A MANAGERIAL PERSPECTIVE ON FACTORS LEADING TO FAILURE IN INFORMATION TECHNOLOGY PROJECTS.

Submitted By

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Statement of Declaration

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Tesfagabir

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Last but not least, my gratitude goes to Mrs Kate Smith from the department of Computer Services and Dr. J.M. Van Zyl from the department of Mathematical Statistics for their assistance in preparation of the data for statistical analysis.

EXECUTIVE SUMMARY

This research is based on data collected between April and May 2004 from 150 sample companies registered at the Johannesburg Stock Exchange.

The study was organised into six chapters. The first chapter presents the research design, a framework that guides the research from beginning to end. Chapter two presents the theoretical background of project management. Then follows the secondary data findings about IT projects and the factors that lead to failure in IT projects. Chapter four presents the research design and methodology follow this. In the fourth chapter design issues such as data collection techniques, sample design and research instruments implemented are described. Following this primary data analysis is presented. Finally the study ends with the presentation of findings, a conclusion and recommendations.

The research results show that

- the overall IT project performance has improved to higher degree than was previously reported
- a high number of projects still exceed the budget, fall behind schedule and fail to provide the expected benefit
- on average, 25 % of IT project work requires reworking
- human resource related (people related) problems are the first predictors of the overall IT project failure, followed by project management related problems
- the project managers lack the soft and managerial skills necessary for managing IT projects

- despite their positive view of project management tools and techniques, the project managers hardly use the project management tools and techniques in practice.
- There was no statistically significant performance difference between in-house and out sourced projects.
- Poor planning and poor business case were the foremost predictors of failure according to the ranking of the project managers.

And the most important recommendations are:

- The alignment of IT project goals with overall business strategy and goals,
- having a good start backed by the clear definition of requirements and clear project definition,
- ensure a general consensus is reached on project success criteria,
- manage risk continuously,
- end-users should be involved for greater success,
- a sound project management methodology should be applied at all times,
- project managers should be developed and empowered to implement the project management methodology.

Key Terms:

Project management; project management tools and instruments; IT projects; business management; IT project management; managing through projects; IT project failure; reasons for failure; project lifecycle; project management capability; project team, project organisational structure, project learning.

Titel: ‘n Bestuursperspektief op faktore wat aanleiding gee tot mislukking in Inligtingstegnologie(IT)-projekte.

UITVOERENDE OPSOMMING

Hierdie navorsing is gegrond op gegewens wat tussen April en Mei 2004 ingesamel is van 150 steekproefmaatskappye wat op die Johannesburgse Aandelebeurs (JSE) geregistreer is.

Die studie is in ses hoofstukke ingedeel. Die eerste hoofstuk verteenwoordig die navorsingsontwerp, ‘n raamwerk wat van begin tot einde ‘n rigsnoer vir die navorsing is. Hoofstuk twee verteenwoordig die teoretiese agtergrond van projekbestuur. Daarna volg die sekondêre bevindings van die gegewens oor IT-projekte en die faktore wat aanleiding gee tot mislukkings in IT-projekte. Hoofstuk vier verteenwoordig die navorsingsontwerp en metodologie volg hierop. In die vierde hoofstuk word sake met betrekking tot ontwerp soos tegnieke vir die insameling van gegewens, steekproefontwerp en navorsingshulpmiddels wat gebruik word, beskryf. Hierna word primêre data-ontleding aangebied. Laastens eindig die studie met die aanbieding van bevindings, ‘n gevolgtrekking en aanbevelings.

Die navorsingsresultate toon dat

- die algehele prestasie van IT-projekte het tot ‘n groter mate verbeter as wat voorheen gerapporteer is
- ‘n groot aantal projekte oorskry steeds die begroting, raak agter by die skedule en slaag nie daarin om die verwagte voordeel te verskaf nie
- gemiddeld 25% van werk aan IT-projekte moet oorgedoen word

- probleme met betrekking tot menslike hulpbronne (dit wil sê wat verband hou met mense) is die eerste voorspellers van die algehele mislukking van IT-projekte, gevolg deur probleme wat verband hou met projekbestuur
- dit ontbreek die projekbestuurders aan die sagte en bestuurs-vaardighede wat nodig is vir die bestuur van IT-projekte
- ten spyte van hulle positiewe siening van die hulpmiddels en tegnieke van projekbestuur, benut projekbestuurders nouliks die hulpmiddels en tegnieke van projekbestuur in die praktyk.
- Daar was statisties geen noemenswaardige prestasieverskille tussen interne en uitgekontrakteerde projekte nie.
- Swak beplanning en 'n swak besigheidsaak was die belangrikste voorspellers van mislukking volgens die ranglys van die projekbestuurders.

