frequency	Percentage (%)
Doctorate degree	3	1.7
Master's degree	11	6.1
Honours/BTech/BSc	27	14.9
HND/Diploma	29	16.0
Certificate	37	20.4
Matriculation	41	22.7
Basic schooling	26	14.4
No qualification	5	2.8
	179	**100.0**
Years of experience in construction	Frequency	Percentage (%)
1-5 years	30	16.6
6-10 years	48	26.5
11-15 years	29	16.0
16-20 years	22	12.2
21-25 years	7	3.9
26-30 years	14	7.7
31-35 years	7	3.9
Over 36 years	9	5.0
	166	**100.0**

4.2   SMEs' profile

Table 2 shows the emerging contractors' distribution according to the nature of their business. It further shows the frequency results of the municipality, in which their business was based. It is evident that the majority of SMEs were either subcontractors (37.6%) or general contractors (31.5%), and operated mostly in Johannesburg (41.4%) and Tshwane (30.9%) Metropolitan Municipalities.

Table 2:   SMCEs' profile

Type of contractor	Frequency	Percentage (%)
General contractor	57	31.5
Subcontractor	68	37.6
Civil contractor	12	6.6
Specialist contractor	32	17.7
Home building contractor	9	5.0
	178	**100.0**
Municipality	Frequency	Percentage (%)
City of Johannesburg MM	75	41.4
City of Tshwane MM	56	30.9
Ekurhuleni MM	19	10.5
West Rand DM	30	16.6
	180	**100.0**

4.3   Risk management practices

Table 3 ranks the mean scores to show which of the nine risk management factors were applied in practice in SMEs.

Table 3:   Ranking of risk management factors

Risk management factor (N=181) (1 = strongly disagree ….. 5 = strongly agree)	MS	Rank
Risk response and action planning	4.00	1
Communication	3.94	2
Risk assessment	3.38	3
Monitoring, review, and continuous improvement	3.29	4
Risk identification	3.27	5
Resource requirement	3.23	6
Risk measurement	3.04	7
Defining project objectives	2.98	8
Organizational environment	2.68	9

Organizational environment with a MS of 2.68 is the least practised factor within SMEs. Risk response and action planning with the highest score of MS of 4.00 was perceived to be commonly practised by SMEs.

4.4 Exploratory factor analysis results

The nine risk management factors were subjected to EFA to assess their validity and reliability. The results report the suitability of the data to be analysed, factor extraction and rotation, and interpretation.

4.4.1 Exploratory factor analysis for organizational environment

In Table 4, four measures defined organizational environment practice. The result posited that Cronbach's *alpha* was greater than 0.70 at 0.889, indicating acceptable internal reliability, as recommended by Hair *et al*. (2006: 102). The Kaiser-Meyer-Olkin (KMO) of 0.740 with Bartlett's Test of Sphericity of *p*<0.000, indicating consistency with the recommended KMO cut off value of 0.60 and Bartlett's Test of Sphericity of *p*<0.05, as suggested by Pallant (2013:190). These results suggest that factor analysis could be conducted with the data.

Table 4:   Organizational environment

Item	Measure	Cronbach level after deletion	Factor loading
Kaiser-Meyer-Olkin value = 0.740		Bartlett's Test of Sphericity value = 0.00	
Eigenvalue 3.073% of variance 76.831		Cronbach's alpha 0.889	
OE1	I/We identify and assess the internal environment factors	0.862	0.878
OE2	I/We identify and assess the external environment factors	0.810	0.943
OE3	I/We use the organization business information system to document the internal and external environment	0.838	0.912
OE4	I/We understand the internal environment, which concerns all factors influencing the manner in which firms manage risks	0.918	0.762

The four measures (OE1, OE2, OE3, OE4) expected to define the organizational environment practice attained factor loadings greater than 0.762, as reported in Table 4. These were greater than the recommended value of 0.40, as suggested by Hair *et al*. (2006: 128) and Pallant (2013: 200). An Eigenvalue greater than 3.073

was established in this factor; this explained 76.831% of the variance in the data. Therefore, sufficient evidence of convergent validity was provided for this construct. It can, therefore, be indicated that this risk management practice is reliable and valid to measure the risk management practices in construction SMEs' projects.

