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BARRIERS TO EFFECTIVE RISK MANAGEMENT ON SMALL CONSTRUCTION PROJECTS IN SOUTH AFRICA

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A research report submitted to the Faculty of Engineering and the Built Environment, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Science in Building.

Johannesburg, 2015

DECLARATION

I declare that this dissertation is my own unaided work. It is being submitted to the Degree of Master of Building Science to the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination to any other University.

……

(Signature of candidate)

…….. day of ……..., ……

(day) (month) (year)

ABSTRACT

This study aims to determine the barriers to effective risk management on small construction projects that exist within the South African construction industry. This was based on the realisation that few studies exist on risk management for small construction projects. This study sets out to fill this gap in the existing literatures with specific reference to the South African construction industry particularly for small projects.

The research methodology was based on cross-sectional survey of registered industry practitioners with the South African Council for Project and Construction Management Professions (SACPCMP) using a semi-structured questionnaire administered online. From 325 practitioners that viewed the online questionnaire, 57 responded, this translates to a response rate of 17.5%. The respondents rated the identified barriers to effective risk management, the perception that risk management implementation will impact on project performance and provided qualitative feedback on contractual and attitudinal issues pertaining to risk management implementation.

The barriers identified as inhibiting effective risk management the most were lack of knowledge, complexity of analytical tools and lack of time. The research revealed that perception of key decision makers pertaining to risk management, impact on risk management implementation. The consensus from the participants was that implementing risk management would positively impact on project performance, especially quality performance. The results revealed that in the South African construction industry Sixty-nine percent of the practitioners indicated SMMEs lack the required skill to implement risk management effectively. Sixty-nine percent of the practitioners indicated that risk is not allocated to the party best equipped to manage the risks. Lastly fifty-six percent of respondents noted that construction partnering and shared risk management may assist in overcoming the barriers to effective risk management implementation as presented in the current research.

TABLE OF CONTENTS

DECLARATION ii

ABSTRACT iii

LIST OF FIGURES viii

LIST OF TABLES viii

LIST OF ACRONYMS ix

DEFINITIONS x

CHAPTER ONE: INTRODUCTION 11

1.1 Overview of the study 11

1.2 Problem statement 13

1.3 Aim 13

1.4 Objectives 14

1.5 Benefits of the study 14

1.6 Assumptions 15

1.7 Delineations 16

1.8 Research methodology 16

1.9 Research limitations 16

1.10 Ethical considerations 17

1.11 Layout and navigation of dissertation 17

1.12 Risk Management on small construction projects [A] 18

1.12.1 The role of SMMEs 19

1.12.2 Context and nature of small construction projects in South Africa 20

1.13 Barriers to effective risk management [B] 21

1.14 Perception of risk management impact on project performance [C] 21

1.15 Contractual and attitudinal issues related to risk management implementation [D] 22

1.16 Risk management tools and techniques [E] 22
CHAPTER TWO: LITERATURE REVIEW 23
2.1 Introduction 23
2.2 Methodology of the literature review 23
2.3 Barriers to effective risk management 25
2.4 Perception of how risk management impacts on project performance 29
2.5 Contractual and attitudinal issues that impact on risk management 31
2.5.1 Risk allocated to the party best suited to manage the specific risk 31
2.5.2 SMMEs lack the required skill to implement effective risk management 31
2.5.3 Construction partnering may assist in improving risk management 32
2.5.4 Contracts used as a tool to manage risk 33
2.6 Risk identification and assessment tools 34
2.7 Conclusion 35
CHAPTER THREE: RESEARCH METHODOLOGY 36
3.1 Research philosophy 36
3.2 Research strategy 36
3.2.1 Data Collection 36
3.2.2 Sections of the questionnaire 38
3.3 Data analysis 41
3.3.1 Alignment to current study 43
3.3.2 Pre-testing (convenience sampling) 44
3.3.3 Ethical considerations 44
CHAPTER 4: DATA ANALYSIS AND FINDINGS 46
4.1 Data analysis 46
4.1.1 Section 1 (General Information) 46

4.1.2 Section 2 (barriers to effective risk management) 49

4.1.3 Section 3 (perception that risk management will impact on project performance)..... 52

4.1.4 Section 4 (exploratory questions to potential barriers and solutions to effective risk management)..... 54

4.1.5 Correlation..... 57

4.2 Findings 61

4.2.1 Current situation as reflected from data gathered 61

4.2.2 Barriers to effective RM on small construction projects in South Africa 62

4.2.3 Perception that risk management implementation can impact on project performance 63

CHAPTER 5: CONCLUSION..... 66

5.1 Barriers to effective risk management on small construction projects .. 66

5.1 1 Lack of knowledge..... 67

5.1.2 Remaining top five barriers..... 69

5.1.3 Perception that risk management can impact on project performance 70

5.1.4 Contractual and attitudinal issues..... 70

5.1.4.1 Risk allocation 70

5.1.4.2 Shared risk management and construction partnering 71

5.1.4.3 Contracts used as tools to manage risk..... 71

5.1.4.4 SMMEs lack the required skill to implement effective risk management 71

5.1.5 Tools and Techniques 72

5.2 Recommendations 72

5.3 Future research opportunities 73

REFERENCES..... 75

Annexure A– SUMMARY OF BARRIERS TO EFFECTIVE RISK MANAGEMENT OBTAINED FROM THE LITERATURE REVIEW 80

ANNEXURE B – ETHICAL CLEARANCE FORM..... 83

ANNEXURE C –QUESTIONNAIRE..... 84

ANNEXURE D – RESPONDENT PROFILE..... 85

LIST OF FIGURES

Figure 1.1 Risk management issues considered in this study 18
Figure 2.1 Number of articles published on risk management per year 24

LIST OF TABLES

Table 0.1 Definition of contractor size x
Table 2.0.1Barriers identified in previous studies 27
Table 4.1 Summary of data collected Section 1..... 47
Table 4.2. Barriers to effective risk management in South Africa..... 50
Table 4.3. Inferential statistics, barriers to effective risk management 52
Table 4.4 One- tailed T-test (time/cost/quality)..... 53
Table 4.5 Findings for Section 4 of questionnaire 55
Table 4.6 Pearson correlation screening 57
Table 4.7 Perception of the impact of lack of knowledge by industry sector..... 59
Table 4.8 Perception of the impact of lack of budget by industry sector..... 59
Table 4.9 Perception of the impact of lack of manpower relative to participant experience. 60
Table 4.10 Perception of risk management being economical to implement on projects relative to Industry Sector 60
Table 4.11 Perception that contracts are used to manage risk relative to the size of the company. 61
Correlation contractual documentation and size of company**Error! Bookmark not defined.**
Table 4.12 Perception of the impact the attitude of key stakeholders have on risk management by industry sector..... 61
Table 4.13 Risk management methodology – tools used currently 63
Table A1: Summary barriers to effective risk management 81
Table A2: Summary RM tools and techniques / perception 82
Table C1 Respondent Profile - Section 1..... 86
Table C2 Respondent Profile - Section 4..... 91

LIST OF ACRONYMS

AHP	Analytic Hierarchy Process
CIDB	Construction Industry Development Board
DMR	Department of Mineral Resources
Et al	And others
EV	Earned Value
FST	Fuzzy Set Theory
JRM	Joint Risk Management
PERT	Program Evaluation and Review Technique
PM	Project Management
RM	Risk Management
SA	South Africa
SACPCMP	South African Council for Project and Construction Management Professions
SMMEs	Small Medium Micro-enterprise(s)

DEFINITIONS

Response rate: The total number of responses divided by the total number in the sample after ineligible respondents have been excluded (Saunders *et al*. 2012).

SMMEs: Small, very small and micro contractors are defined by the number of full time employees, annual turnover and gross asset value as defined in the *National Small Business Act of 1996* (SA Government President's Office, 1996). The information can be presented in the Table 0.1

Table 0.1 Definition of contractor size

Size or class of contractors	**Total full time employees**	**Total annual turnover less than**	**Total gross asset value less than**
Small Contractor	50	R 7.50 million	R 1.00 million
Very small contractor	20	R 2.00 million	R 0.40 million
Micro	5	R 0.15 million	R 0.10 million

SA Government President's Office (1996)

CHAPTER ONE: INTRODUCTION

1.1 Overview of the study

The Project Management Institute (2013) stated that risk management include the processes of conducting risk management planning, identification, analysis, response planning and controlling of risk on a project. Cagliano *et al*. (2015) reasoned that in recent times, sound risk management is a crucial determinate of the success of a project, based on project performance measurement, due to growing time and cost pressure. Iqbal *et al*. (2015) underscored the importance of risk analysis and management as part of the decision-making process in the construction industry. Tang *et al*. (2007) established that risk management was widely accepted as a vital tool to manage projects. Hence risk management forms a critical element in project management.

Risk management is defined as "*the process of identifying and assessing risk, and to apply methods to reduce it to an acceptable extent*" (Serpella *et al*., 2014: 665). Nieto-Morote *et al.* (2011) found that risk management comprising four phase processes:

- Risk identification
- Risk assessment
- Risk response
- Risk monitoring and review

The four risk management processes signifies the current prevailing thinking as confirmed by Hlaing *et al*. (2008).

Lyons and Skitmore (2004) advocated the criticality of project risk management and stated that unmanaged or unmitigated risks are one of the primary causes of project failure. Hwang *et al*. (2014) asserted that project risk management must be

implemented on projects regardless of the project size to ensure achieving project objectives. The critical role that risk management plays in the construction and project environment is emphasised as it forms one of the key knowledge areas in the Project Management Body of Knowledge (2013) 5th edition. Authors (Hwang *et al.,* 2014; Lehtiranta, 2013; Serpella *et al.,* 2014) also supported the importance of risk management.

Steyn (2012), states that the ultimate goal of project risk management is to improve project performance. Additional benefits to project risk management are listed by Frimpong (2003) as follows:

- Provides a better understanding of the threats to the project, its viability and strategies for strengthening its design
- Identifies key factors in the project environment that should be monitored for effective implementation
- Identifies what is beyond the team's control
- Improves communication amongst project stakeholders.

It can be inferred that effective risk management implementation is therefore important to project success. Chileshe and Kikwasi (2013) noted that implementing risk management and assessment practices are usually fraught with barriers. It stands to reason that projects will benefit by identifying and overcoming barriers that prevent the effective implementation of risk management.

Rashaad *et al*. (2013) reflected that democracy in South Africa promoted the development of SMMEs. Masutha and Rogerson (2014) affirmed that SMMEs formed the cornerstone of the national development plan in South Africa. Hence small construction projects are likely to increase in the South African construction industry. Taking into consideration the importance of effective risk management on small construction projects (Hwang *et al.,* 2014; Lehtiranta, 2013; Serpella *et al.*,

2014), and the impact of effective risk management on project performance (Steyn, 2012), the current study is relevant to the construction industry in South Africa.

1.2 Problem statement

Authors, (Chileshe and Kikwasi, 2013; Hwang *et al*., 2014; Marcelino-Sádaba *et al*., 2014) affirmed that there are specific barriers that inhibit risk management explicitly on small construction projects. Chihuri and Pretorius (2010) confirmed that barriers to effective risk management are also found in South Africa. The barriers presented by Chihuri and Pretorius (2010) related to large construction projects only. Masutha and Rogerson, (2014) underpinned the current drive in government to develop SMMEs. It can be reasoned that small construction projects will likely increase and consequently it will be beneficial to determine the barriers to effective risk management for small construction projects in South Africa. No literature was identified in this study focussing explicitly on risk management on small construction projects in South Africa. This study set out to fill this gap in literature.

Risk perception has a profound impact on implementing risk management as supported by Acar's (2011) and Wang *et al*'s. (2010) studies, it was therefore important to determine if risk management was perceived to have an impact on improved time, cost and quality on construction projects for the current study. The perception of how risk management impact on project performance could be a barrier to effective risk management. Contractual and attitudinal issues could also impact on effective risk management and thus formed part of the discussion.

1.3 Aim

The aim of this study is to identify the barriers to effective risk management on small construction projects in South Africa.

1.4 Objectives

The three objectives for this research are:

- Determine the major barriers to effective risk management on small construction projects in South Africa
- Investigate the perceived impacts of risk management on project performance among small construction projects in South Africa
- Determine other contractual and attitudinal barriers impacting on effect risk management in South Africa

1.5 Benefits of the study

The first benefit in undertaking this current study is the opportunity to create awareness in the South African built environment on the importance of effective risk management explicitly on the part of the construction clients and SMME contractors. The benefit of creating awareness lies in identifying shortfalls in performing effective risk management on projects and understanding how these issues impact on project performance.

Frimpong (2003) reasoned that once risks are identified the project team can implement measures to manage the risk, and more importantly know which risks are beyond their control. This will only be possible when he clients and contractors know the risks.

Understanding the barriers to risk management in the South African construction environment will allow project managers, clients and contractors to actively focus on, and take preventative actions to overcome the barriers to effective risk management, improving effective risk management and therefore project performance.

To date little research has been undertaken to identify barriers to effective risk management on small construction projects. The literature that focuses on risk management in South Africa particularly is scarce.

To the best of the researcher's knowledge, no research exists focusing on small construction projects in South Africa. Consequently, this research will fill this identified gap in the literature as its theoretical contribution.

Lastly, as discussed earlier, the South African government is developing SMMEs through small-scale construction projects. As its practical contribution, the findings from this study will be essential to South Africa's construction industry because small project risk management will be an indispensable skill for construction project managers in South Africa. Similarly, it will be useful to construction project management in any other context reliant on SMMEs to execute its construction projects.

1.6 Assumptions

This study has made the following assumptions:

- It is assumed, the study participants are middle to high level managers, that they will not confuse construction risk management with safety risk management
- It is assumed study participants selected form the SACPCMP database possess a basic understanding of construction RM
- For the purpose of the study risk management is implemented on the construction projects in line with good practice

1.7 Delineations

The study has made the following delineations:

- Focus of the study is only on small construction projects in South Africa
- Focus on opinions of consultants registered with the SACPCMP
- Focus on the procurement and construction phases of the projects
- Focus on construction risk management and not safety risk management
- Focus on, if risk management is being implemented, and what constitutes barriers to effective risk management on small construction projects in South Africa

1.8 Research methodology

The study is an exploratory study; According to Saunders *et al*. (2012) exploratory studies are used to establish causal relationships between variables. An inductive approach was adopted for this study. Saunders *et al*. (2012) noted that the inductive approach was suited for use in two case: when a topic is explored and to develop a theoretical explanation, both applicable to the current study. The data collected during this study consisted primarily of qualitative data, and therefore a semi-structured questionnaire was adopted. Some sections of the semi-structured questionnaire made use of quantitative data capturing techniques. Conversely some of the quantitative data collected were interpreted qualitatively.

1.9 Research limitations

The current research limitations are:

- Data collected for the study was only from registered SACPCMP members, this may exclude participants within the construction industry without SACPCMP membership

- The research made use of qualitative data to draw conclusions; the resulting findings therefore reflect the sample groups' view on barriers to effective risk management.

1.10 Ethical considerations

Cooper and Schindler (1998) stated that for research to be ethical it must be designed so a respondent does not suffer physical harm, discomfort, pain, embarrassment of loss of privacy. Hence, the electronic questionnaire adopted in the research, prevented physical harm or pain to participants. In addition, participants could partake in the study at a time that suited them, preventing any discomfort that the participants may experience. Lastly, the design of the questionnaire avoided asking embarrassing questions and ensured the privacy of participants.

For the current study access to participants, intrusion of privacy, disclosure of sensitive information and debriefing were the main considerations as discussed in Chapter 3.

1.11 Layout and navigation of dissertation

This section assists the reader to navigate the main areas central to the concept of risk management identified in the current study. The areas depicted in Figure 1.1, denote the main discourse topics throughout the dissertation and comprise:

- Small construction projects in South Africa [A]
- Barriers to effective risk management [B]
- Perceived benefit of risk management on project performance [C]
- Contractual and attitudinal issues related to risk management implementation [D]

It flows from Figure1.1 that the general concept of risk management should first be discussed in the small construction project environment in South Africa (Section A). Risk management was further discussed under three topical areas. The first of the areas was (Section B) where the main argument centred around, and focused explicitly on barriers to effective risk management. The second of the three areas investigates the perceived impact and benefit that effective risk management may have on project performance (Section C). The last topical area focuses on how contractual and attitudinal issues relate to effective risk management implementation (Section D).