En die belangrikste aanbevelings is:

- Die in lyn bring van IT-projekdoelwitte met die algehele besigheidstrategie en doelwitte,
- om 'n goeie begin te hê, gerugsteun deur die duidelike omskrywing van vereistes en van die projek,
- verseker dat algemene konsensus bereik is oor die kriteria vir die sukses van die projek,
- risiko moet op 'n gereelde grondslag bestuur word,
- eindgebruikers moet betrek word om groter sukses te behaal,
- 'n gesonde metodologie vir die bestuur van die projek moet te alle tye toegepas word,
- projekbestuurders behoort ontwikkel en bemagtig te word om die metodologie van die projekbestuur toe te pas.

Sleutelterme:

Projekbestuur; hulpmiddels en instrumente van projekbestuur; IT-projekte; sakebestuur; IT-projekbestuur; bestuur deur projekte; mislukking van IT-projekte; redes vir mislukking; lewensiklus van die projek; bevoegdheid van die projekbestuur; projekspan, organisatoriese struktuur van die projek, projekonderrig.

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CHAPTER ONE
RESEARCH OUTLINE

1.1 INTRODUCTION

IT projects are crucial to economic growth. Half of all capital investment today occurs in the sphere of information and communication technologies. This investment creates value through the projects that put the technology to work for practical purposes. This growing investment over many years has transformed many aspects of work and society. IT systems and tools are so pervasive that we can scarcely imagine life without them. The importance of IT projects therefore cannot be overestimated.

Information System (IS) can provide the information a business enterprise requires for efficient operation, effective management and achievement of competitive advantage. For this and other reasons, information technology is becoming an integral part of modern business. The fact that not all enterprises follow a modern approach "managing by projects", results in difference in the way enterprises initiate and implement projects. Nevertheless all enterprises initiate IT projects that consume a substantial amount of their resources, both financial and human. Therefore managing information technology projects for optimal value and contribution is very crucial.

IT projects may be as fresh and new as the information technology revolution; however, projects have been part of the human scene since civilisation started. Yet, project management, is on a historical scale almost brand new. Decades ago it was confined to the U.S department of defense and to construction companies. Currently, project management has spread to all avenues of work. The concept behind project management is applied in such diverse industries and

organisations as defense, information technology, construction, pharmaceuticals, chemicals, banking, hospitals, accounting, advertising, law, state and local government and the United Nations (Kerzner, 2003:2, Lock 2000:3).

Although information systems project management involves few characteristics different from those found in operation management, most of the tools can be applied. Information technology can be quite beneficial to business enterprises; however, the information technology environment involves a high turnover of personnel, turbulent work environments, rapidly changing technology that result in high levels of uncertainty with respect to time and cost. Despite this more volatile environment, project management principles applicable to operations management, can be transferred to the information systems environment (Olson, 2001:2).

Presently executives are facing increasingly complex challenges. These challenges result from global competition, escalation of costs for salaries and raw materials, increased union demands, pressure from stockholders and the possibility of long-term inflation accompanied by mild recession. These environmental conditions have existed before, but not to the degree they do today, states Kerzner (2003:1). In order to manage this environmental transformation, enterprises should shift their organisational culture to a project-driven and result oriented one.

Enterprises need to react quickly and frequently to both the problems and the opportunities resulting from the above-mentioned business pressures and drives. Unlike past scenarios where enterprises used to survive by taking traditional actions such as lowering cost, today's dynamic business environment requires some innovative critical response activities such as changing of structure or process. One of these critical response activities is to believe and invest in IT and to

incorporate IT with the basic components of the enterprise. Turban, Mclean and Wetherbe (2002:14) came up with a classic management framework composed of five components, one of which is IT.

