APPLICATION OF RISK MANAGEMENT IN A PROJECT ENVIRONMENT

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Dissertation submitted as partial fulfilment of the requirements for the degree Master in Science at the School for Modelling Science, Potchefstroom University

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POTCHEFSTROOM
1999
I would like to express my gratitude and thanks to the following people for their valuable contributions:

- My loving wife and daughter, Elize and Zonnike for their love and purpose in life.
- The Management of POLIFIN for their support throughout my studies.
- My study leader Dr. Philip Pretorius for his valuable advice and insight.
- To the examiners who offered up their time to examine this study.
- The Project Management Institute South Africa for making the members information available for the research and for distributing the research questionnaire.
- All the people, who so willingly responded to the research.
# TABLE OF CONTENTS

## CHAPTER 1: NATURE AND SCOPE OF STUDY

1. INTRODUCTION 1
2. PROBLEM IDENTIFICATION AND DEFINITION 3
3. OBJECTIVE OF THESIS 4
4. DEFINING THE SCOPE OF THE STUDY 4
5. RESEARCH METHODOLOGY 5
6. LAYOUT OF STUDY 6
7. CONCLUSION 9

## CHAPTER 2: PROJECT MANAGEMENT: A THEORETICAL OVERVIEW

1. INTRODUCTION 10
2. DEFINITION OF A PROJECT 11
3. WHAT IS PROJECT MANAGEMENT? 11
4. RELATIONSHIP OF PROJECT MANAGEMENT TO GENERAL MANAGEMENT 13
5. KNOWLEDGE AREAS OF PROJECT MANAGEMENT 16
6. PROJECT LIFE CYCLE 19
7. CONCLUSION 22

## CHAPTER 3: RISK MANAGEMENT: A THEORETICAL OVERVIEW

1. INTRODUCTION 23
2. DEFINITION OF PROJECT RISK 24
3. WHAT IS RISK MANAGEMENT? 25
4. Definition 25
3.3.2 Risk Management Process
3.3.2.1 Risk Identification
3.3.2.2 Risk Quantification
3.3.2.3 Risk Response Development
3.3.2.4 Risk Response Control
3.3.2.5 Managing the resulting action plan
3.4 WHEN TO DO A RISK ASSESSMENT
3.5 RISK MANAGEMENT SYSTEMS
3.6 CONCLUSION

CHAPTER 4: COLLECTION AND PROCESSING OF EMPIRICAL DATA

4.1 INTRODUCTION
4.2 APPROACH USED IN COLLECTING THE DATA
4.3 QUESTIONNAIRE DESIGN
4.3.1 Section 1: Project Management Information
4.3.2 Section 2: Risk Management Information
4.3.3 Section 3: Risk Information
4.4 RESULTS OF SECTION 1: PROJECT MANAGEMENT INFORMATION
4.4.1 Introduction
4.4.2 Project Management as a Form of Management
4.4.3 Classification of Sectors
4.4.4 The Use of Formal Project Management Systems
4.4.5 Project Management Systems based on a Formal Standard
4.4.6 Project Management Systems Cater for all Phases of a Project Cycle
4.4.7 Experience of Project Managers
4.4.8 Monetary Value of the Projects
4.4.9 Average Duration of the Projects

TABLE OF CONTENTS
4.5 RESULTS OF SECTION 2: RISK MANAGEMENT INFORMATION
4.5.1 Risk Management in Projects 44
4.5.2 Risk Management Systems Cater for all Phases of a Project Cycle 45
4.5.3 The Use of Risk Management Early in a Project 47
4.5.4 The Importance of Using of Risk Management early in a Project 48
4.5.5 The Use of the Project Management Body of Knowledge 49
4.5.6 The Availability of Risk Management Systems 50
4.5.7 The Use of Risk Management in Project Budgets and Schedules 51
4.5.8 The Importance of Risk Management in Projects 52
4.5.9 The Benefits of Applying Risk Management in Projects 53
4.6 RESULTS OF SECTION 3: RISK INFORMATION 54
4.7 CONCLUSION 55

CHAPTER 5: CONCLUSIONS, FINDINGS AND RECOMMENDATIONS 56

5.1 INTRODUCTION 56
5.2 FINDINGS AND CONCLUSIONS 56
5.2.1 Findings from Section 1: Project Management 56
5.2.2 Findings from Section 2: Risk Management 59
5.2.3 Findings from Section 3: Risk Information 62
5.3 RECOMMENDATIONS 62
5.3.1 Potential Risk Assessment Process 63
5.3.2 Illustrative Example: Potential Risk Assessment Applied to a Project 66

TABLE OF CONTENTS
TABLE OF CONTENTS
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.5</td>
<td>CHAPTER 4: SUMMARY</td>
<td>79</td>
</tr>
<tr>
<td>6.5.1</td>
<td>Introduction</td>
<td>79</td>
</tr>
<tr>
<td>6.5.2</td>
<td>Approach Used in Collecting the Data</td>
<td>79</td>
</tr>
<tr>
<td>6.5.3</td>
<td>Questionnaire Design</td>
<td>79</td>
</tr>
<tr>
<td>6.5.4</td>
<td>Questions of Section 1: Project Management Information</td>
<td>80</td>
</tr>
<tr>
<td>6.5.5</td>
<td>Questions of Section 2: Risk Management Information</td>
<td>80</td>
</tr>
<tr>
<td>6.5.6</td>
<td>Questions of Section 3: Risk Information</td>
<td>81</td>
</tr>
<tr>
<td>6.6</td>
<td>CHAPTER 5: SUMMARY</td>
<td>81</td>
</tr>
<tr>
<td>6.6.1</td>
<td>Introduction</td>
<td>81</td>
</tr>
<tr>
<td>6.6.2</td>
<td>Findings and Conclusions</td>
<td>81</td>
</tr>
<tr>
<td>6.6.3</td>
<td>Recommendations</td>
<td>83</td>
</tr>
<tr>
<td>6.7</td>
<td>SUCCESS OF THE STUDY</td>
<td>84</td>
</tr>
<tr>
<td>6.8</td>
<td>FUTURE STUDY OPPORTUNITIES</td>
<td>84</td>
</tr>
<tr>
<td>6.9</td>
<td>FINAL CONCLUSIONS</td>
<td>85</td>
</tr>
</tbody>
</table>
LIST OF FIGURES

FIGURE 1.1 Layout of study 8
FIGURE 2.1 Project objective model 13
FIGURE 2.2 General management process 15
FIGURE 2.3 Project management process 16
FIGURE 2.4 Project life cycle 19
FIGURE 3.1 Risk management integrated model 26
FIGURE 3.2 Risk management model 27
FIGURE 3.3 Cost of fixing risk in projects 31
FIGURE 5.1 Vulnerability map 64
FIGURE 5.2 Project vulnerability map 71
LIST OF TABLES

TABLE 4.1  Project management as a form of management 36
TABLE 4.2  Project management to manage projects and/or operations 36
TABLE 4.3  Field in which project management is used 37
TABLE 4.4  Formal project management system 38
TABLE 4.5  On which standard is the project management system based 39
TABLE 4.6  System covers all phases of a project life cycle 40
TABLE 4.7  Years experience in project management 41
TABLE 4.8  Average monetary value of projects 42
TABLE 4.9  Average duration of projects 43
TABLE 4.10 The use of risk management in projects 44
TABLE 4.11 System covers all phases of a project life cycle 46
TABLE 4.12 The use of risk management early in a project 47
TABLE 4.13 Importance of using risk management early in a project 48
TABLE 4.14 The use of the Project Management Body of Knowledge as a guide when managing risk in Projects 49
TABLE 4.15 Possession of risk management system 50
TABLE 4.16 Commercially available risk management systems 50
TABLE 4.17 Risk assessment of project budget 51
TABLE 4.18 Risk assessment of project schedule 51
TABLE 4.19 Risk management’s contribution to the success of a project 52
TABLE 4.20 Projects late due to not applying risk management 53
TABLE 4.21  Projects overspent due to not applying risk management  53
TABLE 4.22  Awareness of risk in a project environment  55
TABLE 5.1   Action list  65
TABLE 5.2   Project action list  70
LIST OF GRAPHS

GRAPH 5.1   Fields in which project management is used 57
GRAPH 5.2   Years experience as project manager 58
GRAPH 5.3   Monetary value of projects undertaken 58
GRAPH 5.4   The use of risk management in projects 59
GRAPH 5.5   Use risk management early in projects 60
GRAPH 5.6   The importance of using risk management early in a project 60
GRAPH 5.7   Commercially available risk management systems for projects 61
GRAPH 5.8   Awareness of risk in a project environment 62
LIST OF APPENDICES

APPENDIX 1  Research Questionnaire  89
GLOSSARY OF TERMS

PM  PROJECT MANAGEMENT
PMI  PROJECT MANAGEMENT INSTITUTE
PMISA  PROJECT MANAGEMENT INSTITUTE SOUTH AFRICA
PMBOK  PROJECT MANAGEMENT BODY OF KNOWLEDGE
R  RISK
I  IMPACT
P  PROBABILITY
PLC  PROJECT LIFE CYCLE

TABLE OF CONTENTS
CHAPTER 1

NATURE AND SCOPE OF STUDY

1.1 INTRODUCTION

Today globalisation of businesses and markets have become an integral part of the corporate world’s daily life. In South Africa this is manifested in the moving of businesses, e.g. Old Mutual, SAB, etc., to list on the world stock exchanges, e.g. London Stock Exchange. According to Brigham and Gapenski (1994:7) this trend is likely to continue in the future and they give the following factors to justify this statement:

- Improvements in transportation and communications have lowered shipping costs and made international trade more feasible;
- The political clout of consumers, who desire low-cost, high-quality products has helped lower trade barriers designed to protect inefficient, high-cost domestic manufacturers;
- As technology has become more advanced, the costs of developing new products has increased, and, as development costs rise, so must unit sales if the firm is to be competitive; and
- In a world populated with multi-national firms able to shift production to wherever costs are lowest.

To achieve the above, organisations have to make monetary investments, and the result is projects and project teams to build and implement new manufacturing plants and ventures.

But due to most projects not making deadlines, overspending and not meeting standards, opportunities have arisen to develop solutions to these problems. To enable improvement and have successful projects,
Sconberger & Knod (1994:41) propose the following five aspects of effective project management:

- High-performance teams;
- Project organisation structures;
- Information sharing;
- Tools and techniques; and
- Combating project complexity.