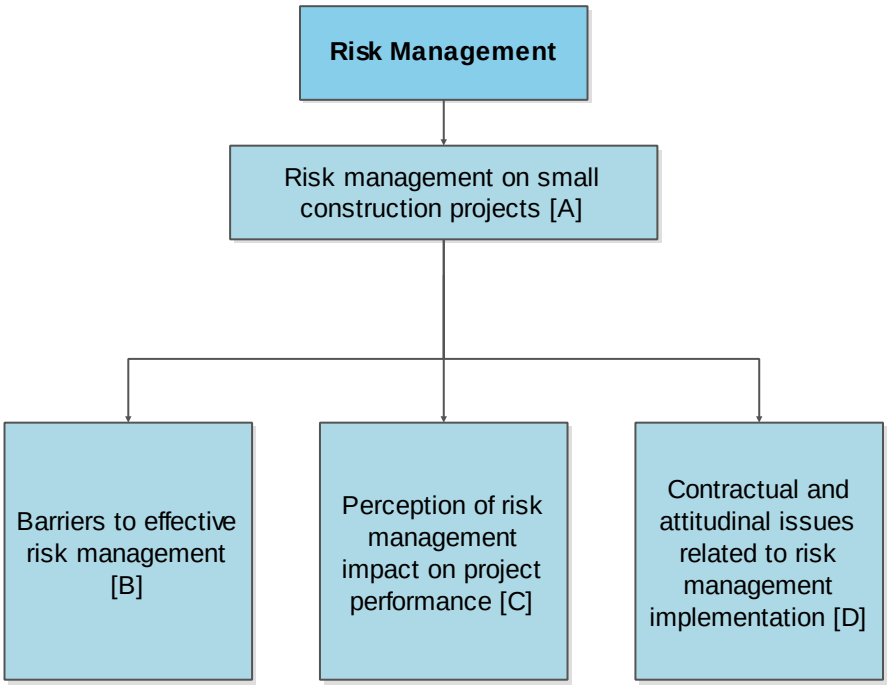

Figure 1.1 Risk management issues considered in this study

1.12 Risk Management on small construction projects [A]

While most project managers intend managing large-scale projects, small construction projects dominate, and will likely be the main stay for companies in South Africa. Rashaad *et al*. (2013) noted that democracy in South Africa significantly promoted the development of SMMEs. Hence an increase in the

volume of small construction projects will occur in an environment where "*the promotion and growth of small medium micro enterprises (SMMEs) is one of the cornerstones for the successful attainment of local economic development programming*." (Masutha and Rogerson, 2014:47). Cagliano *et al*. (2015) underscored how crucial risk management is to project success, while Hwang *et al.* (2014) demonstrated how risk management should be implemented on large and small projects equally. It is therefore, important to develop risk management explicitly on small construction projects, as it will be an integral part of future projects in the South African construction environment.

1.12.1 The role of SMMEs

Further underpinning the shift towards smaller construction projects Masutha and Rogerson (2014), highlighted the effort of the South African government to nurture and support the development of SMMEs.

Aigbavboa *et al.*(2014a) commented that SMMEs played a vital role in development of the economy as they were a significant generator of employment. The Business Intelligence and Planning Unit (2015) established in a construction sector fact sheet explicitly for South Africa, that despite the market being dominated by six large construction firms, small and micro enterprises were characteristic of the market and had mushroomed in recent times. Thus it could be perceived how the future of construction in South Africa is moving to the SMME contractors and how the number of small projects would likely increase in future as more SMMEs gain access to the construction sector.

Hwang *et al.* (2014) underpinned that small projects are prone to more risks, and more challenges as compared to large projects. Hwang *et al. (*2014) noted that this was because of the challenges unique to small projects such as resource contains, short project duration, small budget and low profitability. From the statement it is evident that despite the relatively little monetary value of small construction projects, risk management is especially important because of the unique complexities associated with small projects.

1.12.2 Context and nature of small construction projects in South Africa

It will be beneficial to have a basic understanding of the context and nature inherent in current small construction project in South Africa to identify barriers to risk management in the South African construction environment.

A small construction project, for this study, was consequently defined as a project not exceeding 10 million Rand as adapted from SA Government President's Office (1996), revere to Table 0.1.

The Business Intelligence and Planning Unit (2015) divide the construction sector in SA into six main categories namely:

- General building construction
- Industrial construction
- Commercial building construction
- Heavy civil construction
- Alterations
- Construction of a temporary nature

The construction work done in the six categories mentioned above is also performed in both the public and private sector, revealing the varied nature of construction in South Africa.

The government sector provide a conducive environment for the development of SMMEs as underpinned by the Department of Public works with the following quotation: "*Given that the bulk of the projects arising in the Government sector are of relatively straightforward and limited scope there is an abundance of smaller firms of consultants and contractors who can undertake such projects*."

(Department of Public Works *et al.*, 2007: 5). It can be demonstrated that risk management on small construction projects is not only isolated to small entities but are also performed in large government organisations equally.

From a statement by the Department of Mining Resources (DMR) (2014) affirming that the department will drive economic transformation with specific support given to SMMEs as part of their 2014-2019 strategic plan, it can be noted that large privately owned mining houses will be required to undertake small projects.

It can now be considered that small construction projects in South Africa have varied natures and are undertaken in both the large and small organisations.

1.13 Barriers to effective risk management [B]

With an appreciation of risk management on small construction projects in South Africa and, consequently, the role SMMEs play, this study focus on the barriers that inhibit the effectiveness of risk management explicitly on small construction projects.

The current level of risk management implementation in South Africa on small construction projects will be ascertained from the data collected in this research. For the study, it is anticipated that risk management is implemented on the construction projects in line with good practice.

From the literature, the identified barriers to effective risk management are listed in Annexure A.

1.14 Perception of risk management impact on project performance [C]

An important factor affecting risk management is the perception of risk. Acar *et al*. (2011) stated that the dominant decision maker in a construction project, such as the owner of the construction company, would have a significant impact on risk management, also linked to the personality of that decision maker. As a result ,

"*decision makers perceive risks differently in various situations, which is affected by factors such as early experience, education background, personal beliefs and culture*"(Wang and Yuan, 2011:1). The perception of key individuals pertaining to risk management could therefore be considered as a possible barrier to effective risk management.

1.15 Contractual and attitudinal issues related to risk management implementation [D]

Under this topical area in the dissertation, the study investigated contractual and attitudinal issues that may impact effective RM implementation. Under this topical area risk allocation, SMME skill level, construction partnering and contracts to manage risk were discussed.

1.16 Risk management tools and techniques [E]

Extensive research was conducted on risk management tools and techniques. Annexure A shows that brainstorming is often used along with qualitative methods and expert judgement.

For this current research, it was important to determine what tool and techniques were being used in South Africa. This was discussed in detail subsequently.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The chapter discusses the approach to the literature review for this study. It focuses on the main areas as shown in Figure 1.1, including a general overview of risk management [A], barriers to effective risk management[B]; the perception that risk management implementation will improve project performance [C] and lastly, contractual and attitudinal issues pertaining to risk management [D].

2.2 Methodology of the literature review

An inductive approach was used in the literature review. The key feature of the inductive approach as stated by Saunders *et al*. (2012) is that it explores the available data to formulate theories that will be related to the data captured in the study, therefore the starting point for the literature review will not be predetermined theories or concepts but rather exploratory.

The review enabled the author to identify potential barriers to effective risk management that could be found in the South African construction industry and would provide the background knowledge to collect and evaluate data for the current study.

The literature review comprised over reviewing electronic sources of information focused on key authors, sources and journals centred on the topical areas as depicted in Figure1.1. Specific searches were conducted for literature identified in earlier research papers that would add value to the current research.

The initial literature sources comprised three journal publishers, and one search engine:

- Science Direct
- Pro-quest

- Compendex Engineering Village 2
- Google Scholar

The keywords used in the search were "*Risk Management*" and "*Construction*". "*Safety*" was purposely excluded by making use of the phrase AND NOT or "-"operator where the search function allowed. The search returned many articles and books totalling approximately 7300. The search was then refined to focus explicitly on the fields of project management and construction:

This reduced the number of articles to approximately 420 particularly for risk management. Figure 2.1 indicates the average number of publications on risk management per year recorded by Science Direct, a similar trend was noted for the journal publisher Pro-quest.

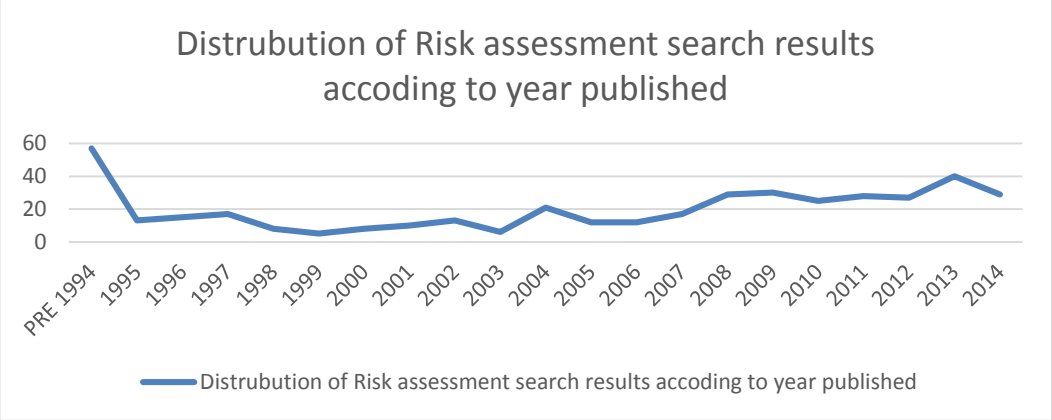

Figure 2.1 Number of articles published on risk management per year

An analysis of the publication dates of the articles identified from the search results indicated that 60% of the available literature was published from 2005 onwards; half of the 60% were published from 2012 to present day. This confirmed that risk management was an important research area and the concept of risk management was implemented widely across most industries. Not much literature was available that focused particularly on risk management in South Africa and these literatures had focused on identifying prominent risk factors rather than barriers to effective risk management. This study is filling this gap.

The search method was repeated for the journal publishers, Science Direct. Pro-quest and Compendex Engineering Village two. The search was also executed using the Google Scholar search engine. Similar results were obtained from the aforementioned searches excluding Google Scholar that returned far fewer articles.

It must be noted that the electronic source "*Compendex Engineering Village 2*" had seemingly relevant articles pertaining to risk management. Of the articles, six were retracted from the journal publisher, citing administrative and legal issues, and therefore did not form part of this review.

Fifty-two articles considered relevant, were reviewed and related directly to the field of construction and project management. The following areas were covered:

- Risk Management (RM) 40%
- Barriers to risk management 13%
- Risk Perception 11%
- Construction Partnering 18%
- Organisational Learning and Governance 16%
- SMMEs 2%

2.3 Barriers to effective risk management

Few journal articles were identified that explicitly focused on barriers to effective risk management. From these the articles that aligned strongly with the current study are listed in Annexure A.

The barriers listed by the authors in Annexure A are not confined explicitly to the topical areas listed in Figure1.1 and originated from different functions within project environment itself. The barriers identified in the literature presented in Annexure A can be grouped together as follows under each heading from Figure 1.1.

Barriers to effective risk management [B]

- Lack of time
- Lack of knowledge
- Lack of potential benefits
- Project not large enough to warrant the use or risk management tools and techniques
- Lack of funds
- Lack of joint risk management
- Competition amongst small construction companies

Perception that will impact in the project performance [C]

- Perception that risk management is expensive
- Majority of risk are subjective

Contractual and attitudinal issues impacting on risk management [D]

- Awareness of risk management

Risk management tools and techniques [E]

- Lack of familiarity with tools and techniques
- Degree of sophistication
- Lack of knowledge
- Availability of data

Chileshe and Kikwasi (2013) explored the barriers to effective risk management explicitly in a developing country, Tanzania. This is relevant to the study as South Africa is also a developing country and therefore similar barriers may be identified in both South African and Tanzania. Chihuri and Pretorius, 2010 identified barriers

to effective risk management in South Africa, however the focus of the study by them was only on large projects and did not consider small construction projects.

An important finding from Lyons and Skitmore (2004) is that all the barriers listed in their study had a low to moderate impact on the effective implementation of risk management. This is unlike the results observed in the other articles listed in Annexure A. It is unclear what underlying factors may cause the findings to differ from other findings (Akintoye and MacLeod, 1997; Chileshe and Kikwasi, 2013; Chihuri and Pretorius, 2010; Hwang *et al*., 2014; Tang *et al*., 2007) where a high impact had been observed from barriers identified in their studies.

Hwang *et al*.'s (2014) study lists ten likely barriers to risk management and correlate to the barriers stated in the studies undertaken by (Akintoye and MacLeod, 1997; Chileshe and Kikwasi, 2013; Chihuri and Pretorius, 2010; Lyons and Skitmore, 2004); Table 2.1 demonstrate what barriers were proposed by the different authors and were the similarities are. It can be informed from Table 2.1 that the most common proposed barriers are cost, lack of knowledge and lack of time. The framework used by Hwang *et al*. (2014) proposed unique barriers that impact on small construction projects such as, competition amongst small and medium contractors, low profit margin and lack of government legislation.

Table 2.0.1Barriers identified in previous studies

Barriers	**Akintoye, A.S., MacLeod, M.J., (1997).**	**Chileshe N and Kikwasi GJ., (2013)**	**Lyons, T., Skitmore, M., (2004)**	**Chihuri S, Pretorius L, (2010)**	**Hwang *et al.* (2014)**	**Tang, *et al.* (2007)**
Competition among SMCs	N	N	N	N	Y	N
Cost	N	Y	Y	Y	Y	N
Different recognition of risk control strategies	N	N	N	N	N	Y
Human / Organisation resistance	N	N	Y	N	N	N
Lack of Coordination	N	Y	N	N	N	N

Barriers	**Akintoye, A.S., MacLeod, M.J., (1997).**	**Chileshe N and Kikwasi GJ., (2013)**	**Lyons, T., Skitmore, M., (2004)**	**Chihuri S, Pretorius L, (2010)**	**Hwang *et al.* (2014)**	**Tang, *et al*. (2007)**
Lack of experience	Y	Y	N	N	N	N
Lack of expertise	N	Y	Y	N	N	N
Lack of government legislation	N	N	N	N	Y	N
Lack of joint risk management	N	N	N	N	N	Y
Lack of knowledge /information	Y	Y	Y	Y	Y	N
Lack of potential benefit	Y	Y	N	Y	Y	N
Lack of resources	N	N	Y	N	Y	N
Lack of time	Y	Y	Y	Y	Y	N
Low profit margin	N	N	N	N	Y	N
Sophisticated Tools	Y	N	Y	N	Y	N

Choudhry and Iqbal (2013) undertook a study on risk management in Pakistan and presented three significant barriers to effective risk management. The barriers in descending order were: the lack of a formal risk management system, a lack of joint risk management shortage of knowledge and or techniques. Choudhry and Iqbal's (2013) foregoing findings are similar to the findings of Tang et al. (2007) study.

The authors, (Akintoye and MacLeod, 1997; Hwang *et al*., 2014; Chihuri and Pretorius, 2010; Tang *et al*., 2007) particularly noted lack of knowledge as a major barrier to implementing effective risk management. In the research from (Akintoye and MacLeod, 1997; Hwang *et al*., 2014; Chileshe and Kikwasi, 2013), lack of time was listed as a major barrier. To a lesser extent, the lack of potential benefit was recorded as a barrier by (Akintoye and MacLeod, 1997; Chileshe and Kikwasi, 2013). Consequently, lack of knowledge and lack of time promised to be barriers on small construction projects in South Africa.

The only study undertaken explicitly on barriers to effective risk management in the South African context was by Chihuri and Pretorius (2010). They list the following barriers in there research:

- Lack of appreciation of the benefit associated with risk management implantation
- Inadequate time to implement risk management effectively on fast paced projects
- Deficiency in project risk management knowledge
- Perception that project risk management is costly

The research by Chihuri and Pretorius (2010) focused on large and complex construction projects leading up to the 2010 FIFA Football World Cup and did not consider small construction projects central to this study.

From existing studies it can be noted that few researches have been undertaken focusing explicitly on barriers to implementing risk management on small construction projects in South Africa.