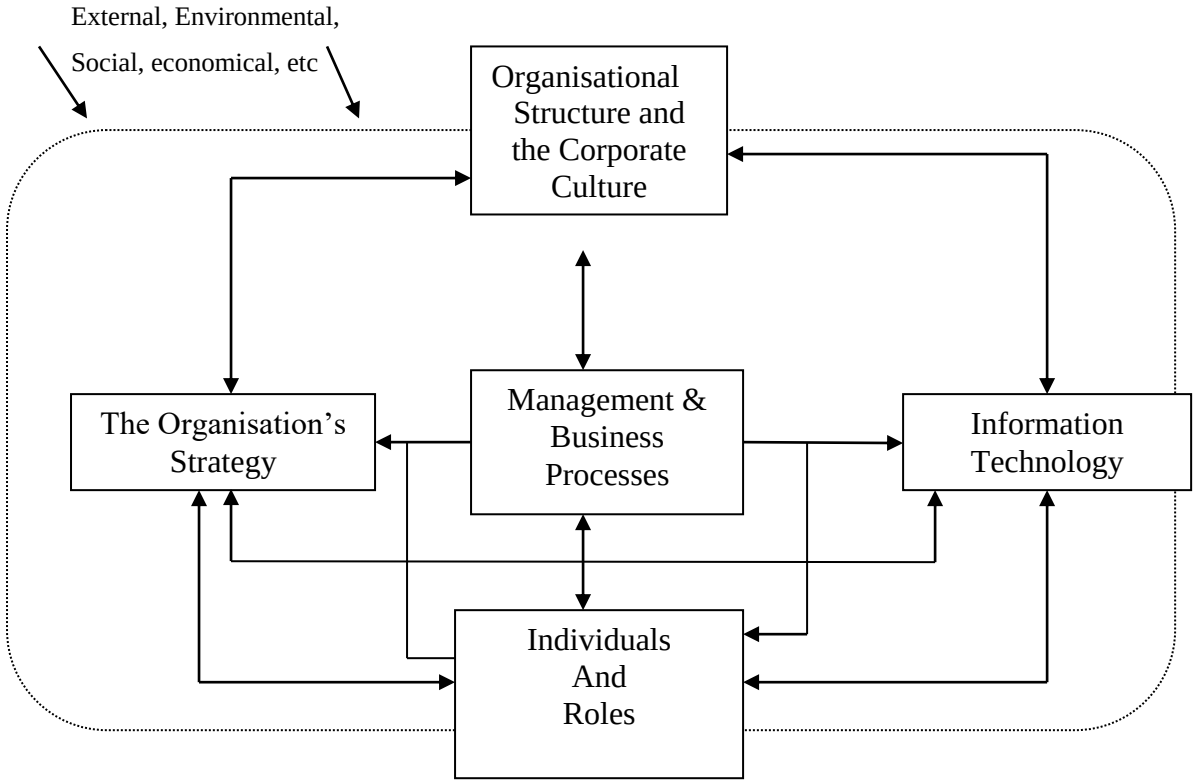

Figure 1.1 Framework for organisational and societal impacts of Information Technology. (Source: as modified by Turban, Mclean and Wetherbe , 2002:14)

Figure 1.1 clearly demonstrates the high degree of interdependence between the components. A change in one can affect the other. It also demonstrates the paramount importance of IT for business enterprises. That is why enterprises constantly initiate IT projects.

In his project classification Lock (2000:3-5) classifies IT projects as management projects. Although such projects might not result in a visible or tangible creation, their outcome affects lots of activities within an enterprise. According to Lock (2000:5) failure to implement

IT systems correctly causes a series operational breakdown and exposes the managers responsible to public discredit. Project management can be as important for IT projects as it is for large construction or manufacturing projects.

Due to the fact that only few people have thought and written about the IT project success criteria, no uniform criteria have been formulated. According to Kerzner (2003:6) a project is considered successful if it is completed

- within the allocated time period
- within the budgeted cost
- at the proper performance and specification level
- with acceptance by the customer or user
- with minimum or mutually agreed upon scope changes
- without changing the corporate culture
- without disturbing the main work flow of the organisation.

Morris and Hough (as quoted by Wateridge 1997:60) came up with their own success criteria. These criteria include the following conditions:

- the project delivers its functionality
- the project is implemented to budget, on schedule and according to technical specifications
- the project is commercially profitable to the contractor
- in the event of a cancelled project, was the cancellation made on a reasonable basis and was the project terminated efficiently.

Turner's success criteria (as quoted in Wateridge 1997:60) include the following aspects:

- it achieves its stated business purposes
- it provides satisfactory benefits to the owners

- it satisfies the needs of the owners, users and stake holders
- it meets its pre-stated objectives to produce the facility
- the facility is produced to the specification within budget and on time
- the project satisfies the needs of the project team and supporters.

A closer look at all the different success criteria reveals that none opposes or rejects the other; but rather supplements and describes one another in different ways. An evaluation of at the above-mentioned criteria leads to the formulation of the following comprehensive success criteria for successful project namely:-

- it is completed to budget, on time and at proper performance and specification levels
- it is completed with acceptance from the customer or end user
- it satisfies the needs of stakeholders including, owner, supporters, end users, project team, contractors and sponsors
- it achieves the stated business purposes.

1.2 STATEMENT OF THE PROBLEM

Information technology is a strategic component of any business enterprise today. At macro level, it is one of the driving forces behind globalisation of the world economies and at enterprise level it plays a crucial role in re-engineering and restructuring of business processes in response to increased competition. Enterprises around the world have made large investments in information technology (IT) projects, as the use of IT-based systems is now considered to be major determinants of competitive advantage. Many of these projects, however, have been afflicted by budget overrun, have fallen behind

schedule and fail to provide the expected benefits. According to the Standish Group (as cited in Whittaker, 1999:23) technology projects are costing enterprises billions of dollars more than they budgeted for, and almost half do not live up to the client's expectations.