The whole point of undertaking a project is to achieve or establish something new, to venture, take chance, to risk. But if the risk is high, high returns are expected and therefore risk management or/and analysis is highly important and necessary because one project is always competing for capital against another.

Brigham and Gapenski (1994:464) define the following three separate and distinct types of project risks:

- **Stand-alone risk**
  Which views the risk of a project in isolation, hence without regard to portfolio effects.

- **Within-firm risk**
  Also called corporate risk, which views the risk of a project within the context of the firm’s portfolio of projects.

- **Market risk**
  Which views a project’s risk within the context of the firm’s stockholders’ diversification in the general stock market.

As can be seen from the above, projects are not only unique and complex, but risk is always associated with them. Therefore an attempt is made with this study to hopefully contribute to this field of management.

**CHAPTER 1: NATURE AND SCOPE OF STUDY**
This chapter serves as an overview of what will be achieved by this study and gives an overview and how the chapters should be read.

1.2 PROBLEM IDENTIFICATION AND DEFINITION

Internationally, Project Management (PM) has become the fastest growing form of Management, ProjectPro (1998:6). Burke (1999:iii) state that “The past ten years have seen project management continue to grow as a profession through a wide range of projects.” One of the reasons is that the tools and techniques unique to PM have the capacity of dealing with rapid radical change resulting from fierce international competition and advances in technology.

In the literature many books exist that focus on the areas of project management, but at the end they all come down to the following areas which the Project Management Institute has identified that comprises the Project Management Body of Knowledge, PMBOK (1996:6). The nine areas are:

- Scope management;
- Time management;
- Cost management;
- Quality management;
- Human resources management;
- Risk management;
- Communication management;
- Procurement management; and
- Integration management.

As can be seen, these areas cover the whole spectrum of management as we know today, and therefore provide additional reasons for the popularity of project management. However, there is always room for
improvement, and the area that will be further explored in this study is risk management.

Project Managers may find it difficult to manage the risk in projects, therefore the purpose of this thesis is to develop a risk management model for a project environment, which will not only facilitate the process but also ease the risk management process.

1.3 OBJECTIVE OF THESIS

The objective of this study is to do a theoretical and an empirical investigation answering the following questions and maybe make useful recommendations:

- Establish if project managers use project risk management systems;
- Determine the level of risk awareness in organisations that are involved in projects; and
- Recommend a model for the application of risk management in a project environment, which is developed from the literature.

1.4 DEFINING THE SCOPE OF THE STUDY

Since the largest portion of the target population of the empirical research are the members of the Project Management Institute of South Africa, and they represent a wide spectrum of industries and institutions, it can be said that the results should be applicable to all types of projects.

The theoretical research will cover projects in broad terms, and will therefore be applicable to projects in general. The information in

CHAPTER 1: NATURE AND SCOPE OF STUDY
chapter 2 could also serve as a basis to get an overview on the subject of project management.

The risk and risk management theoretical research will cover the objectives of a typical project and will largely be applicable to any project. Furthermore the information presented in chapter 3 will explain risk management and risk systems in a project environment.

1.5 RESEARCH METHODOLOGY

The thesis will focus on selected available literature regarding project management, risk and risk management. The available literature will be in the form of books, articles and the Internet. The following research methods will be used in the study:

- Theoretical research will be conducted in order to first establish what normative project and risk management models are available, and than secondly, by using this information, to set the scene or environment for the research on project and risk management.

- Develop a questionnaire, which will be sent to all the members of the Project Management Institute South Africa (PMISA) and selected chemical industries. The questionnaire is subdivided into three sections: the first section deals with project management information; section two is about risk management information; and section three covers the awareness of risk by project teams.

CHAPTER 1: NATURE AND SCOPE OF STUDY
The following is more detailed information on the layout of the questionnaire:

- **Section 1: Project Management Information**
  In this section questions are asked to determine a demographic profile of the organisation and the project manager. The evaluation of these dimensions is important because a positive result will validate the response in the next two sections.

- **Section 2: Risk Management Information**
  In this section the objective is to determine if risk management is applied in projects, if risk management systems are being used, and to what extent risk management contribute to the success of projects.

- **Section 3: Risk Information**
  The purpose of this section is to test if risk is addressed at all in the organisation, and if top management supports it, and the level of awareness.

### 1.6 LAYOUT OF THE STUDY

The layout of this thesis per chapter is as follows:

- **CHAPTER 2: PROJECT MANAGEMENT: A THEORETICAL OVERVIEW**
  This chapter covers a theoretical research of project management as a subject, which could be useful to understand the theoretical concept of risk in a project environment.
• CHAPTER 3: RISK MANAGEMENT: A THEORETICAL OVERVIEW
   In this chapter the application of risk and risk management is explored throughout the project life cycle.

• CHAPTER 4: COLLECTION AND PROCESSING OF EMPIRICAL DATA
   The methods used in the investigation are described and the results are transformed into useful information.

• CHAPTER 5: CONCLUSIONS, FINDINGS AND RECOMMENDATIONS
   This chapter summarises all findings and knowledge gained with the investigation, and concludes with what was learned. Finally recommendations are made which could be useful in future projects.

• CHAPTER 6: SUMMARY AND FINAL CONCLUSIONS
   This chapter summarises the study for easy reading and gives views on the success of the study and possible future study opportunities.
Figure 1.1: Layout of study

Figure 1.1 depicts the layout of the study and gives an overview of how this thesis could be read. Chapter six can be read to gain a quick summarised overview of the whole study.
1.7 CONCLUSION

In chapter 1 the problems which initiated this study were given, as well as the objectives and method of research which will be used were discussed. Finally the layout of this thesis was given.
CHAPTER 2

PROJECT MANAGEMENT: A THEORETICAL OVERVIEW

2.1 INTRODUCTION

The formalised project management approach is relatively modern although, essentially, the concept is not new. Projects have always existed in one form or another and have been managed in different ways over the centuries.

Internationally, project management has become the fastest growing form of management (ProjectPro: 6). Burke (1999:iii) state that “The past ten years have seen project management continue to grow as a profession through a wide range of projects.” One of the reasons is that the tools and techniques unique to project management have the capacity of dealing with rapid and radical change resulting from fierce international competition and rapid advances in technology development.

In this chapter an attempt is made to give a theoretical overview of project management, from the most recent literature, to indicate the place of risk management in a project environment. In section 2.2 definitions of a project is discussed to create an understanding of what a project is.

In section 2.3 an overview of project management is given and the objectives of a project are discussed. In section 2.4 the relationship of project management to general management is discussed to clarify any misunderstanding that may exist on project management. Section 2.5 deals with the knowledge areas of project management as defined by
the Project Management Institute, and then finally a typical project life cycle is given in section 2.6.

2.2 DEFINITION OF A PROJECT

In the literature many definitions exist for a project. The PMBOK (1996:4) defines a project as, "... is a temporary endeavor undertaken to create an unique product or service. Temporary means that every project has a definite beginning and a definite end. Unique means that the product is different in some distinguishing way from all similar products or services".

Kerzner (1998:2) describe a project as, "... can be considered to be any series of activities and tasks that:

- Have a specific objective to be completed within specification;
- Have identified start and end dates;
- Have funding limits; and
- Consume resources".

Both definitions state clearly that a project has defined start and end dates; therefore it can be said that each project will be unique because it will be difficult to repeat a project even if everything was done in the same way.

2.3 WHAT IS PROJECT MANAGEMENT?

The main difference between project management and general management relates to the definition of a project and what the project intends to deliver to the client and stakeholders, Burke (1999:1).
The Association for Project Management (1999:1) defines project management, "... is the planning, organisation, monitoring and control of all aspects of a project and the motivation of all involved to achieve the project objectives safely and within agreed time, cost and performance criteria".

The Project Management Institute (1996:6) on the other hand gives the following definition, "... the application of knowledge, skills, tools and techniques to project activities in order to meet or exceed stakeholder needs and expectations from a project".

Project management is therefore management principles, tools and techniques, which are used by the project manager to meet the objectives of the project and hopefully the requirements of the client.

The objectives of any project are always measured in terms of the following:

- Scope;
- Time;
- Cost; and
- Quality.

Figure 2.1 depicts these objectives and the environment in which it is manifested. The objectives of project management are to manage the project in such away that the objectives of the project are met and that they fulfill the expectations of the client. The success of any project is always measured in terms of these objectives.

The project manager must align himself totally with these objectives and, in order to achieve this; his principal duty must be to analyse with his client the objectives of the project. For any project to be successful...
an overall compromise situation with equal emphasis on all four factors must exist.

2.4 RELATIONSHIP OF PROJECT MANAGEMENT TO GENERAL MANAGEMENT

In an organisation certain activities take place which has to do with obtaining inputs, i.e. resources, capital and raw material, etc., the

Source: Adapted from Burke (1999:20)
processing thereof and the delivery of outputs, i.e. products or services. According to the functional breakdown of an organisation's activities, eight functions can be identified Kroon (1991:3-5), viz.

- General management;
- Human resource management;
- Purchasing management;
- Production management;
- Administration management;
- Marketing management;
- Financial management; and
- External affairs management.

Management is a process where leadership is employed to use resources as efficiently and effectively as possible in order to meet the needs and the objectives of an organisation, Kroon (1991:6).

The process consists of an iterative cycle of management tasks as depicted in figure 2.2.

For comparison the project management process is given in figure 2.3, and as can be seen, project management has much in common with general management. There is however differences mainly due to the discontinuous nature of projects.

CHAPTER 2: PROJECT MANAGEMENT: A THEORETICAL OVERVIEW
Chapter 2: Project Management: A Theoretical Overview

Figure 2.2 General management process

Source: Adapted from Kroon et al. (1991:7)

Where the general manager makes use of the four basic management tasks and six additional management tasks to accomplish the organisation's objectives, the project manager uses the nine project management knowledge areas to achieve the project objectives.
In the literature, many books exist that focus on the knowledge areas of project management with different points of view. But in the end, they all come down to the following nine areas which the Project Managers need to focus on:

- Scope
- Time
- Cost
- Quality
- Human Resources
- Communication
- Risk
- Procurement
- Integration

**Source:** Developed from the PMBOK

**2.5 KNOWLEDGE AREAS OF PROJECT MANAGEMENT**
Management Institute (1996:6) and the Australian Institute of Project Management (1996:3) have identified, viz.

- **Project Integration Management**
  Describes the processes required to ensure that the various elements of the project are properly co-ordinated. It consists of project plan development, project plan execution and overall change control.