2.4 Perception of how risk management impacts on project performance

Firstly, the distinction must be made between risk perception and risk attitude. According to the Project Management Institute (2013) organisations and stakeholders will accept varying degrees of risk depending on their risk attitude, furthermore risk attitude comprise risk appreciate, risk tolerance and risk threshold. Rohrmann (2008) defined risk perception as peoples' judgements and evaluations of hazards they are or might be exposed to. Lehtiranta (2013) underpinned that risk perceptions are a function of people's beliefs, attitudes, judgments, and feelings.

The importance of risk perception and overall attitude to effective risk management is evident from Wang and Yuan's (2011) study that identified factors affecting the

risk attitude of construction contractors. Kaplinski (2013) also placed a high premium on the attitude of key decision makers.

Wang and Yuan (2011) proposed to use the factors that affect risk attitude as a selection tool to match the contractor to the project. Wang and Yuan (2011) argued that this approach would be beneficial to the contractor, however in practice they found that financial considerations usually take preference over 'soft skills'.

Authors, (Lyons and Skitmore, 2004; Tang *et al*.,2007; Chileshe and Kikwasi, 2013) did not discuss the impact of risk perception in aiding or forming potential barriers to effective risk management. In contrast (Akintoye and MacLeod, 1997; Hwang *et al*., 2014) stressed the importance of risk perception in relation to how risk was managed on small projects.

Wang (2010) found that the perception of key decision makers on small construction projects and within small construction firms, played a significant role and impacted on the effective implementation of risk management on projects. Acar (2010) also stated that risk perception is an important part of effective risk management.

It can be appreciated that both risk perception and risk attitude may impact effective risk management on construction projects. Due to the limited scope of the current study, risk perception and risk attitude will not be discussed further. It was in addition worth exploring if implementing risk management was perceived to contribute to project performance positively, pertaining to the time, cost and quality performance.

Acar and Göç (2011) derived from their research that both the risk attitude of key individuals, and the personal traits of the owners of small construction firms have a significant impact on effective project risk management. As the focus of the current study is on small construction projects and SMMEs it was important to

establish if the personal traits of key individuals, such as small company owners, had a significant impact on project risk management.

2.5 Contractual and attitudinal issues that impact on risk management

Under this topical area risk allocation, SMME skill level, construction partnering and the use of contracts to manage risk, are discussed.

2.5.1 Risk allocated to the party best suited to manage the specific risk

An important element of risk management as stated by Lehtiranta (2013) is to ensure that the risk is allocated to the party most suited to handle or deal with the risk. Lehtiranta (2013) argued that this was severely lacking, especially with small contractors being pressured by clients into positions where they accept excessive risk on projects to get work in a challenging economic environment. Adams (2008) noted that due to the competitive nature of the industry in China and the overall lack of knowledge, contractors also find themselves in a position where they cannot manage project risks. As the construction industry in South Africa has been under constant pressure since 2009 as stated by the Business Intelligence and Planning Unit (2015), and with the industry further shedding jobs it can be expected that the South African construction firms may also accept risks they are not best suited to manage, in order to secure work. It was therefore important to identify if risk, in current practice, was allocated to the party best suited to manage the risk.

2.5.2 SMMEs lack the required skill to implement effective risk management

Marcelino-Sádaba *et al*. (2014) confirmed that the size of a company can be considered to be a key factor in business development. Barriers to effective risk management are inherent to the small business environment often lacking skills and taken for granted in major construction companies.

Aigbavboa (2014) indicated that the failures of SMMEs are mainly due to:

- Managerial incompetence
- Lack of managerial experience
- Inadequate planning
- Poor financial control

In addition, Rashaad *et al.* (2013) found that informal SMMEs are far more likely to employ lower educated or lower skilled individuals. This underpins the impression that SMMEs lack the required skills to implement risk management effectively on small construction projects.

The research by (Aigbavboa *et al*., 2014; Masutha and Rogerson, 2014; Rashaad *et al*., 2013) established that SMMEs constitute a very important part of the economy. Taking into account how SMMEs are earmarked to be integrated into projects performed by the South African government, the importance for project managers to perform effective risk management was enforced. It is important to determine if SMMEs are perceived to lack the skills to implement effective risk management in South Africa. Hence this could prove to be a barrier to effective risk management on small construction projects in South Africa.

2.5.3 Construction partnering may assist in improving risk management

Defining the concept of partnering it can be said that "*it is a concept which provides a framework for the establishment of mutual objectives among the building team with an attempt to reach and agreed dispute resolution procedure as well as encouraging the principles of continuous improvement*"(Naoum, 2003: 71). It can be derived from this definition that continuous improvement will be fundamental in aligning the concept of construction partnering to the development of SMMEs. This may prove to be the key in developing capacity in the South African context.

Partnering in construction holds many advantages. "*Partnering is often argued to bring about advantages in the area of quality sustainability, safety performance, dispute resolution, human resource management, innovation, as well as time and cost reduction*" (Eriksson, 2010: 905). Further to the advantages of construction partnering, Eriksson (2010) note that complementary collaborative tools can be implemented on construction projects that use partnering, one such tool is shared risk management. Therefore, the promotion and implementation of construction partnering could improve shared risk management.

In a discussion document published by the department of Public Works (2007) with the aim to promote skills development, the practice of bundling various small projects together to create stable work for SMMEs was discussed. This linked to the concepts of construction partnering and shared risk management requiring longer term commitments in contrast to the once of nature of most construction projects. Frimpong (2003) underpin the importance of project continuity to promote organisational sustainability and hinging on realising long term continuation of project benefits.

Osipova *et al*. (2013) underscored the importance to allow flexibility in joint risk management. Tang *et al*. (2007) established that lack of joint risk management is a barrier to effective risk management. Therefore, the study explored if construction partnering and associated shared risk management were perceived by the participants to be a possible aid to overcome the barriers to effective risk management.

2.5.4 Contracts used as a tool to manage risk

Chaitali *et al.* (2015) noted that contracts can be used as a tool to manage risk during a construction project. For the purpose of this study, it was important to see if risk management on small construction projects was being managed by making use of contracts and contractual clauses in addition to more formalised risk management techniques.

2.6 Risk identification and assessment tools

Marcelino-Sádaba *et al*. (2014) stated that project risk assessment was the most important part of the risk management process. Therefore it is important to determine the risk identification and assessment tools used on small construction projects in South Africa.

From the 1950's onward, there have been many attempts to measure risk both quantitatively and qualitatively. Taroun's (2014) research indicated that the Probability – Impact (PI) method of assessing risk is a recurring method recorded in the literature and remain commonly used. The authors (Sharma, 2013; Taroun, 2014) confirmed the methods using historical and statistical data as being the Monte Carlo simulation, network analysis and matrix propagation. In the 1980s Fuzzy Set Theory (FST) became popular in providing a means to measure risk by making use of qualitative data. Taroun (2014) demonstrated that the FST used natural words to represent the uncertainty rather than specific and precise numbers.

Nieto-Morote *et al*. (2011) proposed modifications to the traditional FST and AHP models to more effectively deal with the increased risk and complexity of modern projects and demonstrated that using a linguistic interface made it easier to implement fuzzy set theory to risk assessment.

Recently, Kaplinski (2013) argued that the current risk assessment models do not take into account the perception of the individual decision maker regarding risk and the utility associated with the risk. This linked to the study by Acar and Göç (2011) where they demonstrated how risk decisions in small companies are not only based on rational evaluations but also on the personal traits of the owners of the companies. Marcelino-Sádaba *et al*. (2014) proposed the development of a project risk management methodology explicitly for small companies, to address the unique challenges faced by small companies in the project environment.

From the literature reviewed it can be understood that qualitative risk identification and assessment methods were currently being used, additionally (Chihuri and Pretorius, 2010; Lyons and Skitmore, 2004 and Tang *et al*., 2007) particularly noted brain storming as the most common method used to identify risk. Brainstorming may therefore be a risk identification and assessment tool used in South Africa.

2.7 Conclusion

From the literature reviewed, it can be concluded that substantial information was available on the subject of risk management. There are few literatures focusing on risk perception and barriers to effective risk management on small construction projects. Therefore, this study sets out to fill the gap in literature explicitly on barriers to effective risk management on small construction projects in the South African construction industry.

CHAPTER THREE: RESEARCH METHODOLOGY

The research approach adopted in this study was that of induction. Saunders *et al*. (2012) noted that for an inductive approach the research starts by collecting data to explore a phenomenon, identify themes and explain patterns.

3.1 Research philosophy

The research completed in this study is exploratory and set out to collect qualitative data. Saunders *et al.* (2012) noted that qualitative research is associated with an interpretive philosophy. Saunders *et al.* (2012) further stated that it is interpretive because researchers must make sense of the subjective and socially constructed meanings.

While some data from the survey were collected, using quantitative means the data were interpreted qualitatively. This is true where participants were required to indicate severity on an interval scale as the data may be quantitative but still reflect the perception of the participants.

The discourse in the research philosophy will centre around four areas focusing on the research strategy, how data were gathered, analysed and applied to fulfil the aim and objectives of this study.

3.2 Research strategy

3.2.1 Data Collection

As the study focuses on small construction projects in South Africa, the data were gathered within the South African construction environment making use of an electronic questionnaire distributed to construction professionals registered with the South African Council for Project and Construction Management Professions (SACPCMP).

The main considerations for choosing a semi-structured questionnaire administered on line, for data collection were:

Financial: Saunders *et al*. (2012) noted that making use of a survey is a very economical way of collecting data. Since the target population is found over a wide geographical area it would have been time consuming and costly to conduct interviews with a large enough representation of the sample population to ensure that the data represents the population. In addition, using an electronic questionnaire saved the costs associated with transcribing interviews.

Target population: To ensure the reliability and quality of data the questionnaire was distributed to a target population, registered with the SACPCMP. An individual is required to have a minimum number of years work experience to register as a professional with SACPCMP, and to successfully complete an interview to ensure professionalism (South African Council for Project and Construction Management Professions 2015).

Quantity of time and resources: Due to the limited scope of this study, the timeframe to complete the research presented a constraint. This coupled with limited financial resources informed the decision to make use of an electronic semi-structured cross sectional survey to collect data. Easterby-Smith *et al*. (2008) identified how cross-sectional survey involved selecting different organisations, or unis, in different contexts to investigate how the factors measured differed across the units. This enabled the study to reach a geographically disbursed population while not incurring excessive cost.

Access to potential participants: Access is defined by Saunders *et al*. (2012) as the process involved in gaining entry into and organisation to undertake research. As the study gathered data of South Africa from specific participants and industry, the current study opted to make use of the SACPCMP. The SACPCMP provided regulation of the relationship between the South African Council for the Project and Construction Management Professions and the Council for the Built Environment; and to provide for matters connected therewith (SA Government President's Office,

2000). Hence, the SACPCMP provided the vehicle to gain access to the participants without involving the participant's organisations.

Saunders *et al*. (2012) confirmed that a semi-structured questionnaire could be used in exploratory research and that it may provide important background and contextual information needed to interpret the research findings. Therefore a semi-structured questionnaire was developed that comprised four sections as is included in Appendix B. The questionnaire was created and hosted on an internet (cloud) platform. The participants were given two weeks to complete the form, the closing date was extended with a week allowing participants a total of three weeks to complete the questionnaire. The questionnaire took approximately 20 minutes to complete.

3.2.2 Sections of the questionnaire

Section 1 – General information regarding the participants

The first section captured the general profile data of the participants and required them to consent to participate in the questionnaire.

This section collected data on the following:

- The sector the participants originate from public or private
- The type of construction (Building, civils electrical that the participants are mainly involved with)
- Years of experience of each participant
- What stakeholders the participants represent in the construction industry
- General information on the current status of risk management in construction projects

In this section, the aim was to determine what level of exposure and experience the participant had working within the construction industry and explicitly on small construction projects. The average amount and duration of small projects that participants were involved with were captured.

The information captured in this section was used to profile the participants to identify if the type of industry, experience, exposure to small construction projects and stakeholder representation influenced the data collected.

Section 2 – Barrier to effective risk management on small construction projects

The second section dealt with barriers to effective risk management. This section captured the main body of data central to this study. There are various barriers as identified by the authors in Annexure A. Chihuri and Pretorius (2010); Hwang *et al*. (2014); Lyons and Skitmore (2004) found similar barriers in their research.
Since the research conducted by (Chileshe and Kikwasi, 2013; Hwang *et al*., 2014) focus explicitly on small projects, it would benefit the study to use a similar framework to produce data that could be comparable to existing literature.

From Table 2.1 in Chapter 2 it can be demonstrated that the framework used by Hwang *et al*. (2014) proved to be a good guide to develop the questionnaire for the current study as it represented the main barriers listed in the literature, moreover it focused specifically on barriers in small projects that correlate to the main aim of the current study. The context of the study by Hwang *et al*. (2014) is in a developed country, Singapore, and it may not adequately address specific issues in a developing country. Conversely it lists a fair representation of barriers to risk management found in the literature review. Hence, the ten barriers identified by Hwang *et al*. (2014) was adopted in Section 2 of the questionnaire.

The barriers that were not specifically listed by Hwang *et al*. (2014), such as lack of expertise, lack of coordination, and lack of experience will be assessed in Section 4 of the questionnaire

The ten barriers identified were scored on a scale of 1 (least severe) to 10 (most severe) by the participants to indicate their perceived impact on implementation of effective risk management. The quantitative data collected in this section were considered reflective of the South African construction industry in general, as the participants were registered with the SACPCMP and are professionals in the field of construction management and construction project management delivering projects across South Africa.

Section 3 – Perception that risk management may positively impact on project performance

The third section focused on how risk management was perceived to affect the performance of a project. The participants' perception of how effective risk management will impact the time, cost and quality deliverables was measured to determine the overall disposition toward the value of risk management on projects.

Quantitative data were collected in this section. Data captured from this section can therefore be subjected to statistical testing to determine the validity of the data, this is done in Chapter Four.

Section 4 – Participant feedback

The last section was open-ended to collect general information and requested participants to provide feedback on how severely they perceived the ten identified barriers to impact on effective risk management on small construction projects in South Africa.

General questions were asked on how risk management is perceived in their specific companies. Jointly the role contracts and attitude to risk affect effective risk management were also questioned. The data collected in this section comprised both qualitative and quantitative data.

3.3 Data analysis

Saunders *et al*. (2012) noted that qualitative research do not use standard devices to report results but instead it was necessary to devise other means to present the findings while maintaining the necessary contextual description and presenting analytical findings. Therefore, Microsoft Excel was used as the platform to capture all the responses received from the participants. In this study data was reviewed to ensure that the input was in the correct format and that the intent of the answer was recorded correctly. General information on every question were also analysed to scrutinise the overall integrity of the feedback obtained from the questionnaire.

Nominal data

Easterby-Smith *et al*. (2008) noted that nominal scales have no natural order. Nominal data collected in the survey captured information that gave more insight into the profile of the participants. This provided information about the demographics of the sample group to interpret the findings and test if correlations exist between the barriers to effective risk management observed and the demographics of the sample.

Numerical data

The data collected in sections two and three in the questionnaire was ordinal data. Saunders *et al*. (2012) demonstrated that with ordinal data, it was possible to determine the relative position of each case within the data set, but the actual numerical measures are not recorded. Hence, the ordinal data collected in the questionnaire was interpreted only in terms of difference between the medians to determine the central tendency following which the dispersion was measured by means of the standard deviation.

Tests

For the study, the decision was made to use the one-tailed T-test and the Pearson correlation to test and interpret data. Hwang et al. (2014) also made use of the one-tailed T-test. Chileshe and Kikwasi (2013) and Tang *et al*. (2007) made use of frequency analysis; ranking analysis; and ANOVA. Saunders *et al*. (2012) clarified that both the T-test and ANOVA is used to measure the variance or difference between groups. They demonstrated that the T-test was suited to measure the variance between two groups only, whereas ANOVA should be used to measure the variance between three or more groups. Since both the one-tailed T-test and ANOVA measured variance the current findings could be related to the findings by the authors listed in Annexure A

Chihuri and Pretorius (2010) did not make use of statistical techniques to determine if the barriers found will apply to the whole of the population and not only the sample. Thus their data may not reflect correctly for population tendency.

Remenyi (1998) demonstrated that external validity is concerned with knowing whether the researchers' findings are generalizable to a wider universe beyond the immediate research environment. This was another consideration to make use of the one-tailed T-test. The one-tailed T-test was adopted to compare the data captured in the current sample will reflect the same when extended to the population of the sample.