Research done in South Africa by Obsurn and Harris (1996:19-27) showed that only 9% of IT projects in large enterprises were viewed as successful, more than 30% were considered outright failures and 61% were challenged in South Africa. A survey conducted by Ernst & Young found that South African enterprises see systems failures as their biggest cause of financial loss. The survey results showed that of the 72% respondents that experienced losses, only 54% had business stability plans in place and only 66% tested these plans at least annually **(http://secure.financialmail.co.za/topco99/uinfo.htm).** In his effort to point out the importance of IT in general and ERP in particular, Kehayas (2002:42) concluded that companies were facing IT project implementation failures. Bateman (2002:20) concluded from research conducted by him that IT project managers were mainly unskilled, untrained and inexperienced and were not held accountable for projects which have failed to meet project objectives, deadlines and budgets. The main focus of this study is to examine the reasons for project failure and to determine how these problems are addressed.

A survey of secondary data shows that there has been such a large number of IT project failures recently. However the researcher could not find evidences of research that investigated the reasons for IT project failures from a broad perspective. This study intends to identify whether IT project failures are affected predominantly by project management-related factors, technical-related or factors relating to the project managers' and team members' personality (people-related factors).

1.3 OBJECTIVES OF THE STUDY

The primary objective of this study is to determine which factors predominantly cause IT project failures. In addition this study will also pursue the following secondary objectives namely:-

- To establish the current state of IT project management.
- Assess the practice and perceived importance of project management tools in selected companies.
- Identify the problems that are often encountered by the current IT project managers.
- Analyse factors that are associated with the frequency of problems encountered on projects.
- Examine the relationship between the respondents' qualifications and the occurrence of failures.
- Gain understanding of how project managers continuously improve their performance by building knowledge through learning.
- Make constructive recommendations to avoid IT project failures.

1.4 METHODOLOGY

In order to achieve the above-mentioned objectives, a background literature review and an empirical investigation were conducted. The literature review included textbooks, magazines, journals, and all other written reports from the on and off line. The literature review focused on the overall project management techniques and practices, the role of project management in IT projects and the role of project managers.

The empirical study attempted to establish and investigate the factors that lead to IT project failures, the application of project management

techniques, and the role of organisational learning to increase knowledge of the project. The empirical study was conducted by means of a self-administered survey. Questionnaires were distributed to a random sample of project managers of 150 companies listed on the Johannesburg Stock Exchange (JSE).

Data analyses were conducted through statistical analysis, graphical presentations and tabulations. In addition some statistical techniques used for analysing the nominal data (Chi-square, T-tests, regression and ANOVA) were applied.

1.5 POTENTIAL BENEFITS OF THE STUDY

The effective completion of IT projects successfully facilitates enterprises' response to the ever-changing pressures and elements of the global economy. Top executives are thus compelled to consider substantial investments in IT projects. However, successful completion of IT projects has never been guaranteed. It was been found that lack of effective management of projects is the primary deterrent in achieving project outcomes successfully. Through a detail examination of the factors that inhibit the success of IT project, the study intend making constructive conclusions and recommendations from which top executives can benefit and improve the IT project management approach they currently apply. This would more than likely reduce the failure rate of such IT projects.

CHAPTER TWO
THEORETICAL CONCEPTUALISATION OF PROJECT MANAGEMENT

2.1 INTRODUCTION

The internal and external environments in which enterprises operate are 'emergent', and are characterised by rapid changes that give rise to much chaos and confusion. The rigid functional approaches of management can no longer cope with the demands of these situations. Steyn (2001:20) states that: "*for project and program management this has become a real challenge since most of what has been assumed in the past century no longer benefits current reality*". Consequently, managing organisations through projects, a management approach that integrates and co-ordinates current chaotic strategic business and operational dimensions, is gaining popularity and attention both in learning institutions and business enterprises.

Project management was initially considered to be strictly engineering related, but is now widely used in non-engineering enterprises as well. Project management can mean different things to different people. Quite often people misunderstand the concept because they have ongoing projects within their enterprise or feel that they are using project management to control these activities.

This chapter presents a theoretical conceptualisation of project management in detail. The first section of this chapter outlines the basic definitions of project management and the growing importance of project management. The next section describes the complete phases of project management. The rationale behind this chapter is to describe the basic terminologies and techniques of project management so as to make it easier for the user to integrate these

concepts with the major concepts of information technology project management that will be described in the next chapter of the thesis.