4.4.2   Exploratory factor analysis for defining project objectives

In Table 5, four measures (DO1, DO2, DO3, DO4) defined the risk management construct of defining project objectives. The findings indicate that the Cronbach's *alpha* was greater than 0.70 at 0.842, indicating acceptable internal reliability, as recommended by Hair *et al.* (2006: 102). The Kaiser-Meyer-Olkin (KMO) of 0.819 with Bartlett's Test of Sphericity of $p<0.000$, indicating consistency with the recommended KMO cut off value of 0.60 and Bartlett's Test of Sphericity of $p<0.05$, as suggested by Pallant (2013: 190). These results suggest that factor analysis could be conducted with the data.

Table 5:   Defining project objectives

Kaiser-Meyer-Olkin value = 0.841		Bartlett's Test of Sphericity value = 0.00	
Eigenvalue 3.358% of variance 83.959		Cronbach's alpha 0.935	
Item	*Measure*	*Cronbach level after deletion*	*Factor loading*
DO1	I/We define the organizational focus, *e.g.*, organizational objectives and strategy	0.934	0.877
DO2	I/We define the objectives and methodology of the risk management process	0.903	0.940
DO3	I/We determine how the responsibility and accountability for the risk management process can be defined	0.923	0.900
DO4	I/We determine how the effectiveness of the risk management process can be assessed	0.897	0.947

The factor loadings for all practices were greater than 0.877, as reported in Table 5. These were greater than the recommended value of 0.40, as suggested by Hair *et al.* (2006: 128). An Eigenvalue greater than 3.079 was established in this factor, which explains 61.557% of the variance in the data. Therefore, sufficient evidence of convergent validity was provided for this construct. It can be inferred that defining project objectives is a reliable and valid practice of RM for construction SMEs' projects.

4.4.3 Exploratory factor analysis for resource requirement

In Table 6, it is evident that there were five measures defining resource requirement. The result indicates that the Cronbach's *alpha* was greater than 0.70 at 0.901, indicating acceptable internal reliability, as indicated by Hair *et al*. (2006: 102). The Kaiser-Meyer-Olkin (KMO) of 0.778 with Bartlett's Test of Sphericity of $p<0.000$, indicating consistency with the recommended KMO cut off value of 0.60 and Bartlett's Test of Sphericity of $p<0.05$, as suggested by Pallant (2013: 190). These results suggest that factor analysis could be conducted with the data.

Table 6:   Resource requirement

Kaiser-Meyer-Olkin value = 0.778		Bartlett's Test of Sphericity value = 0.00	
Eigenvalue 3.606% of variance 72.126		Cronbach's alpha 0.901	
Item	Measure	Cronbach level after deletion	Factor loading
RR1	I/We consider personnel availability and know-how	0.858	0.906
RR2	I/We consider time requirement in terms of scheduling risk meetings/workshops	0.889	0.822
RR3	I/We consider information system requirement in identifying risks, implementing controls and follow-up activities	0.877	0.850
RR4	I/We consider risk communication mechanism, *e.g.*, informal discussions, company newsletter.	0.890	0.814
RR5	I/We consider technology requirements, *e.g.*, use of spreadsheets, risk profile	0.879	0.852

The factor loadings for all practices were greater than 0.814, as reported in Table 6. These were greater than the recommended value of 0.40, as suggested by Hair *et al*. (2006: 128). An Eigenvalue greater than 3.606 was established in this factor, which explains 72.126% of the variance in the data. Therefore, sufficient evidence of convergent validity was provided for this construct. It can, therefore, be indicated that resource requirement is a reliable and valid RM practice for construction SMEs' projects.

4.4.4　Exploratory factor analysis for risk measurement

Table 7 shows the five measures defining risk measurement. The result indicates that the Cronbach's *alpha* was greater than 0.70 at 0.935, indicating acceptable internal reliability (Hair *et al.*, 2006: 102). The Kaiser-Meyer-Olkin (KMO) of 0.837 with Bartlett's Test of Sphericity of *p*<0.000, indicating consistency with the recommended KMO cut off value of 0.60 and Bartlett's Test of Sphericity of *p*<0.05, as suggested by Pallant (2013: 190). These results suggest that factor analysis could be conducted with the data.