In the current study the null hypothesis (H0) was selected as being equal to the mean, with the rejection (H1) indicating that the mean will exceed the sample mean. This is interpreted as follows:
H0 = Acceptance. Sample mean equal to the population mean
H1 = Rejection. Mean for the population likely to exceed the mean of the sample
**p-value for acceptance/rejection 0.05*

The Pearson correlation is explained by Saunders *et al.* (2012) as the correlation coefficient that enables you to quantify the strength of linear relationships between two numerical variables. For this study the Pearson correlation was used to determine if significant correlations exist between the attributes of the groups and the data collection in section two pertaining to the barriers to effective risk management. Saunders *et al.* (2012) demonstrated the following strengths of relationship between variables resulting from the Pearson correlations:

0.2 - 0.2 (positive and negative): None
0.2 - 0.35(positive and negative): Weak
0.35 - .6 (positive and negative): Moderate
0.6 – 0.8 (positive and negative): Strong
0.8 – 1.0 (positive and negative): Very strong.
Any correlation under 0.2 and -0.2 will not be mentioned in this study.

3.3.1 Alignment to current study

The research question for this dissertation is to investigate what barriers exist to effective risk management in the South African construction environment for small construction projects. The objectives of the study are therefore:

- Determine the major barriers to effective risk management on small construction projects in South Africa
- Investigate the perceived impacts of risk management on project performance among small construction projects in South Africa
- Determine other contractual and attitudinal barriers impacting on effect risk management in South Africa

Data collected from the questionnaire enabled the author to align the barriers to effective risk management in South Africa to the barriers that are found in research conducted by other authors such as the ones listed in Annexure A.

The findings were discussed in relation to how they differ or match the barriers identified in the existing literature.

3.3.2 Pre-testing (convenience sampling)

Remenyi (1998) noted that the object of pre-testing the questionnaire was to detect possible shortcomings in the design and administration of the questionnaire. The questionnaire developed for the current study was pre-tested. Three people were sampled to participate in the pre-testing. All three individuals were project managers with a minimum of five years relevant experience in the field of construction project management, including risk management. The questionnaire was considered comprehensive although feedback indicated that there were improvements required to present questions and to prevent ambiguity in questions.

These comments were subsequently addressed and the final questionnaire was sent out to the participants on the SACPCMP database. The questionnaire was sent out requesting participants to return the questionnaire within two weeks from receipt. A reminder was sent to all participants in the week before closing. A low response rate at the end of the second week subsequently led to another week extension given to allow late responses to be captured. After the third week, the internet-based questionnaire was closed and no more questionnaires were included in the research.

The participants selected from the SACPCMP database only comprised the construction management and construction project management professions.

3.3.3 Ethical considerations

For the current study access to participants, intrusion of privacy, disclosure of sensitive information and debriefing was main considerations. Access to participants was discussed under section 3.2.1. The remaining considerations will be discussed in this section.

Intrusion of privacy

To prevent any possible intrusion of privacy a web-based questionnaire was developed allowing participants to complete the questionnaire at the most convenient time that did not impact on their work commitments. No sensitive detail on the participants' projects were requested in the questionnaire. Sensitive detail would include aspects such as project name and location, client and company names, project value and specific dates. This was done to ensure no sensitive or privileged information was made available unknowingly.

Disclosure of sensitive information

The questionnaire was developed to keep the identity of each participant privately distributing the questionnaire by means of the SACPCMP. The SACPCMP administrator is the only person who has access to the actual identities of the participants and the identities of participant's information form part of a non-disclosure agreements within the organisation.

Debriefing

Saunders *et al*. (2012) define debriefing as the process where once an observation has taken place, the persons affected by the observation should be given feedback on the outcome of the observation. Therefore, it was agreed with SACPCMP that a summary of the findings of this study would be formally communicated to them. The SACPCMP would then distribute these findings to all the participants.

The questionnaire developed for the current study was submitted to the ethical clearance committee at the University of the Witwatersrand. The committee provisionally approved the questionnaire upon the rectification of a few minor changes. Ethical clearance was obtained as reflected in Annexure B.

CHAPTER 4: DATA ANALYSIS AND FINDINGS

4.1 Data analysis

The administration department of the SACPCMP confirmed that 325 registered professionals viewed the web-based questionnaire. Fifty-seven responses were obtained to derive a response rate of 17.5%, this is the same low response rate obtained by Hwang *et al*. (2014). Researches by Lyons and Skitmore (2004) and Chileshe and Kikwasi (2013) obtained response rates near 23% indicating that the response rate for this study was low but comparable to similar studies completed.

Hwang *et al*. (2014) noted that the low response rate in their study could be contributed to the confidentiality and sensitivity of the information requested in the questionnaire. This seems to be an unlikely explanation for the current study as every effort was made to ensure the anonymity of participants.

Saunders *et al*. (2012) declared that a sample size of 30 or more will usually result in a sampling distribution close to a normal distribution, with a sample size of 57 the data collected in this study will be adequate to perform statistical tests.

4.1.1 Section 1 (General Information)

The information obtained from this section of the questionnaire (please refer to Annexure D for detail) revealed that respondents have been involved in both the public and private sector construction projects in South Africa. About 21% of the participants indicated that they have only worked on construction projects within the private sector while about 19% of participants have only worked on construction projects in the public sector. The majority of participants (60%) indicated that they have worked on construction projects in both the public and private sectors. The data obtained from this section is presented in Table 4.1

Table 4.1 Summary of data collected Section 1

Section 1 Summary Information			
Public or Private sector Construction		Industry work performed in	%
Sector	(N=57)	Private	21%
		Public	19%
		Both	60%
Area in Construction Sector			%
	(N=57)	Building	44%
		Civil	28%
		Mechanical	7%
		Electrical	5%
		Other	16%
Years of experience		Experience groups	% of participants per group
	(N=54)	Less than 5 Years	13%
		5-9 Years	31%
		10-20 Years	33%
		More than 20 Years	22%
Project team representation		Role	% representation of role in sample group
	(N=55)	Project Manager	36%
		Contractor	20%
		Client	24%
		Client Representative	15%
		Consultant	2%
		Other	7%
Project Data		Classification of projects	Duration in months of projects
	(N=53)	Number of small projects	11.6
	(N=39)	Number of small projects with formal RM	7.3
*Duration in months	(N=51)	Duration of small project with formal RM	6.9
*Duration in months	(N=52)	Duration of small projects without formal RM	7.9

Section 1 Summary Information		
Size of company	Size of company	% of sample
(N=57)	Less than 20 persons	31.58%
	20-60 persons	15.79%
	60-150 Persons	7.02%
	More than 250 Persons	40.35%
	Other	5.26%

The majority (44%) of the participants that took part in the study were from the building industry followed by the civil industry (28%). The participants were project managers (36%), clients and client representatives (24%), and lastly, contractors (20%). About 7% of the respondents identified with more than one of the three groups listed in the previous sentence with 2% percent of the sample represented specialised consultants.

The levels of experience varied in the sample, the majority of participants indicated that they had work experience exceeding 10 years. Only 13% of the sample indicated that they had less than five years' experience. Hence, the feedback obtained from the participants could be considered reliable and reflective of the construction industry in South Africa.

The majority group represented in the sample was the client and/or client representative, and jointly formed 39% of the respondents. The group with the second most representation was project managers at 36%. Contractors only made up 20% of the sample. It could be noted that the contractors' representation in the sample was skewed compared to the representation of the client representatives and project managers, and may reflect in the conclusions derived from this study.

On average, the number of small projects that the participants have completed over the last three years (up to 2014) was approximately 12 projects per respondent. It must be noted that some respondents indicated that they worked on many small construction projects while other indicated that they worked on few, therefore data collected in this regard varied between participants. No weighting was applied to

data collected from participants that had more experience on small construction projects.

Comparing the data from Section 1 on the average duration of projects (as presented in Annexure D) it was noted that 49% of the respondents provided data that could not be included in the comparison. Of the remaining 51%, 21% of the respondents indicated that projects with formal risk management take longer to complete than projects without. Furthermore 18% noted the opposite in that projects without formal risk management take longer to complete. Lastly 12% indicated that project with and without formal risk management take the same amount of time to complete. The results are not reliable enough though to make a deduction as it can be interpreted from Annexure D. From the varied sample sizes for each question on project duration, the indication was that not all the participants completed this section of the questionnaire thoroughly and no conclusion could be drawn to state that the use of formal risk management on projects positively or negatively impacted on the schedule performance.

The size of companies that participated in the study varied in size with 40.3% participants working in companies having more than 250 employees. The second largest group, representing 31.5% of the sample had less than 20 employees. It must be noted that the questions in the study focused on small construction projects in South Africa and not the size of the company. As discussed earlier in Chapter 1, small projects could be executed by both small and large companies.

4.1.2 **Section 2 (barriers to effective risk management)**

In section 2 of the questionnaire, 10 potential barriers to effective risk management were presented to the participants. Participants indicated how severely the barriers were perceived to be impacting on the successful implementation of risk management based on their experience, with a score of 10 being most severe and one being least severe.

All data collected was scrutinised to ensure that the correct information was captured as requested for each question including the correct format (numerical or literary). A basic review of the mean, mode, range, median and standard deviation was done for each proposed barrier to identify any inconsistency in the data. No significant inconsistencies were identified from the data collected.

Descriptive statistics

Saunders *et al*. (2012) demonstrated that descriptive statistics enabled a person to describe and compare variables numerically and the data should be able to describe the central tendency and dispersion. According to Saunders *et al*. (2012) the three measures mostly used to measure central tendency is the mode, median and average, whereas the dispersion is measured using an inter-quartile range or standard deviation.

Saunders *et al*. (2012) confirmed that the mean could be unduly influenced by extreme data values in skewed distributions and proposed using the median to obtain results that are more useful. It can be noted that for the majority of the proposed barriers the range between the lowest and highest score allocated by participants was quite large, and this impacted on the average for each barrier. Hence, the study made use of the median to measure the central tendency and the standard deviation to measure dispersion. The ranking obtained through firstly the median score of each barrier and secondly refining the ranking with the standard deviation is presented in Table 4.2.

Table 4.2. Barriers to effective risk management in South Africa

Rank	Barriers to effective risk management	Median	St Dev	Average
1	Lack of knowledge	10.00	1.98	8.71
2	The complexity of analytical tools	8.00	2.09	7.48
3	Lack of time	8.00	2.70	6.85
4	Lack of sufficient manpower	8.00	2.75	7.09
5	The lack of sufficient budget	8.00	2.78	7.25
6	Low profit margin	7.50	2.84	6.74

7	The lack of potential benefits	7.00	2.69	6.07
8	Lack of government legislation	7.00	2.91	6.22
9	Competition among small construction firms	7.00	2.98	6.02
10	It is not economical	4.00	3.05	4.40

Inferential statistics

Saunders *et al*. (2012) demonstrated that inferential statistics entailed the process of drawing conclusions about the population on the basis of data describing the sample. The study aimed to make use of the data as presented in Table 4.2 to determine if the same means as obtained from the sample for each barrier will reflect the stance of the whole population of the study. This is done by making use of a one- tailed test. Easterby-Smith *et al*. (2008) indicated that T-tests are used to compare the mean scores of two groups of independent observations to compare to the reputation of their energy supplier (where the data originate from), and that the one-tailed test is used where one group is expected to have a higher mean than the other group.

The study therefore stated the null hypothesis (*H0) as* being, that the mean for the population is no different than the mean of the sample, and the rejection of the hypothesis indicating that the likely mean for the population will be greater than the sample mean.

H0 = Acceptance. Sample mean equal to the population mean

H1 = Rejection. Mean for the population likely to exceed the mean of the sample

**p-value for acceptance/rejection 0.05*

The results obtained from the one-tailed T-test reflected that the mean values obtained from the sample group for each barrier could be accepted to reflect the whole population except for two barriers. The two barriers that exceeded the sample mean based on the results from the one-tailed T-test were ‘low profit margin’ and ‘lack of potential benefits’. The findings indicated that the five toped ranked barriers to risk management identified in the sample will be similar for the whole population.

Table 4.3. Inferential statistics, barriers to effective risk management

Rank	Barriers	Mean	N	*H*	df	t Stat	P(T<=t) one-tail
1	Lack of knowledge	8.71	55	0	54	18.22	0.00
2	The complexity of analytical tools	7.48	54	0	53	16.29	0.00
3	Lack of time	6.85	54	0	53	-5.27	0.00
4	Lack of sufficient manpower	7.09	55	0	54	4.29	0.00
5	The lack of sufficient budget	7.25	55	0	54	-1.75	0.04
6	Low profit margin	6.74	54	0	53	-1.29	0.10
7	The lack of potential benefits	6.07	54	0	53	1.49	0.07
8	Lack of government legislation	6.22	55	0	54	12.03	0.00
9	Competition among small construction firms	6.02	55	0	54	2.99	0.00
10	It is not economical	4.40	55	0	54	-6.48	0.00

4.1.3 **Section 3 (perception that risk management will impact on project performance)**

Section 3 was included in the questionnaire to obtain a deeper insight into how risk management is perceived to impact on project performance in small construction projects. The same principle was followed as described under descriptive statistics earlier in this chapter. The central tendency was established by calculating the median for each question, since the variance between the highest and lowest scores for each question in Table 4.3 was large and subsequently could distort the mean as confirmed by Saunders *et al*. (2012).

Thereafter the standard deviation was used to determine the dispersion around the median and rank the perceived time, cost and quality benefit participants associated with implementing risk management on small construction projects. From the data captured and presented in Table 4.4, it can be inferred that there is strong agreement amongst the respondents that risk management on small construction projects will positively impact on project as the median for all the questions listed in Table 4.4 is eight.

From Table 4.4 it can be observed that the respondents were of the opinion that quality performance would benefit the most from implementing risk management. A one-tailed T-test was performed on the feedback obtained by requesting participants if they believed the time performance of a project will improve with improved risk management. The one-tailed T-test was repeated for both the cost and quality performance criteria on projects respectively. The findings indicate that the null hypothesis is rejected for all three proposed project performance criteria, indicating that the findings as presented in Table 4.4 will be similar for the population.

Table 4.4 One- tailed T-test (time/cost/quality)

	Will risk management improve?	**Median**	**St Dev**	**VAR**	**n**	***H=0***	**df**	**t Stat**	**P(T<=t)**
Overall	The overall performance of the project	8.00	2.62	3.91	54.00	0.00	53.00	2.25	0.01
1	The quality performance of the project	8.00	2.38	4.98	54.00	0.00	53.00	0.77	0.22
2	Schedule performance of the project	8.00	2.46	5.22	54.00	0.00	53.00	0.34	0.37
3	The cost performance of the project	8.00	2.47	3.94	53.00	0.00	52.00	0.74	0.23

Overall, data obtained through this section of the questionnaire confirmed that the majority of participants believed that risk management was important and should be implemented on small construction projects. Overall, the indication was that project quality would benefit the most form effective risk management.

4.1.4 Section 4 (exploratory questions to potential barriers and solutions to effective risk management)

Section 4 of the questionnaire presented questions to the participants in order to determine their perception of the most important barrier impacting on effective risk management listed in Section2. In addition questions were presented to determine the perception to other possible barriers and solutions affecting effective risk management. The following questions were presented:

- Will the attitude of key decision makers on projects impact on effective risk management implementation
- What barrier they believed to be most significant to effective risk management
- Are contracts used as a tool to manage risk on construction projects
- Is risk allocated with the party best suited to manage the risk
- Is risk management being implemented by the participants on current construction projects
- Will construction partnering and shared risk management help to address the barriers to effective risk management
- Do SMMEs lack the skill to implement effective risk management

A summary of the data collected from this section of the survey is depicted in Table 4.5.

Table 4.5 Findings for Section 4 of questionnaire

Section 4	**Summary Information**	%
Impact of key decision makers on RM implementation		
(N=56)	Mean	8.68
	St Dev	1.60
Most significant barriers		%
(N=51)	Lack of Knowledge	27.45%
	Complexity of Analytical tools	5.88%
	Lack of budget	15.69%
	Lack of manpower	10.00%
	Low profit margin	9.80%
	Lack of time	11.76%
	Lack of Government Legislation	2.00%
	Lack of potential benefits	4.00%
	Attitude of decision makers	9.80%
	Industry not mature enough	2.00%
	Failure to plan	1.61%
Are contracts and contractual clauses are being used to manage most risks		
(N=56)	Mean	7.5
	St Dev	6.54
Are risk being allocated to the party best suited to deal with the risk?		
(N=50)	YES	31.00%
	NO	69.00%
Currently implementing risk management on small construction projects		
(N=45)	YES	44.44%
	NO	42.22%
	Partially	13.33%
Will construction partnering and shared risk management help to address risk management on small construction projects		
(N=57)	YES	56.14%
	NO	35.0 9%
	Undecided	8.77%

Section 4	Summary Information		%
Do SMMEs lack the skill to implement risk management on small construction projects			
	(N=53)	YES	69.81%
		NO	5.66%
		Other	24.53%
Is risk management on small construction projects important			
	(N=53)	YES	67.92%
		NO	9.43%
		Undecided	22.64%

The questions presented in section4 of the questionnaire endeavoured to obtain deeper insight into the causes and validity of the proposed barriers to risk management presented in Section 2 of the questionnaire.