2.2 DEFINITION OF PROJECT MANAGEMENT

The main difference between project management and general management originates from the definition of a project and what a project intends to deliver to the client and stakeholders. Some of these definitions of project management are outlined below.

The Project Management Institute (PMI) guide to the Project management body of knowledge (as cited in Burke, 1999:2) defines a project as "*a temporary endeavor undertaken to create a unique product or service. Temporary means that every project has a definite end. Unique means that the product or service is different in some distinguishing way from all similar products or services*".

Turner (as cited in Burke, 1999:2) defines a project as "*an endeavor in which human, (or machine), material and financial resources are organised in a novel way, to undertake a unique scope of work, of given specification with constraints of cost, time, so as to deliver beneficial change defined by qualitative and quantitative objectives*". Similarly Gray and Larson (2000: 4) defined a project as "*a complex, non-routine, one-time effort limited by budget, resources and performance specifications designed to meet customer needs".*

According to Kerzner (2003: 2) a project can be considered to be any series of activities and tasks that:

- have specific objectives to be completed with certain specification
- have defined start and end dates
- have funding limits (if applicable)

- consume resources (i.e. money, people and equipment)

The fact that projects have a variety of objectives to meet at a specified time, cost and level of quality that must satisfy all the actors, makes project management a key activity in all enterprises. Likewise there exist different definitions for project management. Some of the most widely accepted definitions of project management are the following:

- Project management is the planning, organising, directing and controlling of company resources for a relatively short term objectives that have been established to complete specific goals and objectives (Kerzner, 2003:4).

- According to the contingency approach (as cited in Nkhalamba, 2000:41) project management is defined as a systems approach management, which combines goal-oriented systems, environment sub-systems and relationships thereof.

- Oisen (as cited in Atkinson, 1999:337) defined project management as the application of a collection of tools and techniques (such as the CPM and the matrix organisation) to direct the use of diverse resources towards the accomplishment of unique, complex, on-time task, set within time, cost and quality constraints.

- The British standard for project management (as stated in Paul, 1999:32) has defined project management as the planning, monitoring and controlling of all aspects of a project and the motivation of all involved to achieve the project objectives safely and within the agreed time, cost and performance criteria.

A closer look at all the definitions of project management reveals a common thread of understanding of what constitutes project management i.e. achievement of short-term goals, an integrative process with constraints of cost, time and performance; aspects that reveal the characteristics of project management and the reasons why project management has become a very important management discipline.

Figure 2.1 constitutes a practical definition of project management whose objective is to show how project management is designed to manage and control company resources on a given activity, within time, within cost and within performance, that are the major constraints within any project. Note that the circle that envelops the three project constraints represents the co-coordinative of management (good interpersonal relations).

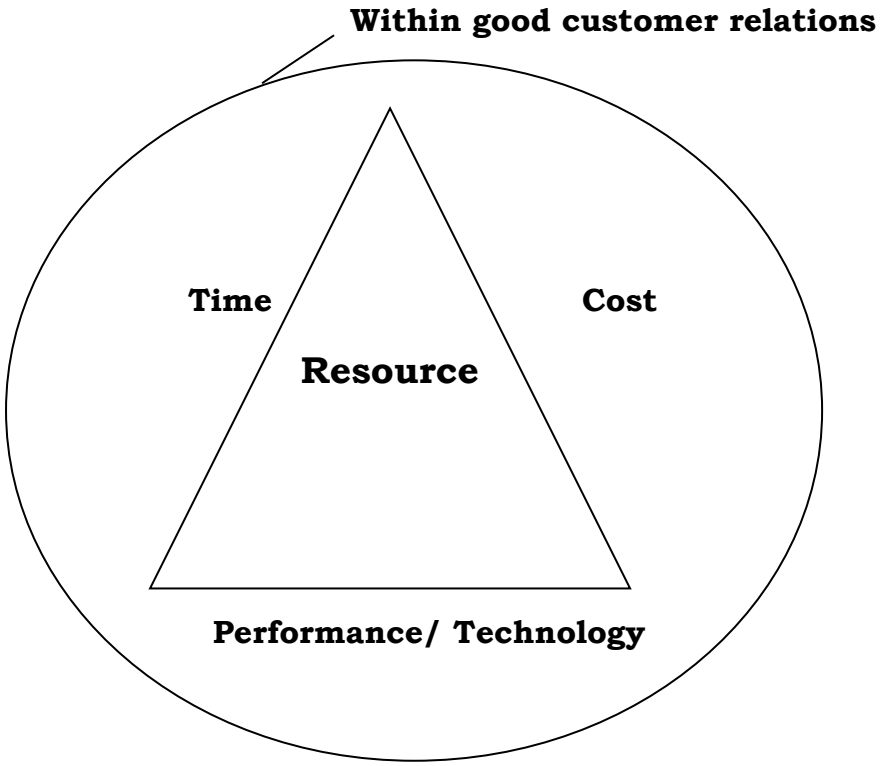

Fig 2.1 A practical Definition of Project Management (source: Kerzner H, 2003:5).

