

THE RISK MANAGEMENT FRAMEWORK FOR ORGANISATIONS DEALING  
WITH CONSTRUCTION PROJECT MANAGEMENT IN SOUTH AFRICA

by

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Treatise

Submitted in fulfilment of the requirements for the degree

MASTER OF SCIENCE (PROJECT MANAGEMENT)

In the Faculty of Engineering, Built Environment and Information  
Technology

University of Pretoria

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February 2011

## **DECLARATION**

I, declare that this research is entirely my own, unaided work, except where otherwise stated. All sources referred to are adequately acknowledged in the text and listed.

I accept the rules of assessment of the University of Pretoria and the consequences of transgressing them.

This treatise is being submitted in partial fulfilment of the requirements for the degree of MSc (Project Management) at the University of Pretoria.

It has not been submitted before for any degree or examination at any other University.

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H. M. Makombo

February 2011

## ACKNOWLEDGEMENTS

I would like to express my heartfelt gratitude to the Lord God Almighty for the many blessings and sustenance through my whole life and for this dream that has finally come true. My thanks also go to the Lord Jesus Christ for the light and wisdom that was given by the Holy Ghost throughout this work. In addition I would like to also say thank you to the some special people who have been a source of inspection, strength and enlightenment during this project.

To my Dear Wife Angela and my Sons Chintala and Kaweme who sacrificed their quality time with me so that I could attend the block week studies and further sacrifice time when I compiled this work. Thank you very much for the great sacrifice.

To my supervisor, Mr. Hendrik Prinsloo who has been encouraging throughout the contacts we have had throughout the work on the write up. I have learnt a number of things from you and I am looking forward to working with you another time in the future.

To my classmates, my fellow MSc students, class of 2007, thanks guys for the company throughout the studies. I enjoyed studying with you all.

Finally, to all my colleagues at work and fellow construction project management professionals and engineers who in one way or another have been a source of information and enlightenment during the study.

Without all of you this work wouldn't have been easy to successfully complete.

Thanks again for being there for me.

## **ABSTRACT**

Title of treatise : The Risk Management Framework for  
Organisations dealing with Construction Project  
Management in South Africa

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Date : February 2011

Risk management framework in the construction project management sector is the solution to a systematic step-by-step management of risks in organisations and projects.

It is vital that all organisations become involved in the management of risks from top management to the general labour force. This is the only way that organisations will manage to handle risks effectively and eventually protect and increase the wealth of enterprises.

A study was conducted to identify the existing risk management frameworks in various institutions as well as the risks commonly encountered in the construction related projects undertaken by engineering and construction project management professionals and firms as well as other stakeholders. In addition, the study also looked at the project management professionals in order to determine their levels of competence and expertise to perform as project managers. The study also looked at the effect that poor knowledge in project and risk management areas have on project performance.

The aim eventually is to present a solution in the form of a risk management framework that is balanced for small, medium and large organisations dealing with construction project management in South Africa.

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## DEFINITIONS OF TERMS

**Consequence:** This is the outcome of an event - There may be one or more consequences from an event. Consequences may range from positive to negative. Consequences may be expressed qualitatively or quantitatively.

**Event:** This is an occurrence of a particular set of circumstances. The event may be certain or uncertain and can be singular or multiple.

**Interested parties:** Persons or groups having an interest in the performance of an organization or project. Examples are customers, owners, employees, suppliers, bankers, unions, partners or society and end users. A group may be an organization, part thereof, or more than one organization.

**Mitigation:** Limitation of any negative consequence of a particular event.

**Probability:** The extent to which an event is likely to occur. The mathematical definition of probability is a real number in the scale 0 to 1 attached to a random event.

**Residual risk:** The risk remaining after risk treatment.

**Risk:** Combination of the probability of an event and its consequence. In some situations, risk is a deviation from the expected.

**Risk acceptance:** A decision to accept a risk.

**Risk analysis:** A systematic use of information to identify sources and to estimate the risk.

**Risk analysis:** This provides a basis for risk evaluation, risk treatment, and risk acceptance.

**Risk assessment:** Overall process of risk analysis and risk evaluation.



**Risk avoidance:** Decision not to become involved in, or action to withdraw from a risk situation. The decision may be taken based on the result of risk evaluation.

**Risk communication:** Exchange or sharing of information about risk between the decision-maker and other stakeholders. The information may relate to the existence, nature, form, probability, severity, acceptability, treatment or other aspects of risk.

**Risk control:** These are actions implementing risk management decisions. Risk control may involve monitoring, re-evaluation, and compliance with decisions.

**Risk criteria:** Terms of reference by which the significance of risk is assessed risk criteria may include associated cost and benefits, legal and statutory requirements, socioeconomic and environmental aspects, concerns of stakeholders, priorities and other inputs to the assessment.

**Risk estimation:** Process used to assign values to the probability and consequence of a risk. Risk estimation may consider cost, benefits, stakeholder concerns, and other variables, as appropriate for risk evaluation.

**Risk evaluation:** A process of comparing the estimated risk against given risk criteria to determine the significance of the risk. Risk evaluation may be used to assist in the acceptance or treatment decision.

**Risk financing:** The provision of funds to meet the cost of implementing risk treatment and related costs.

**Risk identification:** The process to find, list, and characterise elements of risk. These elements may include; source, event, consequence and probability. Risk identification may also identify stakeholder concerns.

**Risk management:** Co-ordinated activities to direct and control an organisation with regard to risk. Risk management typically includes risk assessment, risk treatment, risk acceptance, and risk communication.

**Risk management system:** This is a set of elements of an organisation's management system concerned with managing risk. These may include: strategic planning; decision making; and other processes for dealing with risk. Risk management systems reflect the culture of the organisation.

**Risk optimization:** The process related to a risk, to minimize the negative and to maximize the positive consequences and their respective probabilities.

**Risk perception:** A set of values or concerns with which a stakeholder views a particular risk. Risk perception depends on the stakeholders' expressed needs, issues, and knowledge and may differ from objective data.

**Risk reduction:** Actions taken to lessen the probability, negative consequences, or both, associated with a particular risk.

**Risk retention:** The acceptance of the burden of loss or benefit of gain from a particular risk. It includes the acceptance of risks that have not been identified. Risk retention does not include treatments involving insurance, or transfer by other means.

**Risk transfer:** This is to share with another party the benefit of gain or burden of loss for a particular risk. It may be effected through insurance or other agreements. This may create new risks or modify existing risk.

**Risk treatment:** The process of selection and implementation of measures to modify risk. Risk treatment measures may include avoiding, optimizing, transferring or retaining risk.

**Source:** A thing or activity with a potential for consequence.

**Source identification:** A process to find, list, and characterize sources.

**Stakeholders:** Any individual, group or organisation that may affect, be affected by, or perceive themselves to be affected by the risk.

# CHAPTER 1 – INTRODUCTION

## 1.1 Prologue

Recent challenges in the global economy have seen a lot of jobs and industries shutting down. Global Envision (2009) suggests that some of the most affected sectors are the mining, financial and construction industries. Global Envision also outlines that the construction sector in Dubai for instance is declining as most investors are leaving and many employees have been retrenched. The global economic meltdown has amongst other things, ensured that we institute proper risk management controls, to guarantee that projects are completed despite changes in the political and economic climate.

The fact that the world economy has become global has impacted heavily on developing countries which despite the harsh economic factors, has to equally compete with other international players. In order for the developing countries to be profitable, there is need to standardise processes and ensure that there are proper mechanisms for planning.

Construction projects are now conducted in complex and dynamic environments, which are prone to the fluctuations of diverse market forces. Assaf and Al Hejji (2006) outlines problems that the construction industry experience to achieve their time, cost and budget goals. They identify poor planning as the third major cause of project failures.

This study was therefore conducted in order to investigate the existing risk management frameworks that are currently in use and then propose a risk management framework that would be used by project managers in the in the construction industry of a developing nation. This framework will be important for project managers during the planning, executing and controlling of projects. There are a number of construction firms with proper risk management policies and frameworks aimed at ensuring that project management is successful.

## **1.2 Statement of the problem**

“What is the risk management framework needed for an organisation which deals with construction project management in a developing country?” This statement of the problem can be subdivided into sub-problems as follows:

1.2.1 What Risk Management frameworks are applied in the construction industry and how can they be used to help mitigate risks and their effects?

This sub-problem addressed the existing risk management frameworks in the industry. It was addressed through a literature study. The aim for this sub-problem was to elicit information on risk management frameworks applied in the construction industry. The research was conducted through journal papers and books that deal with these issues.

On the other hand, based on the findings from questionnaires, gaps were discovered in the knowledge on risk management among professional handling projects. Some risk management frameworks were discovered to be currently in use. They were analysed and modified to suit the developing countries in order to help to mitigate risks and their effects.

1.2.2 How does Risk Management affect Project Management?

This sub-problem addressed risk management in project management. The sub-problem focused on the different risks encountered during the project management processes. In order to address this sub-problem, an extensive literature review was undertaken. This became very useful as it unveiled the various models in use which of great use for the development of the model for the construction industry in a developing country.

1.2.3 What are the risks that are associated with the construction industry in a developing country?

A study was conducted on (a specific population and demography) of large civil engineering and construction project management companies as well as smaller civil engineering consulting firms. This was in order to elicit information pertaining to the risks inherent to the construction industry. Empirical data was elicited through the use of questionnaires, and semi-structured interviews.

### **1.3 Objectives**

The main objective of this study is to come up with a modified framework from existing models, which would help minimise risks during project planning, control and execution for a civil engineering and construction management organisation in a developing country. This would enable the identification and treatment of risks in order to improve the successful completion of projects within the right time, budget and quality.

### **1.4 Significance of study**

This study will be helpful to many companies in developing countries, dealing with engineering and construction project management. The study is important because many companies especially smaller emerging firms do not have proper frameworks and methodologies in place to deal with risk and therefore they lose millions of Rands due to poor risk forecasts. The framework once modified and developed will be used by a variety of engineering and management firms in South Africa as well as any other developing country.

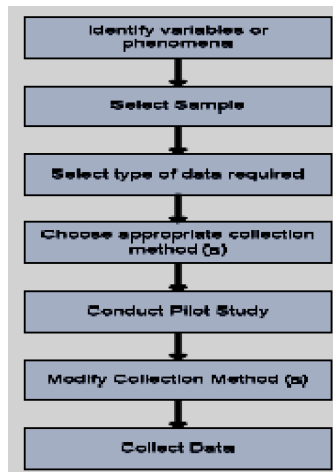
### **1.5 Literature Review**

Various literatures on risk management and project management were consulted. In this study, particular focus was made to be on the civil engineering and construction project management and the various risks from literature found during project planning, execution and control was outlined.

The other literature focused on risk management frameworks used in other sectors and other countries. The purpose for this was to elicit information that could be used to form the theoretical basis for the modified framework to be proposed for use by engineering and management firms in the developing countries.

## 1.6 Research Methodology

The research project undertook a phenomenological approach. The data collection process had several steps associated with it and these included identifying the variables or phenomena, selection of sample, selection of data required, collection methods, pilot study and collection of data.



**Figure 1: Overview of data collection process (Collis & Hussey, 2003)**

This study focused on qualitative variables. From the sample, the target population consisted of mainly South African firms dealing with Civil Engineering and Construction Project Management. Both large and small firms were targeted. The large firms comprised of firms such as BKS (Pty) Ltd, KV3, Vela VKE, PDNA, WSP, and others. The small firms were mainly one man consulting firms that are apparently dealing with some huge government projects especially municipal work. The study was however not only limited to the mentioned firms.

A purposive sample was used for the purpose of this study. Letters were sent using email to ask for permission to interview project managers and engineers at the various levels on projects. Some accepted and others preferred questionnaires which they completed at their convenience and return them. The data collection methods consisted of a semi-structured questionnaire. The questions aimed at eliciting information regarding the management of risks in the projects as well as discovering what models are in place if any. The other information elicited was the project management skills levels and how this affects project success.

Before conducting the data collection in the field, a pilot study was undertaken with the purpose of refining the questionnaire. During the field study, information was transcribed and recorded on a tape recorder for data analysis purposes. The data analysis method used was general analytical procedure which was a non-quantifying method.

With the country going through preparations for the 2010 football world cup, many of the Civil Engineering and Construction Project management companies had major projects to undertake. Some of these projects were:

- Gautrain rapid train facility linking Pretoria, OR Tambo international airport and Johannesburg
- Heineken Sedibeng Breweries
- 2010 Soccer World Cup stadia around the country
- King Shaka Zulu International Airport in Durban
- Capacity increase and improvement at O.R. Tambo international airport
- Free way expansion and improvements in Gauteng
- Coal fired Power Stations for ESKOM
- Municipal infrastructure development all over South Africa
- New hotels and sports complexes.

For the purpose of this study not all of these projects were considered. Some project managers that worked on Gautrain, Sedibeng Brewery, free way expansion, and Sports Complex were however, interviewed

## **1.7 Delimitation of Study**

The research study focussed only on project management related risks. It did not address other management fields such as production, strategic, financial and marketing and operations. The study focussed also on projects within the construction and civil engineering environment. However, literature on frameworks from different sectors was also considered. The study's focus was also on a framework for a developing country. The aim for the study is not to develop or produce a framework for developed countries as problems and operating contexts may be unique.



## **CHAPTER 2 – LITERATURE REVIEW**

### **2.0 Risk Management**

Organisations are based on people and people by nature are risk averse. However, in all instances, they have found ways of managing risk. Van Zyl, (2009), argues that risk is an integral part of the spectrum of man and his actions over his lifetime and further says that risks occur in all spheres that man comes into contact with. Bartram, (2000), in his article on Corporate Risk Management as a Lever for Shareholder Value Creation states that for organisations to be successful in their business endeavours there has to be a formal approach to risk management which will in turn help to achieve corporate objectives and ultimately increasing the shareholder value. What should be important to organisations is the practice of proactively assessing and managing risks to the advantage of business rather than trying to eliminate risks. It is very important to note that we cannot escape risk, but instead since it is all around us, we should learn to identify and assess risks and be able to find loop holes of opportunities or be able to do business carefully once risks have been identified.

The construction industry is one environment that is plagued by risks. Poor performance has often been the result. Carr and Tah, (1999) observed that although risk management techniques have been applied, the lack of a formalised approach has produced inconsistent results. A formalised approach to risk management should therefore be implemented to address the risk matters consistently in order to avoid disastrous consequences. Akintoye and MacLeod (1997) in their paper, “Risk Analysis and Management in Construction”, stated that risk management is essential to construction activities in minimizing losses and enhancing profitability. Construction risk is generally perceived as events that influence project objectives of cost, time and quality. Risk analysis and management in construction depend mainly on intuition, judgment and experience. Akintoye and MacLeod (1997) further outlines that formal risk analysis and management techniques are rarely used due to a lack of knowledge and doubts on the suitability of these techniques for construction industry activities.

Looking at these arguments, it can be deduced that a risk management framework or a formal risk management analysis and process is a principal requirement for business in the civil engineering and construction project management environment. This will enable business to thrive with proper safeguards against unknown factors. Some firms fair quite badly when it comes to managing risks consistently across all the organisation's operations. This is mainly due to the fact that the companies lack formal risk management frameworks which should be used as a generic tool suitable for all projects to give guidance in the process of risk management. According to the Institute of Risk Management, (2002) "A Risk Management Standard", if a proper risk management framework is implemented in organisations, the following are some of the many benefits that can be realised in the business: (IRM, 2002).

- 2.0.1 Providing a framework for an organisation that enables future activity to take place in a consistent and controlled manner.
- 2.0.2 Improving decision making, planning and prioritisation by comprehensive and structured understanding of business activity, volatility and project opportunity/threat.
- 2.0.3 Contributing to more efficient use/allocation of capital and resources within the organisation.
- 2.0.4 Reducing volatility in the non essential areas of the business.
- 2.0.5 Protecting and enhancing assets and company image.
- 2.0.6 Developing and supporting people and the organisation's knowledge base.
- 2.0.7 Optimising operational efficiency.

## **2.1 Introduction**

All organizations face a variety of internal and external risks at both strategic and operational levels, some of which may be beyond their immediate control. Each risk has a certain likelihood of occurrence and a greater or lesser impact, so for any particular risk there may be impacts on people, equipment, property, the environment, image and/or business. Business strategies are normally based on the assumption that business will continue within certain boundaries. Walford, (2004) states that any

contingency that significantly disturbs this system directly affects an organization's ability to fulfil its business objectives and to maintain the livelihoods of those involved. Organisations should aim at systematically identifying and assessing these risks.

We should manage all known risks proactively by implementing appropriate preventive and contingency measures. Norvartis, (2007) supports the argument that such a risk management process should be designed to reduce the residual risk of an event in terms of its likelihood of occurrence and the severity of its consequences to an acceptable level. For business in civil engineering and construction project management, a specific risk management framework must be set up in the organisation in order to be able to address the risk issues and find ways of managing and mitigating the known risks as well as being fairly prepared to handle the unknown eventualities. For a business, if exposure to risk is not handled well, it could lead to disaster.