Participants were asked to indicate which of the ten barriers to risk management presented in the study has the most severe impact on effective risk management on small construction projects and to elaborate on their choice. The different barriers selected by the participants were totalled and divided by the sample size to obtain a percentage representation for each barrier. The resulting top four barriers, in descending order, were identified as:

- Lack of knowledge
- Lack of budget
- Lack of time
- Lack of manpower

Comparing the quantitative and qualitative findings on the barriers to risk management from Section 2 and Section 4 respectively, the result confirmed that lack of knowledge was perceived as the most significant barrier in the South African context. Lack of budget and time were second and third respectively. Complexity of analytical tools was ranked much lower than in Section 2 of the questionnaire.

Approximately ten percent of the participants indicated that the attitude of key decision makers would impact on the level of risk management implementation on projects. This is similar to the findings of Acar and Göç (2011) that demonstrated the impact that key decision maker have on risk management.

4.1.5 **Correlation**

Data collected in Section 2 of the questionnaire were used to correlate to the characteristics of the participants as recorded in Section 1 of the questionnaire.
The results of the Pearson correlation screening are presented in Table 4.7. Easterby-Smith *et al*. (2008) determined that the Pearson correlation is used to test associations for ordered category scales, ultimately indicate correlations between variables. Saunders *et al.* (2012) indicated that a deviation between zero and 0.2 positive or negative holds no significant correlation. From Table 4.6 it can be discovered that only weak correlations were identified in the current study and therefore not much time was spent to derive possible explanations for the correlations.

Table 4.6 Pearson correlation screening

Pearson Correlation Screening				
Barriers	**Rank**	**Size of company**	**Type of industry**	**Level of Experience**
Lack of knowledge	1	0.12	-0.28	-0.14
The complexity of analytical tools	2	0.05	-0.22	0.04
The lack of sufficient budget	3	0.15	-0.25	-0.15
Lack of sufficient manpower	4	0.13	-0.10	-0.27
Lack of time	5	0.14	0.10	-0.13
Low profit margin	6	0.14	0.16	-0.14

Pearson Correlation Screening				
Barriers	**Rank**	**Size of company**	**Type of industry**	**Level of Experience**
Lack of government legislation	7	0.14	-0.05	-0.14
The lack of potential benefits	8	0.02	0.04	0.14
Competition among small construction firms	9	0.14	0.11	-0.14
It is not economical	10	-0.07	0.28	-0.07
General				
The perception of risk management by key decision makers on project affect risk management implementation on projects		0.07	0.18	-0.02
Contracts and contractual clauses are being used to manage most risks on small construction projects.		0.24	0.03	-0.03
Impact of Key decision makers on RM implementation		0.14	0.25	-0.14
Perception that RM impact on project performance		0.02	-0.21	0.03

The first correlation is lack of knowledge, identified as a barrier to effective risk management, compared to the sector of industry that participants deliver construction projects within.

From the Table 4.7 it could be deduced by means of the central tendency that participants that performed construction projects only in the private or public sector viewed the lack of knowledge as a barrier to effective risk management more seriously than the participants that performed construction projects in both the public and private sector. This can be reasoned by observing the higher mean and median in Table 4.7. Participants that worked on construction projects in both sectors had a significantly lower mean value than the participants that worked in the public and private sectors. The difference in scoring by participants working in

both sectors, compared to the rest of the sample, is difficult to explain with the data available.

Table 4.7 Perception of the impact of lack of knowledge by industry sector

Type	Mean	Median	Mode
Public	9.27	10	10
Private	9.42	10	10
Both	7.76	9	10

The second correlation observed was the degree to which available budget was perceived to be a barrier by participants working in different sectors of the industry.

It can be observed from Table 4.8 that participants working on construction projects in the public sector believe the lack of sufficient budget to be a more noteworthy barrier than participants that worked only on projects in the private sector or worked in both sectors.

Table 4.8 Perception of the impact of lack of budget by industry sector

Type	Mean	Median	Mode
Public	8.2	9	10
Private	7.18	8	8
Both	6.28	7	10

The results depicted in Table 4.9 indicated that participants with less than five years experience scored the barrier, lack of manpower, higher than all the other participants. Moreover the participants with more than twenty years' experience scored lack of manpower the lowest in terms of severity in the sample group.
It may be an indication that less experienced participants believed more people will assist with risk management. The more experienced participants emphasise lack of skills and knowledge as a more severe barrier instead, as observed from the open ended questions in Annexure D.

Table 4.9 Perception of the impact of lack of manpower relative to participant experience.

Type	Mean	Median	Mode
Less than 5 Years	7.88	9	10
5-9 Years	7.21	8	9
10-20 Years	7.26	8	10
More than 20 Years	5.55	6	9

The perception that risk management on small projects was not economical relating to the sector of industry participants worked in, was the next correlation observed. The participants that performed work in the public sector felt that whether it was economical to implement risk management was not a noteworthy barrier on small construction projects as depicted in Table 4.10.

Participants that performed work in the public sector gave a lower mean and median score compared to the rest of the sample group.

Table 4.10 Perception of risk management being economical to implement on projects relative to Industry Sector

Type	Mean	Median	Mode
Public	2.09	2	1
Private	4.83	4,5	1
Both	4.73	4	1

The fifth correlation is that of using contracts as a tool to manage risk on projects and size of companies that use contracts as risk management tools. The correlation between the size of the company and contractual elements to manage risk is presented in Table 4.11. From the data captured from participants in the study there was an indication that participants in companies with 20 to 60 employees tended to use contract and contractual clauses more frequently to manage the risk on small construction projects.

Table 4.11 Perception that contracts are used to manage risk relative to the size of the company.

Size	ID	Average	Median	Mode
Less than 20	100	5.5	6	3
20 -60	200	6.44	7	10
60 -250	300	5.6	6	*
More than250	400	5.6	6	8

*The mode cannot be computed for this size company as none of the 4 participants scored the same number.

The last correlation observed gave an indication that participants working on construction projects in the private sector, and both the public and private sector, believed that the impact key stakeholders had on project risk management was more severe to that of the public sector as depicted in Table 4.12.

Table 4.12 Perception of the impact the attitude of key stakeholders have on risk management by industry sector

Type	Mean	Median	Mode
Public	7.8	9	9
Private	8.75	10	9
Both	8.9	10	9

4.2 Findings

4.2.1 Current situation as reflected from data gathered

Participants in the study were requested to indicate if they were implementing risk management on the small construction projects. The percentage of small construction projects implementing a formal risk management was found to be over 61%. This is similar to the finding by Hwang *et al*. (2014) that the medium level for risk management implementation in Singapore was 50%. Sixty-eight percent of

the respondents indicated that they believed risk management was important on small construction projects

The main theme reflected in the response was that the upfront engineering and planning phase was perceived to have the best impact and contribution to effective risk management on small construction projects. It was also mentioned by several participants that the key to effective risk management is to tailor the level of risk management and tools/techniques used to the specifics of each project.

4.2.2 Barriers to effective RM on small construction projects in South Africa

Lack of knowledge

The highest ranked barrier in the South African context, lack of knowledge, was also identified by Serpella *et al*. (2014) in the Chilean construction environment. It has also been identified as a significant barrier in similar studies undertaken by (Akintoye and MacLeod, 1997; Chihuri and Pretorius, 2010). This is contrary to the findings of Hwang *et al*. (2014) that lack of time and budget were more significant barriers. Lyons and Skitmore, (2004) presented similar barriers to participants in their study as selected for this research, however Lyons and Skitmore (2004) reported that all barriers presented in their research have been rated moderate to low in how they were perceived to impact on risk management.

Complexity of analytical tools

Bearing in mind that the first barrier identified in the study is lack of knowledge, the second barrier, complexity of analytical tools can be argued to be an extension of the lack of knowledge and understanding of risk management. In Section 4 of the questionnaire participants scarcely mentioned complexity of analytical tool as a barrier. This was contradictory to the findings from the sample group in Section2.

A question was presented to all participants in Section 4 of the questionnaire where they were asked to state what type of risk management tools were being used. The feedback as presented in Table 4.13 indicated that 41% of the participants were not making use of any risk management tool or methodology on small projects.

Table 4.13 Risk management methodology – tools used currently

What risk management methodology or tool used currently		
Method / Tools Used	Number of Participants	%
Contracts	2	4%
Lessons learned	2	4%
Nothing	21	41%
Other / Tailored approach	6	12%
PmBok	7	14%
Risk matrix	3	6%
Risk Registers	2	4%
Training and mentoring	3	6%
Upfront planning and engineering	5	10%

The largest group that used risk management were at 14% and made use of the PmBok principles. Thereafter 12% used methods and tools that they tailored to suite the project, and 10% noted that they make use of upfront planning and engineering to address risks on small construction projects.

Other barriers identified in the feedback section include: lack of budget; lack of time; and lack of manpower.

4.2.3 Perception that risk management implementation can impact on project performance

From Table 4.4 it can be informed that the respondents were of the opinion that the time, cost and schedule performance of a project can benefit from effective risk management, in particular schedule performance would benefit the most.

Construction partnering as potential solution to the barriers to risk management

In the literature review, construction partnering was discussed as a potential aid in overcoming the barriers to effective risk management. The project participants were asked if they agreed that construction partnering would help to overcome the challenges being faced on small construction projects. Fifty-six percent of the respondents indicated that construction partnering and shared risk management could help in addressing the barriers to effective risk management identified in this study. The main concern from participants that responded that partnering will not assist in overcoming barriers to effective risk management as it could add complexities to the project could impact project performance negatively.

Inadequate skills in SMMEs as contributing factor to poor risk management in South Africa

From Rashaad *et al*. (2013), the lack of skills in SMMEs was to be a potential challenge to effective risk management. Participants were asked if they agreed that lack of skill is a barrier to effective risk management.

Sixty-nine percent of the participants indicated that this was a challenge in the South African context and related to the level of skill, lack of structure and experience in most SMMEs. The exception could be noted for SMMEs working in specialised niche-markets where the company did not reflect the typical profile of a small developing company, but instead that of an established and stable company of small size focused on specialised markets.

Risk allocated with the party best suited to manage the risk

Lehtiranta (2013) and Adams (2008) expressed the importance that project risk should be allocated with the party best suited to manage the risk. Adams (2008)

demonstrated that this is not always the case, as contractors tend to take on more risk due to lack of knowledge and competition to get work.

The participants were asked if project risk is allocated with the party best suited to manage the risk in the South African construction environment. A large percentage (69%) of the participants indicated that risk was not being managed by the party best suited to deal with the risk. Lack of understanding was considered the main reason. This is because most risks are transferred from the client to the contractor who is frequently too eager to accept the risk (without a full understanding) to get the project.

CHAPTER 5: CONCLUSION

The study set out to identify the barriers to effective risk management on small construction projects in South Africa. The three objectives for this research were to determine the major barriers to effective risk management on small construction projects in South Africa, to investigate the perceived impacts of risk management on project performance among small construction projects in South Africa and lastly, to determine other contractual and attitudinal barriers impacting on effect risk management in South Africa.

The main areas of discourse identified under risk management (please refer to Figure1.1) comprise the barriers to effective risk management, the perception that risk management can impact on project performance, contractual and attitudinal issues relating to risk management. To obtain these objectives an exploratory study was undertaken to collect data by using a semi-structured questionnaire.

5.1 Barriers to effective risk management on small construction projects

The aim of this study was to determine the barriers to effective risk management on small construction projects in South Africa. With respect to the aim and the first objective of this study, it can be concluded that the participants in the study were of the opinion that the South African construction environment experienced lack of knowledge as the barrier most severely affecting effective risk management on small construction projects. This was followed in descending order by the complexity of analytical tools, lack of time, lack of sufficient manpower and lastly, lack of budget.

It was demonstrated by the data captured in the current study that 44% of the participants implemented some form of formal risk management on small construction projects with a further 13% of the participants indicating that they had an informal risk management system in place. The remaining 42% established that no risk management was being used on the projects they were involved in.

5.1 1 Lack of knowledge

Lack of knowledge has also been identified as a barrier to risk management by the authors (Akintoye and MacLeod, 1997; Chihuri and Pretorius, 2010; Hwang *et al*., 2014; Tang *et al*., 2007; Serpella *et al*., 2014). The findings of this research, that lack of knowledge was a barrier to effective risk management, correlated to the findings of Smith and Bohn (1999). Chileshe and Kikwasi (2013) recognised that knowledge and understanding of the risk management process would contribute to the identification and effective management of risk on construction projects. The significance of the barrier, lack of knowledge in the South African construction industry, can be supported by respondent ID 41's position that "*Lack of knowledge is the most significant barrier because capacity begins with relevant knowledge*".

Lyons and Skitmore (2004) only found lack of knowledge to have a moderate impact on effective risk management. This was dissimilar to the findings in this study and similar existing studies (Akintoye and MacLeod, 1997; Chihuri and Pretorius, 2010; Hwang *et al*., 2014; Tang *et al*., 2007). Seemingly, no other literature drew a similar conclusion as presented by Lyons and Skitmore (2004).

Tang *et al*. (2007) demonstrated lack of knowledge to be one of the top-three barriers along with, lack of joint risk management and different recognition of risk management control structures. The research undertaken by Serpella *et al*. (2014) strongly linked to the current dissertation and focused on knowledge management to address poor risk management in construction projects.

As demonstrated by Serpella *et al*. (2014), lack of knowledge is further complicated by the loss of knowledge caused during projects. Knowledge was further linked to experience and retaining knowledge from one project to another was identified as very important. Serpella *et al*. (2014) underscored the importance of, having a proper and systematic risk management methodology and, more importantly, knowledge and experience.

The Business Intelligence and Planning Unit (2015) estimated that 95% of construction work in South Africa was performed by SMMEs. Given that the topped ranked barrier was lack of knowledge, the importance of understanding the characteristics of SMMEs relating to this barrier became apparent, in particular the characteristic of SMMEs being project based organisation. Almeida and Soares' (2014) study on project-based organisations established how the characteristics of the project-based organisation directly impacted on knowledge management. Almeida and Soares (2014) determined that project based organisations poses complex problems for information and knowledge management due to the fragmentation and lack of uniformity of organisational structures, processes, practices and technologies. Almeida and Soares argued that the required relevant knowledge was trapped in an 'information limbo' that made it inaccessible to the rest of the project-based organisation. Hence from the study by Almeida and Soares it could be demonstrated that the characteristics of project based organisations, similar to the characteristic of SMMEs made information management difficult and translated into knowledge and learning not being transferred from one project to the following.

The unique complexities identified for project based organisations by Almeida and Soares (2014) were further underscored by Marcelino-Sádaba *et al*. (2014). Marcelino-Sádaba *et al*. (2014) presented a risk management methodology that explicitly focuses on SMMEs due to the unique challenges SMMEs face. Consequently it could be derived that a framework which integrate both the studies presented by Almeida and Soares (2014) and Marcelino-Sádaba *et al*. (2014) may help overcome the barrier, lack of knowledge, and promote effective risk management on small construction projects.

Building on the argument by Almeida and Soares (2014), the authors noted that information management and concepts derived from organisational learning needed to be incorporated into small construction project to ensure quality and continuity of knowledge from one project to the next.

Contextualising the discussion to the South African construction industry, the structural problems presented to be significant for developing countries as demonstrated by Hlaing *et al*. (2008:1) "*structural problems of the construction industry in developing countries are more fundamental, more serious, more complex and overall, much more pressing than those confronting their counterparts elsewhere*". It can be concluded that the structural problems as discussed by Hlaing (2008) combined with the traditional once-off project environment contribute much to the formation of information limbo. Continuity of work for SMMEs will be required to create a stable environment to promote effective information management and organisational learning.