Table 7:　Risk measurement

Kaiser-Meyer-Olkin value = 0.837		Bartlett's Test of Sphericity value = 0.00	
Eigenvalue 3.985% of variance 79.700		Cronbach's alpha 0.935	
Item	*Measure*	*Cronbach level after deletion*	*Loading factor*
RM1	I/We define the risk measurement criteria to be used, *e.g.*, high/medium/low	0.933	0.841
RM2	I/We define risk materiality, *i.e.*, when risk is important	0.925	0.873
RM3	I/We define risk time frame applicable to risk impact and risk probability, *i.e.*, when risk is expected to occur	0.922	0.887
RM4	I/We clarify risk terminology, *i.e.*, use of terms such as impact, consequence, probability/likelihood	0.907	0.941
RM5	I/We determine the level of acceptable risk, *i.e.*, the risk tolerance level of the firm	0.913	0.920

All five variables (RM1, RM2, RM3, RM4, RM5) expected to measure risk measurement loaded together on this factor. The factor loadings for all variables were greater than 0.841, as reported in Table 7. These were greater than the recommended value of 0.40, as suggested by Hair *et al.* (2006: 128). An Eigenvalue greater than 3.985 was established in this factor, which explains 79.700% of the variance in the data. Therefore, sufficient evidence of convergent validity was provided for this construct. The reliability values were also above the recommended value of 0.70, as considered by Hair *et al.* (2006: 102). It can be posited that risk measurement is a reliable and valid RM practice for construction SMEs' projects.

4.4.5 Exploratory factor analysis for risk identification

Table 8 indicates that there were four measures of risk identification. The Cronbach's *alpha* for risk identification was greater than 0.70 at 0.825, indicating acceptable internal reliability, as suggested by Hair *et al.* (2006: 102). The Kaiser-Meyer-Olkin (KMO) of 0.712 with Bartlett's Test of Sphericity of $p<0.000$, indicating consistency with the recommended KMO cut off value of 0.60 and Bartlett's Test of Sphericity of $p<0.05$, as recommended by Pallant (2013: 190). These results suggest that factor analysis could be conducted with the data.

Table 8:   Risk identification

Kaiser-Meyer-Olkin value = 0.712		Bartlett's Test of Sphericity value = 0.00	
Eige value 2.642% of variance 65.628		Cronbach's alpha 0.825	
Item	Measure	Cronbach level after deletion	Factor loading
RI1	I/We develop risk information database, *e.g.*, information gathering, risk history database	0.779	0.818
RI2	I/We identify how and why risk arises	0.764	0.839
RI3	I/We conduct present and future risk identification, *e.g.*, develop risk register information quality, management techniques	0.741	0.861
RI4	I/We use physical inspection to identify the risk	0.830	0.725

All four measures (RI1, RI2, RI3, RI4) expected to define risk iden-tification loaded together on this factor. The factor loadings for all practices were greater than 0.741, as reported in Table 8. These were greater than the recommended value of 0.40, as suggested by Hair *et al.* (2006: 128). An Eigenvalue greater than 2.642 was established in this factor, which explained 66.057% of the variance in the data. Therefore, sufficient evidence of convergent validity was provided for this construct. The reliability values were also above the recommended value of 0.70, as considered by Hair *et al.* (2006: 102). The results infer that risk identification is a reliable and valid RM practice for construction SMEs' projects.

4.4.6 Exploratory factor analysis for risk assessment

Table 9 shows the five measures explaining risk measurement. The result stipulates that the Cronbach's *alpha* was greater than 0.70 at 0.908, indicating acceptable internal reliability (Hair *et al.*, 2006:

102). The Kaiser-Meyer-Olkin (KMO) of 0.849 with Bartlett's Test of Sphericity of $p<0.000$, indicating consistency with the recommended KMO cut off value of 0.60 and Bartlett's Test of Sphericity of $p<0.05$, as suggested by Pallant (2013: 190). These results suggest that factor analysis could be conducted with the data.