- **Project Scope Management**
  Describes the processes required to ensure that the project includes all the work required, and only the work required, to complete the project successfully. It consists of initiation, scope planning, scope definition, scope verification and scope change control.

- **Project Time Management**
  Describes the processes required to ensure timely completion of the project. It consists of activity definition, activity sequencing, activity duration estimating, schedule development and schedule control.

- **Project Cost Management**
  Describes the processes required to ensure that the project is completed within approved budget. It consists of resource planning, cost estimating, cost budgeting and cost control.

- **Project Quality Management**
  Describes the processes required to ensure that the project will satisfy the needs for which it was undertaken. It consists of quality planning, quality assurance and quality control.
• **Project Human Resource Management**
  Describes the processes required to make the most effective use of the people involved with the project. It consists of organisational planning, staff acquisition and team development.

• **Project Communications Management**
  Describes the processes required to ensure timely and appropriate generation, collection, dissemination, storage and ultimate disposition of project information. It consists of communications planning, information distribution, performance reporting and administrative closure.

• **Project Risk Management**
  Describes the processes concerned with identifying, analysing and responding to project risk. It consists of risk identification, risk quantification, risk response development and risk response control.

• **Project Procurement Management**
  Describes the processes required to acquire goods and services from outside the performing organisation. It consists of procurement planning, solicitation planning, solicitation, source selection, contract administration and contract closeout.

These areas evolved over the years and comprise the project management body of knowledge and are recognised and used widely in project management.

They cover the whole spectrum of project management, as we know it today, and therefore, a further reason for the popularity of project management. There is a belief that project management is a hot
profession for young people looking for a career, and is one of the best ways to rise to the upper levels of a corporation, ProjectPro (1999:11).

2.6 PROJECT LIFE CYCLE

A project life cycle is made up with different phases; these phases could vary depending in which industry the project is carried out. The knowledge areas of project management apply to all phases of a project life cycle.

According to Ritz (1990:4-7) all projects go through a typical life cycle as shown in figure 2.4 with the following distinct phases:

- Conceptual;
- Definition;
- Execution;
- Start-up; and
- Divestment.

**Figure 2.4 Project life cycle**

![Graph showing project life cycle]

**Source:** Developed out of Ritz (1990)
The Project Management Institute (1996:11) states, "... because projects are unique undertakings and they involve a degree of uncertainty, organisations performing projects will normally divide each project into phases to provide better control. Collectively than these phases are known as the Project Life Cycle.

Further the Project Management Institute (1996:11-25) divide project life cycles up into different sectors of business, e.g. engineering, construction, software development, etc.

Kerzner (1998:73) has identified the phases much like Ritz. His project life cycle phases are:

- Conceptual;
- Definition;
- Production;
- Operational; and
- Divestment.

The main reason for these carefully defined phases is to:

- Focus attention on the key issues involved in each phase, thus better control; and

- Introduce decision points in the progression of the project to ensure that the objectives are being met at all times.

Distinct deliverables exist for each of these phases in many cases different project teams perform each phase. The second last phase, namely operational phase, is not part of the project. This is performed by an operations team, which could consist of some of the project members, after completion of the project.

CHAPTER 2: PROJECT MANAGEMENT: A THEORETICAL OVERVIEW
These phases will now briefly being discussed for completeness, Kerzner (1998:73-81):

- The **conceptual phase** includes the preliminary evaluation of the idea. The most important consideration in this phase is a preliminary analysis of risk and the resulting impact on the project objectives, together with the potential impact on company resources.

- The second phase, the **definition phase**, is mainly a refinement of the elements in the conceptual phase. The definition phase requires firm identification of the resources required to accomplish realistic objectives for the project. This phase also includes the initial preparation of all documentation necessary to support the system.

- The **production phase**, is predominantly a testing and final standardisation effort, so that operations can begin.

- The fourth phase is the **operational phase** and integrates the project's product or services into the existing organisation.

- The final phase is **divestment**, and includes the real location of resources. This divestment phase evaluates the efforts on the total system and serves as input to the conceptual phases for new projects and systems.

Out of this literature the following project phases were identified, which will cover most of the industries and institutions that make up the target population of this study and will be used in the questionnaire for research purposes:

**CHAPTER 2: PROJECT MANAGEMENT: A THEORETICAL OVERVIEW**
2.7 CONCLUSION

The definition of a project indicates the uniqueness and complexity of a project. To assist project managers in this unique and complex environment, project management evolved over the years into a management science where the knowledge areas must be mastered in order to be successful in projects. These knowledge areas of project management must further be applied to all the phases of a project life cycle in order to achieve the objectives set for a project.

Risk management, as was evident from the theoretical overview, is a knowledge area of project management, and this hopefully has set the scene for the next chapter where an overview of risk management in a project environment will be discussed.
CHAPTER 3

RISK MANAGEMENT: A THEORETICAL OVERVIEW

3.1 INTRODUCTION

Risk has always been an intrinsic part of project work. In today's markets with increasing competition, advanced technology and tough economic conditions, risk taking has assumed significantly greater proportions.

Risk management should provide a valuable input into project management to ensure the success thereof. Such input should be iterative, adaptive, and flexible and not too complex otherwise due to the time constraints project teams are faced with, it will not be implemented.

In this chapter a theoretical overview of project risk and risk management in a project environment is given as preparation for the research which will be undertaken in this study. In section 3.2 different definitions of project risk are discussed to create an understanding of what project risk is.

In section 3.3 an overview of risk management is given, a risk management integration model and a risk management process is discussed. In section 3.4 a brief view on when to do a risk assessment is discussed.
3.2 DEFINITION OF PROJECT RISK

It is essential that project managers understand project risk and that they address or pay the required attention to it, if they want to be successful in implement their projects. Definitions will now be given and discussed to clarify the meaning of project risk.

The Australian Institute of Project Management (1996:23) defines risks as, "... factors, which might adversely affect project outcomes".

Brigham & Gapenski (1994:145) give the following definition, "...risk refers to the chance that some unfavourable event will occur.

Burke (1999:230) defines project risk, "... any event that prevents the achievement or limits the achievement of the objectives as defined at the outset of the project, these objectives may be revised and changed as the project progresses through the project life cycle".

In a project, Ruskin & Estes (1995:109) explain, "Projects contain uncertainties and thus involve the probability that something could go wrong and adverse consequences that will occur if it does go wrong. The product of these two factors is called risk".

Therefore one can conclude that risk is an unfavourable outcome which could, if it should occur, negatively affect the deliverables or objectives of a project. To quantify risk the following simple equation could then define risk, De Villiers et al. (1999):

- Risk = Probability x Impact
3.3 WHAT IS RISK MANAGEMENT?

3.3.1 Definition

Risk management as was discussed and shown in the previous chapter forms an integral part of project management and definitions from literature will now be given.

Ruskin & Estes (1995:109) states, "that the precautions taken to minimise the risk are called risk management".

The PMBOK defines risk management as, "the process concerned with identifying, analysing and responding to uncertainty to project risk. It includes the results of positive events and minimising the consequences of adverse events.

Risk management can therefore be seen as preparation for possible events in advance rather than responding to identify alternative action plans and select that risk which is most consistent with project objectives.

Risk Management is also the formal process whereby risk factors are systematically identified assessed, actioned, monitored and reviewed.

Burke (1999:234) gives the integrated structure in figure 3.1, which could be useful in the risk assessment process.
3.3.2 Risk Management Process

The following steps can be used to implement risk management in any project (PMBOK, 1996:111):

- **Risk identification**
  Determining which risks are likely to affect the project and documenting each.

- **Risk Quantification**
  Evaluating risks and risks interactions to assess the range of possible project outcomes.

- **Risk Response Development**
  Defining enhancement steps for opportunities and responses to threats.
- **Risk Response Control**
  Responding to changes in risk over the course of the project.

Tusler 1996 (1-5) has a slightly different model, but the outcome is the same when it is applied to a project. The elements are as follows, viz.

- Identify uncertainties;
- Analyse risks;
- Prioritise risks;
- Mitigate risks;
- Plan for emergencies; and
- Measure and control.

Out of the above one can then develop "The implementation cycle model", which is depicted in Figure 3.2. This is an iterative process, which project managers can use when risk is being managed in a project.

**Figure 3.2 Risk management model**

![Risk management model diagram](image)

**Source:** Developed from PMBOK and Tusler
From the PMBOK (1996:111) and Tusler (1996:1-5) the risk management model will now be discussed, viz.

3.3.2.1 Risk Identification

Risk identification consists of determining which risks are likely to affect the project and one should explore the entire project plan and look for areas or items of uncertainty or constraints. For example “The project will be overspent”, is not a risk, it is an impact. One should carefully go over the plan to search for things, which could cause the project to be overspent.

3.3.2.2 Risk Quantification

Risk identification analysis requires that the project be broken down into management tasks closely related to project activities. Care should be taken not to overlook the possibility of significant impact as a result of same combination of apparently minor events. A series of seemingly insignificant schedule delays could result in missing a ‘window of opportunity’, for example, reaching the market before a competitor does.

Quantifying the identified risks must be done in terms of probability of occurring and the severity of impact on the project objectives. By using the simple equation, Risk = Probability x Impact, could simplify this step. It is important to realise that the use of this equation could create a false impression of precision and reliability. For this reason senior and properly experience project team members should be used when applying a risk assessment to a project.
3.3.2.3 Risk Response Development

Subsequent to careful risk identification and quantification a picture of the project risk will emerge. This will include when, where, and to what extent, the risk profile for the project will be set.

Having established the associated risks it is then possible to formulate suitable risk management strategies, whether by way of mitigation, or systematic contingency planning. Mitigation may simply involve the proper recognition of certain risks by appropriate modification of the project’s objectives, i.e. scope, budget, time, quality specifications or all four.

Adequate contingency allowance and good control, even on a tight budget, will reduce the chance of overrun. A logically developed schedule, with attention to resource requirements and conflicts, will reduce the probability of schedule overrun.

At this step one should set target dates and appoint a responsible person to ensure that the identified items or actions are completed in time.

3.3.2.4 Risk Response Control

Risk response control involves executing the risk management plan in order to respond to risk events over the course of the project.

Risk response should be considered in terms of avoidance, reduction, transfer or retention.

Risk events will affect the project’s objectives to an extent, which depends on the event and how it is handled. The overall project risk
will also vary considerably throughout the life of the project. It will increase as tasks with risk events of high probability are undertaken and will generally tend to decrease as the bulk of the work is completed.