Long term partnering as described by Bygballe *et al.* (2010) could prove to provide the stability and structure needed to develop and transfer knowledge. This effort can be promoted as part of the development of SMMEs in the South African context as emphasised by the CIDB (2009).

5.1.2 Remaining top five barriers

Barriers two to five found in this study, in descending order are:

- Complexity of analytical tools
- Lack of time
- Lack of sufficient manpower
- Lack of budget

The top two barriers found by Hwang et al. (2014) were lack of time and budget, in the current study lack of time and budget were ranked third and fifth respectively for small construction projects in South Africa. Thus lack of time and budget is ranked highly when comparing South Africa to Singapore. The findings in Tanzania by Chileshe and Kikwasi (2013) however, found that lack of time and budget were ranked low.

5.1.3 Perception that risk management can impact on project performance

With respect to the second objective for this study, it was demonstrated that the perception of key decision makers regarding risk management can severely impact on the effective implementation of risk management on small construction projects in South Africa. This aligned with the research undertaken by Lehtiranta, (2013) and Wang and Yuan, (2011). With the focus on SMMEs and small construction projects in South Africa as underpinned by Rashaad *et al*. (2013), the impact that key decision makers have on project risk management as stated by Acar and Göç (2011) will form a key element to address and improve effective risk management on small construction projects.

5.1.4 Contractual and attitudinal issues

With respect to the third objective, the findings pertaining risk allocation, shared risk management, construction partnering, contracts as tools to manage risk and the perception that SMMEs lack the required skill to implement effective risk management are discussed subsequently.

5.1.4.1 Risk allocation

From the literature it was demonstrated by (Adams, 2008; Lehtiranta, 2013) that risk was not allocated to the parties best equipped to manage the risk on construction projects. This was also found for small construction projects in South Africa with 69% of the participants indicating that risk was not allocated with the correct party suited to manage the risk. The two main reasons identified for this form the data presented in Annexure D is firstly that the client simply transfer all the risk to the small contractor as the contractor do not understand the implication of the risk and is eager to do the work. Secondly because of a lack of understanding and resources

associated with small projects, the appropriate structures are not put in place to ensure risk is identified and allocated to the different project participants.

5.1.4.2 Shared risk management and construction partnering

Fifty six percent of the participants in the study confirmed that they believe construction partnering and shared risk management will aid SMMEs to overcoming the barriers to effective risk management. Construction partnering, shared risk management, and retention of knowledge in construction were identified as important elements that could assist in overcoming the identified barriers to effective risk management in the South African context

5.1.4.3 Contracts used as tools to manage risk

From the data collected, it was demonstrated that in some cases contracts are used as a tool to manage risk on small construction projects, though not exclusively. A weak correlation have been presented in the current study to indicate that participants in companies of 20 to 60 employees tend to use contract as a tool to manage risk more frequently than companies both smaller and larger than this group.

5.1.4.4 SMMEs lack the required skill to implement effective risk management

The majority of participants (69%) in the current study indicated that SMMEs lack the skill to implement risk management and are overall inadequately equipped to deliver on projects. Fifty-six percent of participants indicated that long term partnering will assist in developing capacity in line with the research presented by Bygballe *et al*. (2010).

5.1.5 Tools and Techniques

The second most prominent barrier found in the current study was the complexity of analytical tools, similar to the main barriers found by Akintoye and MacLeod (1997). Overall most participants in the current study indicated that they use a risk register or risk matrix to manage risk on site.

Serpella *et al*. (2014) argued that the main reason risk identification tools and techniques were ineffective was the lack of knowledge management. This linked to the first barrier in this current study, lack of knowledge. Marcelino-Sádaba *et al*. (2014) developed a project a risk management methodology explicitly for small companies as most methodologies focus on large projects. The risk management methodology developed by Marcelino-Sádaba *et al*. (2014) focused explicitly on factors that SMMEs usually neglected, Their methodology was successfully tested on five projects. The risk management methodology presented by Marcelino-Sádaba *et al*. (2014) contributed to the findings in the current study, by providing a simplified methodology to manage risk on small construction projects. Hence future research could focus on testing the methodology presented by Marcelino-Sádaba *et al*. (2014)in the South African construction environment as this model holds promise to overcome some of the barriers presented in this study.

5.2 Recommendations

From the current study, it can be stressed that knowledge management is a critical factor intertwined with the two top ranked barriers, lack of knowledge and complexity of analytical tools. Knowledge management should be a key consideration for current small project undertaken in South Africa and in future research that aim to investigate ways to overcome the barriers to effective risk management on small construction projects.

In the South African project environment, involvement and buy-in of key stakeholders to project risk management is crucial as the beliefs of these individuals to risk management affects the successful implementation of risk management on

projects. The lack of skill identified within SMMEs combined with the second ranked barrier (i.e. complexity of analytical tools) calls for an adaptive risk management approach tailored to the unique challenges faced by SMMEs as noted by (Department of Public works *et al.*, 2007; Marcelino-Sádaba *et al*., 2014; Rashaad *et al*., 2013). To promote effective risk management on small construction projects within South Africa, risk allocation must be reviewed and re allocated, if needed, since the current study found that 69% of the participants believed risk was not allocated with the party best equip to manage the risk. It stands to reason that current practice is not addressing risk on small construction projects adequately.

5.3 Future research opportunities

- The current study was undertaken to fill the gap in literature pertaining to the barriers to effective risk management particularly on small construction projects in South Africa. Future studies may be embarked on to validate the current findings using larger sample sizes, and focus more on data collection within SMMEs, as this was a limitation of the current study
- The impact that the risk perception of key stakeholders have on risk management has been identified in this study as a factor that impact on effective risk management. Future research may focus on how to identify and manage the perceptions of key stakeholders on small construction projects to align with identified project risks, rather than perceived risk
- The importance of information management was stressed as a possible aid to overcome the most prominent barrier, lack of knowledge, to risk management in South Africa. Further research into information management on small construction projects may provide a tool to create and retain knowledge explicitly on risk management within small projects
- The second barrier identified in the study that impact on effective risk management is that risk management tools and techniques are too complex for use on small construction project. Future research can be carried out to determine if a simplified risk methodology as presented by Marcelino-

Sádaba *et al*. (2014) will prove to overcome complexity of analytical tools and techniques as a barrier to effective risk management

- A combined framework that incorporate both knowledge management and a simplified risk methodology may assist to overcome the top two ranked barriers, lack of knowledge and complexity of analytical tools. It can be argued that the potential benefits of such a framework will go some way to alleviate pressure on the time, cost and human resources constrains on small projects, which are barriers three to five identified in this study. Hence future studies may set out to develop a combined framework based on the studies presented by Almeida and Soares (2014) and Marcelino-Sádaba *et al*. (2014).

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ANNEXURE A– SUMMARY OF BARRIERS TO EFFECTIVE RISK MANAGEMENT OBTAINED FROM THE LITERATURE REVIEW

Table A1: Summary barriers to effective risk management

Summary of Barriers to effective Risk Management and risk management tools and techniques						
Author	Akintoye, A.S., MacLeod, M.J., (1997).	Chileshe N and Kikwasi GJ., (2013)	Lyons, T., Skitmore, M., (2004)	Chihuri S, Pretorius L, (2010)	Hwang *et al.* (2014)	Tang, *et al.* (2007)
Title	*Risk analysis and management in construction*	*Perception of barriers to implementing risk assessment and management practices by construction professionals in Tanzania*	*Project risk management in the Queensland*	*Managing risk for success in a South African engineering and construction project environment*	*Risk management in small construction projects in Singapore: Status, barriers and impact.*	*Risk Management in the Chinese Construction Industry*
Barriers to effective risk management	Lack of familiarity with the techniques. The degree of sophistication involved in the techniques Lack time/ info /knowledge. Techniques not applicable Projects too small to use RM Availability of sound data to ensure confidence. The vast majority of risks are contractual or are fairly subjective, Lack of potential benefit	Awareness of risk management processes Lack of experience Lack of coordination Lack of information Availability of specialist risk management consultants Time constraints Implementation costs	No dominant factor that limits implementing risk management. Cost effectiveness Lack of benefit Human / organisational resistance; Lack of accepted model for risk analysis; Lack of resources; Lack of expertise and familiarity with techniques; Lack of information Lack of time.	Lack of appreciation of benefits of risk management Speed to complete the projects on time. Deficiency in project risk management knowledge. Perception that project risk management is costly.	Lack of time Lack of budget Low profit margin Not economical Competition among SMCs Lack of knowledge Lack of government legislation Complexity of analytical tools Lack of manpower	Lack of joint risk management Shortage of knowledge / techniques on risk management Different recognition of risk control strategies

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Table A2: Summary RM tools and techniques / perception

Summary of RM tools and techniques / Perception						
Author	Akintoye, A.S., MacLeod, M.J., (1997).	Chileshe N and Kikwasi GJ., (2013)	Lyons, T., Skitmore, M., (2004)	Chihuri S, Pretorius L, (2010)	Hwang *et al.* (2014)	Tang, *et al*. (2007)
RM Tools and Techniques used	RM in construction depend mainly on intuition judgement and experience		Brainstorming intuition / judgement / experience are the most frequently used risk assessment techniques. Qualitative methods of risk assessment are used most frequently, ahead of quantitative and semi-qualitative methods	Brainstorming then interviewing are predominant risk identification tool used in engineering and construction in South Africa. then	N/A	Brainstorming - identifying risks Joint evaluation by key stakeholders - risk analysis Reducing risks - response strategies Periodic document reviews - monitoring.
Risk Perception	Risk perception is generally believed to be influenced by people's belief, attitudes, judgement and feelings	No focus on how risk perception impact on RM	No focus on how risk perception impact on RM	Perception – perception that project risk management is costly.	It terms of important RM, respondents recognised significant importance of RM in improving overall, cost and schedule performance of small projects while the importance to project quality was perceived at the neutral stand	No focus on how risk perception impact on RM

Fischer (2015)

ANNEXURE B – ETHICAL CLEARANCE FORM

School of Construction Economics and Management Ethics Committee

Ethics Clearance Application Feedback

ETHICS APPLICATION CHECKLIST AND FEEDBACK/APPROVAL

Name Riaan Fischer (St. Number 595915)

Degree: Masters by Research Report (Ethics clearance application number: CEM/14/04/MRR)

DOCUMENTATION	SUBMITTED		APPROVED		COMMENTS
	YES	NO	YES	NO	
Research Proposal	x				
EC Application	x				
Research instrument(s)	x				
Information letter	x				
Informed consent	x				

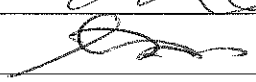
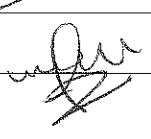
ETHICS CLEARANCE APPROVAL DECISION			
APPROVED X	NOT APPROVED	PENDING	SUBJECT TO SATISFACTION OF SUPERVISOR X

ADDITIONAL COMMENTS

Application approved pending the following:

- Alter Masters by Dissertation to Masters by Research Report on Ethics application form (page 2 of 6)
- All asterisk's (indicating required) to be removed from questionnaire
- Question 2 on questionnaire (name of company) to be removed

Ethic's clearance awarded on condition the above recommendations are met to the satisfaction of the supervisor

Ethics Committee Member	Signature	Date
E Heron		23-9-2014
K Ijasan		23-9-2014
O Babatunde		23-9-2014

ANNEXURE C –QUESTIONNAIRE

Barriers to Effective Risk Management

Compiled by R Fischer

SECTION 1

BASIC PROFILE

1. **1) Do you consent to partake in the questionnaire**
   Herewith I give my consent that I am willingly partaking in this questionnaire and have not been forced or coerced by any means whatsoever
   Mark only one oval.
   - YES
   - NO

2. **2) Please Choose your User Name**
   This is to protect your identity

3. **3) Does your company do work in the public or private sector**
   Mark only one oval.
   - Public
   - Private
   - Both

4. **4) Indicate the number of small construction projects that you have been involved in over the last 3 Years**
   Small projects are defined to have a monetary value less than 10 Million Rand

5. **5) Indicate the number of projects identified in the previous question with formalized risk management implementation**

6. **6) What is the average duration (in months) of the small construction projects with formalized Risk Management**

7. **7) What is the average duration (in months) of the small construction projects without formalized Risk Management**

.....

8. **8) What is the nature of these small projects with formal RM**
Mark only one oval.

- ◯ Building
- ◯ Civil
- ◯ Mechanical
- ◯ Electrical
- ◯ Other: .....

9. **9) Who do you represent in the project environment**
Mark only one oval.

- ◯ Contractor
- ◯ Client
- ◯ Project Manager
- ◯ Client Representative
- ◯ Other: .....

10. **10) Please indicate your job title**
Mark only one oval.

- ◯ Company Director
- ◯ Client / Client Representative
- ◯ Construction Manager
- ◯ Project Manager
- ◯ Cost Control /QS
- ◯ Contracts Manager
- ◯ Other: .....

11. **11) Please indicate relevant experience in current position**
Mark only one oval.

- ◯ Less than 5 Years
- ◯ 5-9 Years
- ◯ 10-20 Years
- ◯ More than 20 Years

12. **12) How many persons are employed by your company**
Mark only one oval.

- ◯ Less than 20 persons
- ◯ 20-60 persons
- ◯ 60-150 Persons
- ◯ 150 - 250 Persons
- ◯ More than 250 Persons

SECTION 2

BARRIERS TO EFFECTIVE Risk Management (RM)

13. **2) Rank the following in order of relevance where 1 is least relevant and 10 is most relevant for the following statements:**
2.1) Competition among small construction firms is a barrier to effective RM on small construction projects
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Least Relevant	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Most Relevant

14. 2.2) The complexity of analytical tools is a barrier to effective RM on small construction projects
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Least Relevant	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Most Relevant

15. 2.3) The lack of potential benefits to the company is a barrier to effective RM on small construction projects
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Least Relevant	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Most Relevant

16. 2.4) Lack of sufficient budget is a barrier to effective RM on small construction projects
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Least Relevant	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Most Relevant

17. 2.5) Lack of government legislation to promote RM is a barrier to effective RM on small construction projects
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Least Relevant	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Most Relevant

18. 2.6) Lack of knowledge is a barrier to effective RM on small construction projects
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Least Relevant	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Most Relevant

19. 2.7) Lack of sufficient manpower on small projects is a barrier to effective RM on small construction projects
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Least Relevant	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Most Relevant

20. 2.8) Lack of time is a barrier to effective RM on small construction projects
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Least Relevant	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Most Relevant

21. 2.9) Low profit margin for small projects is a barrier to effective RM on small construction projects
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Least Relevant	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Most Relevant

22. 2.10) It is not economical to implement RM on small construction projects.
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Least Relevant	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Most Relevant

SECTION 3

RISK PERCEPTION

23. **3) Will the implementation of Risk Management in small construction projects improve:**
3.1) The overall performance of the project
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Strongly Disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Strongly Agree

24. 3.2) The quality performance of the project
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Strongly Disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Strongly Agree

25. 3.3) The cost performance on the project
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Strongly Disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Strongly Agree

26. 3.4) The schedule performance on the project
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Strongly Disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Strongly Agree

27. **3.5) It is important to implement Risk Management on small construction projects**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Strongly Disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Strongly Agree

28. **3.6) Quality performance can be severely impacted by the level of Risk Management implemented on a small construction project**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Strongly Disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Strongly Agree

29. **3.7) Cost performance can be severely impacted by the level of Risk Management implemented on a small construction project**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Strongly Disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Strongly Agree

30. **3.8) Schedule performance can be severely impacted by the level of Risk Management implemented on a small construction project**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Strongly Disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Strongly Agree

31. **3,9) Over all project performance can be severely impacted by the level of Risk Management implemented on a small construction project**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Strongly Disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Strongly Agree

32. **3,10) The attitude of key decision makers on projects affect the effective implementation of RM on projects**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Strongly Disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Strongly Agree

SECTION 4

GENERAL - Paragraph questions

33. **4.1) From the listed barriers to RM implementation in section 2. What barrier in your opinion is the most relevant?**
Please elaborate on why you think the specific barrier is the most severe / relevant

.....

.....

.....

.....

.....

34. **4.2) A vital element of effective RM is that risk must be allocated the party that is best equip to manage the specific risk. Is this being done on small construction projects?**
If no, please elaborate on why it is not the case.