Table 9:   Risk assessment

Kaiser-Meyer-Olkin value = 0.849			Bartlett's Test of Sphericity value = 0.00	
Eigenvalue 3.669% of variance 73.379			Cronbach's alpha 0.908	
Item	Measure		Cronbach level after deletion	Factor loading
RA1	I/We determine the risk cause, risk duration, risk volatility		0.890	0.850
RA2	I/We determine the probability of the risk occurring, the impact, classification consistency, *i.e.*, high/medium/low		0.892	0.843
RA3	I/We establish the risk profile, *e.g.*, high probability/high impact, high probability/low impact		0.871	0907
RA4	I/We assess risks by quantitative analysis methods, *e.g.*, probability, sensitivity, scenario, simulation analysis		0.875	0.899
RA5	I/We assess risks by qualitative analysis methods, *e.g.*, direct judgement, comparing option, descriptive analysis		0.908	0.777

All five variables (RA1, RA2, RA3, RA4, RA5) expected to measure risk measurement loaded together on this component. The factor loadings for all variables were greater than 0.777, as indicated in Table 9. These were greater than the recommended value of 0.40, as suggested by Hair *et al*. (2006: 128). An Eigenvalue greater than 3.669 was established in this factor, which explains 73.379% of the variance in the data. Therefore, sufficient evidence of convergent validity was provided for this construct. The reliability values were also above the recommended value of 0.70, as considered by Hair *et al*. (2006: 102). It can be postulated that risk assessment is a reliable and valid RM practice for construction SMEs' projects.

4.4.7   Exploratory factor analysis for risk response and action planning

Table 10 indicates the six measures of risk response and action planning. The Cronbach's alpha of the construct was greater than 0.70 at 0.864, indicating acceptable internal reliability, as

recommended by Hair *et al*. (2006: 102). The Kaiser-Meyer-Olkin (KMO) of 0.796 with Bartlett's Test of Sphericity of $p<0.000$ were also obtained, indicating consistency with the recommended KMO cut off value of 0.60 and Bartlett's Test of Sphericity of $p<0.05$, as suggested by Pallant (2013: 190). These results suggest that exploratory factor analysis could be conducted with the data.

Table 10:   Risk response and action planning

Kaiser-Meyer-Olkin value = 0.796		Bartlett's Test of Sphericity value = 0.00		
Eigenvalue 2.041; 1.451% of variance 34.021; 24.177		Cronbach's alpha 0.864		
Item	Measure	Cronbach level after deletion	Factor loading	Factor loading
RP1	I/We identify risk treatment options by avoiding risk	0.952	0.276	**-0.699**
RP2	I/We identify risk treatment options by mitigating risk	0.944	0.368	**0.657**
RP3	I/We identify risk treatment options by retaining risk	0.86	**0.742**	-0.292
RP4	I/We identify risk treatment options by transferring risk	0.812	**0.696**	0.127
RP5	I/We predefine actions to counter the identified project risks	0.940	0.516	**0.582**
RP6	I/We prepare and implement risk action plan	0.922	**0.727**	-0.302

The exploratory factor analysis using principal component analysis extracted two components. The results revealed that three of the measures (RP3, RP4, RP6) strongly loaded on the first component renamed "*risk action plan*" and the other three measures (RP1, RP2, RP5) loaded on the second component renamed "*risk response*". The factor loadings were greater than 0.40, as reported in Table 10, therefore acceptable measures of the factors (Hair *et al*. 2006: 128; Pallant, 2013: 200). An Eigenvalue of "*risk action plan*" greater than 2.041 was established in this component, which explained 34.021% of the variance in the data. An Eigenvalue of "*risk response*" greater than 1.451 was established in this component, which explained 24.177% of the variance in the data. Therefore, sufficient evidence of convergent validity was provided for these two constructs. It can, therefore, be indicated that risk action plan and risk response are risk management practices that are reliable and valid to measure the RM practices in construction SMEs' projects.

4.4.8 Exploratory factor analysis for communication

Table 11 indicates the four measures of communication. The Cronbach's *alpha* of the construct was greater than 0.70 at 0.841, indicating acceptable internal reliability, as recommended by Hair *et al*. (2006: 102). The Kaiser-Meyer-Olkin (KMO) of 0.735 with Bartlett's Test of Sphericity of $p<0.000$, indicating consistency with the recommended KMO cut off value of 0.60 and Bartlett's Test of Sphericity of $p<0.05$, as suggested by Pallant (2013: 190). These results suggest that exploratory factor analysis could be conducted with the data.