Risk management involves the use of the right tools, methods and processes to manage risk and avoid disastrous consequences. Van Zyl, (2009) in a personal interview stated that businesses can be safeguarded and can increase their success rate by having an effective risk management policy and framework in place. By identifying the risks before the actual events occur, you will have the time and space and other resources to prepare and to put solutions in place if needed. For successful risk management to be achieved, a number of systematic processes will have to be followed. To achieve this, businesses have to understand the concepts in the whole process of risk management and the benefits thereof. This is what is lacking in most civil engineering and construction project management firms concerning management of risks in a systematic and standardised format. The Association of Insurance and Risk Managers with the Institute of Risk Managers in their “A Risk Management Standard” have pointed out a number of important aspects of the risk management processes that should be understood and well managed. These are listed and described briefly below:

- 2.1.1 A Methodical identification of the risks surrounding the activities of the business.

- 2.1.2 Review of the probability of the occurrence of events in a particular business operation.
- 2.1.3 Identification of the events before they create problems and dealing with them accordingly.
- 2.1.4 Understanding of the events and ways to respond to the eventualities.
- 2.1.5 Systematizing the tools required to tackle the penalty or consequences (formal framework for managing risks)
- 2.1.6 Supervising the risk management process by a competent manager.

When all the aspects of risk management process are addressed and all steps followed, there are a number of benefits that will be realized in a business of engineering and construction project management nature. Below are some of these benefits as echoed by several authors (Kim Heldman (2005), Bruce Barkley (2007), Mark Dorfman (2007), Chris Chapman (2004) and Robert Walford (2004)

The major benefits that the business will realize when a formal risk management process is implemented in the business include:

- a) Improved decision-making
- b) Planning and prioritising skills.
- c) Well-organized allocation of the resources and finances
- d) Enables anticipation of the problems leading to the use of optimum amount of resources to fight and prevent disastrous results.
- e) Proper risk management significantly improves the probability of the delivery of the business plan, within your time frame and budget.

In order to understand the terminology used in the risk management processes, it is important that the major terms are discussed. This will give a clear picture of the processes involved in the management of risks and also lay a foundation for the framework to be utilized with understanding.

## **2.2 Definition of Risk**

There is a wide range of definitions of risk by various people in various sectors of human dwelling. In a general sense, risk can be defined as a chance that something undesirable and unplanned for may happen. In the construction industry, which is our main focus in this text, Humphreys (2000) defines as a measure of a project's inability to achieve system life cycle objectives. Risk comprises two components namely the probability of failing to achieve particular system life cycle objectives, and the consequences of failing to achieve those objectives.

The Oxford English explanatory dictionary defines risk as situation involving exposure to danger and the possibility that something unpleasant will happen. Luhmann, (1996) from another light defines risk is a concept that denotes the precise probability of specific eventualities. Technically, the notion of risk is independent from the notion of value and, as such, eventualities may have both beneficial and adverse consequences. However, in general usage the principle is to focus only on potential negative impact to some characteristic of value that may arise from a future event.

The International Organisation for Standardisation (ISO) in 2009 came up with another definition of risk. ISO 31000, (2009) defines risk as the “effect of uncertainty on objectives”.

Luhmann (1996) further defines risk as the threat or probability that an action or event will adversely or beneficially affect an organization's ability to achieve its objectives. In simple terms risk is ‘uncertainty of outcome’, either from pursuing a future positive opportunity, or an existing negative threat in trying to achieve a current objective. Risk is an event, occurrence or situation that could have a negative influence or impact on the achievement of a specific goal or objective. According to Kerzner, (2006), risk is the measure of the probability and consequence of not achieving a defined project goal.

It can be concluded, based on the arguments above, that risk involves a big element of uncertainty of which the outcomes are not known before hand. In many instances it is

not known for sure how the end product of the endeavour will be or if the value for the said undertaking will be achieved within defined cost, schedule, and technical constraints.

It is important to note the following as Meucci (2005) suggests:

2.2.1 Risks constitute a lack of knowledge of future events. These future events can be favourable or unfavourable. Favourable events are called opportunities or benefits while unfavourable events are called threats to success or risks. In many civil engineering and construction project management firms, risk for some reason has been seen as a source of fear or a bad thing which should be avoided. With this attitude or culture towards risk, people develop the tendency to be too careful as a natural defence mechanism.

What is forgotten is that there is a flip side to risk which is opportunity. Galway (2004) is of the opinion that if people could start to look for opportunity as they undertake risky work, it will be satisfying knowing that there is an opportunity ready to be seized. Chapman and Ward (1997) supports the thought and adds that whenever people take off the culture of carefulness and fear and start to search for opportunities work become enjoyable.

2.2.2 Meucci (2005) further argues that risks and opportunities may be uncorrelated or only partially correlated on a given particular project.

2.2.3 Risk increases with hazard and decreases with safeguards. Hence the development of frameworks for the purpose of investigating, assessing, prioritising and monitoring of various risks to ensure that the projects run successfully and profitably to completion within constraints of time, resources, budget and quality.(Meucci, 2005). It has been observed van Zyl (2009) that the more hazards there are in a project or any business undertaking, the more the risk increases, this results in the people shying away from risky work. But if proper safeguards are instituted, the risks are reduced causing a scenario where project deliverables are achieved in time and within the budget and with available resources. The above

situation could be fostered by the implementation of a risk management framework which ensures that the risks are identified and eventually safeguarded so that they do not negatively affect the project.

In all types of undertaking or projects, there will be and always has been likelihood for events and consequences that constitute opportunities for benefit (positive outcomes) or threats to success (negative outcomes). The Risk management vocabulary, Guidelines for use in standards, ISO/IEC Guide 73, (2002) clearly states that risk management is increasingly recognised as being concerned with both positive and negative aspects of risk.

There are so many risks present in our day to day operations in business. All these give rise to the need for coordinated and economical use of resources to minimise, monitor and control the probability and impact of unfortunate events. This can only be done using the risk management process hence the need to understand what this process is all about.

## **2.3 Definition of Risk Management**

Hubbard (2009) defines risk management as the identification, assessment, and prioritisation of risks followed by coordinated and economical application of resources to minimize, monitor, and control the probability and/or impact of unfortunate events. Valsamakis and Vivian, (1996) also defines risk management as the process of determining the maximum acceptable level of overall risk to and from a proposed activity, then using risk assessment techniques to determine the initial level of risk and, if this is excessive, developing a strategy to ameliorate appropriate individual risks until the overall level of risk is reduced to an acceptable level. Heldman, (2005) in her book “Project Manager’s spotlight on risk management” defines risk management as “applying skills, knowledge, and risk management tools and techniques to the project in order to reduce threats to an acceptable level while maximising opportunities.

It can be deduced then that the aim of risk management is to reduce threats that may be encountered during the execution of projects or undertakings to acceptable levels and at the same time maximising opportunities or positive outcomes.

## **2.4 Risk Management Process**

The main aim of risk management is to protect and add value to the organisation and its stakeholders. The process of risk management should strive to achieve the following goals:

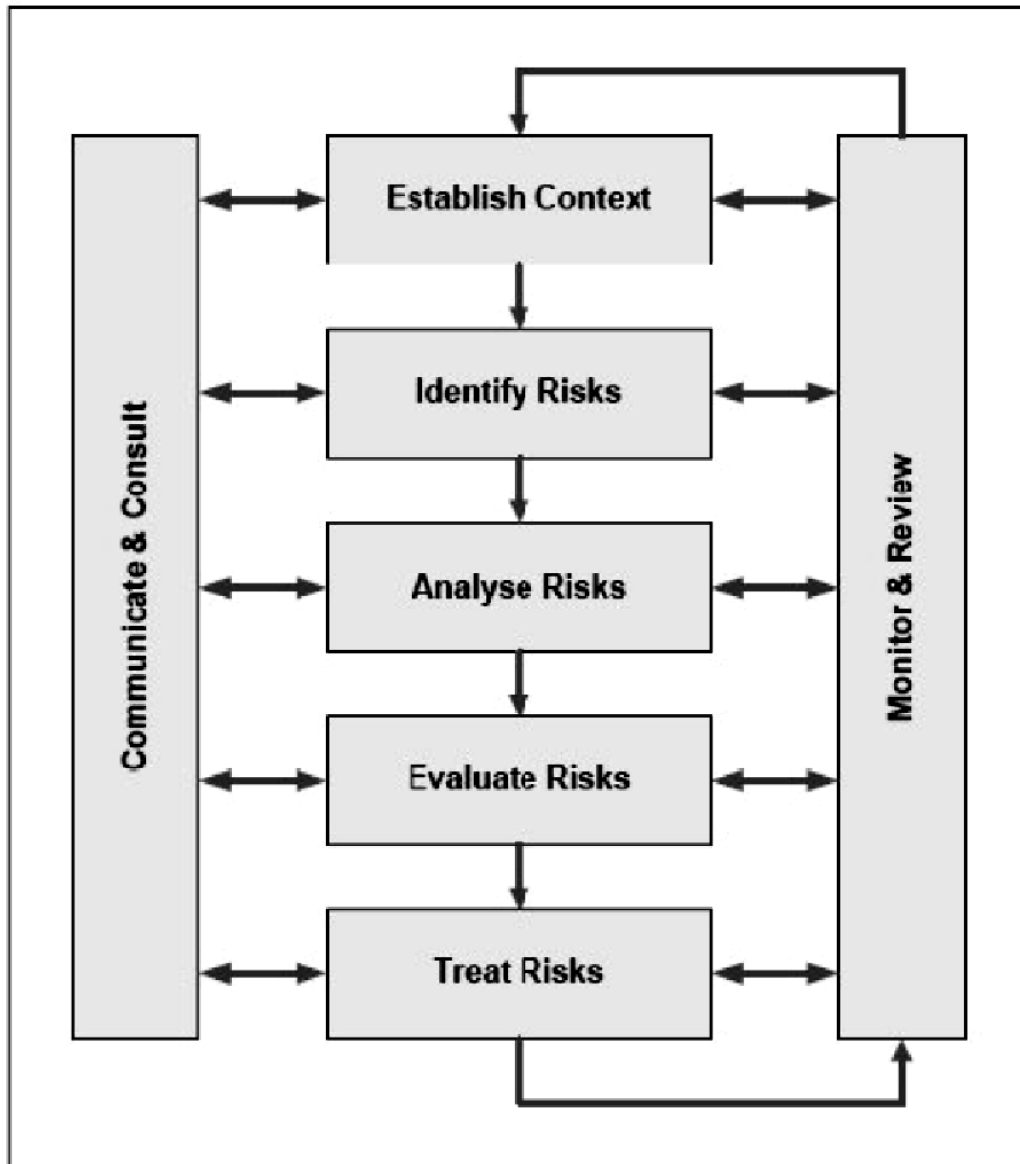
- a) Provide a framework that will enable the companies to manage business activities in a consistent and controlled manner ensuring that the risks and opportunities are dealt with in a professional and beneficial way to the core business objectives.
- b) Ensure that the decision making process, planning and prioritisation are achieved whilst understanding the objectives of business activities.
- c) Contribute to the efficient use and allocation of capital and other resources in the organisation.

To achieve the above goals of risk management, there has to be a specific risk management process which shows all the necessary steps needed to be followed to implement risk management in the organization. These processes can be utilized to monitor and control risks. This will ensure that the objectives of the organization are met. All the relevant steps that are needed in the risk management process to mitigate risks are described in figure 2.

Heldman, (2005) states that risk planning is part of the risk management process which is basically a tool that helps to foresee risks, identify actions to prevent them from occurring and reduce their impact should they eventuate. The risk management plan is created as part of the risk planning process. It lists all foreseeable risks, their ranking and priority, the preventative and contingent actions, along with a process for tracking them.

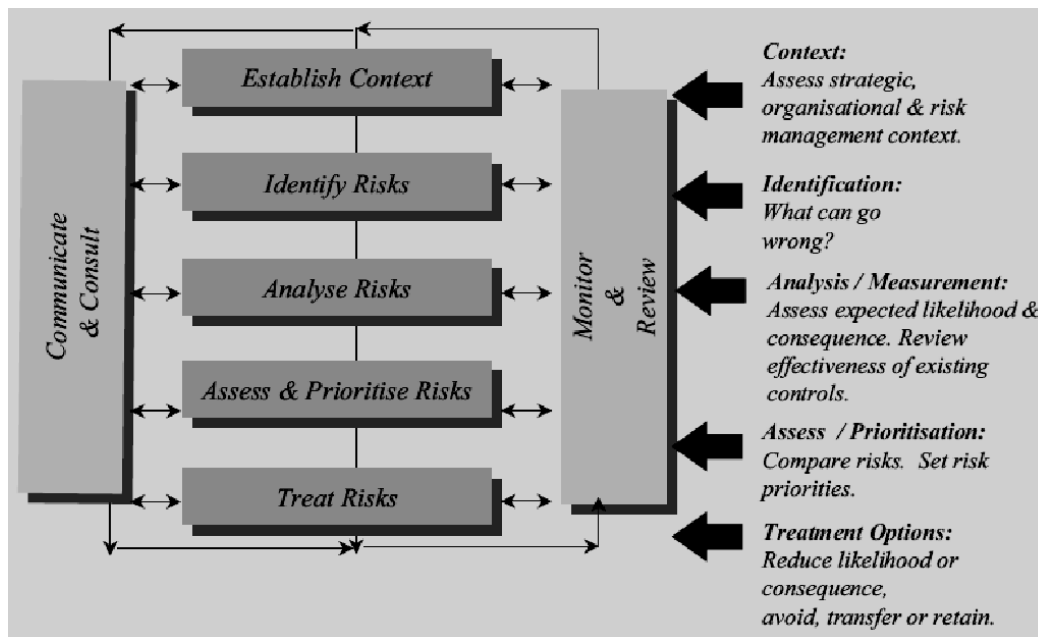


Whenever risks are to be carefully managed, a risk plan should be used. The best time to implement the risk plan is during the start up of any undertaking or project. This will enable the identification and management of the risks involved with the delivery of the project. This plan will at all times during the project lifecycle, be referred to frequently to ensure that all identified risks are mitigated timeously. When this is done, the chances of succeeding on the project are greatly improved.



**Figure2: The Risk Management Process.** Adapted from AS/NZS 4360, (2004)

Below is the risk management processes graphically explained in further detail.  
 (Adapted from AS/NZS 4360, (2004))



**Figure 3: The detailed Risk Management Processes.** Adapted from AS/NZS 4360, (2004)

The Australian and New Zealand standard for risk management AS/NZS 4360, (2004) gives a guide to the implementation of a risk management plan which enables the following benefits in summary:

- a) Establish goals and context
- b) Identify the critical and non-critical risks
- c) Analyse the risks in depth
- d) Evaluate and Document the risks
- e) Treat the risks and take action to reduce the likelihood of risks occurring
- f) Monitor and review

The creation of a risk management plan is a critical step in the construction project management industry with all its business undertakings being projects. This will help to reduce the likelihood of risks from occurring by knowing about the risks and the consequences thereof if the risks were to occur. The plan will help to identify risks

and implement a plan to reduce them. In its guidelines ISO 31000, (2009) specifies that the risk management plan should be utilized in order to put in place processes and procedures for reducing the likelihood of risk occurring by giving a complete procedure showing how to take action to reduce risk in the project or business. This will greatly improve the success of projects and businesses as a whole by continuous monitoring and controlling of risks effectively, increasing chances of achieving success.

The risk management process which is part of the risk planning yields a number of steps in the process as depicted in figure 2 above and elaborated further in the details below (adopted from the Australian and New Zealand Standard for Risk Management AS/NZS 4360, (2004)).

#### **2.4.1 Establish goals and context**

Risk assessment should be undertaken within the context of the organisational goals. The identification and validation of the goals should therefore be a critical first step in the risk management process. Effective risk management requires a thorough understanding of the context in which the organisation operates. Understanding of this operating environment will enable the definition of the parameters within which the risks to projects and business as a whole need to be managed.

The following points must be noted:

- a) Risk management occurs within the context of endeavouring to achieve the goals and objectives
- b) Failure to achieve the objectives is one set of risks that need to be managed, and
- c) The goals and strategies assist to define whether a risk is acceptable or unacceptable.

The risk management context defines that part of the organization (goals, objectives, or project) to which the risk management process is to be applied.