### 3.3.2.5 Managing the resulting action plan

By performing the risk assessment, the project manager knows the most likely areas of the project, which will go wrong. Consequently, continuous review of the situation, with appropriate adjustments to response planning, is required.

The owner of each risk area/item should be responsible to the project manager to monitor his risk and to take the appropriate action to prevent it from happening, or take recovery action if the problem does occur. Nothing can be controlled which cannot be measured. In a project there are three things, which can always be measured: the time, the cost, and the quality.

These steps then are the risk management process which when properly applied to projects should ensure success.

### 3.4 WHEN TO DO A RISK ASSESSMENT

Tusler (1999:2) says, “money invested in reducing risk in the early stages of a project phase is money well invested. Any risk incurred during the project has to be diagnosed, and fixed. Also things have already gone wrong by the time the problem is detected and this will add to the costs. Figure 3.3 illustrates the way costs of correcting risks at the beginning of a phase against costs of correcting and managing a failure. The rate of increase in cost of risk is exponential and any risks

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CHAPTER 3: RISK MANAGEMENT: A THEORETICAL OVERVIEW
that can be reduced or eliminated during the initial stages of a project will limit the total cost”.

It is therefore very important for project managers to realise the implications of not addressing the risk issue early in projects. If it is done, it will not only save money but will also add to the success of project in general.

This is not only applicable to the knowledge area risk but applies to all the other project knowledge areas and the integration thereof, and the integration risk management model, figure 3.1, should be used.

**Figure 3.3 Cost of fixing risk in projects**

Source: Adapted from Tusler (1996:2)
3.5 RISK MANAGEMENT SYSTEMS

There are a number of commercially available Risk Management Systems or Methodologies available in the marketplace, (Badelow 1997:4):

- Cost-Benefit Analysis;
- Value Analysis;
- Hazardous and Operability Studies; and
- Potential Deviation Analysis.

It is not known if these commercial systems are being used by project managers, this will however be tested in the research of this study.

3.6 CONCLUSION

In this chapter risk and risk management in a project environment was discussed. It is evident from the literature that it is important to use a systematic process in managing the risk and to use it as early as possible. To be successful, the team must consist of appropriately experienced members, who can implement the whole risk management process.

These theories were used in the design of the questionnaire that was used in the research, and the results will be processed and discussed in the next chapter.
CHAPTER 4

COLLECTION AND PROCESSING OF EMPIRICAL DATA

4.1 INTRODUCTION

The theory, which was described in chapters 2 and 3, gave an overview of project and risk management. The function of risk management and the use thereof in a project environment was designed into a questionnaire and was tested and measured in practice.

In this chapter the findings obtained from the completed questionnaires will be analysed and discussed.

The research is conducted to establish if the respondents are working in a project environment, to what extent they use risk management in their projects, and the level of risk awareness amongst them.

4.2 APPROACH USED IN COLLECTING THE DATA

A questionnaire was designed and sent to selected project managers, via the Internet, in order to obtain their view on project and risk management. The questionnaire was designed in such a way that it meets the objectives set out in this thesis.

The target group of this investigation are all the project managers affiliated to the Project Management Institute of South Africa (PMISA) and selected chemical industries. The
questionnaire was sent out to all the members of the PMISA, via e-mail, by the institute themselves for which the author is grateful and the author sent out the other questionnaires.

4.3 QUESTIONNAIRE DESIGN

The questionnaire is subdivided into three sections, the first section concerns project management information, section two is about risk management information and section three covers risk information.

The questionnaire will be further discussed in the subsequent paragraphs.

4.3.1 Section 1: Project Management Information

In this section questions are asked to determine a demographic profile of the organisation and the project manager. The evaluation of these dimensions is important because a positive result will validate the response in the next two sections.

4.3.2 Section 2: Risk Management Information

In this section the objective is to determine if risk management is applied in projects, if risk management systems are being used, and to what extent risk management contributes to the success of projects.
4.3.3 Section 3: Risk Information

The purpose of this section is to test if risk is addressed at all in the organisation, and if top management supports it.

4.4 RESULTS OF SECTION 1: PROJECT MANAGEMENT INFORMATION

4.4.1 Introduction

The result of the questionnaire could be affected by factors such as experience, qualifications and perception of the respondent. The questions were in general well answered and all questionnaires received back were filled in correctly.

In the next sections the project management responses will be evaluated.

4.4.2 Project Management as a Form of Management

i) Introduction

The purpose of this question, although the questionnaire was sent to members of the PMISA, is to determine if the respondents’ use project management as a form of management. If they do, will it be to manage projects and/or operations.

ii) Results

Tables 4.1 and 4.2 indicate the results of the empirical study.
Table 4.1: Project management as a form of management

<table>
<thead>
<tr>
<th>Answer</th>
<th>Quantity</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>230</td>
<td>100%</td>
</tr>
<tr>
<td>No</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>230</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 4.2: Project management to manage projects and/or operations

<table>
<thead>
<tr>
<th>Answer</th>
<th>Quantity</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>To manage projects</td>
<td>230</td>
<td>100%</td>
</tr>
<tr>
<td>To manage operations</td>
<td>35</td>
<td>13%</td>
</tr>
<tr>
<td>Total</td>
<td>265</td>
<td>113%</td>
</tr>
</tbody>
</table>

iii) Findings

Out of table 4.1 it is encouraging that all respondents use project management as a management tool, which is an indication that the results of this study will definitely be representative of all project managers in South Africa.

In table 4.2 it can be seen that all respondents use project management to manage projects and in addition to that, 13% use project management to manage their operations, which confirms that the trend is moving towards manage-by-projects.
4.4.3 Classification of Sectors

i) Introduction

The purpose of this question is to determine in which field project management is being used.

ii) Results

In the table below the classification of the sector or field in which project management is being used is given.

Table 4.3: Field in which project management is used

<table>
<thead>
<tr>
<th>Answer</th>
<th>Quantity</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering</td>
<td>115</td>
<td>40%</td>
</tr>
<tr>
<td>Construction</td>
<td>100</td>
<td>34%</td>
</tr>
<tr>
<td>Information Technology</td>
<td>75</td>
<td>26%</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>290</td>
<td>100%</td>
</tr>
</tbody>
</table>

iii) Findings

Table 4.3 shows that 40% of the projects are done in the engineering field, 34% in the construction field, and the rest are in the information technology field. The total 290 is higher than the number of respondents. This is due to the fact that some of them are using project management in more than one field.
4.4.4 The Use of Formal Project Management Systems

i) Introduction

The purpose of this question is to determine if the respondents use a project management system to manage their projects.

ii) Results

Table 4.4 indicates the results of the empirical study.

Table 4.4: Formal project management system

<table>
<thead>
<tr>
<th>Answer</th>
<th>Quantity</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>200</td>
<td>87%</td>
</tr>
<tr>
<td>No</td>
<td>30</td>
<td>13%</td>
</tr>
<tr>
<td>Total</td>
<td>230</td>
<td>100%</td>
</tr>
</tbody>
</table>

iii) Findings

These results indicate than a great majority of project managers are using a formal project management system, which shows the level of maturity and professionalism of not only the project managers, but also the organisations that they are part of.

CHAPTER 4: COLLECTION AND PROCESSING OF EMPIRICAL DATA
4.4.5 Project Management Systems based on a Formal Standard

i) Introduction

With this question, one wants to determine if the project management system in use is based on any formally known standard.

ii) Results

The table below gives the results.

Table 4.5: On which standard is the project management system based

<table>
<thead>
<tr>
<th>Answer</th>
<th>Quantity</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not applicable</td>
<td>5</td>
<td>2%</td>
</tr>
<tr>
<td>ISO 9000</td>
<td>130</td>
<td>57%</td>
</tr>
<tr>
<td>Other</td>
<td>40</td>
<td>17%</td>
</tr>
<tr>
<td>Experience</td>
<td>55</td>
<td>24%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>230</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

iii) Findings

As can be seen in table 4.5, 57% of the respondents are using ISO 9000 as a standard on which they base their project management systems and 24% based them on experience. This gives an indication that the International Standards Organisation remains the benchmark.
4.4.6 Project Management Systems Cater for all Phases of a Project Life Cycle

i) Introduction

The purpose of this question is to establish whether the project management systems in use cater for all phases of typical project life cycle.

ii) Results

The results are shown in table 4.6.

Table 4.6: System covers all phases of a project life cycle

<table>
<thead>
<tr>
<th>Answer</th>
<th>Never</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Always</th>
<th>5</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conceptual design and feasibility study</td>
<td>5</td>
<td>25</td>
<td>60</td>
<td>40</td>
<td>100</td>
<td></td>
<td>230</td>
</tr>
<tr>
<td>Specification and design</td>
<td>0</td>
<td>10</td>
<td>25</td>
<td>65</td>
<td>130</td>
<td></td>
<td>230</td>
</tr>
<tr>
<td>Procurement</td>
<td>10</td>
<td>20</td>
<td>45</td>
<td>70</td>
<td>85</td>
<td></td>
<td>230</td>
</tr>
<tr>
<td>Construction or installation</td>
<td>0</td>
<td>0</td>
<td>35</td>
<td>45</td>
<td>150</td>
<td></td>
<td>230</td>
</tr>
<tr>
<td>Start-up and commissioning</td>
<td>5</td>
<td>35</td>
<td>45</td>
<td>45</td>
<td>100</td>
<td></td>
<td>230</td>
</tr>
<tr>
<td>Operation or utilisation</td>
<td>25</td>
<td>30</td>
<td>70</td>
<td>50</td>
<td>55</td>
<td></td>
<td>230</td>
</tr>
<tr>
<td>Evaluation</td>
<td>25</td>
<td>30</td>
<td>70</td>
<td>65</td>
<td>40</td>
<td></td>
<td>230</td>
</tr>
<tr>
<td>Total</td>
<td>70</td>
<td>150</td>
<td>350</td>
<td>380</td>
<td>660</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
iii) Findings

From table 4.6 it is clear that the systems cater for all phases, however most of the respondents indicate that it is being used for the conceptual design and feasibility study phase, specification and design phase, construction or installation and start-up and commissioning phase.

4.4.7 Experience of Project Managers

i) Introduction

With this question the purpose is to determine how experienced the respondents are in project management.

ii) Results

Table 4.7 gives the results of the research.