Table 11: Communication

Kaiser-Meyer-Olkin value = 0.735		Bartlett's Test of Sphericity value = 0.00		
Eigenvalue 3.281% of variance 65.628		Cronbach's alpha 0.841		
Item	Measure	Cronbach level after deletion	Factor loading	Factor loading
C1	I/We establish a communication process for interactive (two-way) consultation with stakeholders	0.856	**0.796**	-0.040
C2	I/We establish a communication process for two-way consultation with external stakeholders	0.843	**0.743**	-0.547
C3	I/We establish a crisis communication strategy facilitating immediate information exchange	0.765	**0.641**	0.159
C4	I/We develop a communication evaluation mechanism	0.786	0.387	**0.870**

The exploratory factor analysis using principal component analysis extracted two components. The results revealed that three of the measures (C1, C2, C3) strongly loaded on the first component renamed "*communication approach*" and only one measure (C4) loaded on the second component renamed "*communication evaluation*". The factor loadings were greater than 0.40, as reported in Table 11, therefore acceptable measures of the factors (Hair *et al*. 2006: 128; Pallant, 2013: 200). However, the rule of thumb suggests that a factor cannot be measured by one variable. Therefore, based on this suggestion, the two components were combined and the communication practice was renamed "*communication approach and evaluation*". An Eigenvalue greater than 1.745 for "*communication approach*" was established in this first component, which explained 43.617% of the variance in the data. The second

component named *"communication evaluation"* attained an Eigenvalue of 1.083 and explained 27.0635 of the variance in the data. The renaming of the RM practice suggests that sufficient evidence of convergent validity was provided for this construct. It can, therefore, be indicated that this risk management practice is reliable and valid to measure the risk management practices in construction SMEs' projects.

4.4.9 Exploratory factor analysis for monitoring, review, and continuous improvement

From Table 12, it is evident that the five measures of monitoring, review and continuous improvement attained acceptable internal reliability. The Cronbach's *alpha* was greater than 0.70 at 0.892, as recommended by Hair *et al*. (2006: 102). The Kaiser-Meyer-Olkin (KMO) of 0.802 with Bartlett's Test of Sphericity of $p<0.000$, indicating consistency with the recommended KMO cut off value of 0.60 and Bartlett's Test of Sphericity of $p<0.05$, as suggested by Pallant (2013: 190). These results indicate that factor analysis could be conducted with the data.

Table 12: Monitoring, review, and continuous improvement

Kaiser-Meyer-Olkin value = 0.802		Bartlett's Test of Sphericity value = 0.00	
Eigenvalue 3.540% of variance 70.796		Cronbach's alpha 0.892	
Item	Measure	Cronbach level after deletion	Factor loading
MR1	I/We assign responsibility for monitoring and review actions	0.876	0.830
MR2	I/We identify and select monitoring and review techniques	0.850	0.912
MR3	I/We assess control effectiveness, measured in terms of meeting departmental/organizational objectives	0.890	0.777
MR4	I/We do control enhancement by revising ineffective controls identified	0.877	0.826
MR5	I/We report the new results from monitoring and review activities	0.868	0.856

All five measures (MR1, MR2, MR3, MR4, MR5) expected to define the monitoring, review, and continuous improvement of risk management practice attained factor loadings greater than 0.800, as reported in Table 12. The loadings were greater than the recommended value

of 0.40, as suggested by Hair *et al*. (2006: 128) and Pallant (2013: 200). An Eigenvalue greater than 3.540 was established in this factor, which explains 70.796% of the variance in the data. Therefore, sufficient evidence of convergent validity was provided for this construct. It can, therefore, be indicated that this risk management practice is reliable and valid to measure the risk management practices in construction SMEs' projects.

5. Discussion of the results

5.1 Organizational environment

The results found that four measures defined organizational environment practice of RM. This suggests that the four measures, empirically tested, strongly congregated on this practice. Hence, the result supported its theoretical conceptualization. In order for the organizational environment practice of RM to be demonstrated, four activities must be evinced, namely identify and assess the internal environment factors; identify and assess the external environment factors; use the organization business information system to document the internal and external environment, and understand the internal environment, which concerns all factors influencing the manner in which firms manage risks. These measures strongly congregated in defining organizational environment practice. Furthermore, the empirical finding inferred that the organizational environment practice of RM was reliable and valid. Previous studies by Smit (2012: 62), Olander & Landin (2005: 324), El-Gohary *et al*. (2006: 596), Bosher *et al*. (2007: 167), and Momeni *et al*. (2015: 418) are in line with this finding. It can be suggested that understanding the organizational environment is an important practice of RM and project success.