## **2.4.2 Identify the critical and non-critical risks**

It is important to identify the risks most likely to impact on the outputs, together with their sources and degree of effects. It is also important to be rigorous in the identification of the sources and impacts as the risk treatment strategies will be directed towards sources (preventive or pre-emptive) and impacts (reactive). Heldman, (2005) is of the opinion that identifying risks is half of the job done and the other half is having the risks documented for future reference. The main objectives of risk identification are outlined below in line with the thoughts of David B. Ashley, James E. Diekermann and Keth R. Molenaar, (2006). These are:

- a) To identify and categorize risks that could affect the project.
- b) To document the identified risks.

The outcome of risk identification is a list of risks. What is done with the list of risks will depend on the nature of the risks and the project. For low-cost projects or non-complex projects with few risks, the list of risks may be kept simply as a list of red flag items. These items can then be watched throughout the lifecycle of the project and may be used for risk allocation purposes. In other words, risk identification is not a onetime event; it should rather be performed on a regular basis throughout the project's life. On big projects or high-cost projects with high uncertainties, the risks will require stringent processes of assessment, analysis, mitigation and planning, allocation, monitoring and updating.

Heldmann, (2005) suggests that the risk identification process should be able to promote a culture of creative thinking and should be able to empower the team experience and knowledge.

According to FIRMA, (2008) at the Futron's Risk Identification Workshops, Risks can be identified via the following methods, tools and techniques:

#### **2.4.2.1 Brainstorming**

Facilitated brainstorming sessions are effective for risk identification. It is important to use facilitators from outside the organization to provide objectivity and allow maximum participation from organization members. Futron's "risk identification workshops" typically include brainstorming a significant list of risks, qualitative analysis of the risks, and classification of risks into groups. (FIRMA, 2008)

#### **2.4.2.2 Workshops**

Workshops are useful for generating teamwork and a shared understanding of the risks faced by the organization or department. However, to be most successful it is generally agreed that workshops need to be facilitated either by a facilitator, such as an external consultant, who does not work for the organization or by an internal facilitator from another area of the organization such as perhaps the organization's risk manager or safety officer.

#### **2.4.2.3 Interviews**

The interviewing technique involves question and answer sessions with experts, Clients and other relevant stakeholder that are affected in one way or another by the undertaking, managers, project team members and others that can assist with identifying risks. Other project managers with similar past experience should also be interviewed for their inputs.

#### **2.4.2.4 Questionnaire survey**

This technique involving the use of the questionnaire and context sensitive probing questions to elicit issues, concerns, or risks that might jeopardize the successful completion of the project. A risk

identification questionnaire is a great document to share with key stakeholders early in the project cycle.

#### **2.4.2.5 Feedback from similar projects**

Experience with similar projects can be a source of identification of risks as similar projects may have similar risks although environments may differ. A quick reference to all the risks that were previously identified in a similar project may prove helpful.

#### **2.4.2.6 Use of specialists or experts**

Experts should be knowledgeable individuals that have either an internal or an external affiliation to the project. External experts are useful to compensate for possible biases and to contribute independent views and opinions.

#### **2.4.2.7 Previous experience**

Based on previous risks experienced on similar work in the past, a comparable repeatable trend could be utilized thereby identifying what type of risk could be repeated.

### **2.4.3 Analyse the risks in depth**

Identify the controls (currently in place) that deal with the identified risks and assess their effectiveness. Based on this assessment, analyse the risks in terms of likelihood and consequence.

In simple terminology, risk analysis can be defined as the science of risks and their probability and evaluation. The process of risk analysis is an integral part of the risk management process and should therefore be approached as part of risk management process holistically. Akintoye and MacLeod, (1997) supports the above statements that some data for risk analysis can be derived from risk

discussions workshops, interviews, questionnaires and previous experience. This can then be used to identify potential risk issues and risks ahead of time. The process will help to understand the costs or negative impacts that may result.

#### **2.4.4 Evaluate, Assess and Document the risks**

This stage of the risk assessment process will determine whether the risks are acceptable or unacceptable. This decision of risk evaluation will be made by persons with appropriate authority. A risk that is determined as acceptable should be monitored and periodically reviewed to ensure it remains acceptable. A risk deemed unacceptable should be treated appropriately as described below. In all cases the reasons for the assessment should be documented to provide a record of the thinking that led to the decisions. Such documentation will provide a useful context for future risk assessment.

According to David B. Ashley *et al.* (2006), risk assessment can be defined as the process of quantifying the identified risk events after they have been documented. It can also be defined as a measure of the probability, the severity, and the exposure of all hazards of an activity.

Smook, (2009) also defines risk assessment as the overall process of risk identification, quantification, evaluation, acceptance, aversion and management. He further suggests that risk assessment includes risk determination and risk evaluation and risk management includes risk assessment.

Construction projects often fail to achieve their time, budget, and quality goals. This is frequently due to the failure to analyse and assess all risk factors. Dukakis, (1994) hinted that risks should be analysed in a process whereby, from bidding stage, risks are identified and assessed to avoid consequences.

Risk assessment is a management activity that should be supported by people who understand risk management activities.

When assessing risks, the approach must be both qualitatively and quantitatively combined together. The evaluation of risks should be on their worst case effects and their relative likelihood of impacts when done qualitatively. In this way the focus will be on strategies and tactics for avoiding risks or reducing a risk's negative impacts.

#### **2.4.5 Treat the risks and take action to reduce the likelihood of the risks**

Heldman, (2005) in her book suggests some forms of risk treatments. They are as follows:

##### **2.4.5.1 Avoiding the risk by discontinuing the activity that generates it.**

This is the elimination of risk whereby you completely avoid doing certain things that are known to have a disastrous consequence or discontinuing that thing after it has been discovered to have disastrous consequences if further pursued. An example of this is avoiding certain projects because there is a risk of unsuccessful completion because of say issue of health and safety risks which may hamper the completion of the project. It should be noted however that not all risks can be avoided. By avoiding certain risks, some benefits may be forfeited. Where avoidance is not possible or desirable, loss control is the next best thing to do. In many institutions, some projects have been difficult to carry out due to some clients having to refuse to allow for occupational health and safety in the contingency fund. This project if allowed to continue has a potential to cause many costly problems because compliance by all parties on the project may not be seen as a priority. This is a potential source of disaster on projects if not handled properly. The best decision to make in instances like this is to walk away from the project than to have to deal with costly consequences later on in the project life cycle



#### **2.4.5.2 Reducing the likelihood and consequences of the occurrence**

This involves deliberate methods that are aimed at mitigating the severity of the loss or the likelihood of the loss from occurring. For example, sprinklers are designed to put out a fire to reduce the risk of loss by fire. Outsourcing could be another example of risk reduction if the outsourcing company can demonstrate higher capability of managing or reducing risks. This way, the company can concentrate more on the core business development without having to worry as much about the risks as the outsourcing or insurance company will handle this part of the works.

#### **2.4.5.3 Transferring (outsource or insure) the risk**

Insurance is a form of risk management primarily used to hedge against the risk of a contingent loss. Cammack, Robert I. Mehr & Emerson, (1976) describes insurance as the equitable transfer of the risk of a loss, from one entity to another, in exchange for a premium, and can be thought of as a guaranteed and known small loss to prevent a large, possibly devastating. Transference is a technique that transfers risk and its consequences to a third party. Heldman, (2005).further stated that the risk does not go away, but the responsibility for managing that risk at the time of insurance rests with someone else. Other forms of transference in addition to insurance are contracting, warranties, guarantees, and performance bonds.

#### **2.4.5.4 Retaining the risk.**

Spaulding, (2005) expounds that retaining risk can also be called active retention or risk assumption. It is the process of handling the risks that cannot be avoided internally within the project or organization, either because insurance cannot be purchased for the risk, because it costs too much, or because it is much more cost-effective. Usually, retained risks occur with greater frequency, but have a low severity.

#### **2.4.6 Monitor and review**

The relevant manager is required to monitor the effectiveness of risk treatments and has the responsibility to identify new risks as they arise and treat them accordingly. Managers are also required to report on the progress of risk treatments at regular intervals.

Since risk management is a continuous and iterative process throughout the project life cycle. Wiegers, (2007) suggests that all responsible risk management team members and affected project team members should convene regularly and at specific project milestones, to review the risk register mitigation plans and make changes to it as appropriate and following those changes re-run the risk model. By constantly monitoring risks, these can be successfully mitigated resulting in cost and time savings with a positive impact on the project. This results in gain or positive use of opportunity

Once the organization or project team has developed a risk management plan and all functions of risk management are in place and running, risks require continuous monitoring throughout the lifecycle of the project or business endeavour. Monitoring of risk therefore means, according to van Zyl, (2009), to review the risk management plan and updating it continuously. As the review of the plan proceeds, the following items of work are to be done:

2.4.6.1 Identification of new risks as the risks occur

2.4.6.2 Decide where and how to handle that risk

2.4.6.3 Look for other risks that might be reduced or eliminated and no longer need coverage

2.4.6.4 Check operating capacity

It should be emphasized that risk management really is an ongoing process and risk monitoring is the last major element of risk management which has to be regularly done on a continual or on-going basis.

Identified risks require continued and periodic re-evaluation of the risks of the project which is very essential for continued risk management. The risk management process is not a once off process. According to Pritchard, (1997) risks emerge and disappear as time passes and they change their form throughout the project. Project managers should continually identify, assess and mitigate risks associated with the project in order to stay victorious over their negative effects.

Risk monitoring and control continues throughout the project until the project is complete. Heldman, (2005) defines risk monitoring and control as the process of identifying and analysing new risks, keeping track of these new risks and forming contingency plans in case they arise. Risk monitoring and control ensures that the resources that the company puts aside for a project is operating properly.

Nuseibeh and Easterbrook, (2000) asserts that the key to risk monitoring and control is communication among the team members, identifying potential risks bringing them to the project team, analysing the risks, and planning for them as they arise. Individual project team members or stakeholders are individuals or organizations who stand to gain or lose from the success or failure of a system.

With the above steps elaborated we can actually give another further specification to the risk management process as the steps you need to take to identify, analyse, monitor and control risks. Within this process, a risk can be specified as any future event that may prevent the achievement of the intended goals and a risk management process makes it possible to identify each risk, quantify the impact and take action now to prevent it from occurring and reduce the impact should it occur in the future.

Whenever the ability to meet the intended objectives is at risk, the risk management process must be implemented. If the risk is experienced on a regular basis as is the case in the construction and engineering management consultancy industry, then the risk management process should be in place to

monitor and control risks removing all uncertainties regularly (Eloff et al., 1993). Risk reviews must be conducted all the time in order to identify and quantify risks.

The resultant risks should be documented once identified. This should help in future to take actions to reduce the likelihood of them occurring.

In summary the risk management process would help the organisation to put in place the right processes for managing risks today before disastrous or detrimental consequences are encountered tomorrow.

#### **2.4.7 The process of risk monitoring and control**

Nathan & Everett Jones, (2008) suppose that for risk monitoring and control to succeed the following inputs should be in place during the process of risk management:

##### **2.4.7.1 Risk management plan**

This is a detailed methodology and approach of how to manage project risks. The risk management plan also will provide a guide around budgeting and scheduling for risk-related activities, thresholds, reporting formats, and tracking.

##### **2.4.7.2 Risk register**

The register contains a detailed risk listing for the project. Within this listing, the key inputs into risk monitoring and control are introduced and agreed upon.

##### **2.4.7.3 Approved change requests**

Approved change requests are the necessary adjustments to work methods, contracts, project scope, and project schedule. Since changes

can impact on existing risks and give rise to new risks, approved change requests are required to be able to make reviews from the perspective of whether they will affect risk ratings and responses of existing risks, and or if new risks may result.

#### **2.4.7.4 Work performance information**

This is information showing the status of the scheduled activities being performed to accomplish the project work. When comparing the scheduled activities to the baseline, it is easy to determine whether contingency plans need to be put into place to bring the project back in line with the baseline budget and schedule. By reviewing work performance information, one can identify if trigger events have occurred, if new risks are appearing on the radar, or if identified risks are dropping from the radar.

#### **2.4.7.5 Performance reports**

The performance reports show the details of the project's performance with respect to cost, scope, schedule, resources, quality, and risk. Comparing actual performance against baseline plans may reveal risks which may if unattended to, cause problems in the future. Performance reports can be bar charts, S-curves, tables, and histograms.

All of these inputs will help the project or risk manager or project team members to monitor risks and ensure successful project completion. Once all of the inputs have been gathered together, the next step will now be to engage in risk monitoring and review. The Project Management Institute (PMI) gives a guide on the best practices for risk monitoring and control, these are:

##### **a) Risk reassessment**

This is normally addressed at the status meetings. The risk picture fluctuates throughout the project as new risks arise, identified risks

change, and some risks may simply disappear. In order to ensure that team members remain aware of changes in the risk picture, risks are reassessed on a regularly scheduled basis. Reassessing risks enables risk owners and the project manager to evaluate whether risk probability, impact, or urgency ratings are changing; new risks are coming into play; old risks have disappeared; and if risk responses remain adequate. If a risk's probability, impact, or urgency ratings change, or if new risks are identified, the project manager may initiate iterations of risk identification or analysis to determine the risk's effects on the project plans.

b) **Status meetings.**

These meetings are very essential as they will provide a forum for team members to share their experiences and inform others of their progress and plans. Risk is discussed regularly here.

c) **Risk audits**

Risk audits examine and document the effectiveness of planned risk responses and their impacts on the schedule and budget. Risk audits may be scheduled activities, documented in the project management plan, or they can be triggered when thresholds are exceeded. Risk audits are often performed by risk auditors, who have specialized expertise in risk assessment and auditing techniques. To ensure objectivity, risk auditors should not be members of the project team. Outside firms may be brought in to perform audits.

d) **Variance and trend analysis**

Variance analysis examines the difference between the planned and the actual budget or schedule in order to identify unacceptable risks to the schedule, budget, quality, or scope of the project. Earned value analysis is a type of variance analysis. Trend analysis involves

observing project performance over time to determine if performance is getting better or worse using a mathematical model to forecast future performance based on past results.

e) **Technical performance measurement (TPM)**

The TPM identifies deficiencies in meeting system requirements, provide early warning of technical problems, and monitor technical risks.

f) **Reserve analysis**

Reserve analysis makes a comparison of the contingency reserves to the remaining amount of risk to ascertain if there is enough reserve in the pool. Contingency reserves are buffers of time, funds, or resources set aside to handle risks that arise as a project moves forward. These risks can be anticipated, such as the risks on the risk register. They can be unanticipated, such as events that come about unexpectedly. Contingency reserves are depleted over time, as risk triggers and reserves are spent to handle them.

Outputs of the risk monitoring and control process are produced continually, and are fed into a variety of other processes pertaining to business. Outputs of the process are also used to update project and organizational documents for the benefit of future project managers and business strategic planning.

According to Nielsen, (2007), the outputs of risk monitoring and control are:

a) **Updates to the Risk Register**

An updated risk register emanating from risk assessments, audits, and risk reviews. It is also updated with the resulting outcome of the project risk and risk response. Was it a good response? Did the response have the desired effect?

The updated risk register is a key part of the historical record of risk management for the project and will be added to the historical archives.

b) **Updates to Organizational Process Assets**

Organizational process assets should be documented in light of the risk management processes to be used in future projects.

c) **Updates to the Project Management Plan**

Updates to the project management plan occur if any approved changes have an impact on the risk management process.

d) **Recommend Corrective Actions**

Recommended corrective actions consist of two types: contingency plans and workaround plans. A contingency plan is a provision in the project management plan that specifies how a risk will be handled if that risk occurs. The plan may be linked with money or time reserves that can be used to implement the plan. A workaround plan is a response to a negative risk that was passively accepted or not previously identified.

e) **Recommend Preventative Actions**

Recommended preventative actions ensure that the project follows the guidelines of the project management plan.

f) **Requested Changes**

Requested Changes are any identified changes to the project management plan. Change requests are completed and submitted to the integrated change control process. All requested changes must be



documented, and that approvals at the right management levels are sought and obtained.

In the construction industry, according to Klemetti, (2006), projects have over the years become shared efforts of multiple parties such that the project outcome is delivered in an extremely complex network. Managing risks in these construction projects has been recognized as a very important management process that aids to achieve the project objectives in terms of time, cost, quality, safety and environmental sustainability. Understanding what types of risk are likely to be encountered in the construction industry would be advantageous in the process of risk management.

## **2.5 Risks in Projects**

Compared with many other industries, the construction industry is subject to more risks due to the unique features of construction activities, such as long period, complicated processes, abominable environment, financial intensity and dynamic organization structures, Flanagan & Norman, (1993), Akintoye & MacLeod, (1997), Smith, (2003). Hence, taking effective risk management techniques to manage risks associated with variable construction activities has never been more important for the successful delivery of a project. It is also important to understand what a project is as well as project and construction management in order for us to understand the risks associated with projects and the management of construction projects.