2.3 THE GROWING IMPORTANCE OF PROJECT MANAGEMENT

The growth of project management has developed more through necessity than desire. Its slow growth can be attributed mainly to lack of acceptance of the new management techniques necessary for its successful implementation. An inherent fear of the unknown acted as a deterrent for those managers wishing to change over (Kerzner, 2003: 22).

The purposes of project management are to foresee or predict as many dangers as possible and to plan, organise and control activities so that the project is completed as successfully as possible in spite of many risks. This process starts before resources are committed and must continue until all work is finished. Brown (1999: 33) supports this by saying "*project management can be described as being concerned with the achievement of complex goals by integrating multifunctional inputs into a team relationship, under guidance of a singular responsibility, authority and leadership*".

As driving sources overtook the restraining forces, project management began to mature; executives began to realise that the approach was in the best interest of the enterprise. Traditional organisational forms and ways of managing enterprises are becoming obsolete as they fail to meet the demands of a very volatile business environment (Steyn, 2001: 20; Bachy and Hameri 1997: 211).

Steyn (2001:20) states further that managing organisations through projects and programmes has become the integrative implementation link between corporate strategy, business strategy and operations strategy. In support Kerzner (1998:29) states that *"Project management, if properly implemented, can make it easier for executives to overcome the impact of both internal and external obstacles."*

In his effort to explain the changing approaches in project management, Laszlo (as cited in Cicmil, 2000: 554) states that project management is no longer an organised and orderly game where the players pursue pre-conceived plans to achieve predetermined ends but an ongoing play involving chance and probability in an environment where not only the players but also the rules of the game are subject to change.

According to Webster (1994: 22) *"best practice project management gives the general manager all that is needed to run the business*". Project management embraces the techniques of task definition planning budgeting, measurement, and contingency planning, together with all the good practices of people management skills. This is one of the reasons that makes project management the best process to be practiced by all self-respecting managers.

Project management is no longer a special-need management. It is rapidly becoming a standard way of doing business. An increasing percentage of the typical firm's effort is being devoted to projects (Gray and Larson, 2000: 7). An influential project management writer, David Cleland (As cited in Gray and Larson, 2000: 7) declares that this is the dawning of the "*age of project management*". Cleland further mentions that the compression of the product lifecycle, knowledge explosion, corporate downsizing, increased customer focus, global competition and rapid development of economies, to be the phenomena that justify his statement.

While mentioning that project management is the best way to put together the best possible team, Kerzner (1998:30) explains that the previously existing organisational structures were unable to accommodate the wide variety of interrelated tasks necessary for successful project completion creating an apparent need for project management.

Project management, though a new phenomenon on the historical timescale, appears to be ideally suited for the business environment requiring accountability, flexibility, innovation speed and continuous improvement.

2.4 PROJECT LIFE CYCLE

Although there are a number of different lifecycle models in project management literature, most projects go through similar stages on the path from origin to completion. The following are some of the definitions and descriptions of the project life cycle as presented by several writers of project management.

Meredith and Mantel (1995: 13) state that a project is born (its startup phase), a manager is selected, the project team and the initial resources assembled and the work program organised. Then work gets under way, momentum quickly builds and progress is made. This continues until completion.

The PMI's guide to the body of knowledge (as cited in Burke, 1999: 24) state that because projects are unique and involve a certain degree of risk, companies performing projects will generally subdivide their projects into several project phases to provide better management control. Collectively these project phases are called the project life cycle.

Maylor (1999:8) gives a unique description of the project life cycle and divides a project into three phases: Design it, Do it and Develop it. Maylor (1999: 9) further mentions that this generic life cycle for a project involves considerations about how the level of activity varies with time.

While mentioning that the project life cycle is one way of illustrating the uniqueness of project work, Gray and Larson (2000: 5) declare that project managers find it useful to use the project life cycle as a cornerstone for managing projects. The life cycle recognises that projects have a limited lifespan and that there are predictable changes in levels of effort and focus over the lifespan of the project.

According to Burke (1999:24) there is agreement amongst authors on the following phases of the life cycle.