Table 4.7: Years experience in project management

<table>
<thead>
<tr>
<th>Answer</th>
<th>Quantity</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 5 years</td>
<td>45</td>
<td>20%</td>
</tr>
<tr>
<td>5 – 10 years</td>
<td>80</td>
<td>35%</td>
</tr>
<tr>
<td>11 – 15 years</td>
<td>55</td>
<td>24%</td>
</tr>
<tr>
<td>16 – 20 years</td>
<td>35</td>
<td>15%</td>
</tr>
<tr>
<td>20 years and more</td>
<td>15</td>
<td>6%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>230</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
iv) Findings

Table 4.7 shows that more then 80% of the respondents have more then five years experience in project management. One can therefore say that the results obtained in this study could be accepted as representative of project managers, which are members of the PMISA.

4.4.8 Monetary Value of the Projects

i) Introduction

The monetary value of the projects managed by the respondents is the aim of question.

ii) Results

The results are shown in table 4.8.

Table 4.8: Average monetary value of projects

<table>
<thead>
<tr>
<th>Answer</th>
<th>Quantity</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>R 0 - R 5 million</td>
<td>55</td>
<td>24%</td>
</tr>
<tr>
<td>R 5 - R 10 million</td>
<td>60</td>
<td>26%</td>
</tr>
<tr>
<td>R 10 - R 20 million</td>
<td>50</td>
<td>22%</td>
</tr>
<tr>
<td>R 20 - R 40 million</td>
<td>25</td>
<td>11%</td>
</tr>
<tr>
<td>R 40 million and more</td>
<td>40</td>
<td>17%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>230</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
iii) Findings

From table 4.8 one can see that more than 75% of the projects managed by the project managers in this study, have a monetary value that exceeds R 5 million, which in any terms is a fair amount. This indicates then that the projects undertaken by the respondents are in line with their experience as was established in the previous question.

4.4.9 Average Duration of the Projects

i) Introduction

The purpose of this question is to establish the average duration of the projects undertaken by the respondents.

ii) Results

In table 4.9 the results are shown.

Table 4.9: Average duration of projects

<table>
<thead>
<tr>
<th>Answer</th>
<th>Quantity</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 months – 1 year</td>
<td>70</td>
<td>30%</td>
</tr>
<tr>
<td>1 year – 1.5 years</td>
<td>75</td>
<td>33%</td>
</tr>
<tr>
<td>1.5 years – 2 years</td>
<td>60</td>
<td>26%</td>
</tr>
<tr>
<td>2 years and more</td>
<td>25</td>
<td>11%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>230</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
iii) Findings

Table 4.9 shows that approximately 70% of the projects undertaken in this study will be implemented over more than one year. This is in line with the monetary value of the projects as was determined in the previous question.

4.5 RESULTS OF SECTION 2: RISK MANAGEMENT INFORMATION

4.5.1 Risk Management in Projects

i) Introduction

The purpose of this question is to determine if the respondents use risk management when they manage projects.

ii) Results

Table 4.10 indicates the results of the empirical study.

Table 4.10: The use of risk management in projects

<table>
<thead>
<tr>
<th>Answer</th>
<th>Never</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Always</th>
<th>5</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk management in projects</td>
<td>10</td>
<td>10</td>
<td>65</td>
<td>85</td>
<td>60</td>
<td></td>
<td></td>
<td>230</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>10</td>
<td>10</td>
<td>65</td>
<td>85</td>
<td>60</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
iii) Findings

In table 4.10 it can be seen that most respondents use risk management in their projects. Only 4% never use risk management, and 33% sometimes, thus an indication for improvement.

4.5.2 Risk Management Systems Cater for all Phases of a Project Life Cycle

i) Introduction

The purpose of this question is to establish whether the risk management systems in use cater for all phases of typical project life cycle.

ii) Results

The results are shown in table 4.11.
Table 4.11: System covers all phases of a project life cycle

<table>
<thead>
<tr>
<th>Answer</th>
<th>Never</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Always</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conceptual design and feasibility study</td>
<td>15</td>
<td>15</td>
<td>45</td>
<td>80</td>
<td>75</td>
<td>230</td>
</tr>
<tr>
<td>Specification and design</td>
<td>5</td>
<td>20</td>
<td>40</td>
<td>85</td>
<td>75</td>
<td>230</td>
</tr>
<tr>
<td>Procurement</td>
<td>35</td>
<td>25</td>
<td>40</td>
<td>75</td>
<td>55</td>
<td>230</td>
</tr>
<tr>
<td>Construction or installation</td>
<td>10</td>
<td>5</td>
<td>45</td>
<td>85</td>
<td>85</td>
<td>230</td>
</tr>
<tr>
<td>Start-up and commissioning</td>
<td>15</td>
<td>25</td>
<td>45</td>
<td>75</td>
<td>79</td>
<td>230</td>
</tr>
<tr>
<td>Operation or utilisation</td>
<td>35</td>
<td>35</td>
<td>35</td>
<td>75</td>
<td>50</td>
<td>230</td>
</tr>
<tr>
<td>Evaluation</td>
<td>40</td>
<td>40</td>
<td>55</td>
<td>70</td>
<td>25</td>
<td>230</td>
</tr>
<tr>
<td>Total</td>
<td>155</td>
<td>165</td>
<td>305</td>
<td>545</td>
<td>444</td>
<td></td>
</tr>
</tbody>
</table>

iii) Findings

From table 4.11 it is clear that the systems are being used in all phases, however most of the respondents indicate that it is being used mainly for the conceptual design and feasibility study phase, specification and design phase, construction or installation and start-up and commissioning phase. This response is similar to that of the question posed in the previous section.

CHAPTER 4: COLLECTION AND PROCESSING OF EMPIRICAL DATA
4.5.3 The Use of Risk Management Early in a Project

i) Introduction

With this question one wants to establish if the respondents use risk management early in a project.

ii) Results

Table 4.12 gives the responses of the respondents.

Table 4.12: The use of risk management early in a project

<table>
<thead>
<tr>
<th>Answer</th>
<th>Never</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Always</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use risk management early</td>
<td>10</td>
<td>10</td>
<td>45</td>
<td>70</td>
<td>95</td>
<td>230</td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>10</td>
<td>45</td>
<td>70</td>
<td>95</td>
<td></td>
</tr>
</tbody>
</table>

iii) Findings

The majority, 72% of the respondents are using risk management early in their projects. This point will be further explored with the other questions in this section.
4.5.4 The Importance of Using Risk Management Early in a Project

i) Introduction

The purpose of this question is to establish if the project managers realise the importance of using risk management early in a project.

ii) Results

The results are given in table 4.13.

Table 4.13: Importance of using risk management early in a project

<table>
<thead>
<tr>
<th>Answer</th>
<th>Quantity</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>220</td>
<td>96%</td>
</tr>
<tr>
<td>No</td>
<td>10</td>
<td>4%</td>
</tr>
<tr>
<td>Total</td>
<td>230</td>
<td>100%</td>
</tr>
</tbody>
</table>

iii) Findings

A majority of 96% of the respondents gave a positive answer to this question, which confirms the importance of starting early in a project with risk management.

CHAPTER 4: COLLECTION AND PROCESSING OF EMPIRICAL DATA
4.5.5 The Use of the Project Management Body of Knowledge

i) Introduction

With this question, the use of PMBOK by the respondents is the aim.

ii) Results

Table 4.14 gives the results.

Table 4.14: The use of the PMBOK as a guide when managing risk in projects

<table>
<thead>
<tr>
<th>Answer</th>
<th>Never</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Always</th>
<th>5</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>The use of PMBOK</td>
<td>30</td>
<td>35</td>
<td>60</td>
<td>75</td>
<td>30</td>
<td></td>
<td>230</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>30</td>
<td>60</td>
<td>75</td>
<td>30</td>
<td></td>
<td>230</td>
</tr>
</tbody>
</table>

iii) Findings

Since PMBOK is the official body of knowledge of the PMI and all the respondents are members of the PMISA, the results are somewhat surprising, because a great percentage of the respondents never use the PMBOK as a guide. This indicates that this study may fill an actual need that exists or make a meaningful contribution to PMBOK.
4.5.6 The Availability of Risk Management Systems

i) Introduction
The purpose of these questions is to establish the availability of risk management systems in the marketplace.

ii) Results

The results are given in tables 4.15 and 4.16.

Table 4.15: Possession of risk management systems

<table>
<thead>
<tr>
<th>Answer</th>
<th>Quantity</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>105</td>
<td>46%</td>
</tr>
<tr>
<td>No</td>
<td>125</td>
<td>54%</td>
</tr>
<tr>
<td>Total</td>
<td>230</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 4.16: Commercially available risk management systems

<table>
<thead>
<tr>
<th>Answer</th>
<th>Quantity</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>30</td>
<td>13%</td>
</tr>
<tr>
<td>No</td>
<td>200</td>
<td>87%</td>
</tr>
<tr>
<td>Total</td>
<td>230</td>
<td>100%</td>
</tr>
</tbody>
</table>

iii) Findings

Most of the respondents gave a negative answer, which indicates that there is definitely an opportunity in the market for risk management systems.
4.5.7 The Use of Risk Management in Project Budgets and Schedules

i) Introduction

The aim with this question is to determine if the respondents use risk management in their project budgets and schedules.

ii) Results

Tables 4.17 and 4.18 show the responses to these questions.

Table 4.17: Risk assessment of project budget

<table>
<thead>
<tr>
<th>Answer</th>
<th>Never</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Always</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assess budget for risk</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>230</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>15</td>
<td>45</td>
<td>75</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>15</td>
<td>45</td>
<td>75</td>
<td>85</td>
<td>230</td>
</tr>
</tbody>
</table>

Table 4.18: Risk assessment of project schedule

<table>
<thead>
<tr>
<th>Answer</th>
<th>Never</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Always</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assess schedule for risk</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>230</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>5</td>
<td>40</td>
<td>85</td>
<td>95</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
<td>5</td>
<td>40</td>
<td>85</td>
<td>95</td>
<td>230</td>
</tr>
</tbody>
</table>
iii) Findings

As can be seen, most of the respondents are using risk management to manage two of the objectives of any project.

4.5.8 The Importance of Risk Management in Projects

i) Introduction

The objective with this question is to determine if the respondents in this study realise the importance of risk management in their projects.

ii) Results

The results are given in table 4.19.