5.2 Defining project objectives

Defining project objectives practice of RM was defined by four measures. The result was supported by the theoretical construction of this construct. The empirical finding established that the practice was reliable and valid. The following measures defined this practice: define the organizational focus (*e.g.*, organizational objectives and strategy); define the objectives and methodology of the RM process; determine how the responsibility and accountability for the RM process can be defined, and determine how the effectiveness of the RM process can be assessed. The finding is also supported by the argument of Goetz (2010) that vaguely defined objectives,

without objectives, leads the project into overruns, personality clashes, missed milestones, and unhappy clients. Furthermore, defining project objectives helps align the organization, whereby the project objectives are clear and understood. In addition, the positive and negative risks in achieving the objectives are identified and understood, and risk responses are aligned (Boubala, 2010: 88).

5.3 Resource requirements

The resource requirement practice of RM was reliable and valid. Therefore, it can be used to manage the risks of projects involving construction SMEs. The measures of this RM practice congregated strongly on this practice; hence, construct validity was achieved. These measures were: personnel availability and their knowledge base; consider time requirement in terms of scheduling risk meetings/workshops; consider information system requirements in identifying risks; implement controls and follow-up activities; consider risk communication mechanism (*e.g.*, informal discussions, company newsletter), and consider technology requirements (*e.g.*, use of spreadsheets, and risk profile). Haughey (2014: 2-3), Manfredi & Auletta (2013), Scheid (2011), and Muthuramalingam (2008: 4) support this finding, as the availability of resources was a good predictor of RM performance, thus contributing to successful completion of the project.

5.4 Risk measurement

The five measures of risk measurement practice identified in the literature congregated strongly on this practice after empirical testing; hence, construct validity was achieved. These measures were: define the risk measurement criteria to be used (*e.g.*, high/medium/low; define risk materiality (*i.e.*, when risk is important); define risk time frame applicable to risk impact and risk probability (*i.e.*, when risk is expected to occur); clarify risk terminology (*i.e.*, use of terms such as impact, consequence, probability/likelihood), and determine the level of acceptable risk (*i.e.*, the risk tolerance level of the firm). Furthermore, this practice of RM was reliable and valid. Therefore, it can be used to manage the risks of projects involving construction SMEs. In line with this finding, Smit (2012: 68) established that defining and documenting the risk measurement of a project was crucial to its success. Smit (2012: 68) observed that risk measurement influences the outcome of the project in defining the risk measurement criteria to be used (*e.g.*, classification system of high, medium or low); defining risk materiality (when risk is important), and in determining the level of acceptable risk and risk

time frame applicable to risk impact and risk probability (*i.e.*, when risk is expected to occur: next month, next year, and so on). Karimi *et al*. (2010: 9108) indicated that, when risk measurement is used, it reduces risk impact on the project regarding schedule, budget, and quality. Goossens & Van-Gelder (2002) demonstrated that risk measurement, being one of the activities of RM, influenced project success and project performance.

5.5   Risk identification

The risk identification practice of RM was reliable and valid. Therefore, it can be used to manage the risks of projects involving construction SMEs. The results are supported by Al-shibly *et al*. (2013: 26) and De Bakker *et al*. (2011: 82) who inferred that, when management involvement increases in risk identification, the risk of unclear or misunderstood scope seems to lessen and improve project performance and, hence, influence positively project outcome. Further, the four measures of RM practice identified in the literature review congregated strongly on this practice; hence, construct validity was achieved. In order to ensure that risk identification is practised in the SMEs' construction projects, the following four activities must manifest as per the empirical findings: develop risk information database (*e.g.*, information gathering, risk history database); identify how and why risks arise; conduct present and future risk identification (*e.g.*, develop risk register information quality, management techniques), and physical inspection to identify the risk.

5.6   Risk assessment

The current findings posit that five activities must be practised for risk assessment practice to be evinced in the construction projects of SMEs. The following activities defined risk assessment practice as they empirically congregated strongly on it: determine the risk cause, risk duration, and risk volatility; determine the probability of the risk occurring, the impact, and classification consistency (*i.e.*, high/medium/low); establish the risk profile (*e.g.*, high probability/ high impact, high probability/low impact); assess risks by quantitative analysis methods (*e.g.*, probability, sensitivity, scenario, simulation analysis), and assess risks by qualitative analysis methods (*e.g.*, direct judgement, comparing option, descriptive analysis). Furthermore, the risk assessment practice was empirically deemed to be reliable and valid, and is supported by the findings of Roque & De Carvalho (2013: 101), Al-Shibly *et al*. (2013: 33), Smit (2012: 78); Zeng & Smith

(2007: 593), El-Sayegh (2008: 433), and Abu Mousa (2005: 20) as a RM practice to influence the successful delivery of construction projects.