### **2.5.1 Projects defined**

In project management, according PMBOK, (2004), a project is defined as a temporary endeavour undertaken to create a unique product, service or result. Chatfield & Johnson:, (2002) defines a project as a temporary endeavour, having a defined beginning and end usually constrained by date, but can be by funding or deliverables, undertaken to meet particular goals and objectives, usually to bring about beneficial change or added value. Another definition from PRINCE2, (2002) is that a project is a management environment that is

created for the purpose of delivering one or more business products according to a specified business case. In order to achieve the planned benefits, the project objectives must be reached at the end of the project. Failure to achieve this means failure of the project.

### 2.5.2 Project Management

Project management is the discipline of planning, leading, organizing, and controlling resources to bring about the successful completion of specific project goals and objectives. It is often closely related to and sometimes conflated with management, Cleland & Gareis, (2006). From the Project Management Institutes' (PMI) point of view, project management is a methodical approach to planning and guiding project processes from start to finish. Kerzner, (2007), defines project management as the use of knowledge, skills, tools, and techniques to plan and implement activities to meet or exceed stakeholder needs and expectations from a project. According to the PMI, the processes of project management are guided through five stages namely: initiation, planning, executing, controlling, and closing. Project management can be applied to almost any type of project and is widely used to control the complex processes as found in construction and engineering projects.

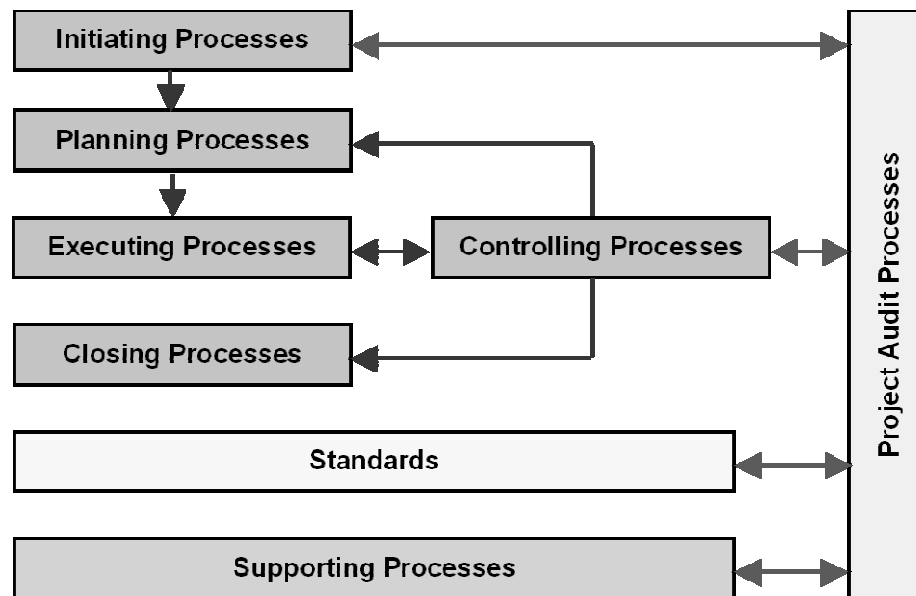
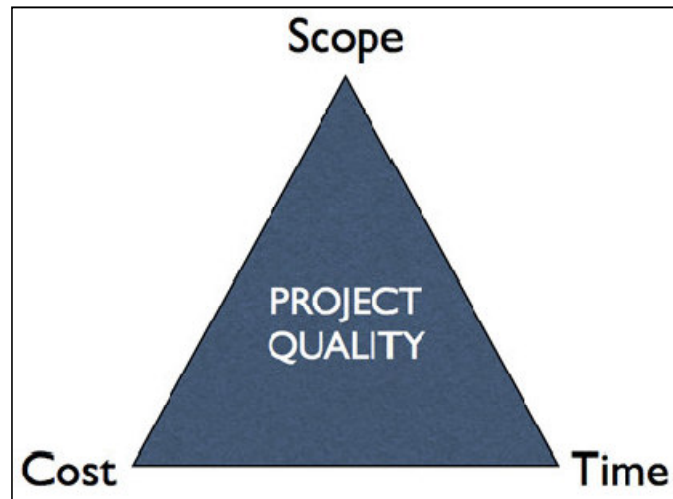


Figure 4: The Processes of Project Management. Adapted from (BKS (Pty) Ltd)

Phillips, (2003), Cleland and Ireland, (2006) state that the primary challenge of project management is to achieve all of the project goals and objectives while honouring the predetermined project constraints. Typical constraints are scope, time (schedule), and budget (cost). The secondary and more ambitious challenge is to optimise the allocation and integration of inputs or resources necessary to meet pre-defined objectives of quality and value for the money, time and other resources.



**Figure 5: Project Constraints.** (Hub, 2008)

### **2.5.3 Construction Management**

The Construction Management Association of America defines construction management as the study and practice of the managerial and technological aspects of the construction industry (including construction, construction science, construction management, and construction technology). It also is a practice pertaining to a business model where one party to a construction contract serves as a construction consultant, providing both design and construction advice. The responsibilities of a construction manager fall into the following seven categories namely: project management planning, cost management, time management, quality management, contract administration, safety management, and construction management professional practice which includes specific activities like defining the responsibilities and management

structure of the project management team, organizing and leading by implementing project controls, defining roles and responsibilities and developing communication protocols, and identifying elements of project design and construction likely to give rise to disputes and claims.

#### **2.5.4 Risks in Construction Project Management**

Looking at the above statements and various definitions, it can be deduced that projects, and the management of these projects through construction project management as found in civil engineering and construction project management firms, has a variety of risks associated with the whole process due to the complexity of the networks of clients, stakeholders, contractors, sub-contractors and sub-consultants as well as the processes involved.

Klemetti, (2006), Akintoye & MacLeod, (1997) agree that there are a number of risks which can be found in the civil engineering and construction project management environment. These risks are elaborated in the text below:

##### **2.5.4.1 Risk Categories.**

There are various categories of risk found in the engineering and management environment and these form the basis of classification during identification of risks in the framework. The following are the common categories of risks.

##### **2.5.4.1.1 Management Risks**

These risks relate to the scope, structure and strategy of a particular project. The risks under this category are listed below:

- a) Extremely large and complex project scope which may prove impossible to attain.
- b) Poor definition of project requirements and outcomes which may result in ambiguities thereby causing disputes.

- c) Poor or ineffective sponsorship or management support.

#### **2.5.4.1.2 Technology Risks**

These are specific technical risks including design omissions, version conflicts, operational failures and incompatibilities of designs. Examples of these risks are:

- a) Potential incompatibilities existing within current desktop platforms or internally customized applications.
- b) Outdated or insufficient hardware existing for running new software products.
- c) Early adopter's risk. This is early adoption of new technology which limits the ability to benefit from the experiences of others.

#### **2.5.4.1.3 Resource Risks**

We can consider human resource risks under this category of risk. Mbachu & Vinasithamby, (2005) elaborate that resource risks involves staff changes or turnover, a lack of skilled resources, staff non-performance, or the reliability and availability of external service providers. This can all work to the detriment of the project and the business as a whole. The following are the examples of resource risks:

- a) Loss of resources due to lengthy projects.
- b) The loss of key staff to competitors or vendors once they are trained and skilled in new products or technologies.

#### **2.5.4.1.4 Timing Risks**

Timing and scheduling risks can include product delivery delays, or missed deadlines along the critical path. Examples are as listed below:

- a) Annual budgets lapsing if product delivery is delayed.
- b) An overly aggressive project schedule limiting the execution of thorough test plans.

#### **2.5.4.1.5 Political Risks**

There are a number of political infiltrations on projects which have potential to affect the projects negatively. Internal sensitivities relating to project support, sponsorship, internal cooperation and communications are some of the inherent political attributes which if not handled well could be to the detriment of the project. The following are the example of political risks commonly encountered:

- a) Dependence upon one individual for visibility and support. The problem with this situation would be what would happen if the one individual were to leave the firm. There should not be dependence on only one individual to carry out marketing and support.
- b) Misalignment of project deliverables with stated company priorities.
- c) Availability of political issues that could negatively impact resource availability and cooperation.
- d) Existence of competition between projects within the company.
- e) Organizational changes that result into projects being negatively impacted.

#### **2.5.4.1.6 External Risks**

External risks are those risks which are beyond the direct control of the project team. They are caused by external environmental or industry factors and they have the potential to affect the project in many forms. Examples of external risks are given below:

- a) Potential regulatory changes from sources of work.
- b) Potential economic changes like exchange rates, global recession and other economic climates that may not be conducive for project execution.
- c) Potential company mergers.
- d) Seasonal issues, including conflicts with holidays or weather related issues.

With the above categories of risks, the end result should be a listing of likely project risks organized under appropriate category. The list should be the step by step guide from the analysing and assessing of the impacts of these risks and ultimately to the forming of an effective plan and framework for the management of risks through effective response and control.

## **2.6 Conclusion**

Risk management is a very important aspect of project management and should be dealt with as an integral part of project management. There are huge benefits that can be derived from the process of risk management. A lot of money can be gained if uncertain project events are handled in a proactive manner. When this is done, the result would be that the impact of project threats will be minimized tremendously and the opportunities to make money will be seized as they occur. With these concepts kept in mind, projects can be delivered on time, on budget and with the quality results as demanded by the clients or the project sponsors. In addition to this, the project team members will be happier and more motivated having to work in an environment where all necessary implements are in place to avoid fighting fire by preventing the fire before it can start. A number of lessons can be learned from the process of risk management. These are:

### **2.6.1 Make risk management part of your project**

In civil engineering and construction project management practice, it is important to make risk management part of the day to day operations and to include it in meetings and in the training of staff.

### **2.6.2 Identify project risks early in your project.**

Two main sources of identifying risks are people and paper. The people are the team members that bring along their experience and expertise and people outside the project that may have a track record with the type of project being faced. Paper on the other hand is a trail of documents that have been left behind from similar project done in the past. They may be in a position to reveal some information about possible risks to be encountered.

### **2.6.3 Communicate about risks.**

This is an important aspect of project management. A lot of unseen dangers can be avoided if there is effective communication between team members. It is important to consistently include risk communication in the tasks being carried out on a regular basis. The project manager and the project sponsor should also have strong lines of communication.

### **2.6.4 Consider both threats and opportunities.**

When dealing with risks focus should not only be on the incidences that may harm the project. There is always a positive chance that opportunities with high payoffs may just happen.

### **2.6.5 Clarify who owns the risks.**

This is important so that there is no confusion with responsibility and also with who should pay the bill.



### **2.6.6 Prioritise risks.**

Risks should be prioritised so that the risks with high impact are dealt with accordingly with the required resources appropriately allocated to mitigate them.

### **2.6.7 Analyse the risks.**

It is important to analyse the risks and to understand what the identified risks are all about.

### **2.6.8 Plan and implement risk responses.**

This is the activity that actually adds value to your project. There are three options available; risk avoidance, risk minimization and risk acceptance.

### **2.6.9 Create a risk register.**

A risk register should be developed and it should be regularly revisited over and over.

### **2.6.10 Track risks with associated tasks.**

When all the project risk management process has been worked through, the risks have to be tracked together with associated tasks so that improvements can be made where necessary.

Risk management should be a continuous process and there should be continuous improvement. There should also be a measure of effects of the process of risk management efforts so that the improvements can be continuous. This will ensure greater project success.

## **CHAPTER 3 – RESEARCH METHODOLOGY**

### **3.1 Introduction**

After establishing the literature review, the next step was to conduct a field study which focused on the challenges of establishing a model or a framework for management of risks in civil engineering and management firms in developing countries. The field study was aimed at investigating what risks are commonly encountered on projects as well as establishing how the risks were mitigated. In addition the study also focussed on obtaining information pertaining to the existing frameworks that are being used by some organisations so that from the existing frameworks a modification could be done to enable successful use in a developing country.

In order to elicit the required information of risks and other challenges faced in project management, various project managers and project engineers were interviewed so as to gain understanding of the risks they encountered during the project lifecycles of the projects they have managed in the past or currently working on. This section seeks to explain the data collection process, data analysis, limitations and ethical considerations of the research.

### **3.2 Data Collection Process**

Several steps are involved in the data collection process. This includes identification of variables or phenomena, selection of sample, selection of the type of data required, collection methods, pilot study, modifying collection methods and the final data collection. Figure 1.5 illustrates the data collection process suggested by Collis and Hussey (2003).

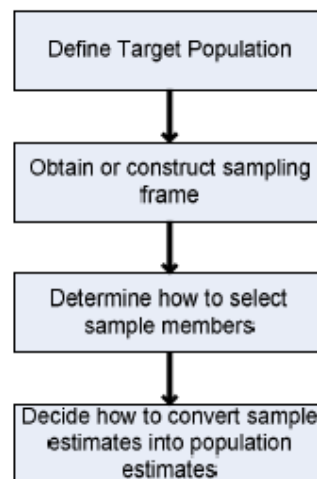
#### **3.2.1 Variables**

Martella, Nelson & Marchand- Martella, (1999) define a variable as an entity chosen as a unit of analysis. A variable can change from time to time. Collis

and Hussey (2003) outline that there are quantitative and qualitative variables and the former is a numerical attribute whereas the latter is a non-numerical attribute. There are also independent and dependent variables. Independent variables can be manipulated to predict the values of dependent variables whereas dependent variables are those whose values are predicted by the independent variables (Collis & Hussey, 2003). Variables are however used more in quantitative research than qualitative research. This research project focuses on qualitative variables.

### 3.2.2 Sample

A sample is a subset of a population. In a given population, it is impossible to consider all entities and therefore a small part of the population is chosen to represent the whole. An example of a population is the whole Civil engineering and construction project Management firms including all other stakeholders. However, a small number of these firms is chosen to represent the whole population. When selecting a sample, certain measures have to be taken. These include defining the target population, constructing a sampling frame, determining how to select sample members and deciding how to convert sample estimates into population estimates. Figure 4.1 illustrates the steps taken on selecting the sample.



**Figure 6: Selecting a sample** (Collis & Hussey, 2003)

The target population consisted of Civil Engineering and construction project management firms. The research was conducted in Gauteng and Mpumalanga Provinces of South Africa therefore the sampling frame was the civil engineering and construction project management companies dealing with various types of civil engineering related projects. The sampling frame included large Engineering and management firms such as BKS (Pty) Ltd, KV3, Vela VKE, PDNA, WSP and others. The frame also included smaller one man consulting firms such as Afrisa Consulting (Pty) Ltd, Bapedi Consulting, Mingilo Property developers and Construction project management and others.

A purposive sample was used for this research. Saunders, Lewis and Thornhill, (1997) state that a purposive or judgemental sampling enables a researcher to select cases that best enable him/her to answer research questions and meet objectives. Neuman, (1991) agrees with Saunders et al. (1997), by outlining that a purposive sample is also used when research is informative and the sample size is small. Saunders et al. (1997), further mentions that, under purposive sampling there is a common strategy called heterogeneous or maximum variation sampling which enables a researcher to collect data in order to describe and explain the key themes under observations in this case the research project seeks to acquire in-depth information from respondents, within a particular context.

When eliciting information from the recipients, the researcher uses convenience sampling which involves conducting research with individuals available to the researcher (Martella, et al., 1999). Saunders et al. (1997), agrees with Martella et al. (1999), and states that convenience sampling involves selecting cases which are easiest to obtain.

This research took place at different project sites and offices in various companies. Interviews were conducted with project managers and project engineers responsible for various projects in Gauteng and Mpumalanga provinces.

The focus for interviews was on project directors, project managers, assistant project managers, project engineers.

### **3.2.3 Type of Data Elicited**

Collis and Hussey, (2003) define data as known facts or things used as a basis for inference or reckoning. The difference between data and information is that information is data which has been organised into a useful form. The sources of data are primary data and secondary data with the former being survey data obtained from a controlled situation by asking questions and making observations and the latter being data which already exists such as books, documents, published statistics, annual reports and films (Collis & Hussey,2003).

The data collected was mainly primary data obtained through interviews and observations. The type of data collected was qualitative. Qualitative data is non-numerical data. Since this research project aimed at discovering the risks inherent to projects and discovering what risk management frameworks are in use for the purpose of modifying a model to be used for project management in a developing country, open-ended questions were presented in an effort to acquire information from interviewees. For this qualitative research, data is represented in narrative forms and the phenomena are studied holistically as a complex system (Martella, et al. 1999).

Qualitative research was used in this research because the nature of issue at hand involved managerial and organisational issues resulting in qualitative research methods being more favoured than quantitative research methods (Myers, 1997). Qualitative research methods build new operations and management theories (Meredith, 1998). Thus the researcher collected qualitative data which would be useful in the model that would help in the management of risks in project management. The model would be arrived at from a combination the existing risk management frameworks used previously elsewhere and the types of risks likely to be encountered during the project

lifecycle. This leads to the next section which explains the data collection methods including permission from the organisations to allow the researcher to conduct the research with their project managers and engineers.