Table 4.19: Risk management's contribution to the success of a project

<table>
<thead>
<tr>
<th>Answer</th>
<th>Never</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Always</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contribution to risk management</td>
<td>0</td>
<td>10</td>
<td>40</td>
<td>90</td>
<td>90</td>
<td>230</td>
</tr>
<tr>
<td>Total</td>
<td>0</td>
<td>10</td>
<td>40</td>
<td>90</td>
<td>90</td>
<td></td>
</tr>
</tbody>
</table>

iii) Findings

Most, 78% of the respondents, do realise the contribution of risk management to the success of their projects. This is in line with the answers given in this section so far.
4.5.9 The Benefits of Applying Risk Management in Projects

i) Introduction

With these questions one wants to establish the benefits of applying risk management in projects.

ii) Results

The results are given in tables 4.20 and 4.21.

Table 4.20: Projects late due to not applying risk management

<table>
<thead>
<tr>
<th>Answer</th>
<th>Never</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Always</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projects late</td>
<td>30</td>
<td>60</td>
<td>90</td>
<td>40</td>
<td>10</td>
<td>230</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>60</td>
<td>90</td>
<td>40</td>
<td>10</td>
<td>230</td>
</tr>
</tbody>
</table>

Table 4.21: Projects overspent due to not applying risk management

<table>
<thead>
<tr>
<th>Answer</th>
<th>Never</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Always</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projects overspent</td>
<td>30</td>
<td>90</td>
<td>80</td>
<td>25</td>
<td>5</td>
<td>230</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>90</td>
<td>80</td>
<td>25</td>
<td>5</td>
<td>230</td>
</tr>
</tbody>
</table>
iii) Findings

Tables 4.20 and 4.21 shows that most of the respondents agree that by applying risk management their projects are seldom late and overspent.

4.6 RESULTS OF SECTION 3: RISK INFORMATION

i) Introduction

This section is based on an article by MacNamee (1999:1-4), which discusses risk and risk management in companies today. It includes a self-assessment questionnaire, adapted for a project environment, which was used in the research for this thesis.

ii) Results

The results as mentioned are based on self-assessment, where ten questions are asked, see appendix A, and then the scores added up with the following meanings:

- **Scores less than 24**: Risk management is not part of project management now. The organisations should work on building an appreciation for risk management in projects.

- **Scores 24 – 36**: Risk management is part of project management, but it needs a bigger input from corporate governance culture.
- **Scores more than 36**: Risk management plays an important part of project management, and this philosophy should be maintained.

### Table 4.22: Awareness of risk in a project environment

<table>
<thead>
<tr>
<th>Answer</th>
<th>Quantity</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scores less than 24</td>
<td>30</td>
<td>13%</td>
</tr>
<tr>
<td>Scores 24 - 36</td>
<td>150</td>
<td>65%</td>
</tr>
<tr>
<td>Scores more than 36</td>
<td>50</td>
<td>22%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>230</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

### iii) Findings

From this table it is clear than only 13% of the respondents are not using risk management in their projects. The majority, 65%, are using risk management in their projects but there is room for improvement. The rest, 22%, accepts that risk and risk management is important for the success of their projects and are making use of it.

### 4.7 CONCLUSION

In this chapter, the design of the questionnaire to collect the data for this study, the approach in collecting the data, the responses processed and results obtained were discussed.

In the next chapter concluding remarks on the results obtained will be discussed and recommendations will be made concerning risk management in a project environment.
CHAPTER 5

CONCLUSIONS, FINDINGS, AND RECOMMENDATIONS

5.1 INTRODUCTION

In chapter 4 the results obtained from the questionnaire, which was used in the empirical study, were processed, analysed and discussed.

In this chapter conclusions will be made on the results obtained in this study. Then guidelines on how to address the problems and shortcomings, which were identified in this research, will be recommended.

5.2 FINDINGS AND CONCLUSIONS

The findings and conclusions based on the results and remarks from the empirical study will be discussed in following paragraphs.

5.2.1 Findings from Section 1: Project Management

In this section the following findings came to the fore:

- 100% of the respondents use project management to manage their projects.
- 40% of the organisations are in the engineering field, 34% in the construction field, and the remaining, 26% are in the information technology field, graph 5.1.
Fields in which Project Management is used

- Information Technology: 26%
- Engineering: 40%
- Construction: 34%

Graph 5.1

- 87% of the respondents have a formal project management system, which in most cases is based on ISO 9000 or experience, and covers most phases of a typical project.
- It is clear from the information obtain that the respondents are experienced project managers as 80% of them have more than five years experience in projects management, see graph 5.2.
Graph 5.2

- They handle large projects. In graph 5.3 one can see that more than 75% of the projects exceed R 5 million. More than 70% of the projects take more than one year to be implemented.

Graph 5.3

CHAPTER 5: CONCLUSIONS, FINDINGS AND RECOMMENDATIONS
From the information gathered in this study the conclusion can be drawn that one is dealing with a group of experienced project managers, which for the purpose of this study, can be classified as being representative of project managers in general. This will be discussed further in the following paragraphs.

5.2.2 Findings from Section 2: Risk Management

In this section the following was found:

- Although most of the respondents indicated that they are using risk management in their project, graph 5.4, there is too high a percentage, which do not.

![The Use of Risk Management in Projects](image)

Graph 5.4

- Most of the risk management systems can be used on all phases of a typical project.
Most of the respondents, 72%, use risk management early in their projects, graph 5.5 and they realise the importance thereof, graph 5.6.
• Most of the project managers are members of the PMISA, but don’t make use of the PMBOK.

![Commercially Available Risk Management Systems for Projects](image)

Graph 5.7

• Most of the respondents indicated that they either don’t have a risk management system or these systems are not commercially available, graph 5.7.
• Most of the project managers use risk management in their project budget and schedules, tables 4.17 and 4.18.
• 78% of the respondents realise the importance which risk management contributes to the success of their projects.

The conclusions, which can be made from this information, are that there is room for improvement as far as the use of risk management is concerned. There are opportunities for the development of a commercial risk management system or at least use of the PMBOK should be made.
5.2.3 Findings from Section 3: Risk Information

In this section, see graph 5.8, it was found that only 13% of the respondents are not using risk management in their projects. The majority, 65%, is using risk management in their projects but there are room for improvement. The rest, 22%, accept that risk and risk management is important for the success of their projects and are making use of it.

![Graph 5.8](image)

The conclusion from these results is in line with the findings in section two, that the majority of the respondents are using risk management, but there are still many project managers which are not using risk management.

5.3 RECOMMENDATIONS

Since it was concluded from this study that there is need for a risk management system in a project environment, it is recommended that a
Potential Risk Assessment Process adapted from De Villiers et al. (1999), be used to identify and manage the risk in projects, viz.

5.3.1 Potential Risk Assessment Process

- **Step 1: Identify Potential Risk Areas/Items**
  Explore the entire project plans and look for areas of uncertainty and list them.

- **Step 2: Impact Analysis**
  Take each area/item, which was identified in step 1, and assign the following to it:
  - Probability of occurring (score \( P = 0-1 \))
  - Impact on the project (score \( I = 0-100 \))
  - Calculate the risk (risk = \( P \times I \))

- **Step 3: Prioritise each item**
  Listing the highest to the lowest risk item or area can prioritise the items or areas.

- **Step 4: Draw a vulnerability map**
  In this step the project team will draw a vulnerability map and decide what the risk profile should be for the project based on the risk they are willing to expose the project to.

A vulnerability map will now be used, with probability (\( P \)) on the y-axis and impact (\( I \)) on the x-axis, see figure 5.1.

The risk profile can now be determined by drawing a line on the map as shown in figure 5.1. Indicating which areas/items will be looked
at (all those above the line) and which are going to be ignored or looked at later if time and money permits (those below line).

Figure 5.1 Vulnerability map

- **Step 5: Response planning**
  Once all the areas/items to address have been identified, an action plan, responsible person, and target completion date must be developed and set for each area/item. Table 5.1 shows a typical action plan.

- **Step 6: Manage the resulting action plan**
  After step 5 has been completed the project manager must ensure that all actions are completed, reviewed, or monitored, to ensure that the intended risk profile for the project is achieved.
<table>
<thead>
<tr>
<th>A/I No.</th>
<th>Area/Item</th>
<th>P</th>
<th>I</th>
<th>R</th>
<th>Action</th>
<th>Responsible Person</th>
<th>Target Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NB. \( P \) = probability (0-1); \( I \) = impact (0-100); \( R \) = risk \((P \times I)\)

Table 5.2 Action list

CHAPTER 5: CONCLUSIONS, FINDINGS AND RECOMMENDATIONS
5.3.2 Illustrative Example: Potential Risk Assessment Applied to a Project

5.3.2.1 Project Description

Name: Year 2000 Readiness Project.

The project objective is to ensure readiness for date related problems leading up to and through the rollover to the new millennium. The project team’s efforts shall be directed towards minimising or eliminating the impact of these date related problems on the Company’s employees, assets, business processes, business systems, profitability and the surrounding environment. The project covers all major divisions, subsidiaries and group functions.

5.3.2.2 Time Scale

The time scale extends over the period August 1997 to 29th February 2000.

5.3.2.3 Project Budget

A central budget of R 20M is available for Year 2000 related issues and approval must be sought according to the project cost management and control procedures. At year-end, divisions must transfer all their incremental Y2K costs incurred to Corporate, where the central budget amount will be applied to absorb these expenses.

Each Division, Subsidiary Company and Joint Venture Company is, however, responsible for all incidental/by the way/partial Y2K costs and will absorb this as part of their operational costs.

CHAPTER 5: CONCLUSIONS, FINDINGS AND RECOMMENDATIONS
5.3.2.4 Project Objectives

The objective of the project is to minimise the effect of the millennium change on all business processes and business systems. This will be achieved by means of a diligent approach to ensure that all processes and systems are ready and able to support the business through and after the Year 2000. To create a clearly documented audit trail, and to ensure readiness, the approach involves the following iterative process:

- identify all systems with embedded processors and/or intelligence, or that are controlled by processor-based systems (i.e. an Inventory);
- assess the potential risk of each system or component;
- review the compliance status of each system or component;
- define appropriate acceptance criteria for each system, based on their criticality;
- perform testing, reparation and re-testing activities to ensure that all critical items will meet the acceptance criteria in time to demonstrate compliance;
- identify and document all failures that have not been dealt with, either because failure can be tolerated, or contingency steps can be taken to avoid problems;
- clearly document and test any contingency plans and disaster recovery plans; and
- ensure that sufficient expertise is available on-site to deal with un-identified Year 2000 failures as they occur.
5.3.2.5 Potential Risk Assessment for the Project

For the purpose of this project only ten areas/items were selected from the Business Systems to illustrate the process, viz.

- **Step 1: Identify Potential Risk Areas/Items**
  In table 5.2, the identified potential risk areas/items can be seen.