- **Project concept and initiation phase**; also called project definition stage. Specifications of the project are defined, selections are made, tasks, responsibilities are defined and teams are defined.
- **Design and development phase;** also called the planning phase. Plans are developed to determine what the project will entail, when it will be scheduled, whom it will benefit, what quality levels should be maintained and what the budget will be, using the guidelines set in the initial stage.
- **Implementation or construction phase;** also called execution stage. Here a major portion of the project work takes place both physically and mentally as per the baseline plan developed in the previous phase.
- **Delivery stage**; this usually includes two activities; delivering the project product to the customer and redeploying project resources.

Figure 2.2 depicts the project life cycle and the activities undertaken in each cycle.

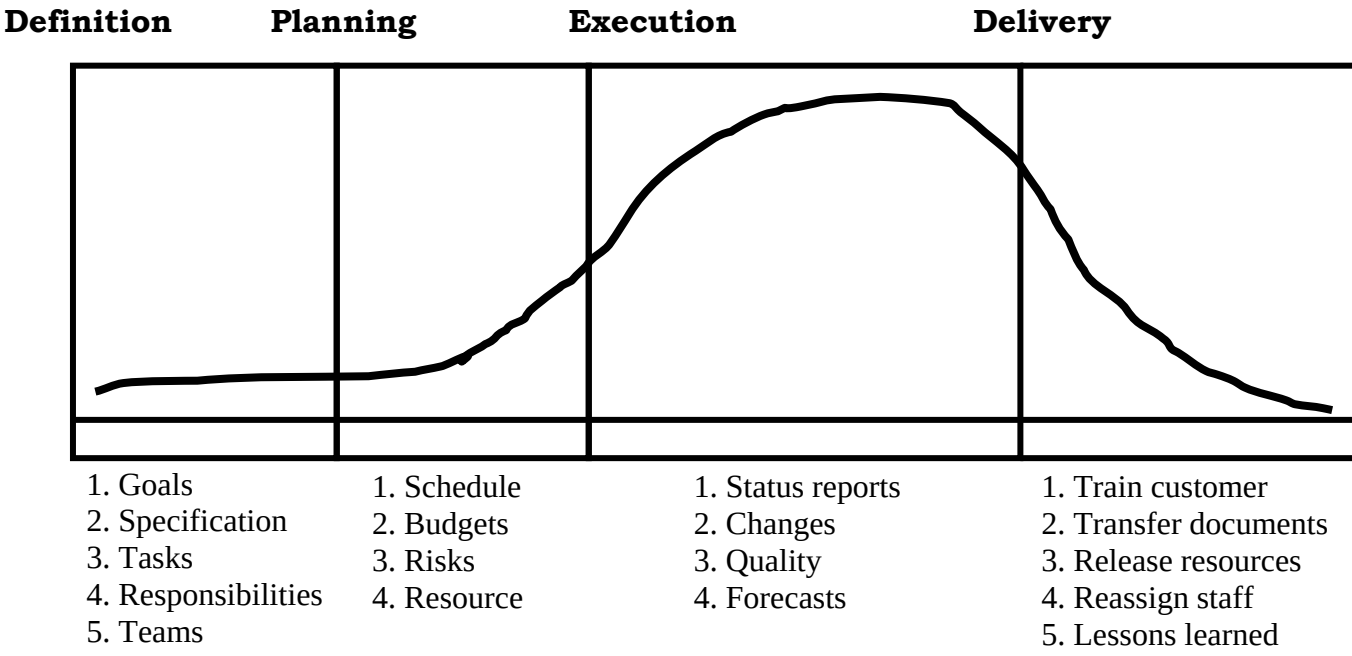

Figure 2.2 Project Lifecycle (Adapted from: Gray and Larson, 2000: 6).

The above figure depicts the four project phases along with the activities that are normally undertaken during each phase. These phases and the activities to be undertaken are described in greater detail in the following sub-sections.

2.4.1 Project Definition

Project definition (also called conception or initiation) is the phase with the most crucial influence on the eventual success of a project. The ultimate goal of the project must be compatible, accomplished within constrains of the limited resources. As the project progresses, the influence of this phase on the project outcome will diminish if the scope of the project is unrealistic in terms of the given constraints.

Project definition is quite a time consuming task. Webster (1999:241) states that creating a good definition (even for a small project) is expressed in hours rather than minutes and substantial project can

take days of effort. Project selection, project scope definition, project risk assessment, project organisation, selecting the project manager and selecting the project team are the most important activities of the project definition phase.

2.4.1.1 Project selection

Project selection, the process of evaluating individual projects or a group of projects, is a crucial decision for the long-term profitability and survival of an enterprise. Project selection involves making a commitment to the future. The execution of a project will tie up enterprise resources and preclude the taking on of another project. *"We live in a world of finite resources and therefore cannot carry out all the projects we may want or need"* (Burke, 1999: 48). Therefore a process is required to select and rank projects on the basis of beneficial change to the enterprise.