5.7   Risk action plan

The findings stipulated that *risk response and planning* of RM practice was empirically represented by two practices. This result did not support the theoretical conceptualized *risk response and planning* practice. The results revealed that the renamed first practice (*i.e.*, risk action plan) was defined by three of the measures *i.e.*, risk treatment options by retaining risk, identify risk treatment options by transferring risk, and prepare and implement risk action plan, congregated strongly on the renamed practice of risk action plan. It can further be inferred that risk action plan is a reliable and valid RM practice for managing construction SMEs' projects.

5.8   Risk response

The findings on *risk response and planning* of RM practice were empirically represented by two practices. As discussed earlier, this result did not support the theoretical conceptualized practice. The results revealed that the other three measures *i.e.* identify risk treatment options by avoiding risk, risk treatment options by mitigating risk, and predefine actions to counter the identified project risks, congregated strongly on the renamed RM practice of *risk response*. It can be inferred that this RM practice was valid and reliable. This finding is supported by the findings of Omphile (2011: 54) and Aimable (2015: 9-10) who established that risk response activities are strongly linked to the success of construction projects as an individual RM practice. However, Gajewska & Ropel (2011: 32) contrast this finding, as their RM practice combined risk response and action planning.

5.9   Communication approach and evaluation

The findings stipulated that communication as a RM practice was empirically represented by two practices. This was not in line with its theoretical conceptualization despite the evidence of two empirical practices manifesting. The first practice was renamed "*communication approach*" and was measured by three activities. The second practice was renamed "*communication evaluation*" and was measured by one variable. However, the rule of thumb suggests that a factor cannot be measured by one variable. Therefore, based on this rule of thumb, the two components were combined, and the communication practice was renamed "*communication approach and evaluation*". The essence of

retaining the measures was informed by the sufficient evidence of convergent validity in each of the two renamed constructs. It can, therefore, be indicated that this RM practice is reliable and valid to measure the RM practices in construction SMEs' projects. Partially, the finding and argument are supported in the studies of Aulich (2013: 97), Kelkar (2011: 102), and Zulch (2012: 51-52). De Bakker *et al*. (2011: 83) stipulated that, in situations where risks are not shared openly, the positively communicative effect may not occur, thus stifling the success of a project.

5.10 Monitoring, review and continuous improvement

Monitoring, review and continuous improvement practice of RM empirically supported its conceptual theory. This practice was valid and reliable as a practice of RM. This finding corroborates with the studies of Prabhakar (2008: 7), Papke-Shields *et al*. (2010: 658), Hwang & Lim (2013: 206), and Kamau & Mohamed (2015: 90). Rezakhani (2012: 19) indicated that project monitoring and continuous improvement are crucial to planning in achieving project success. In addition, the following five theoretical activities that were deemed to evince this practice empirically converged strongly on this RM practice: assign responsibility for monitoring and review actions; identify and select monitoring and review techniques; assess control effectiveness, measured in terms of meeting departmental/ organizational objectives; undertake control enhancement by revising ineffective controls identified, and report the new results from monitoring and review activities.

6. Conclusion

The empirical investigation of RM practice deduced and helped better understand the difference in the conceptualised RM practice and the empirically extracted RM practices. The empirical investigation inferred that 10 and not nine practices are reliable and valid to be used by construction SMEs. These RM practices are: organizational environment; defining project objective, resource requirements, risk measurement, risk identification, risk assessment, communication approach and evaluation, risk response, action planning, and monitoring, review and continuous improvement. The researchers suggest that the SMEs should be made aware of these RM practices and be trained in their implementation.

7.   Further areas of research

The researchers recommend that these reliable and valid RM practices can be used to successfully manage risks in construction projects undertaken by SMEs in South Africa. However, to justify these statements, these RM practices should be validated in a national study to ensure that they positively influence the successful delivery of construction projects. Furthermore, further research can be undertaken to justify the manifestation of two RM practices on each of the risk response and planning practice, and communication practice.

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