### **3.2.4 Data Collection Methods**

It was imperative that the researcher should seek permission to interview project directors and managers as well project engineers in the organisations in the sample frame. Letters of permission to conduct the study were sent to the firms prior to the interviews. Permission was granted and the next thing to be done was to design the questionnaire that would be used during the interviews.

## **3.3 Construction of Questionnaires**

The process of designing the questionnaires spanned from the beginning of March 2009 to end of March 2009. It consisted of four sections. The questions were semi-structured interviews to enable the easy understanding of the interviewees. The semi-structured interviews enable recipients to provide their own answers and opinions to the questions (Martella et al., 1999).

**3.3.1** The first Section of the questionnaire focused on information pertaining to the project manager as individual relating to the project. To enable the researcher to know some critical information about the interviewee, this section of the questionnaire was included although some details like the name of individuals was not mandatory. This section of the questionnaire enabled the researcher to know the levels of experience and positions of authority the various individuals occupied in their firms.

**3.3.2** The second section dealt with the issues of project and risk management methodologies to determine the knowledge base of the personnel handling projects in various organisations

**3.3.3** The third section was meant to determine the presence of formal risk management processes in the organisations, this part of the

questionnaire was included so that the whole process of risk management is investigated to determine what risk management frameworks are in place. The results will indicate if there is formal risk management processes in place or not. With this section, the researcher could also deduce the various risks apparent in various undertakings.

**3.3.4** The fourth section was included in order for the researcher to have a conclusive determination of the consequences of existing policies, processes, frameworks of risk management including the various risks the projects are exposed to in various situations. It was necessary to have success rate for the projects so that it gives indication of effort and result.

After designing the questionnaires, a pilot study was conducted in order to verify if different respondents understood the questions in the same way.

### **3.4 Pilot Study**

The questionnaire was tested prior to use in the field study. The testing of the questionnaire lasted for 2 weeks. The pilot study was conducted in order to modify the questions. However there were no changes made to the questionnaire.

After the testing of a questionnaire, the next stage was to collect the data from the field, record it then analyse it.

### **3.5 Collecting the data**

At the start of the interviews, the interviewee was assured of confidentiality and that any information given would only appear in the research paper, conference papers and journals which would add value to the organisation because of the risk management framework. The data collection process ranged from the end of April 2009 to end of May, 2009. The interviewees and questionnaire respondents were thanked for their participation.

### **3.6 Recording Data**

During interviews, notes were taken and a tape recorder was used to capture all the information. This information was later transcribed. Before recording any information, the respondent had to grant permission to have an audio recording. After the data collection, data analysis followed.

### **3.7 Data Analysis**

Qualitative data analysis comprises of quantifying methods and non-quantifying methods of data analysis. Quantifying methods of qualitative data analysis involve changing qualitative data to numerical data whereas non-quantifying methods do not. The methods associated with quantifying methods of qualitative data analysis include informal methods, content analysis and repertory grid techniques. The non-quantifying methods of qualitative data analysis include general analytical procedure, cognitive mapping, data displays, grounded theory and quasi-judicial methods (Collis & Hussey, 2003).

The non-quantifying methods were used when analysing the collected data from questionnaires from interviews and recipient's questionnaires. A general analytical procedure was used in analysing the data. Many data analysis steps were taken after data collection.

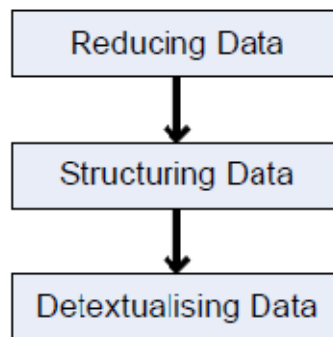


- 3.7.1** The first step was to convert the rough notes into written record. The rough notes consisted of the interviews on tape recorder as well as observation notes. These interviews and observations notes were transcribed onto a word document which took considerable lengths of time. No interpretation was done and everything was copied word for word.
- 3.7.2** When transcribing every interview, the researcher would refer to his diary and record the name of the interviewee, the date of the interview and also the context in which the interview took place. The researcher would take note of the job description of the interviewee and add that to the document being transcribed.
- 3.7.3** The next step was to start the coding process. Similar trends within the data were observed. The code might have been a word or phrase. The significance of that word or phrase to the research would be explained. Data was reorganised and categorised.
- 3.7.4** After finding the necessary codes, the next step was to categorise the codes into smaller categories. Certain themes would emerge from the data and data would be reorganised and further categorised.
- 3.7.5** After each category, summaries were written and thoughts were also put on paper.
- 3.7.6** In the last step, generalisations were constructed from the findings.

The process of analysis took place in workbooks which helped differentiate the raw data, coded data, categorised data, summarised data and generalisations. The following are the work papers used in the research

- 3.7.7 Work paper 1: contains raw material from interview notes
- 3.7.8 Work paper 2: summarised the raw data in work book 1 for each of the main points
- 3.7.9 Work paper 3: reconstructed the data in work book 2 and further reorganised and categorised the data
- 3.7.10 Work paper 4: summaries of findings and the overall assessment of the social grant distribution process.
- 3.7.11 Work book 5: contains the findings of the research and the recommendations (adapted from, Collis & Hussey, 2003)

There were however, challenges during the data analysis stage. These included reducing, structuring and detextualising the data.



**Figure 7: Challenges of Qualitative Data Analysis** (Collis & Hussey, 2003)

Reducing the data was a challenge in that there was a large volume of field notes collected and so correct coding procedures had to be undertaken to avoid losing important data in the mix-up. In order to overcome this, main themes were outlined while data was being analysed. The questionnaire was structured and that made analysis easier. The disadvantage was that the outcome of data was controlled and this is known as anticipatory data reduction which is not preferred in phenomenological studies (Collis & Hussey, 2003). Detextualising data was a problem because all of the text was not in numerical form and consisted of risk management processes and actual risks and other knowledge challenges encountered during the project executions. This made it difficult to convert text into diagrams and illustrations for analysis and presentations (Collis & Hussey, 2003).

### **3.8 Limitations**

The limitations of the research were that it focused on risks encountered in projects, existing frameworks in the project management to manage risks and also the skills levels to undertake project management. There are several other problems that inhibit project success. The research was however limited to risk management frameworks and risk encountered in projects. The other challenge was that some respondents and interviewees could not make time for the scheduled appointment and some could not reschedule entirely while some chose not return the questionnaires. This naturally resulted in the data collection process lasting longer than anticipated. Some respondents were not always willing to disclose certain information especially information regarding political influence in procurement processes. It took a while to build trust between the interviewer and the interviewee. This had to be done through assurance that the information would remain confidential and that names would remain anonymous.

### **3.9 Ethical Considerations**

Whenever there is potential for conflict of interests according to Babbie & Mouton, (2001), ethical issues arise out of interactions with other individuals. In qualitative research, information is collected through interviews but not at the expense of the organisation or individuals being interviewed. Some of the information elicited was sensitive since it dealt with some company financial and operational issues. Some information also involved incriminating data about existence of political influence in the procurement system. The researcher however ensured that no harm came to the participant's reputation and job and that they remained anonymous (Kuale, 1996). The researcher assured all the participants that all the information would remain private and confidential and it would be only found in the library, academic journals and within the organisation if so required. The disclosure of some of this sensitive information would reflect badly on the organisations since the study was on investigating on risks and the frameworks used to manage risks.

### **3.10 Conclusion**

The overall research methodology consisted of the data collection process, data analysis and limitations of the data collection process. The data collection process involved identification of variables, selection of the sample, and selection of the type of data that would be required, the collection methods, the pilot study and data collection. The research study focussed on qualitative variables.

Semi structured interviews and observations were used to elicit data. A pilot study was conducted in order to further refine the questionnaires. During data collection, data was recorded and later transcribed for analysis purposes. General analytical procedure technique was used during data analysis.

## **CHAPTER 4 – FINDINGS AND DATA ANALYSIS**

### **4.1 Introduction**

A total of thirty questionnaires were prepared for both sending to project personnel on various projects and offices as well as for personal interviews with the project managers and engineers that would be available for interviews. Some project managers were managing currently running projects at the time while others recently completed their projects and were in process of redeployment to new projects. There was no discrimination regarding the level of success, size and complexity.

From the combination of interviews and questionnaires, the response rate was 73.3% which is a fairly good response for the purpose of this study. For the purpose of conformity during the analysis, the 73.3% response rate will be interpreted to be equal to a total of 100% respondents as a baseline.

A diverse number of risks were discovered to be generally encountered on projects by various respondents. These risks are common to recently completed and ongoing projects. It is important to note that the listing is not necessarily showing the importance of the risks discovered.

### **4.2 Identified risks**

#### **4.2.1 Material price increases**

This is one of the common issues picked up from the study generally experienced on the majority of recently completed and current projects. The price of steel and other major construction material on most projects was found to be a risk that was not anticipated such that it affected the duration of projects and caused major increases in the cost of the projects giving rise to numerous variation orders. In addition the price of fuel for major projects involving heavy industrial plant has had a very heavy toll on the overall cost

of the projects as this has escalated tremendously over the past few years. 100% of the respondents confirmed having had problems with cost escalations due to material price increases on the projects.

#### **4.2.2 Late Design problems creating more concurrent work**

These events of delayed designs subsequently on a number of projects caused delays in the commencement of work generally. This eventually gave rise to unavoidable concurrent work. Despite this arrangement, the contractual completion date still was pushed out resulting in extension of time with costs in most of the affected projects.

59% of the respondents encountered design problems on foundations on major projects. Some of these delays in design completion were as a result of poor communication or response from the Client. This resulted in delays for subsequent works that depended on the completion of foundation work. It was concluded that a lot of attention has to be on the preliminary design stages where all aspects of the design especially of the foundation is attended to such that there is no hold up on the construction or implementation phase of the whole structure. In addition to that, it was concluded that there must be adequate liaison between the designers and client to avoid last minute changes that may hold works and cause unnecessary cost escalation due to poor designs.

#### **4.2.3 Inadequate Risk Management, Planning and Identification of Risks at the start of the project**

Risk planning has to be done during the inception of the project. This is to enable the project management team to understand what they are up against as they pursue the project and to find ways of alleviating the effects and if possible find ways of avoiding the risks altogether.

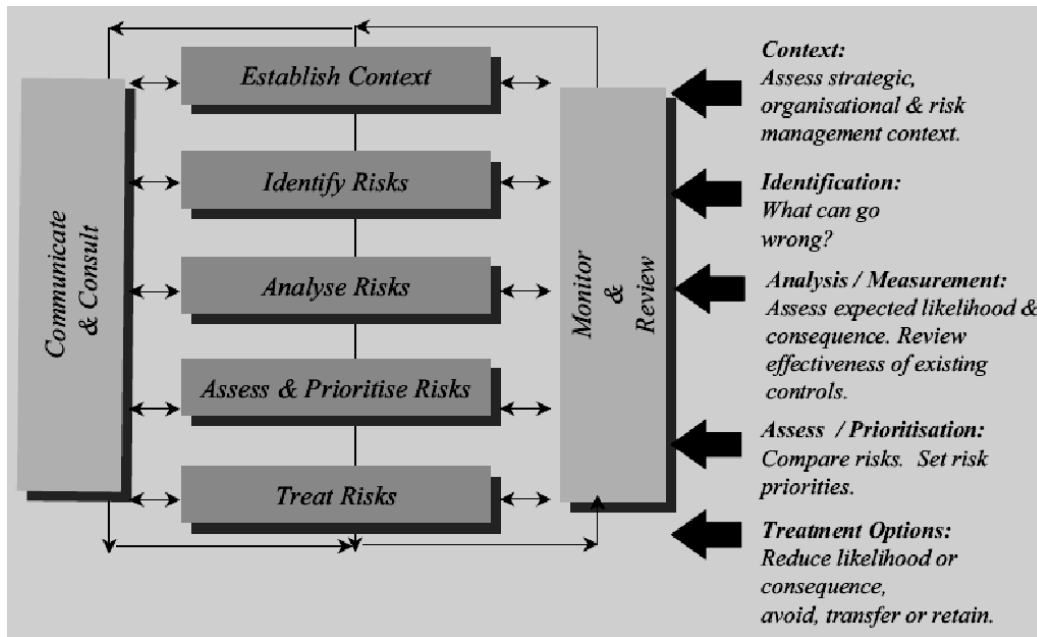
Only 16% of the Project Managers and Engineers interviewed start the management of their projects with risk management planning. 84% do not

bother to plan for risk. Half of this figure – 42%, specifically mentioned that they handle risk management issues at the end of the project. This is too late to deal with risks on a project since the effects would have been suffered by the time the project is completed. At the end of the project, the manager should be doing final risk auditing. This shows the need to have a strict culture of risk management together with a risk management framework that will simplify the work of identification, assessment, analysis and treatment of risks in a more consistent professional format.

Of the 16% of professionals who handle risk management planning, it was observed that before the tender stage, they do a risk profile for the job they plan to undertake. At the time they are appointed and are now accepting the offer, they do another risk assessment. When they commence works they do another risk assessment. At all these times, it was discovered that they uncover more and more different risks and they are more able to handle all as the work progresses.

The common procedure noticed through out the survey was that risks were dealt with as they appeared. This is a very big risk in itself. Risks have to be identified before they occur and ample preparations should be made to mitigate them or planned for if unavoidable, well in advance so that surprises are avoided.

Below is the model of risk management procedures conducted by the few professionals in one company that does risk management activities from tender stage through to handover of project: This risk management procedure came about as own initiative based on guidelines from the Australian and New Zealand standards for risk management. For each stage of the project lifecycle, the project manager is tasked to undertake all the risk identification processes so that further analysis and treatment procedures could be instituted. The risk management efforts pay off usually despite the absence of a structured formal methodology for handling risks.



**Figure 8: Existing risk management model for Mingilo Property Development and Construction Project Managers (Pty) Ltd. Adapted from AS/NZ 4360,(2004)**

#### **4.2.4 Lack of sponsorship of risk management activities**

It was also observed that some project sponsors have no budget allocated to take care of the management of risk. With time, if risks are not investigated and contingency plans not put in place, the result will be potentially catastrophic as time bombs are set in motion and ready to surface at any time along the project timeline.

84% of the respondents pointed out that there is no budget allocated for the risk management activities on projects. 16% said despite the lack of sponsorship, they still handle the risks at risk to remain on a safe side. Note that the 16% is also the more senior professionals with vast experience in project management and they all came from one firm where it apparently is company policy to do risk management as a quality assurance operation within the firm although there is no budget for it.



#### **4.2.5 Lack of project management knowledge**

Some site personnel handling certain major intricate projects lack project management knowledge and expertise. A number of projects have been noted to have in key positions, young and inexperienced Engineers as Project Managers charged with delivery of complex and involving Tasks. Depending on the size of projects, the Project Manager should have relevant knowledge and experience to handle the intricacies inherent to the projects.

16% of respondents have had prior project management learning coupled with vast years of experience on projects as Project Managers. They are experienced and handle very complex projects of both Civil Engineering and building nature. A further 33% have had engineering qualifications and low level Project and Engineering Management skills. They do not see fully the relevance of risk management activities and so go with the flow of the project which may be catastrophic in the end. The rest (51%) have only engineering qualifications and lack project management exposure and mention that they are not interested in any of it despite being in the project management environment.

#### **4.2.6 Higher risk component due to higher capital budget for the projects.**

Some projects visited during the survey had very well seasoned project managers (16%), whose teams handled risks from inception to completion due to the fact that the risks in place are very high. This ensures that the project successfully completes with all deliverables achieved. They institute more stringent measures in order to reduce the effects of the risks and ensure successful completion.

#### **4.2.7 Unreasonable short project construction periods**

Nearly 100% of respondents complained that clients insist on unreasonable time frames for the projects resulting in short durations. Unreasonable time constraints result in reduced quality of projects. It was noticed that some

projects had been restricted to very short construction periods. This resulted in a compromise on quality and inevitably having a risk of increasing cost due to unacceptable works done in a rush which in turn cause unnecessary and unavoidable time costs due to redoing of the work. The construction period should be optimum so that even when tradeoffs are put in place, a balance is easily achieved between time, cost and quality.

#### **4.2.8 Design change at very late stage.**

This will always result in several costly variations and eventual claims and if not well handled will cause serious disputes with a chance of ending in litigation. This was noticed from 33% of respondents who made mention of the fact that some clients have this tendency of changing project scope as they see fit at any time disregarding the cost and time effects on the project as a whole together with the other contractual complications that come along resulting in disputes eventually.

#### **4.2.9 Severe competition over price**

Service delivery has been hampered a lot by the fact that some clients have lately insisted on appointing service providers based on a low price. This is in the long run affecting the quality of the service provided since most of the bidders with low price have little capacity and not certainly driven by quality. In addition there is also a chance that the level of skill is low in these firms. 100% of respondents have encountered this problem where they are forced to issue ridiculous discounts for them to just secure an appointment. In most case this still does not work for them.