- **Step 2: Impact Analysis**
  The Probability of failing, the Impact on the project were assigned to each area/item and the Risk calculated, table 5.2.

- **Step 3: Prioritise each item**
  This was done in table 5.2.

- **Step 4: Draw a vulnerability map**
  The vulnerability map is shown in figure 5.2. Items 1-7 are the once that need to be actioned, the other three do not need any action therefore they can be discarded.

- **Step 5: Response planning**
  Actions, responsible person, and target completion date were developed, table 5.2.

- **Step 6: Manage the resulting action plan**
  The project manager must now ensure that all actions are completed or reviewed to ensure that the intended risk profile for the project is achieved.

---

CHAPTER 5: CONCLUSIONS, FINDINGS AND RECOMMENDATIONS
5.4 CONCLUSION

In chapter two a theoretical overview of project management was given, and in chapter three, risk management was discussed, with the emphases in project management. In chapter four the results of the research were processed and discussed, and finally in chapter five the findings and conclusions of these results were further discussed and recommendations made.

What is clear from this study is that there is definitely a place for risk management in projects, and that there are opportunities for the development of risk management systems in a project environment.

In the next and final chapter a summary of the study is given for a quick overview, for busy reader, of this thesis.
### PROJECT DESCRIPTION: Year 2000 Readiness Project

**DATE:** 10/01/1999

**PROJECT MANAGER:** Joe Soap

**REVISION:** 1 OF 20

<table>
<thead>
<tr>
<th>A/I No.</th>
<th>Area/Item</th>
<th>P</th>
<th>I</th>
<th>R</th>
<th>Action</th>
<th>Responsible Person</th>
<th>Target Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SAP R3 System</td>
<td>1</td>
<td>100</td>
<td>100</td>
<td>To be upgraded and tested</td>
<td>A Venter</td>
<td>Mar-1999</td>
</tr>
<tr>
<td>2</td>
<td>Novell Netware 3.11</td>
<td>1</td>
<td>95</td>
<td>95</td>
<td>To be upgraded and tested</td>
<td>D Smit</td>
<td>Jun-1999</td>
</tr>
<tr>
<td>3</td>
<td>ORACLE Database</td>
<td>1</td>
<td>90</td>
<td>90</td>
<td>To be installed and tested</td>
<td>C Verwey</td>
<td>Mar-1999</td>
</tr>
<tr>
<td>4</td>
<td>Digital 8200 Server</td>
<td>1</td>
<td>80</td>
<td>80</td>
<td>To be tested</td>
<td>L Louw</td>
<td>Feb-1999</td>
</tr>
<tr>
<td>5</td>
<td>Digital 4100 Server</td>
<td>1</td>
<td>75</td>
<td>75</td>
<td>To be tested</td>
<td>G Muller</td>
<td>Jun-1999</td>
</tr>
<tr>
<td>6</td>
<td>MS Access 95</td>
<td>0.7</td>
<td>90</td>
<td>63</td>
<td>To be upgraded to 97</td>
<td>A Venter</td>
<td>Jul-1999</td>
</tr>
<tr>
<td>7</td>
<td>Fire Protect. System</td>
<td>0.7</td>
<td>60</td>
<td>42</td>
<td>To be tested</td>
<td>L Louw</td>
<td>Jun-1999</td>
</tr>
<tr>
<td>8</td>
<td>Wide Area Network</td>
<td>0.1</td>
<td>100</td>
<td>10</td>
<td>Confirmed not-date aware components</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Access Control</td>
<td>0.1</td>
<td>10</td>
<td>1</td>
<td>Can use keys instead – no further action</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>HP 9000 Server</td>
<td>0.1</td>
<td>10</td>
<td>1</td>
<td>Make redundant</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 5.2 Project action list**

CHAPTER 5: CONCLUSIONS, FINDINGS AND RECOMMENDATIONS
Figure 5.2 Project vulnerability map
6.1 INTRODUCTION

In this chapter a summary of the study is given and final conclusions made on what was found in the research of this study.

Furthermore questions, which were not answered, will be highlighted and possible future study opportunities will be mentioned.

6.2 CHAPTER 1: SUMMARY

6.2.1 Introduction

This chapter serves as an overview of what will be achieved by this study and gives an overview and how the chapters should be read.

6.2.2 Problem Identification and Definition

Project management consists of nine knowledge areas, which covers the whole spectrum of management as we know today, and therefore provide additional reasons for the popularity of project management.

However, there is always room for improvement, and the area that will be further explored in this study is risk management.
6.2.3 Objective of Thesis

The objective of this study is to do a theoretical and an empirical investigation; to establish if project managers use project risk management systems; to determine the level of risk awareness in organisations that are involved in projects; and recommend a model for the application of risk management in a project environment.

6.2.4 Defining the Scope of the Study

The theoretical research will cover projects in broad terms, and will therefore be applicable to projects in general.

The risk and risk management theoretical research will cover the budget and time constrains of a project and will largely be applicable to any project.

6.2.5 Research Methodology

Theoretical research will be conducted in order to first establish what normative project and risk management models are available, and than secondly, by using this information, to set the scene or environment for the research on project and risk management.

Develop a questionnaire, which will be sent to all the members of the Project Management Institute South Africa (PMISA) and selected chemical industries. The questionnaire is subdivided into three sections; the first section deals with project management information; section two is about risk management information; and section three covers the awareness of risk by project teams.
6.2.6 Layout of the Study

This thesis consists of six chapters, the first gives the reason for the study, the second is a theoretical overview of project management and chapter three is a theoretical overview of risk management. In chapter four an empirical study is conducted, chapter five gives the conclusions of the empirical study and finally in chapter six a summary of the first five chapters is presented, possible future study opportunities and with final conclusions.

6.3 CHAPTER 2: SUMMARY

6.3.1 Introduction

This chapter gives a theoretical overview of project management, from the most recent literature, to indicate the place of risk management in a project environment.

6.3.2 Definition of a Project

The definitions, discussed in chapter 2, state clearly that a project has defined start and end dates; therefore it can be said that each project will be unique because it will be difficult to repeat a project even if everything was done in the same way.
6.3.3 What is Project Management?

Project management is management principles, tools and techniques, which are used by the project manager to meet the objectives of the project and hopefully the requirements of the client.

The objectives of project management are to manage the project in such a way that the objectives of the project are met and that they fulfill the expectations of the client. The success of any project is always measured in terms of these objectives.

The project manager must align himself totally with these objectives and, in order to achieve this; his principal duty must be to analyse with his client the objectives of the project. For any project to be successful an overall compromise situation with equal emphasis on all four factors, i.e. cost, time, quality and scope, must exist.

6.3.4 Relationship of Project Management to General Management

Management is a process where leadership is employed to use resources as efficiently and effectively as possible in order to meet the needs and the objectives of an organisation.

Project management has much in common with general management. There is however differences mainly due to the discontinuous nature of projects.

6.3.5 Knowledge Areas of Project Management

In the literature, many books exist that focus on the knowledge areas of project management with different points of view. But in the end,
they all come down to the following nine areas which comprises the project management body of knowledge (PMBOK), viz.

- Project integration management;
- Project scope management;
- Project time management;
- Project cost management;
- Project quality management;
- Project human resource management;
- Project communications management;
- Project risk management; and
- Project procurement management.

6.3.6 Project Life Cycle

A project life cycle is made up with different phases; these phases could vary depending in which industry the project is carried out.

Out of this literature the following project phases were identified, which will cover most of the industries and institutions that make up the target population of this study and will be used in the questionnaire for research purposes:

- Conceptual design and feasibility study;
- Specification and design;
- Procurement;
- Construction or installation;
- Start-up and commissioning; and
- Operation and utilisation.
6.4 CHAPTER 3: SUMMARY

6.4.1 Introduction

In this chapter a theoretical overview of project risk and risk management in a project environment is given as preparation for the research which will be undertaken in this study.

6.4.2 Definition of Project Risk

Project risk is an unfavourable outcome, which could, if it should occur, negatively affect the deliverables or objectives of a project. To quantify risk the following simple equation could then define risk:

\[ \text{Risk} = \text{Probability} \times \text{Impact} \]

It is essential that project managers understand project risk and that they address or pay the required attention to it, if they want to be successful in implement their projects.

6.4.3 What is Risk Management?

Definition

Risk management as was discussed and shown in the previous chapter forms an integral part of project management.

Risk management can be seen as preparation for possible events in advance rather than responding to identify alternative action plans and select that risk which is most consistent with project objectives.
Risk Management is also the formal process whereby risk factors are systematically identified, assessed, actioned, monitored, and reviewed.

**Risk Management Process**

The following steps can be used to implement risk management in any project:

- Risk identification;
- Risk quantification;
- Risk response development;
- Risk response control; and
- Managing the resulting action plan.

**6.4.4 When to do a Risk Assessment**

It is very important for project managers to realise the implications of not addressing the risk issue early in projects. If it is done, it will not only save money but will also add to the success of the project in general.

This is not only applicable to knowledge area risk but applies to all the other project knowledge areas.

**6.4.5 Risk Management Systems**

There are a number of commercially available Risk Management Systems or Methodologies available in the marketplace:

- Cost-Benefit Analysis;
- Value Analysis;
- Hazardous and Operability Studies; and
6.5 CHAPTER 4: SUMMARY

6.5.1 Introduction

Research is conducted to establish if the respondents are working in a project environment, to what extent they use risk management in their projects and the level of risk awareness amongst the project team.

6.5.2 Approach Used in Collecting the Data

A questionnaire was designed and sent to selected project managers, via the Internet, in order to obtain their view on project and risk management. The questionnaire was designed in such a way that it meets the objectives set out in this thesis.

6.5.3 Questionnaire Design

The questionnaire is subdivided into three sections, the first section concerns project management information, section two is about risk management information and section three covers risk information.

In section one, questions are asked to determine a demographic profile of the organisation and the project manager. The evaluation of these dimensions is important because a positive result will validate the response in the next two sections.
In section two the objective is to determine if risk management is applied in projects, if risk management systems are being used, and to what extent risk management contributes to the success of projects.

The purpose of section three is to test if risk is addressed at all in the organisation, and if top management supports it.

6.5.4 Questions of Section 1: Project Management Information

The questions were in general well answered and all questionnaires received back were filled in correctly.

The questions that were asked in this section was to obtain data on the following:

- Project management as a form of management;
- Project management systems based on a formal standard;
- Project management systems cater for all phases of a project life cycle;
- Experience of project managers;
- Monetary value of the projects; and
- Average duration of the projects.