35. **4.3) Contracts and contractual clauses are being used to manage most risks on small construction projects.**
Please indicate if you agree of disagree with the statement above
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Agree

36. **4.4) Are you currently implementing RM on small construction projects, and if so what methodology or technique do you use**

37. **4.5) In your opinion, will construction partnering (shared risk management) help in overcoming the barriers as described in section 2**
If yes, please elaborate

38. **4.6) Do you think that SMME's lack the skills to implement effective risk management**
Please elaborate on response

39. **4.7) Do you think that RM on small construction projects is important**
Please elaborate on response

.....

.....

.....

.....

.....

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ANNEXURE D – RESPONDENT PROFILE

Table C1 Respondent Profile - Section 1

ID	*Work performed in public or private sector*	*Number of small construction projects worked on in over the last 3 Years*	*Number of stated projects with formal RM*	*Average duration in months of projects with formal RM*	*Average duration in months of Projects without RM*	*Nature of small Projects*	*Representation*	*Job Title*	*Relevant experience*
1	Both	4,00	0,00	0,00	5,00	Building	Project Manager	Project Manager	5-9 Years
2	Both	10,00	1,00	6,00	6,00	Building	Contractor	Company Director	More than 20 Years
3	Private	12,00	4,00	10,00	10,00	Civil	Project Manager	Project Engineer	More than 20 Years
4	Private	2,00	1,00	18,00	6,00	Civil	Project Manager	HSE Specialist	5-9 Years
5	Both	10,00	0,00	0,00	0,00	No response	No response	No response	No response
6	Both	15,00	1,00	1,00	4,00	Civil	Client	Company Director	10-20 Years
7	Both	6,00	5,00	6,00	3,00	Civil	Client Representative	Engineer	10-20 Years
8	Public	6,00	6,00	10,00	14,00	Building	Client Representative	Company Director	More than 20 Years
9	Both	12,00	0,00	0,00	0,00	No response	No response	No response	No response
10	Both	0,00	0,00	0,00	0,00	Building	Project Manager	Project Manager	5-9 Years
11	Private	0,00	0,00	0,00	7,00	rail	Contractor	Project Manager	5-9 Years
12	Both	10,00	2,00	12,00	6,00	Building	Client Representative	Project Manager	10-20 Years
13	Both	4,00	2,00	12,00	6,00	Civil	Consultant	Project Manager	5-9 Years

ID	*Work performed in public or private sector*	*Number of small construction projects worked on in over the last 3 Years*	*Number of stated projects with formal RM*	*Average duration in months of projects with formal RM*	*Average duration in months of Projects without RM*	*Nature of small Projects*	*Representation*	*Job Title*	*Relevant experience*
14	Both	3,00	1,00	0.5	11.5	Civil	Project Manager	Project Manager	5-9 Years
15	Private	1,00	1,00	6,00	9,00	Building	Project Manager	Project Manager	More than 20 Years
16	Public	15,00	0,00	0,00	15,00	Building	Client Representative	Cost Control /QS	10-20 Years
17	Both	3,00	3,00	6,00	12,00	Civil	Contractor	Company Director	More than 20 Years
18	Both	49,00	49,00	6,00	3,00	Civil	Client	Client / Client Representative	10-20 Years
19	Both	7,00	2,00	9,00	11,00	Building	Project Manager	Project Manager	10-20 Years
20	Public	6,00	6,00	6,00	0,00	Mechanical	Project Manager	Project Manager	5-9 Years
21	Public	100,00	100,00	3,00	0,00	Building	Project Manager	Company Director	10-20 Years
22	Public	3,00	0,00	6,00	2,00	Building	Client Representative	Project Manager	10-20 Years
23	Both	7,00	0,00	0,00	0,00	Building	Project Manager	Project Manager	Less than 5 Years
24	Public	4,00	2,00	12,00	30,00	Mechanical	Client	Project Manager	5-9 Years
25	Private	0,00	0,00	0,00	0,00	Civil	Project Manager	Construction Manager	More than 20 Years
26	Private	3,00	0,00	0,00	12,00	Building	Client Representative	Cost Control /QS	5-9 Years
27	Both	20,00	20,00	12,00	8,00	Building	Client Representative	Project Manager	5-9 Years

ID	*Work performed in public or private sector*	*Number of small construction projects worked on in over the last 3 Years*	*Number of stated projects with formal RM*	*Average duration in months of projects with formal RM*	*Average duration in months of Projects without RM*	*Nature of small Projects*	*Representation*	*Job Title*	*Relevant experience*
28	Both	2,00	2,00	8,00	0,00	Civil	Client	Project Manager	10-20 Years
29	Public	17,00	15,00	6,00	15,00	Building	Client	Project Manager	10-20 Years
30	Both	10,00	0,00	12,00	0,00	Civil	Client	Project Manager	10-20 Years
31	Private	50,00	50,00	1,00	3,00	Building	Client	Project Manager	Less than 5 Years
32	Both	2,00	0,00	0,00	26,00	No response	Contractor	Project Manager	5-9 Years
33	Private	0,00	0,00	0,00	0,00	No response	Project Manager	Project Manager	5-9 Years
34	Both	6,00	0,00	9,00	9,00	Civil	Client	Project Manager	10-20 Years
35	Both	5,00	0,00	0,00	6,00	Civil	Contractor	Company Director	5-9 Years
36	Both	6,00	2,00	3,00	3,00	Building	Contractor	Company Director	10-20 Years
37	Both	1,00	1,00	32,00	0,00	Building	Contractor	Project Manager	Less than 5 Years
38	Both	12,00	11,00	8,00	3,00	Electrical	Client	Project Manager	10-20 Years
39	Private	3,00	0,00	0,00	6,00	No response	Project Manager	Project Manager	Less than 5 Years
40	Public	10,00	0,00	6,00	6,00	Building	Client Representative	Cost Control /QS	5-9 Years
41	Both	12,00	3,00	8,00	8,00	Building	Contractor	Project Manager	5-9 Years

ID	*Work performed in public or private sector*	*Number of small construction projects worked on in over the last 3 Years*	*Number of stated projects with formal RM*	*Average duration in months of projects with formal RM*	*Average duration in months of Projects without RM*	*Nature of small Projects*	*Representation*	*Job Title*	*Relevant experience*
42	Both	7,00	0,00	0,00	9,00	N/A	PrQS. Principal Agent	Company Director	More than 20 Years
43	Public	40,00	0,00	0,00	18,00	Gov Schools & social housing	Project Manager	Project Manager	More than 20 Years
44	Both	5,00	0,00	5,00	0,00	Civil	Contractor	Company Director	More than 20 Years
45	Both	2,00	0,00	0,00	24,00	Building	Project Manager	Project Manager	More than 20 Years
46	Both	10,00	10,00	6,00	0,00	Civil	Client	Company Director	10-20 Years
47	Both	20,00	20,00	8,00	0,00	Building	Project Manager	Project Manager	10-20 Years
48	Both	15,00	10,00	10,00	12,00	Building	Project Manager	Project Manager	10-20 Years
49	Private	60,00	20,00	6,00	3,00	Mechanical	Client	Project Manager	Less than 5 Years
50	Both	2,00	2,00	4,00	2,00	Civil	Contractor	Company Director	10-20 Years
51	Both	10,00	7,00	6,00	3,00	Building	Contractor	Contracts Manager	Less than 5 Years
52	Private	10,00	0,00	6,00	3,00	Mechanical	Client & Project manager	Company Director	More than 20 Years
53	Public	4,00	0,00	0,00	6,00	Electrical	Client	Technician	Less than 5 Years
54	Both	0,00	0,00	0,00	0,00	N/A	Project Manager	Project Manager	N/A

ID	*Work performed in public or private sector*	*Number of small construction projects worked on in over the last 3 Years*	*Number of stated projects with formal RM*	*Average duration in months of projects with formal RM*	*Average duration in months of Projects without RM*	*Nature of small Projects*	*Representation*	*Job Title*	*Relevant experience*
55	Public	8,00	3,00	8,00	15,00	Electrical	Project Manager	Project Manager	5-9 Years
56	Both	2,00	0,00	11,00	11,00	Building	Client	Project Manager	More than 20 Years
57	Private	4,00	3,00	6,00	1,00	Building	Project Manager	Project Manager	5-9 Years

Table C2 Respondent Profile - Section 4

ID	*Company Size*	*What barrier in your opinion is the most relevant?*	*Is risk allocated with party best suited to manage the risk?*	*Currently implementing RM on small construction projects? Methodology technique used?*	*Will construction partnering (shared risk management) help in overcoming the barriers to RM*	*Do you think that SMMEs lack the skills to implement effective risk management*	*Do you think that RM on small construction projects is important*
1	Less than 20 persons	Lack of Knowledge	Note necessarily, Contractor are usually left to carry the majority of the risk.	N/A	Yes, the right party will carry the relevant risk and they will be more suited to put the correct safeguard measures in place.	Yes, lack of knowledge and exposure contributes to their ignorance of the implementation on risk management programmes.	Of course, this process is critical to any project no matter the size and magnitude. However, economic circumstances and unwillingness to participate in shared risk approach kills this process.
2	60-150 Persons	Low profit margins does not allow for RM to be implemented	In an unofficial manner by the directors of companies	Only company policies regarding risks	yes, need professional input regarding RM	no comment	yes to identify the risk will help inexperienced contractors manage the project more effectively
3	Less than 20 persons	Lack of technical knowledge	No. Small projects are underestimated by clients who prioritise commercial performance over technical expertise.	No, we do not implement any RM technique. We endeavour to make in depth technical analysis of the Construction methods of projects and involving as much as possible all specialities needed.	Partnering will assist as long as the required RM and construction technical expertise is with one of the partners.	There are a number of SMME companies with technical expertise and therefor effective RM. They are generally companies operating in niche markets.	Yes, it shall be combined with the required technical expertise though.

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4	Less than 20 persons	Insufficient budget because it underpins all other activities. Stakeholder engagement is compromised as is implementation of control strategies. Also if contingencies are inadequate or non existent the project may ne terminated due to a host of reasons including failure to anticipate risks.	To some extent yes. However, the risk owners may not have the skills and knowledge to act on information turning risks into issues.	Yes. As prescribed in the PMBOK	lt could but unless there is more education and training in project management it could make the situation even worse through abdication of responsibility.	Yes and no. It is an industry problem. Risk management is a skill that must be learnt and practiced to improve upon. lt affects all business sizes.	Yes definitely...it can make or break projects if poorly managed.
5	Less than 20 persons	Section 3 - Risk perception	No Not at all	No - Identifying risks on inception of the project	Yes definitely	Yes - Need a legislated ruling that RM be undertaken	Yes
6	More than 250 Persons	Low profit margin on small projects	No, SMME contractors have little knowledge of the risks involved in construction projects and most of the risk should therefore be on the Employer.	Use risk register and regularly evaluate risks registered.	Yes, but there are usually insufficient time and money to do this on small projects which is unfortunate.	SMME Contractors usually don't have the training and skills for effective risk management.	Small projects are usually not managed properly due to a lack of time and money and then have cost and time over runs.
7	Less than 20 persons	Lack of sufficient budget	Not really	Yes I am. Monitoring Meetings on monthly basis where Guantt Charts, cashlows projections, tracking of contractors payments,	Yes	Yes	Yes, it will help to address the risks early so that solutions can be implemented

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				Consultants payments and risks are always discussed and form part of the Agenda			
8	No Response	No Response	No Response	No Response	No Response	No Response	No Response
9	20-60 persons	Lack of knowledge - due to competition, the small project environment is populated by players who's level of skill and competence are well short of what is required to effectively carry out projects successfully. Accordingly there are many project areas that are not covered suitably - RM being one of them. The players do not have the experience and skill to appreciate the short and longer term value of RM.	NO - players in the small project market simply do not understand or know this concept. The acceptance of allocation of risk to the correct party, and then the ability to apply that in practice only comes with many years of project management experience.	Only involved with major projects currently… Risk matrices with cost projections.	Not in all cases, it's a deeper issue. As previously noted, the allocation of risk needs to be correctly understood between parties. If a respective party who is not suitably positioned to share risk has to share it, it will create problems elsewhere as parties end up doing things that they're not supposed to do.	Yes, in most cases, however there are a few who have grasped the value of it. SMMEs generally are in experienced, unsuitably qualified, and not sufficiently resourced to do the jobs that they're doing.	Of course it is, it is a fundamental project requirement, whether small project or big project. Further to that, it is one of the 9 key elements contained in PMBOK which forms the basis of all project management application. Many people (especially in the small project market) refer to themselves as project managers, but have never ever heard of PMBOK and the 9 elements of project management.
10	More than 250 Persons	The attitude and the need for RM is seen as just more to do. Does	Can't answer on this - no knowledge on this issue.	No Response	The understanding and sharing of risk will contribute to	My opinion would be that they do not understand the advantages of RM	Not sure - not much exertions!!

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		not understand the advantage of RM			competitive pricing as an advantage.	to their project successes.	
11	More than 250 Persons	Duration of projects are most of the time underestimated thus contractors are always under pressure to complete on agreed date and that results in them not able to identify their risk and put proper measures in place to minimize those risks. If they do identify risks there is a need to allocate resources to mitigate them thus resulting in higher cost estimate and that might compromise their chances of getting the project due to competition.	No, most of the time risks are left to the contractor to deal with and due to lack of experience they never see this and accept the project as is and this results in them not finishing the project.	Yes, the organization is using contract and instructions to perform work to enforce risk management.	Not really, in my opinion all parties involved in the project must share risks i.e. client. consultant and contractors there is no need to add another partner to manage risks	No, the skill is there even thou it can always be improved but SMMEs are always desperate to get work thus they overlook risk management	Yes
12	60-150 Persons	Apparent lack of benefits.	No, because of lack of structure in small firms.	Yes, PMbok methodology.	Yes. Concentrate on your core competencies.	Yes. Lack of structure and expertise.	Yes, even more so than bigger projects.

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13	More than 250 Persons	Low profit margin - people think that because the project is small it does not pose a risk to the company. Reputational risk is never considered when risk assessment are done.	Time is never allocated to undertake an appropriate level of risk assessment and mitigation.	Not working on small project currently	No. It will actually make the problem more. A risk of disputes among the partners will be introduced.	Yes they do, or they may not be experienced enough to understand the risks involved.	Very important in small projects because once risk is realized, the potential for recovery is almost non-existent.
14	More than 250 Persons	Industry not mature enough	No. It is simply passed on to the small contractor	Mentoring of contractors	Yes. The employer must also be educated	Yes. Clearly out of experience	Ye. It does effect programme, cost and quality.
15	Less than 20 persons	companies must be trained to the importance of Risk management in projects	not really	no	off course yes	yes they do	it is important irrespective of small contracts
16	150 - 250 Persons	2.9 Low profit margin. There is often insufficient budget and time to effectively and efficiently implement adequate RM on small construction projects. The system of choosing the lowest bidder is impacting badly on the civil construction sector.	Yes, in our company it is.	Training and making staff aware of identifying the risks on the project. Then involving them in the solution to the problem risk.	No.	No. They have no experience and until they have experienced and understood the risks, they will not efficiently be able to manage risk.	Yes. It is the major activity on eliminating losses/costs and thus remaining in business.
17	More than 250 Persons	Attitude of key decision makers not willing to	No. Assumed that it will be a waste of time	YES, Risk Registers and Risk Management Plan	Yes	Yes. Focusing on the bottom line	Yes, save money

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		invest time and money for RM					
18	20-60 persons	1. Attitude 2. Lack of Knowledgeable personnel	No, due to lack of understanding as well as the attitude of management	No	Yes, this will lead to sharing of important resource - human skill	Yes, Most SMMES lack the financial muscle to hire and retain professional staff	Yes, it is important, it will enhance chances for project delivery
19	More than 250 Persons	quality performance relevant as risk is taken care of contractor can concentrate on quality	no small projects tend not to have specialist in this field as profit are low to cater for it	Previous experience on completed projects	No	Some of them	Yes, small contractors run the risk of liquidating if risk is not seen as important
20	20-60 persons	Lack of budget. Smaller companies do not often have the funding to perform risk management or respond adequately to risk. They are in an overcrowded section of the market and will cut corners to provide a competitive price.	It is being done.	Risk research is done up front, at planning and concept phase.	Yes. Risk is allocated to those who have the knowledge and skills to mange it appropriately. It also avoids a shirking of responsibility if all risk becomes the responsibility of a single stakeholder.	Yes. They often do not have the knowledge, skills or experience.	Yes. It is as important as on large projects. The size of the project is not always proportionate to its importance to the clients strategic goals.
21	More than 250 Persons	Capacity which includes Human Resources and skills	Not as such due to the above mentioned fact of capacity which might include contractor's return on investment which include profit margins and lack of knowledge and skilled personnel	We do have an Occupational & Health Directorate as well as Risk directorate which drafts policies for the Construction Projects to mitigate risks and safety issues.	Yes if each and every project participant is educated and take shared responsibilities on the project.	Yes , due to limited experience and resources to enhance the skills.	Yes because it eliminates health and safety issues as well as efficient execution of a project.