#### **4.2.10 Channels of Communication on projects**

Information flow should be channelled through the rightful person on the project, the Project Manager or the Project Engineer on engineering projects. It was discovered on some projects with 21% of respondents claiming that the flow of information is haphazard with the various parties to the project assuming some of the roles of the project manager.

It was particularly discovered that on some government projects, the client's project coordinators and technicians instruct the contractor in the absence of the project manager overriding his delegated powers. Eventually when problems arise, due to the said instructions, they turn around and blame the project manager. This is very common apparently.

The channel of communication should always be through the Project Manager or Engineering Manager whoever is driving the project.

#### **4.2.11 Poor and no response by Clients to Contractual issues on projects**

An observation was made on a number of projects that there was often unacceptable delays when responding to key issues communicated to clients by Engineers and Project Managers and in several instances no response at all when key contractual issues are to be decided. This has potential of causing disputes later on in the project as reported by 63% of the respondents. This is particularly common on Municipal infrastructure projects where the Technical Personnel in client's offices are very reluctant to commit themselves.

It was observed from the same lot of respondents also that they have encountered some clients who have a tendency of trusting the judgement of the Consulting Engineers and Project Managers to decide on everything that is encountered on site without their knowing about the matters. The unfortunate part is that the client later blames the engineer if anything goes wrong despite having been forewarned.

#### **4.2.12 Inclement weather on projects**

Excessive rainfall is one risk that was also commonly submitted by respondents working on projects of building and civil engineering nature such as building works, roads, storm-water and water pipeline projects. Unplanned for excessive rainfall has potential to hamper works and therefore slow down progress with the eventual risk of having extension of time due to bad weather.

This is unforeseeable and an act of God. 82% of the respondents have been affected by rainfall on their projects.

#### **4.2.13 Political interference on the procurement process**

83% of the respondents deal with projects attached to the Government procurement system. One of the findings common to all the professionals is the frustration caused by the political interference in the procurement processes in Central and Local Government Departments. There are complaints of favouritism on the basis of political affiliations even though some so-called professionals and contractors have no capacity to perform certain works. This has resulted in poor project performance and eventual unnecessary costs.

### **4.3 Risk Categories observed**

The risks discovered were further analysed and grouped to give a more clear understanding of the findings. These risks are financial, management, quality, and market, technical, legal, political and environmental risks.

#### **4.3.1 Financial Risk**

The current global economical situation has affected a lot of business operation including businesses in the construction industry. This has caused the construction industry to pay a considerable price through high cost of material and running costs due to high fuel prices. Financial risk is thus a serious risk to consider which has to be well planned for to maintain good profitability of projects.

The risks that can be considered under financial risk in this study are listed below:

- a) Material price increases
- b) Design problems causing cost overruns and delays thus culminating in financial loss.
- c) Lack of sponsorship of risk management activities. This can have an impact on the cost of the project due to the fact that there was no adequate funding of risk activities. This may end up offsetting the finances of the project.
- d) Severe competition over price is another risk under financial risk. The tendered price has to be financially viable for the project to be successfully completed. Ridiculous discounts mean low profits or no profits at all. This eventually causes poor quality.

#### **4.3.2 Management Risks**

Management risks are mainly organisational risks that require direct or indirect input from management as they depend on the decisions of the corporate body. The risks in this group are:

- a) Lack of project management knowledge. It is up to management to equip the labour force with the necessary skills in project management so that they can complete the tasks in time, at right cost and to quality expected.
- b) Lack of sponsorship of risk management activities. For risk activities to succeed, management has to deliberately put in place measures and funds to govern and carry out risk management activities consistently.
- c) Inadequate risk management planning and identification at the start of the project. This is also very much dependent on management policies. If management insists on risk management policies regardless of the size of the project, all personnel will follow through with the policy.

#### **4.3.3 Quality Risk**

For the project to be successfully complete, the component of quality should be to the expected level. A number of events can cause quality to be compromised thereby causing project failure, these are:

- a) Severe competition over price causing poor quality of service due to heavy discounts
- b) Unreasonable short project construction periods causing rushed work overlooking quality
- c) Lack of project management knowledge. Even though the project manager is not responsible for quality, he can influence quality by his level of proficiency

#### **4.3.4 Market Risk**

Material shortage & steep increase in material prices have affected the construction industry a lot in recent years. This has caused many projects to slow down or be on hold causing high competition for the few projects available. Examples of this risk are:

- a) Material price increases
- b) Severe competition over price
- c) Unreasonable short project construction periods to see who can deliver faster and cheaper

#### **4.3.5 Technical Risk**

Improper planning, designs and budgeting, improper feasibility studies, no past experience in similar projects are some technical risk faced on projects by many companies. Examples of this risk are:

- a) Design problems on foundations
- b) Design change at very late stage
- c) Poor communication from the clients' side in terms of approval of designs and other technical procedures.

#### **4.3.6 Legal Risk**

All risks with the potential of giving rise to disputes have been considered and listed below.

- a) Design problems on foundations and Design change at very late stage giving rise to variation orders. If not handled well may cause costly legal complications.
- b) Channels of Communication on projects could be a source of legal risk if not managed well.

#### **4.3.7 Political Risk**

Political risks are rampant in projects from the central government and local government organisations. It is always present and very risky for professional service work.

#### **4.3.8 Environmental Risk**

During rainy season, sustained heavy downpours cause water to pond in foundations and wide working surface areas to the disadvantage of progress on the projects.

Extreme temperatures are also a source of delays on some projects since the workers are unable to work in direct sunlight in such high temperatures. This as well causes delays.

### **4.4 Conclusion**

Risk management can be concluded to be a very important aspect of project management which cannot be detached from project management. Without proper consideration of risk and opportunity side of projects, prediction of project outcome cannot be foretold since the project team cannot tell what they are up against.

As can be seen from the analysed data, there is a very imperative need to research risks and analyse them before the project starts and while the project is running so that check and rechecks are conducted to keep the project on a profitable side. There are certainly so many factors that affect the project negatively and positively as seen in

the findings. To manage these risk factors, a systematic risk management framework is required which would ensure that all the aspects of risks are explored to determine the effects that they will have on the project. Sometime the effects of some of the risk items are not as bad as they may be feared. The framework will enable good informed decisions regarding risks.



# **CHAPTER 5 - PROPOSED RISK MANAGEMENT FRAMEWORK**

## **5.1 Introduction**

A well balanced and proactive risk management framework for an engineering and management firm can not just happen automatically, there has to be much ground work, laying down the right foundation for the risk management framework activities. All the various framework component functions must align with the business management context.

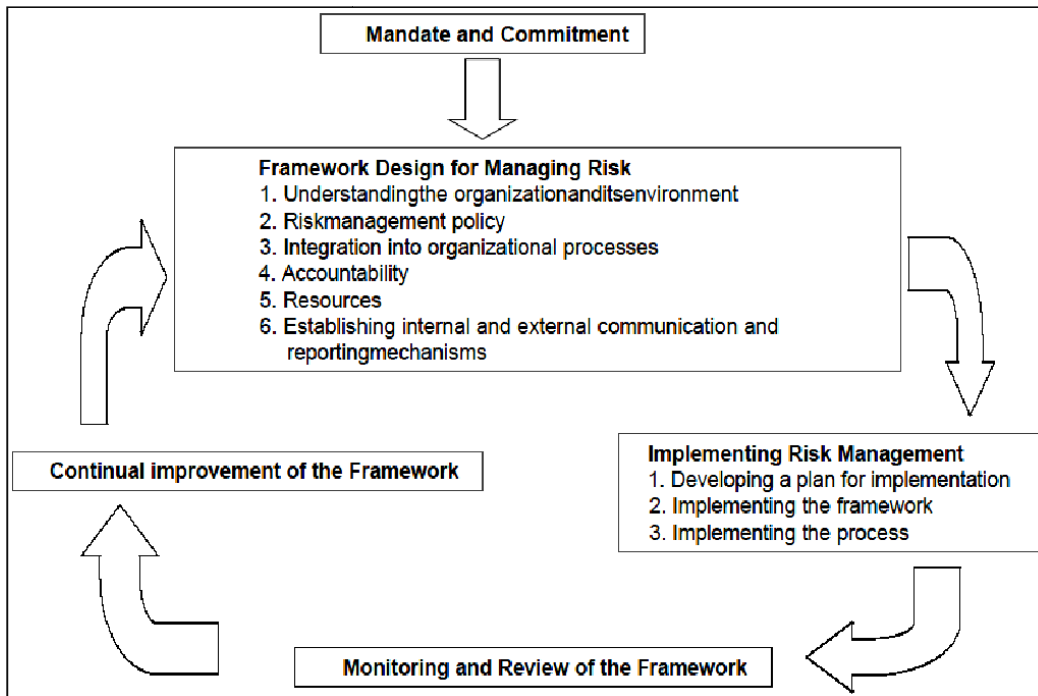
There is one fact that cannot be further emphasised that risk management is a very important integral part of project management which requires strong and continuous commitment by all relevant personnel involved at all levels of the organisations that are involved in carrying out projects. It is also very important that top management be as well much involved and committed to risk management for the successful implementation and positive results of the risk management processes.

For any business operation to be successful and sustainable in the organisation, risk management should be embedded in the organization's core operation and should be supported by top management in such a way that there is commitment and involvement of all.

## **5.2 The Risk Management Framework**

The purpose of having a framework for managing risks is to assist an organization to manage its risks in the most effective and efficient way, making use of the risk management processes at varying levels and within specific contexts of the organization. All the information derived from the risk management processes must be reported adequately so that it may be used as a basis for making informed decisions at all relevant levels in the framework.

The figure below shows the interconnection and interdependence of various items of work at various stages during the risk management.



**Figure 9: Risk Framework Design, Implementation Monitoring and Improvements. ISO 31000, (2009)**

### 5.2.1 Mandate and commitment

Since risk management is not an exercise that should be carried out once and forgotten, for effective results to be seen, Risk management should be done as an ongoing activity requiring constant commitment until the project closure. Therefore, there has to be a mandate from top management in order to see effective results and commitment by all subordinate offices. There has to be support from the highest office in the organisation to the lowest for risk management to succeed.

### 5.2.2 Design of framework to manage risk

For effective implementation and management of the risk management framework, quality time has to be spent on the planning and design of the framework. This will include the following: formulation of the risk

management policy, determination of processes and strategies, embedding the processes into practice, assigning resources, determining responsibilities and defining the context of the risk management framework.

In addition to the above, the design of the periodic reporting system and associated frequency of reporting to all stakeholders will be required. The effective communication between the stakeholders will sustain and ensure achievement of goals and effective risk management implementation.

### **5.2.3 Implementing risk management**

This stage of the process is the core of the whole exercise. It will involve detailed and concerted communication and training to ensure that the risk management process is understood by all risk owners, stakeholders and practitioners. The processes involved will take place through risk assessment, risk workshops, brainstorming etc. Once the risk management framework has been designed and detailed, implementation will now commence by putting the developed theory into tangible practical application.

### **5.2.4 Monitoring and reviewing framework**

This is not a one day process. It will involve checks, verifications and confirmations that the various risk management elements and activity stages are working effectively and harmoniously in line with the expectations. If at any point there is discovery of inconsistency, the matter is to be identified and documented and efforts should be in place to make corrections.

### **5.2.5 Continual improvement**

Room has to be created to do regular inspections of the whole process steps and to make new discoveries of where to make new improvements on a continuous basis. Over time a more mature risk management framework could be developed if there is a high level of commitment and involvement by all players.

## **5.3 The Proposed Risk Management Framework Flowchart**

The risk management framework is illustrated in the flowchart in figure 7 below and further detailed in the proposed generic risk management framework in projects. The illustration is a modification of the existing risk management processes as detailed in the Australian and New Zealand standard for risk management AS/NZS 4360, (2004). The flowchart shows what constitutes the risk management framework which should be followed when managing risks. It comprises of five key activities. These key activities are highlighted further below:

### **5.3.1 Communication and consultation**

In the risk management framework, this activity is concerned with engaging all the involved internal and external Stakeholders throughout the risk management process. It is very important that all the stakeholders are well informed through good communication. The framework will promote consultation between various parties within the project. Good communication will help to establish expectations and to shape the framework of risk management thereby ensuring that all stakeholders' inputs are considered. This will promote participation and commitment to the process. Communication will have to be seriously practiced throughout the risk management process with both written and verbal communications done between the risk manager, risk owner and stakeholders continuously.

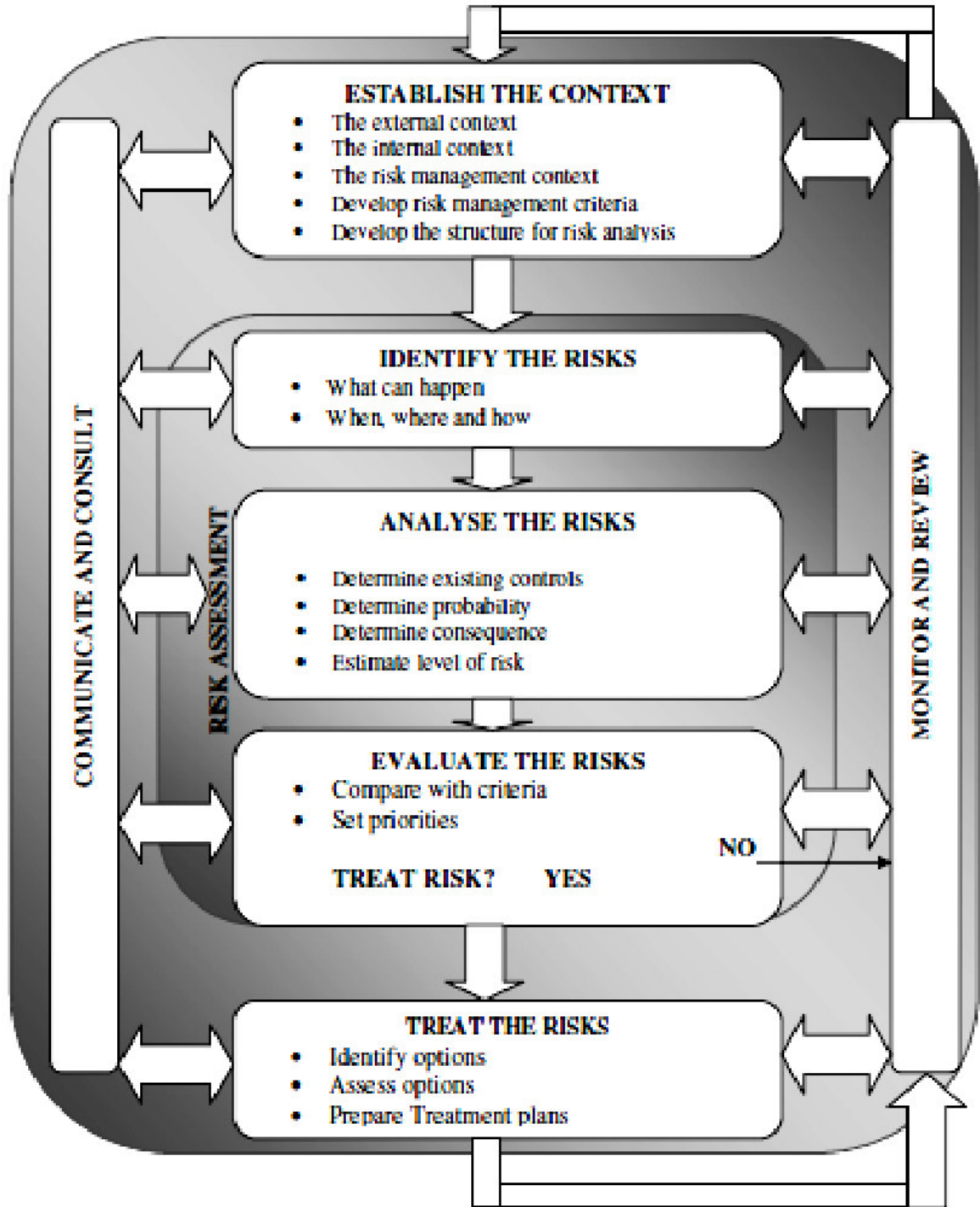


Figure 10: The Proposed Risk Management Framework Flowchart

### **5.3.2 Establishing context**

The aim or purpose of establishing the context is simply to set the boundaries around the organisation's risk management activities and the applicable policy governing the risk management operations. Both external and internal factors must be considered when establishing the context. The external factors to be considered are: social, cultural, political and economic while internal factors are: strategic, resources and capacity. Establishing a risk management policy is an important step and includes processes, methodologies, plans, and risk rating criteria, training and reporting processes. The political, economic, social, cultural and technological environment must also be thoroughly analysed to be able to understand the risks involved.