6.5.5 Questions of Section 2: Risk Management Information

The questions that were asked in this section was to obtain data on the following:

- Risk management in projects;
- Risk management systems cater for all phases of a project life cycle;
• The use of risk management early in a project;
• The importance of using risk management early in a project;
• The use of the project management body of knowledge;
• The availability of risk management systems;
• The use of risk management in project budgets and schedules; and
• The importance of risk management in projects.

6.5.6 Questions of Section 3: Risk Information

The questions that were asked in this section was to obtain data on the following:

• Risk management is not part of project management now;
• Risk management is part of project management; and
• Risk management plays an important part of project management.

6.6 CHAPTER 5: SUMMARY

6.6.1 Introduction

In this chapter conclusions will be made on the results obtained in this study. Then guidelines on how to address the problems and shortcomings will be recommended.

6.6.2 Findings and Conclusions

The findings and conclusions based on the results and remarks from the empirical study will be discussed in following paragraphs.

CHAPTER 6: SUMMARY AND FINAL CONCLUSIONS
Findings from Section 1: Project Management

In this section the following findings came to the fore:

- 100% of the respondents use project management to manage their projects.
- 40% of the organisations are in the engineering field, 34% in the construction field, and the remaining, 26% are in the information technology field.
- 87% of the respondents have a formal project management system, which in most cases is based on ISO 9000 or experience, and covers most phases of a typical project.
- It is clear from the information obtain that the respondents are experienced project managers as 80% of them have more than five years experience in projects management.
- They handle large projects. More than 75% of the projects exceed R 5 million. More than 70% of the projects take more than one year to be implemented.

From the information gathered in this study the conclusion can be drawn that one is dealing with a group of experienced project managers.

Findings from Section 2: Risk Management

In this section the following was found:

- Although most of the respondents indicated that they are using risk management in their project, there is too high a percentage, which do not.
- Most of the risk management systems can be used on all phases of a typical project.
• Most of the respondents, 72%, use risk management early in their projects.
• Most of the project managers are members of the PMISA, but don’t make use of the PMBOK.
• Most of the respondents indicated that they either don’t have a risk management system or these systems are not commercially available.
• Most of the project managers use risk management in their project budget and schedules.
• 78% of the respondents realise the importance which risk management contributes to the success of their projects.

The conclusions, which can be made from this information, are that there is room for improvement as far as the use of risk management is concerned. There are opportunities for the development of a commercial risk management system or at least use of the PMBOK should be made.

Findings from Section 3: Risk Information

In this section it was found than only 13% of the respondents are not using risk management in their projects. The majority, 65%, is using risk management in their projects but there is room for improvement. The rest, 22%, accept that risk and risk management is important for the success of their projects and are making use of it.

6.6.3 Recommendations

Since it was concluded from this study that there is need for a risk management system in a project environment, it is recommended that a
Potential Risk Assessment Process be used to identify and manage the risk in projects, viz.

Potential Risk Assessment Process

- Step 1: Identify potential risk areas/items;
- Step 2: Impact analysis;
- Step 3: Prioritise each item;
- Step 4: Draw a vulnerability map;
- Step 5: Response planning; and
- Step 6: Manage the resulting action plan.

Illustrative Example

A Potential Risk Assessment applied to a project was given and discussed in this section.

6.7 SUCCESS OF THE STUDY

To determine if the study was successful, the objective of this dissertation must be met, as described in chapter 1, section 1.3.

- The objective was met in that the questions were answered and a potential risk assessment process was recommended.

6.8 FUTURE STUDY OPPORTUNITIES

A statement was made in chapter one that, “project management is the fastest growing form of management”. This was only tested from information obtained from project management literature and could be

CHAPTER 6: SUMMARY AND FINAL CONCLUSIONS
biased, therefore a study opportunity exist to determine the real situation.

This study only focused on risk management systems future studies could focus on risk management tools and techniques in a project environment.

6.9 FINAL CONCLUSIONS

This study gave a framework for risk management in a project environment. With this attempt, the intention was never to become an expert on the subject of project and risk management, but to hopefully make a contribution towards this specialised form of management.

It was determined in this study that the selected target population was correct, in that all the respondents indicated that they work in a project environment, and most of them are experienced project managers, managing large projects. It was also found that although most of the respondents realise the importance of risk management, most don't have a risk management system, and they don't use the PMBOK for this purpose.

Risk management should start to enjoy its rightful place, together with the other knowledge areas of project management if managers want to be successful in implementing their projects.

This study concludes with the view that project management will evolve with perhaps a faster pace into the new millennium if applied successfully.


1 July 1999

SUBJECT: RESEARCH WORK - APPLICATION OF RISK MANAGEMENT IN A PROJECT ENVIRONMENT

I, D de Villiers, am currently enrolled at the PU for CHE as a MSc student. As part of the course, a thesis needs to be submitted, and to complete this, research work will be undertaken.

I have decided to use Risk as a topic and have chosen the members of PMISA due to the nature of this dissertation. The title of my study is The Application of Risk in a Project Environment.

This questionnaire measures if the respondent applies project and risk management. You have been selected to complete the questionnaire because I believe you can help me with this research.

As only a limited number of questionnaires are being distributed, it is important that you respond to each question. If you do not know the precise answer to a question, please respond with your "best guess."

This questionnaire has been designed to be filled out quickly and easily. The results of this survey will only be used for the purpose as mentioned above.

Please return the questionnaire within fifteen days. If you require any further information, please contact me on one of the above telephone numbers or on e-mail daan.devilliers@polifin.com.

I thank you for your participation in this research

Thank you.

D de Villiers

RESEARCH QUESTIONNAIRE
Questionnaire

SECTION 1: PROJECT MANAGEMENT INFORMATION

Please answer the following questions with a cross next to your choice. As a rule, all those choices that you have selected, should be true.

1.1 Do you use Project Management as a form of management?  
[ ] Yes  [ ] No

If YES complete:

<table>
<thead>
<tr>
<th>To manage projects</th>
<th>To manage operations</th>
<th>Other (Indicate)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.2 Please indicate in which field do you use Project Management.

<table>
<thead>
<tr>
<th>Engineering</th>
<th>Construction</th>
<th>Information Technology</th>
<th>Other (Indicate)</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.3 Do you have a formal Project Management System?

[ ] Yes  [ ] No

1.4 Please indicate if your Project Management system is based on any standard?

<table>
<thead>
<tr>
<th>Not Applicable</th>
<th>ISO 9000</th>
<th>Any other system (Indicate)</th>
<th>Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.5 Please indicate on the specified scale how your system cover all the phases of a Project Life Cycle (PLC)?

<table>
<thead>
<tr>
<th>Conceptual design and feasibility study</th>
<th>Never</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specification and design</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procurement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction / Installation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start-up and commissioning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operation / utilisation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Any other PLC Model (Indicate)

1.6 How many years of experience do you have in Project Management?

<table>
<thead>
<tr>
<th>0 - 5 years</th>
<th>6 - 10 years</th>
<th>11 - 15 years</th>
<th>16 - 20 years</th>
<th>20 years and more</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

RESEARCH QUESTIONNAIRE
1.7 What is the average monetary value of projects undertaken by you?

<table>
<thead>
<tr>
<th>0 - R5 million</th>
<th>R5 - R10 million</th>
<th>R10 - R20 million</th>
<th>R20 - R40 million</th>
<th>R40 million and more</th>
</tr>
</thead>
</table>

1.8 What is the average duration of projects undertaken by you?

<table>
<thead>
<tr>
<th>6 months - 1 year</th>
<th>1 - 1.5 years</th>
<th>1.5 - 2 years</th>
<th>2 years and more</th>
</tr>
</thead>
</table>

**SECTION 2: RISK MANAGEMENT INFORMATION**

Please answer the following questions with a cross next to your choice. As a rule, all those choices that you have selected, should be true.

2.1 Do you use Risk Management in your project?

<table>
<thead>
<tr>
<th>Never</th>
<th>Sometimes</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

2.2 Please indicate on the specified scale to what extent you are using Risk Management in all the phases of a project life cycle (PLC)?

<table>
<thead>
<tr>
<th>Conceptual design and feasibility study</th>
<th>Never</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specification and design</th>
<th>Never</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Procurement</th>
<th>Never</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Construction / Installation</th>
<th>Never</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Start-up and commissioning</th>
<th>Never</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operation / utilisation</th>
<th>Never</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Never</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Any other PLC Model (Indicate)

2.3a Do you use Risk Management early in the phases of the project life cycle?

<table>
<thead>
<tr>
<th>Never</th>
<th>Sometimes</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

2.3b Do you think it is important to use Risk Management early in the phases of the project life cycle?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

2.4 Do you use the PMBOK as a guide when you manage risk in your projects?

<table>
<thead>
<tr>
<th>Never</th>
<th>Sometimes</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

RESEARCH QUESTIONNAIRE
2.5 Do you have a formal Risk Management System?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

2.6 Do you use any commercially available system when you assess the risk in your projects?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

Please indicate (This is optional)

<table>
<thead>
<tr>
<th>2.7 Do you assess the budget of your projects for risk?</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Never</th>
<th>Sometimes</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2.8 Do you assess the schedule of your projects for risk?</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Never</th>
<th>Sometimes</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2.9 Risk management contributes to the success rate of projects.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Never</th>
<th>Sometimes</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2.10 Your projects were late because you didn't apply risk management.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4 5</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2.10 Your projects were overspent because you didn't apply risk management.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Never</th>
<th>Sometimes</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

SECTION 3: RISK INFORMATION

Please answer the following questions on the given scale.

<table>
<thead>
<tr>
<th>3.1 Your project team discusses risk at your project meetings.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Never</th>
<th>Sometimes</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3.2 Your project team reports on major decisions referring to risks in those decisions.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Never</th>
<th>Sometimes</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3.3 You as the Project Manager consult with a risk manager on all your projects.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Never</th>
<th>Sometimes</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3.4 Risk management is a subject for discussion at you Steering Committee and Board.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Never</th>
<th>Sometimes</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

RESEARCH QUESTIONNAIRE
3.5 Your project team attends workshops (either in-house or public conferences on risk management practises).

3.6 Your project team is faced with many surprising difficulties.

3.7 When one decision turns out poorly, the project team learns from it.

3.8 Your project team is provided with tools needed to assess risk.

3.9 Risk management is supported within your company.

3.10 Risk management results are part of your project team's performance rating.