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22	Less than 20 persons	No Response	No Response	No Response	No Response	No Response	No Response
23	More than 250 Persons	The lack of budget. the company can't buy relevant RM tools and train its personnel	Its because of lack of knowledge and skill.	HIRA	Everybody is equally responsible and accountable	Yes, they need training	Yes, to enhance the quality, responsibility and accountability of company. Future contracts
24	More than 250 Persons	Low profit margins leads to no risk management and excessive risks being taken.	No. Lack of knowledge a problem.	No small projects.	Yes. Employer's attention to risk management brought to the contractor's attention.	Yes. Most of them do not understand it, especially those that are not technically trained.	Yes. It ensure that unsafe practices are avoided and projects completed in time and budget.
25	Less than 20 persons	lack of knowledge of RM, because there are no skilled people to manage ram, focus is mainly on cost and project management	not at all, most people are unclear the confuse RM with safety risk	not really	definitely, same support and small contractor partnering with big companies will help	yes, they lack sometimes even the skills to manage the project or produce quality work, so RM they are far from it	it is if the contractors want to build sustainable businesses
26	More than 250 Persons	Lack of knowledge is the most relevant factor because if there is no one who can apply risk management techniques in the project organisation-then there is a big challenge.	Yes	Qualitative and quantitative risk analyses tools and techniques.	Yes, because if the company does not have the expertise in a certain field-the other party can provide those services and the risk will be shared in that sense.	Yes, because they donk have sufficient knowledge on how to apply risk management techniques in real life projects.	Yes, because it make the project manager/team proactive rather than reactive when dealing with issues.
27	60-150 Persons	No Response	No Response	No Response	No Response	No Response	No Response

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28	Less than 20 persons	Many small contractors are not aware of the Risk Management tools that are available.	Yes and No. When tendering selective disclosure prevents effective risk assessment. Clients expect Consultants to assume responsibility for poor management skills by Contractors Poor communication of issues results in delayed RM, this includes consultants, clients and contractors	Yes Structured Adjudication Templates Regular inspections and assessments Maintaining daily diaries Adhering to project plans Early warnings and other notifications	Yes provided that one of the partners is more skilled at Risk Management	Yes Tender documentation is at times too complex for them to understand They tend to employ partly skilled people who are not familiar with contractual processes Their cash flow management skills are poor	Indeed it is. Integrating RM strategies into tendering processes would help filter out Systematic RM will mitigate potential risks on any project prior to appointment. RM would improve performance of the contractor by planning resourcing effectively During construction issues that could delay a project can be dealt with before they impact on the programme.
29	More than 250 Persons	Complex Analytical tool may require high level of skills and experience to be grasped. 2.4 Budget constraints always prevents desired level of service. 2.6 People must always detect precisely the risk associated with the project and have strategy and tactics to	No ; In some cases the Client is not fully aware of the capacity of the small firm executing the works. In other cases the appointment is based on corruption practices which always ignore the risk factors.	No	Yes ; Big experienced players must be compelled to share a high degree of the risk by effective mentoring of small less experienced partners. The Client must monitor the implementation of such undertaking.	Yes ; Most of them, neither understand nor appreciate the importance of RM. People are more concerned with getting quick a money without analysing the mechanisms to make sustainable profit	Yes; Sustainable Environment promotes Sustainable Development and vice versa . This can be effectively dealt with by implementing RM at all levels. Any one involved with any development must be full conversant with the risks associated with the undertakings of that development, thus RM

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		deal with the risk. This necessitate knowledge. 2.7 Shortage of Skilled Personnel is a challenge					
30	More than 250 Persons	complexity of analytical tools - most contractors don't understand the tool and the resources which understand the tool are very expensive so the contractor cannot afford them	Not often, this is because of the non-affordability of the third party by the contractor	Risk Analysis Matrix	Yes, there will be more expertise involved in the project	Yes, because they cannot afford to employ the skilled resources	Yes, the risk is not only applicable to big project. a person can be injured on site even if its a small project
31	Less than 20 persons	Time. Companies don't want to spent time on intangible things. Time is money spent. Even though the results are only evident later down the line.	No. No emphasis on RM. Seen as not important. Budget and Schedule are seen as more important.	No. Only larger construction projects.	No.	Yes. Tools to manage. Understanding. Results are not seen.	Yes. But focussed, and must be driven from the top.
32	Less than 20 persons	No Response	No Response	No Response	No Response	No Response	No Response

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33	More than 250 Persons	2.4 Lack of funds on projects minimise all kinds of supervision tools	No, Funds not available from clients	No, risk is identified by the professional involved and dealt with on a as and when basis	Yes, when partnering the prof team works with the contractor and it is in everybody's interest to do the work once in order to make a profit	Yes, they need to be uplifted first and mentored	Yes, it will create an open book on risk
34	More than 250 Persons	lack of experience, complexity, skill levels of staff	small projects are targeted at small contractors who don't have the means	We use the formal planning system with jr staff and this serves as training fields	no, it adds to complexity	yes	yes, you get one chance to do it right
35	No Response	No Response	No Response	No Response	No Response	No Response	No Response
36	Less than 20 persons	Barrier 2.6 is the most severe barrier because people enter into construction with out professional back ground and at the same time barrier 2.4 comes into play as they can’t afford to hire professionals to compile risk assessment and implement strategies thereof.	It is not done because it is has costs implications and this always affect these small companies because they do not Always have enough funds.	No	Yes, because once you know the possible risks in a project , you will be in a better position to mitigate them and in so doing your work schedules, quality, budget and project duration will be honoured and the client with be happy at the end of the day.	Yes	For SMMEs to survive risk assessment is key and once the assessment is done it is then that those identified risks should be managed effectively.

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37	More than 250 Persons	Schedule performance, I state this because risk management is know about the risks that could happen and when they happen, its about being able to control them and allocating time to control them therefore I think its crucial for the schedule to strongly consider RM aspects.	no because contractual clauses are being used to manage most risks and nobody is willing to take responsibility even though minimising risk can be done through relocating responsibilities, but professionals are starting to shift too many responsibilities and they will end up being in breech with basic labour laws due to allocating responsibilities and risks to 3rd parties that are no competent enough to handle those risks.	Yes Though RMS,PMO and QMS Systems available onsite.	no	No Response	Yes, because no matter how small projects are there are always risks and they need to be controlled and monitored in order for your project to run smoothly.
38	More than 250 Persons	Insufficient training and knowledge of Risk Management and mitigating actions	No not all the time. Currently some clients are not aware that they are responsible for the risk management processes on smaller projects.	Our company have risk templates that are compulsory for any project. The templates are implemented at various stages of either design or construction phases of the project. The methodology used is to eliminate the risk as far as possible as first choice and to mitigate	No. More partners will increase the risks simply due to the nature of humans to pass the buck unless assigned to a responsible person.	No, they are capable but need to be accountable to manage risk effectively.	Yes, any risk can turn a project into a big disaster. Dangers are all around and managing the risks will save lives and equipment. The added value of risk management has proven to increase productivity due to safe working environment and better understanding of the construction environment.

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				and manage the risks that can't be eliminated			
39	20-60 persons	2.4 - Most of the emerging contractors in these small projects do not have enough capital and when there is a payment delay, the projects comes to halt due to insufficient funds.	No. The small contractors does not necessary have knowledge of Effective Risk Management and as a result, this leads to contract termination because of poor performance.	No.	Yes it will, I believe developed contractors should assist the emerging contractors and maybe enter a JV with these small contractors. This will somehow mentor them.	Yes, in my experience this has been the factor that resulted in poor/ lack of progress.	Yes, it is vital to eliminate the financial risks and plan the works accordingly. Planning is the most important role in any project.
40	More than 250 Persons	2.6 most of them are not educated both in terms of formal or informal training	No, because there is never a time to look at the risk factors but the interested on indulging in making profits.	No	Yes so that the small contractors can get the transfer of skills on risk management from the bigger contractors.	Yes, most of them don't even have the required skills to run a business.	Yes because it will quickly alerts you of the risk that can be imposed in your project so that you can limit the risk at an earliest possible time.

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41	20-60 persons	Lack of knowledge is the most significant barrier because capacity begins with relevant knowledge. If construction practitioner knew enough about the relevance, techniques and application of risk management, they will be in a better position to know how to use it. And also advocate the policies be formulated and legislation enforced.	No, this is not be done. And it because of practitioners do not understand the intricacies of risk management neither do relevant authorities enforce compliance through appropriate legislation.	No	No. If partners are still not aware about standards, techniques and best practices in risk management then no value will be added on the long run.	That's where much of the problem lies. There is little innovation amongst SME's in the construction sector right from start-up. Many businesses are a replica of previous failed/failing firms.	Absolutely. Without risk apportioning, returns can not be effectively projected and resources cannot be effectively allocated.
42	Less than 20 persons	Lack of time. Small projects are executed within limited timelines. The project execution team does not have the 'luxury' of time to implement formal RM. Further, the potential impact of risk occurrence on small projects is also relatively small.	Due to the project size, clients are not necessarily keen to be fully involved in RM of such projects and would rather allocate most of the risks to the contractor.	No	Partnering in small projects would be unusual. Partnering should apply to sizeable, complex projects.	Yes. Small projects are often seen as simple and straightforward	It depends. RM is essential to manage complexity, not simplicity. If a small project requires complex interaction of elements, say, combination of M&E services with wet trades in a difficult-to-access site, then it would be crucial to implement RM formally. Otherwise, RM could become unnecessarily burdensome.

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43	Less than 20 persons	Lack of knowledge and interest	Yes to no avail.	Yes risk Management templates and monthly project review meetings	No the contracts do not enforce any measures, they are also awarded contracts as a development process	No, even with skills RM will not be enforced	No as they won't apply them, regardless of training, skills or legislation.
44	Less than 20 persons	What risks are shared, or what risks are not, and finally what risks are only the contractors.	Not at all. Risk never, or very seldom identified.	We sort out the risks at time of tender. We list them. Obviously the total cost of labour in the tender/rates is compared with the cost of the labour derived from the programme. Similarly with plant and equipment.	It will reduce risk to both parties, but not necessarily favour either side.	Yes. It is too sophisticated for a small uneducated, unqualified, group who may have come up via the tools.	Yes, but difficult to implement.
45	Less than 20 persons	Low profit margin for small projects is a barrier	Yes	No Response	Yes	No	Yes
46	20-60 persons	Lack of knowledge, most project team members are ignorant to the benefits and methods of risk management.	Yes in my organization	Yes, risk matrices	yes, we could share more lessons learnt	Yes because of lack of skills and failure to afford and attract highly skilled personnel.	yes, no project is less important than another
47	More than 250 Persons	Failure to plan	No as they don't have the qualified resources.	PMBOK	Yes as it will help the smaller contractors implement the project holistically	Yes as indicated before they don't possess the proper skills and resources	Yes

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48	Less than 20 persons	Lack of time	No, because the consultants feel that there is no economies of scale on the small projects hence, they allocate them to their Junior personnel who are not equipped to understand the importance of RM. In most cases, wall projects are awarded to small contractors whom usually do not have established standards and procedures to assess and mitigate the risk.	No. scope supervision / quality control, cost control and schedule control procedures.	Yes	Yes. Usually the SMMEs do not have enough experience on the projects and they lack administrative systems and business support systems.	Yes. the importance hereof is to ensure that SMMEs learn the standards and procedures while still early in business. RM also improve the chances of making profit on the job and increase the earned value management.
49	More than 250 Persons	Lack of government legislation to promote RM is a barrier to effective RM on small construction projects, because this is not covered in the construction regulation it might be seen as not important.	Yes, only if the complexity justify it, otherwise don't do it, you might over complicating the project and posing another risk!.	Not on all small projects, but the by using the Risk matrix methodology with RACI makes it well manageable.	Should be.	Not to sure.	Only if the complexity of the project justifying it, otherwise don't do it, you might over complicating the project and posing another risk of delay in schedule and over spending on budget and it might negatively influencing quality.

ID	*Company Size*	*What barrier in your opinion is the most relevant?*	*Is risk allocated with party best suited to manage the risk?*	*Currently implementing RM on small construction projects? Methodology technique used?*	*Will construction partnering (shared risk management) help in overcoming the barriers to RM*	*Do you think that SMMEs lack the skills to implement effective risk management*	*Do you think that RM on small construction projects is important*
50	Less than 20 persons	Time Resources Knowledge	No, clients and main contractors still want to transfer the complete risk on small contractors. The lack of knowledge in covering risk and/or costing for it, leave contractors with minimal profits, breaking even or even losses or/and non-performance	Risk identification, analyses, elimination or mitigation, monitoring and review	Yes. Clients need to understand that transferring total risk is not the best way of covering themselves because contractors will always feel compromised and/or costing the risk into the prices they submit to clients.	To a large level, yes	Yes it is
51	60-150 Persons	To an extent it is beneficial but spending to much time, effort and cost on RM is not worth it	Small projects tend to have a foreman or site supervisor that manage the project so the supervisor and contracts manager carries all the risk and manage them.	We do most of our risk identification in the planning stages and manage them accordingly.	No I can’t see any benefit in it that will make it worth while	In some cases yes, but I also think the benefit of RM is not worth it to develop the skills on the smaller projects	Once again on smaller projects RM doesn't have to much value or benefits. Some of the risks will be cheaper to take a change on it than spend time planning for it. Most risk on smaller projects are also of small monetary value and effect and can be easily offset by proper planning and management.

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52	More than 250 Persons	Knowledge, nobody knows how to implement as system that integrates it and reduces work. Not even on large project.	Risk and Program must be one	Self developed method that actively measures risk and manage it like every deliverable on a project.	Only if we start taking competence serious and reward teams that succeed. At this sate this rarely happens, a PM with90% success rate is deemed to be lucky and the one with 17 and less % success rate is getting the same type of projects and he is paid the same type of money. As long as we do this there is little one can do to implement any methodology that works, I have been removed from a project because the client did not like the fact that I insisted in measuring the risk.	Yes, most large organisations run an un integrated system how do you expect the smaller companies to see the value	Yes my success rate as a PM is knowing how to integrate this into the rest of my management systems seamlessly
53	20-60 persons	Lack of government legislation to promote RM is a barrier to effective RM on small construction projects, and the lack of knowledge from other managers they don't take serious this RM.	YES	No Response	No Response	No Response	Yes because you have to look at the risk of the project on implementation stage so that everything can be catered for. it helps so that you can't find any surprises during the project.

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54	More than 250 Persons	The lack of manpower and knowledge due to not being suitably informed regarding the benefits of RM being properly implemented.	From past experience I do not believe so.	No Response	No - not for small construction projects.	Yes, more education and training required.	Yes - the fact that a project is small in value does not mean it is not exposed to risk. In fact, the reverse may apply. Sometimes smaller projects are more exposed to risk for many reasons.
55	More than 250 Persons	No Response	No Response	No Response	No Response	No Response	No Response
56	20-60 persons	The time constraint on small projects and the lack of manpower makes it not economical. Cost of budget is limited, period.	Sometimes yes, when no, there is a lack of RM and how to implement	Yes, I use contracts to guide and use progress meetings to manage risks as per the contract program	Yes, this should be implemented as an requirement on tender stage. This is being done successfully with Health and Safety and quality	Yes, educating the individual supervising the works on RM pertaining to the contract requirements, and how to manage risk as a company should be put in place	Yes, I think so, most cases the contractor fails contractually due to the lack of proper RM, therefore not so may are successful.
57	20-60 persons	Lack of sufficient budget is a barrier to effective Risk Management on small construction projects, because budget hold project and leading to the productive route.	Yes	Cost risk analysis and schedule risk analysis which assist in producing good work at the end which includes root cause analysis.	Yes, lot of manpower and experienced individuals will assist in ensuring professional outcome in the working environment.	Yes since they never orientate or rather familiarise themselves with the risk management as an important tool at work.	Yes because the risk taken in small project is the same with big projects. Project is project no matter how big or small might be.