### **5.3.3 Risk assessment**

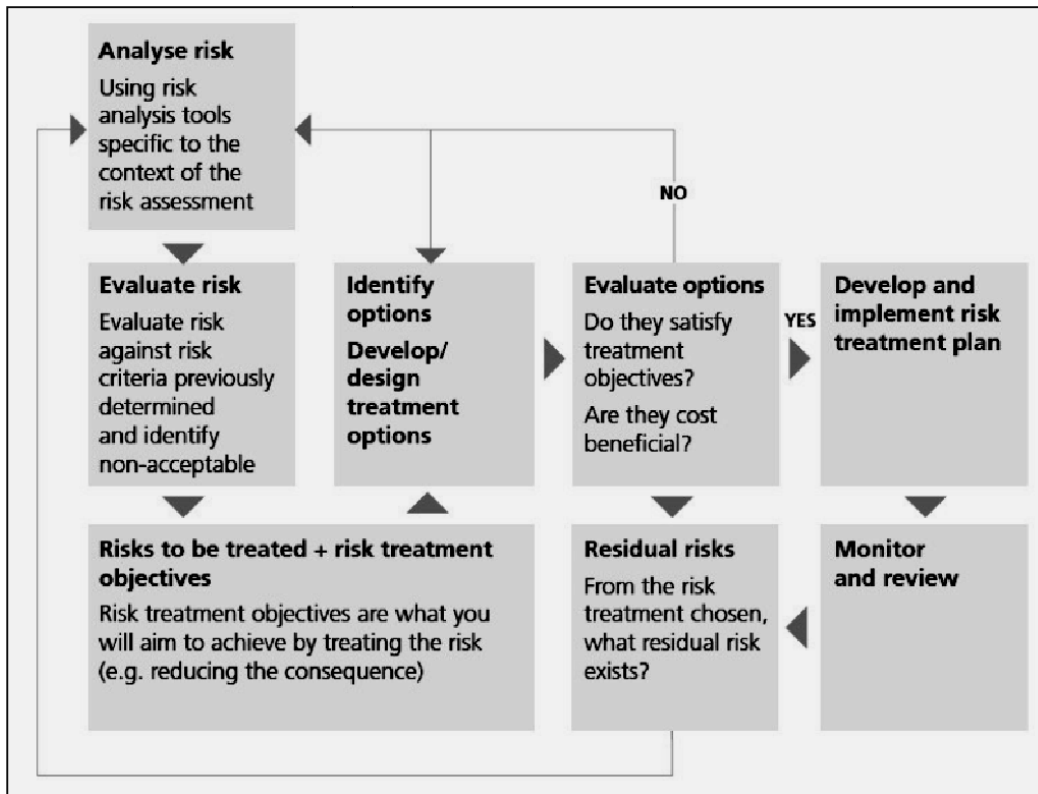
Risk assessment comprises of the processes of Identifying, Analysing and Evaluating Risks. A number of risk identification techniques are available and these will include brainstorming, work breakdown analysis and expert facilitation, ISO/IEC 31010, (2009).

Risk analysis considers possible causes, sources, probability and consequences to establish the inherent risk. Existing management controls should be identified and their effectiveness assessed to determine the level of residual risk. After this analysis, an evaluation of the level of risk is required to make decisions about further risk treatment. Below is the model for the risk assessment process with forms that show some necessary requirements during assessment.

### **5.3.4 Risk treatment**

After the risks have been assessed, all the intolerable risks must be treated. There are various ways of treating risk. Risk owners can treat risks by avoiding the risk, treating the risk sources, modifying the likelihood or probability, changing the consequences or further still sharing the elements of the risk. If there is some level remaining, the retained risk should be within the

risk level that can be handled by the organisation depending on the risk appetite of the organisation.



**Figure 11: Risk Treatment.** Adapted from AS/NZS 4360, (2004)

### 5.3.5 Monitoring and review

In order to maintain the risk management framework relevant to the changing needs of the organisation and other external influences, it is important to regularly monitor risks and the risk management framework including all the processes involved.

The process of monitoring and reviewing will have to be undertaken by risk owners and top management as well as an independent review of the risk management framework from time to time.

## **5.4 The Proposed Generic Risk Management Framework**

In order to have a detailed description of actions while at the same time being able to follow step by step the processes in the risk management flow chart, a detailed framework was adopted and presented in the spreadsheet below.

All the major activities from project inception are incorporated since risk has to be identified from pretender stage through construction project management until handover. The framework covers all aspects of construction project management such that all risks as observed in the findings can be as much identified and dealt with as possible.

The framework can be utilised using computer programmes or using hands where the information gets filled, analysed and filed for future reference.

This model is easy to monitor and review as well as modifying should a need arise to suite the needs of a project.



THE GENERIC RISK MANAGEMENT FRAMEWORK IN PROJECTS				
ESTABLISH THE CONTEXT OF THE PROJECT				
<b>1</b>	<b>PROJECT DETAILS</b>			
1.1	Project description			
1.2	Project location			
1.3	Is this a further stage/new area of an existing project?		No	Yes
1.4	Does the scope of the project fall within your firm's core business?		No	Yes
1.5	What is the strategic value of the project?		Low	Average
1.6	What is the Main discipline (e.g. engineering, project management)			
1.7	What other disciplines are involved?			
RISK ASSESSMENT				
<b>2</b>	<b>COMPETITIVE POSITION</b>			
2.1	How did your firm get involved?	Open tender		Direct appointment
2.2	Who are the other competitors?	1.		
		2.		
		3.		
2.3	What is your firm's competitive edge?			
2.4	What is the probability of your firm being appointed?		Low	Medium
				High
IDENTIFY AND ANALYSE AND EVALUATE THE RISKS				
<b>3</b>	<b>COMMERCIAL RISKS</b>			
<b>3.1</b>	<b>Financial Issues</b>			
3.1.1	What is the currency of the tender/appointment?			
3.1.2	How will your firm be protected against currency fluctuations?			
3.1.3	What is the validity period of the tender?			
3.1.4	Are funds in place for the works and the professional fees?		No	Yes
3.1.5	Does the client expect a discount on professional fees?	Yes	%	No
3.1.6	Is your firm required to work at risk?		Yes	No
3.1.7	How much is your firm prepared to spend on landing the project and/or working at risk?			
	Time costs:			
	Other expenses:			
3.1.8	What is your firm's expected net fee:			
3.1.9	What is the expected Group level net profit percentage	0 - 10%	10 - 20%	20 - 30%
				> 30%
3.1.9	What is the invoicing frequency (monthly, on milestones)?			
3.1.10	Is interest payable on overdue accounts?		No	Yes
3.1.11	Number of weeks within which work must be carried out to ensure a profitable project:			
<b>3.2</b>	<b>If it is a direct appointment</b>			
3.2.1	Is it based on a procurement policy?		Yes	No

3.2.2	Is the client's procurement policy public knowledge?		N/A	No	Yes
3.2.3	Is the client's procurement policy considered to be fair?		N/A	No	Yes
<b>3.3</b>	<b>Joint Venture</b>				
3.3.1	Will a JV be formed?			Yes	No
3.3.2	Is the JV a client requirement?		N/A	Yes	No
	If yes				
3.3.3	Does the client dictate who the JV partners would be?			Yes	No
3.3.4	Are the JV partners acceptable to your firm?	No: give reasons	N/A		Yes
3.3.5	Who is the lead member of the JV?				
3.3.6	<b>JV Partners</b>				
	<i>Partner 1</i>				
	Name	N/A			
	Work to be allocated				
	Estimated value of work				
	<i>Partner 2</i>				
	Name				
	Work to be allocated				
	Estimated value of work				
	<i>Partner 3</i>				
	Name				
	Work to be allocated				
	Estimated value of work				
<b>3.4</b>	<b>Sub-Consultants/Sub-Contractors</b>				
	Are sub-consultants to be appointed?			Yes	No
	<i>Sub-consultant 1</i>				
	Name				
	Work to be allocated				
	Estimated value of work				
	<i>Sub-consultant 2</i>				
	Name				
	Work to be allocated				
	Estimated value of work				
	<i>Sub-consultant 3</i>				
	Work to be allocated				
	Estimated value of work				
<b>4</b>	<b>CONTRACTUAL RISKS</b>				
4.1	What agreement will be used between your firm and the client?				
4.2	Will the liability of your firm be limited to between twice the net fee amount and 10% of the fees and is the liability limited in time to between one and five years?			No	Yes
	If no what is your firm's liability?				
4.3	Has your firm been appointed as the Agent in terms of the Construction Regulations? If the answer is yes, ensure that you are fully conversant with the duties and responsibilities of the Agent.			Yes	No
4.4	Is the potential risk covered by your firm's PI insurance?			No	Yes
4.5	Will pre-contract award agreements be signed between your firm and JV partners?			No	Yes
4.6	What agreement will be used between your firm and the JV partners?				
4.7	What agreement will be used between your firm and the sub-consultant/sub-contractor?				

<b>5</b>	<b>ENVIRONMENTAL RISKS</b>				
	Have all the environmental authorisations been obtained?	N/A		No	Yes
<b>6</b>	<b>CLIENT</b>				
6.1	Business sector			Private	Public
6.2	Client's name				
6.3	Client's representative				
6.4	Is the client a new or existing client?			New	Existing
6.5	What is your firm's general experience of the client?	Unknown	Bad	Average	Good
6.6	What is the client payment history?	Unknown	Bad	Average	Good
<b>7</b>	<b>STAFFING</b>				
7.1	Does your firm have the necessary experience in the field?			No	Yes
7.2	What size of unit from your firm will be involved in the work?				
7.3	Does your firm have the resources to carry out all the work?			No	Yes
	Name				
<b>8</b>	<b>TECHNICAL RISKS AND TREATMENT OF TECHNICAL RISKS</b>				
	List the possible technical risks associated with the project	Actions taken to mitigate OR TREAT the risks			
<b>9</b>	<b>CLIENT SATISFACTION</b>				
	Will the client be surveyed for satisfaction?			No	Yes
	If yes update the client satisfaction spreadsheet				
	Form completed by:				
	Date of completion:				
<b>10</b>	<b>APPROVAL BY THE BUSINESS TOP MANAGEMENT HEAD OF DEPARTMENT</b>				
	Does the Business top management Head of department authorise the compilation of a tender or acceptance of appointment?			No	Yes
	Name of Project Director				
	Name of Project Manager				
	Name of Authorised Bid Manager (if applicable)				
	Business Head of Department				
	Date				
	Signature				
	Project number:				
	Further comments				
<b>11</b>	<b>GENERAL COMMENTS</b>				

## **5.5 Conclusion**

The risk management framework is held together and enhanced by a number of principles that should be inherent in the risk management process. For risk management to be effective and successful, these principles are to be incorporated in the context and in the training of project and risk management staff as they are the essential qualities needed in the risk management framework. The following are the principles for the risk management process ISO 31000, (2009) and they should always be embedded in the process of risk management:

### **5.5.1 Risk Management creates and protects value**

The whole purpose why risk management should be exercised is that it adds value and all efforts should be in place to protect and create that value. One of the greatest challenges for risk managers is to demonstrate to top management and the organisation at large that risk management adds value. It is common knowledge that the application of this knowledge to risk management helps organisations to realise and achieve the objectives.

Looking at the framework mentioned above, once the organisation has established the context, policy and processes, applying risk management knowledge helps to maximise the opportunities and minimise threats. There are many benefits to managing risks and this increasing the likelihood of achieving objectives, improving stakeholder confidence, minimising losses, improving operational effectiveness and efficiency and establishing a reliable basis for decision making and planning.

### **5.5.2 Risk Management is an integral part of organisational processes and projects**

This fact cannot be over emphasised that all risk management activities should not be separated from the main activities and processes of the organisation. Risk management activities should be incorporated into business processes and management controls at all levels of the business operations and should be

part of management's responsibilities where there is a culture of enterprise wide involvement in the activity.

### **5.5.3 Risk Management is part of decision making**

With risk management in place, a culture is cultivated in the managers such that whenever they are to make decisions, they are helped to make better judgement thereby minimising risks and optimising opportunities. Decision making in organisations is done all the time and every time a manager makes a decision, there is exposure to risk. Therefore, informed decision making is guaranteed when good risk management is in place.

### **5.5.4 Risk Management explicitly addresses uncertainty**

To dismiss any doubts or uncertainty which unfortunately is intrinsic in all business endeavours, it is important to know that the risk management process will explicitly address the uncertainty through the process of risk analysis where a number of risks are identified and analysed such that there can be controls and treatment of risk put in place to deal with the threats and uncertainty.

### **5.5.5 Risk Management is systematic, structured and timely**

Risk management is another management activity which can also only flourish in the environment of planning and control to ensure efficiency and perfection. Risk management provides a structured and systematic management process with a detailed framework in order to achieve consistent and reliable results.

### **5.5.6 Risk Management is based on the best available information**

During the processes of risk management, the risk manager can only achieve the results if they can gather information from many sources. These sources should include observations, experience from similar undertakings, forecasts and expert advice.

### **5.5.7 Risk Management is tailored**

Since every organisation is unique, there cannot be a rigid risk management framework. The framework can be a generic one such that it can be tailored to suite any organisation depending on appropriateness to the organisation whilst considering the organisation's stakeholders, context and risk profile.

## **CHAPTER 6 – RECOMMENDATIONS & CONCLUSION**

### **6.1 Introduction**

The aim of the study was to determine what risk management frameworks are applied in the construction industry and to detail how risk management affect project management. The study also focused on discovering what risks are endemic to the construction industry in a developing country and to eventually develop a risk management framework that can be used to help mitigate the effects of the said risks.

This study focused on the Engineering and Management firms dealing with Civil Engineering and Construction Project Management such as BKS (Pty) Ltd, VELA VKE, WSP, KV3, PDNA and others. The study however is not limited only to the mentioned firms.

Chapter 1 is the introductory chapter which introduces the study in summary focusing on aims and objectives, that is, what the study should and should not achieve. Chapter 2 focuses on the various literatures, particularly on risk management and how it relates to construction project management and project management in general.

The literature review in chapter 2 set up the discussions that gave direction and guidance to areas of importance in research on the risk management frameworks in the engineering and project management environment. The review discussed risk management from a broader perspective and eventually narrowed the scope to the specific areas relevant to the study, being risk management processes and the risk management framework in project management.

During the study, it was discovered that there has been very little research conducted on the risk management frameworks in the engineering construction industry in a developing country, the literature review was conducted based on literature from journal and books, standards and manuals from United States of America, New Zealand, Australia and the United Kingdom. A number of references to some firms using risk management framework were also made.

Chapter 3 elaborated on the research methodology used in the study together with the data collection method used. A sample of structured questions used in the questionnaire is given in this section. Information was gathered from Engineers and Project Managers who are currently managing projects or recently completed projects in the construction industry.

An analysis of the collected data was conducted using the qualitative method of analysis in chapter 4. Based on the findings and analysis of the data, a proposed risk management framework was discussed and developed in chapter 5.

## **6.2 Recommendations**

Based on the many findings and the subsequent analysis of the findings, a number of recommendations have been made. The recommendations relate back to the sub problems as tabled in chapter 1 together with the literature findings in the literature review as well as the findings from the questionnaires.

### ***6.2.1 Sub Problem 1: What Risk Management frameworks are applied in the construction industry and how can they be used to help mitigate risks and their effects?***

#### ***6.2.1.1 Findings***

Only 16% of professionals and / or firms surveyed have risk management frameworks implemented in their projects. 42% specifically said they have no planned risk management activities during the project lifecycle. They handle risk issues at the end of the project. The absence of risk management frameworks is also evidenced by the fact that the professionals handle risks as they appear. This is simply because there is no guidance from the framework.

There was a notable absence of formal risk management frameworks in many of the organisations surveyed during the



study. Since the surveyed organisations and individuals are a representative sample for the engineering and management firms, it can be assumed that the observation is representing the general trend in the industry. There is however a way few highly experienced and qualified project managers and engineers handle the risk issues.

The few professionals from past experience compare the current project to the past works and identify some critical risks which they evaluate after their assessment. They have developed some form of risk management framework which is tailored for specific projects. 16% of the surveyed professionals have the risk management framework in place.

The following group of professionals have some risk management system still in its infancy under development. They do some surface risk investigations and do evaluations but do not further it with decisions on risk treatment. 38% of professionals are in this category and their inadequate risk management procedures translate into poor project results. It was found that there are prolonged project durations, escalated costs and poor quality.

The last group is the less experienced professionals who tend to leave risks unidentified and deal with them as they surface during the course of the project. This group is the majority at 46%. The chances of having project success in this category are lower since the projects are executed without any idea of what can go wrong and as a result there is not adequate preparation for eventual effects of the risks. Risks have to be identified, analysed, evaluated and from then good judgement could be made on the treatment of risks.

### **6.2.1.2 Recommendations**

For risk management in the organisation or in projects to succeed, and to have project successful completion, there has to be a formal risk management tool in the form of risk management framework that should be utilised to conduct all the risk management issues such that project management becomes a success.

A generic risk management framework as laid down in chapter 5 is required by all professionals and firms in order to standardise the risk management activities and be able to bring about increase in profits and maintenance of good client confidence and satisfaction.

The organisation without risk management frameworks and those with the framework in its infancy will have to involve detailed and concerted communication and training to ensure that the risk management process is understood by all risk owners and other stakeholders.

The risk management framework process that should be initially implemented will have to start with the internal environment with the objectives being set, identifying the risk events, assessment of risks, setting up risk responses, developing risk control activities, information and communication and continuous routine monitoring of the whole process. This process is detailed in chapter 5 and implementation of the processes eventually culminates in the developed theory being put into tangible practical application tailored for every individual undertaking as detailed in chapter 5 under 5.3. The form is the methodical risk management framework that can help many organisations with a systematic way to handle and manipulate all risk activities as may be encountered in the engineering and management environment.

## **6.2.2 Sub problem 2: How does risk management affect project management?**

### **6.2.2.1 Findings**

Risk management procedures are perceived to be a waste of time by many professionals. They were found to be handling risks in a haphazard way without a formal approach. Only 16% of the respondents had a systematic approach to risk management. 46% did not have any risk management activities going on. 38% have some risk management system in its infancy.

Some professionals handling projects have no formal risk or project management training and experience. This eventually has a negative impact on the project as some risks are actually as a result of poor knowledge and poor skills in project and risk management.

### **6.2.2.2 Recommendations**

It is evident that risk management affects project management. The ultimate goal in project management is to ensure that project deliverables are attained at the end of the agreed project completion time to the agreed quality at the agreed cost. This can only be achieved if the sources of threats can be investigated and their effects planned against.

A risk management framework should be implemented and the management of risks should not be for a few only but should be in the whole enterprise with all the personnel from top management to grassroots involved. This will ensure success in project management.

Exposure to risk management and project management skills is very important, this if well handled will greatly increase the Project management performance.

**6.2.3 Sub problem 3: What are the risks that are associated with the construction industry in a developing country?**

**6.2.3.1 Findings**

Several risks were discovered to be present and affecting the construction industry in developing countries. Notably, the following risks were discovered common to many projects managed by various professionals who responded to the questionnaire:

*6.2.3.1.1 Material price increases*

This risk was common to all project managers and caused a number of escalations in the overall project performance.

*6.2.3.1.2 Late Design problems creating more concurrent work*

Design issues emanating from the clients causing delays in the commencing of works. These events further delays subsequent works. In order to catch up with programmes, concurrent works unavoidably get under way thereby causing other problems with completion.

*6.2.3.1.3 Inadequate Risk Management, Planning and Identification of Risks at the start of the project*

Inadequate risk management planning and identification due to poor risk management knowledge was identified as one risk affecting the overall project performance.

*6.2.3.1.4 Lack of sponsorship of risk management activities*

Many firms have no budgets allocated to activities of risk management. Lack of risk management sponsorship creates a situation whereby projects get carried out without taking care of the management of risks. If projects are left to be executed without risk

management processes, the probability of having catastrophe are very high.

#### *6.2.3.1.5 Lack of project management knowledge*

Inadequate knowledge and expertise by some site personnel handling projects is another common risk discovered. Project Manager should have relevant knowledge and experience to handle the intricacies inherent to the projects.

#### *6.2.3.1.6 Higher risk component due to higher capital budget for the projects.*

Bigger projects always have higher capital budgets which require rigorous project and risk management skills.

#### *6.2.3.1.7 Unreasonable short project construction periods*

All respondents have had experiences where the clients set unreasonable time frames for the projects resulting in short durations which are not possible to achieve, resulting in quality and cost compromises.

#### *6.2.3.1.8 Design change at very late stage.*

Changes in project scope resulting into design changes at late stages. This further gives rise to variation orders and unnecessary contractual disputes.

#### *6.2.3.1.9 Severe competition over price*

There has been lately notable severe competition for few jobs. This has culminated in the bidders coming up with ridiculously low

prices just to secure a project. Usually bidders with low prices have very little capacity to perform the given tasks.

#### *6.2.3.1.10 Channels of Communication on projects*

Communication always is a very important area in project management. Haphazard flow of information from undefined sources other than through the project manager is a concern with the potential of jeopardising all efforts of project management. Government officials have been cited to be very notorious for assuming roles that are not to be played by them on project causing so much confusion on projects.

#### *6.2.3.1.11 Poor and no response by Clients to Contractual issues on projects*

For success to be guaranteed on projects, effective communication has to be seen between project manager and all stakeholders on the projects. Unacceptable delays when responding to key issues has potential of causing disputes.

#### *6.2.3.1.12 Inclement weather on projects*

Some projects have had some experience with excessive rainfall that slows down the progress giving rise to claims for extension of time. This however is an unforeseeable event and an act of God and so eventualities have to be planned for.

#### *6.2.3.1.13 Political interference on the procurement process*

Most of construction projects come from the Government institutions. Unfortunately, the procurement system has been infiltrated with political interference and favouritism which is frustrating all efforts to do decent professional work.

### 6.2.3.2 Recommendations

Several risks have been presented and as can be seen from the findings, the main issues are knowledge and experience in project and risk management and sponsorship of risk management activities. The other risks are all covered under the risk management and project management knowledge and experience since with the relevant experience and exposure, the project manager should be able to identify and assess and make informed decisions based on the past experience.

#### 6.2.3.2.1 Project and Risk Management Knowledge and experience

Most of the risks mentioned above are hinged on the need for knowledge in the area of project management and risk management. With this knowledge at the disposal of professionals handling projects, simple systematic techniques will be developed and easily implemented in order to manage project risks in a methodical way from inception of the project to final handover. Training for project engineers and managers in the areas of risk and project management and use of risk management frameworks should be implemented. This will afford the professionals with the means to effectively handle risks and attain successful completion of projects.

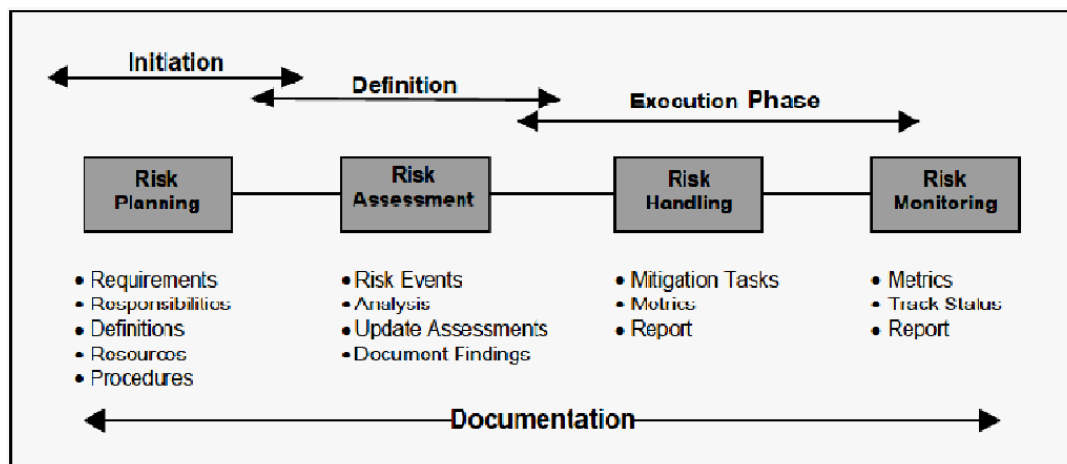


Figure 12: Relationship between Project and Risk Management activities

#### *6.2.3.2.2 Project risk management sponsorship*

Risk management should be an enterprise wide activity that should span through all the ranks from Top Management to lower level personnel. With this in mind, sponsorship for risk management activities would not be a problem as all personnel are involved and the benefit is not only for the project but for the business enterprise as a whole.

#### *6.2.3.2.3 Overall Recommendation regarding encountered risks*

There are a lot of risks found in the construction management environment and many more have not been documented in this work. Proper risk management processes in a risk management framework should be instituted and followed strictly in order to identify the various risks and be able to assess and evaluate them effectively. Risk identification should be adequately carried out such that after the assessment and evaluation of the identified risks precautions can be put in place to handle these risks. Without a risk management framework in place, it would be impossible to make informed decisions on the actions to be made when treating risks. It is therefore highly recommended that a risk management framework be adopted in order to effectively handle risks in a consistent and methodical format. Dealing with risks haphazardly is unprofessional and inconsistencies are highly probable.

### ***6.2.4 Sub problem 4: What risk management frameworks can be used to help mitigate risks and their effects?***

#### ***6.2.4.1 Findings***

There was a notable absence of formal risk management frameworks in many of the organisations surveyed during the study. Since the surveyed organisations and individuals are a representative sample for the engineering and management firms, it can be assumed that the



observation is representing the general trend in the industry. There is however a way few highly experienced and qualified project managers and engineers that handles the risk issues.

The few professionals from past experience compare the current project to the past works and identify some critical risks which they evaluate after their assessment. They have developed some form of risk management framework which is tailored for specific projects. 16% of the surveyed professionals have the risk management framework in place.

The following group of professionals have some risk management system still in its infancy under development. They do some surface risk investigations and do evaluations but do not further it with decisions on risk treatment. 38% of professionals are in this category and their inadequate risk management procedures translate into poor project results. It was found that there are prolonged project durations, escalated costs and poor quality.

The last group is the less experienced professionals who tend to leave risks unidentified and deal with them as they surface during the course of the project. This group is the majority at 46%. The chances of having project success in this category are lower since the projects are executed without any idea of what can go wrong and as a result there is not adequate preparation for eventual effects of the risks. Risks have to be identified, analysed, evaluated and from then good judgement could be made on the treatment of risks.

#### **6.2.4.2 Recommendations**

A generic risk management framework as laid down in chapter 5 is required by all professionals and firms in order to standardise the risk management activities and be able to bring about increase in profits and maintenance of good client confidence and satisfaction.

The organisation without risk management frameworks and those with the framework in its infancy will have to involve detailed and concerted communication and training to ensure that the risk management process is understood by all risk owners and other stakeholders.

The risk management framework process that should be initially implemented will have to start with the internal environment with the objectives being set, identifying the risk events, assessment of risks, setting up risk responses, developing risk control activities, information and communication and continuous routine monitoring of the whole process. This process is detailed in chapter 5 and implementation of the processes eventually culminates in the developed theory being put into tangible practical application tailored for every individual undertaking as detailed in chapter 5 under 5.3. The form is the methodical risk management framework that can help many organisations with a systematic way to handle and manipulate all risk activities as may be encountered in the engineering and management environment.

### **6.3 Contribution Made by this study**

This research study brought forth the risk management challenges experienced by many engineering and management firms in South Africa as well as the many risks encountered during the project life cycle.

A number of problems have been cited together with proposed solutions to the cited problems. A proposed solution on how these challenges can be alleviated was proposed in Chapters 5 and 6 with associated relevant literature highlighted in the literature review in chapter 2.

In addition to the recommendations referred to in chapter 5 and 6 it should be emphasised that the risk management framework will be able to greatly alleviate the

risk management challenges faced by countless professionals. This framework is a step by step systematic method of risk identification, analysis, evaluation and treatment.

This framework will encourage enterprise wide participation in risk management activity which will promote participation by all involved from top management to bottom ensuring project success. With this model, various misgivings regarding skills and experience will be easily identified and sorted out before projects are led to failure. The ultimate objective is to aid successful project completion.

## **6.4 Directions for Future Research**

Future research should focus on the importance of implementation of a systematic risk management framework in the Engineering and management firms where project management is the main activity.

Many smaller and medium sized firms have not been very keen to implement the frameworks for risk management. It will be very important to find out why it is so and also to discover what the alternative is that they propose on how to manage risks in a professional and systematic way.

## **6.5 Epilogue**

This research project presented a study to establish a risk management framework for organisations which deal with construction project management in South Africa. Several firms were identified to be having a form of risk management systems in place but not fully functional as some professionals have not embraced the efforts of risk management. There were some firms where professional feel they do not need risk management and some have started realising the need and are progressing towards the implementation of a risk management framework

A number of risks were discovered which confirmed the need to have a risk management framework to aid in the identification, analysis, evaluation and treatment of the various risks on projects. Management can only make sound decisions if the threats are identified, analysed and well evaluated. In project management operations, risk management cannot be separated from project management. Therefore it is very important that the professionals handling projects also embrace risk management because failure to do this will mean failure to do project management and ultimately will cause unnecessary losses and poor quality of service.

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## **Appendix A**

### **The questionnaire**

#### **Project Risk Management Questionnaire**

Dear Sir/Madam,

I would like to thank you for taking the time to go through and complete this questionnaire. The purpose of this questionnaire is to aid research into risk management as part of my treatise for my **MSc in Project Management** that I am currently studying for at the University of Pretoria. The driving force behind this research is to develop a **risk management framework** for organisations which deal with Civil Engineering and Construction Project Management in a developing nation such as South Africa. This will aid the effective management of risks in these organisations.

All the information submitted will remain anonymous, be used purely for the purpose of this treatise and will not be passed on to any third party.

If you have any further questions or improvements towards this questionnaire please do not hesitate to contact me on the contact details below. May I further re-iterate my appreciation for you taking the time to complete this questionnaire.

#### **Honorius Makombo**

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**Section 1: About You and the Project**

*Please remember that all details will remain confidential*

*When completing the questions please refer to the most recent project you were involved in where appropriate.*

Name: \_\_\_\_\_

Job Title: \_\_\_\_\_

Name of Organisation: \_\_\_\_\_

Position within organisation: \_\_\_\_\_

How long have you been in this position? \_\_\_\_\_

What was the budget for the project? \_\_\_\_\_

What was the main objective/product/benefit of the project?  
\_\_\_\_\_  
\_\_\_\_\_

If you are happy to take further part in the study, or would like to find out about my findings please provide your contact details below:

Email : \_\_\_\_\_

Cell : \_\_\_\_\_

Telephone: \_\_\_\_\_

Fax : \_\_\_\_\_

## Section 2 – Project Management in your organisation

A methodology is defined by the Oxford English Dictionary as

*‘Method or body of methods used in a particular field of study or activity’*

- Did your organisation use a methodology to guide the project?(please circle) **Y**  
/ **N**
- If yes what methodology e.g. PRINCE2, DSDM etc was used? Please specify:  
\_\_\_\_\_  
\_\_\_\_\_
- Have you ever undergone formal project management training? (please circle) **Y**  
/ **N**
- If yes please give details:  
\_\_\_\_\_  
\_\_\_\_\_
- Is risk management a part of your project methodology? (please circle) **Y** / **N**

## Section 3 - Risk Management

The APM Body of Knowledge, 5<sup>th</sup> Edition provides the following definitions;

*Project Risk: The exposure of stakeholders, to the consequences of variation in outcome.*

*Issue: A threat to the project objectives that cannot be resolved by the project manager*

*Project Risk Management: A structured process that allows individual risk events and overall project risk to be understood and managed proactively, optimising project success by minimising threats and maximising opportunities.*

- Is a generic risk management process used on all your projects? (please circle)  
**Y** / **N**

- If NO please specify how projects are differentiated.  

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- When was the risk register produced in respect to the project life cycle?  

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- Was there a systematic risk identification system in place for example through document reviews, information gathering techniques such as interviews etc?  
Please describe:  

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- How often was the Register referred to?  

---

---
- Who owned or who was responsible for the risk register?  

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---
- Where was the risk register kept?  

---

---
- How often was the risk register updated?  

---

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- Was a trade off analysis performed?  

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- Was a formal risk response plan produced?  

---

---
- Was this plan adhered to?  

---

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- How much of the project budget was allocated to risk contingency? (As a percentage)?

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- How was this value determined?

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- Was there a risk manager or team specifically assigned within your organisation to deal with risk? **Y / N** \_\_\_\_\_

- If yes please specify:

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- Was probabilistic planning used within the project? (please circle) **Y / N**

- If yes please specify:

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---

- Is formal risk management training undertaken in your organisation? (please circle) **Y / N**.

- If Yes please specify

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---

- Approximately what is the budget for this per person per year (if available)?

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---

- Did any issues occur in the project?(please circle) **Y / N**

- If yes please specify:

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**Section 4 - Project Performance**

- How would you rate the performance of the project? (Please tick all boxes that apply):

	0 – 19%	20 – 39%	40 – 59%	60 – 79%	80 – 99%
Budget					
Time					
Cost					
Quality					
Benefits Realisation					

- How would you rate the level of success of the risk management approach that was followed in the execution of your projects? (Please tick all boxes that apply)

	0 – 19%	20 – 39%	40 – 59%	60 – 79%	80 – 99%

Thank you for your participation