Each project will have different costs, benefits, and risks attached to it. These are rarely known with certainty. In the face of such uncertainties, the selection of one project out of a number of alternatives is a difficult task. Choosing a number of different complementary projects, a portfolio, is even more complex. Project evaluation is a very important part of the project life cycle because project success is finally judged by the degree to which the project meets its goals. Since project selection is based on a direct statement of some measurable goals, a project manager should have clarity on them in order to perform effectively (Meredith and Mantel, 1995: 42).

The search for reliable techniques and models for selecting a project dates back for decades. The issue is not only of concern to academicians or managers, but has become more and more important to investors and all stakeholders. There is no shortage of selection models. *"The variety of models available to practitioners is*

*unlimited"(*Gray and Larson, 2000: 36). However, some of the models are unable to incorporate some of the rapidly changing criteria that do affect the selection and the outcome of a project.

Two basic sets of project evaluation and selection models exist, the numeric and the non-numeric. Most enterprises use both sets simultaneously or use a combination of two sets. Numeric models are usually financially focused and quantify the projects in terms of either the time needed to repay the investment or the return on the investment. According to Gray and Larson (2000: 36), numeric models based on financial criteria were used almost to the exclusion of other criteria. However, in the last two decades a dramatic shift to include multiple criteria in project selection developed.

When choosing a selection model, the points to consider are: realism, capability, flexibility and minimum cost (optimum efficiency). Most importantly the chosen model should evaluate projects by how efficiently they meet the strategic goals and mission of the enterprise (Burke, 1999: 49).

(i) The numeric models

The numeric models are subdivided into financial models and scoring models. A large majority of enterprises using project evaluation and selection models use profitability as the sole measure of acceptability. Some of the profitability-based models include:

Payback Period. The payback period is the time taken to gain a financial return equal to the original investment. This model assumes that cash inflows will persist at least long enough to pay back the investment and ignores any cash inflows beyond the payback period. This model also observes the proxy for risk as inadequate. Under this

model, the project that takes a shorter time to recover its outlay is selected first (Meredith and Mantel, 1995:50; Burke, 1999:53).

Return on Investment (ROI). Another popular investment appraisal technique that looks at the whole project is return on investment (ROI). This method first calculates the average annual profit that is simply the project outlay deducted from the total gains, divided by the number of years the project will run. Under this model an investment with high initial profit takes preference (Burke: 1999:55).

Net Present Value (NPV). This method determines the net present value of all cash flows by discounting them at the required rate of return. It uses the management's minimum desired rate of return as a discount rate. If the result is positive, and the project meets the minimum desired rate of return, it is eligible for further consideration. Higher positive NPV's are desirable. The fact that NPV considers the time value of money results in its being an often used and widely accepted profitability-based model. Obviously the project with the largest NPV is selected first (Meredith and Mantel, 1995:53; Gray and Larson, 2000:36).

Internal Rate of Return (IRR). The IRR is the value of the discount rate when the NPV is zero. It is the rate that equates the present values of the stream of cash inflows and outflows over the duration of the project. Under this method the project with highest IRR is selected. This allows the manager to compare IRR with the current interest rates.

The above-mentioned numeric models look at and solely depend on a financial element, which constitutes serious limitations. To broaden the selection criteria, a scoring model called the factor model, which uses multiple criteria to evaluate a project, was developed. The factor model simply lists a number of desirable factors on a project as well

as selection factors, along with columns selected and not selected (Burke, 1999: 62).

(ii) The non numeric models

The Sacred Cow. In this case, a senior and powerful official in the enterprise suggests the project. Often the project is initiated with a simple comment such as 'if you a have chance, why don't you look into. . .' and then follows an undeveloped idea for a new product, for the development of a new market, for installation, planning or for some other project requiring an investment of the resources of the enterprise. The project is "sacred" in the sense that it will be maintained until successfully concluded or until the boss personally discovers that the project has failed and terminates it (Meredith and Mantel, 1995: 47).

The Operating Necessity. If a flood is threatening the plant, a project to build a protective dike does not require much formal evaluation. According to Gray and Larson (2000: 37) there are projects that "must" be selected. "Must-be-selected" projects are those that must be implemented or the enterprise will suffer direct consequences. Any project placed in the "must" category ignores other selection criteria and gets implemented as efficiently as possible.

Competitive Necessity. Here, decisions to undertake the project, are based on a desire to maintain the competitive position of the enterprise in the market. For example, many business schools are restructuring their undergraduate and MBA programs to stay competitive with the more forward-looking schools (Meredith and Mantel, 1995: 47).

Comparative benefit model. In the case when an enterprise has many projects, senior management would like to select a subset of the

projects that would most benefit the enterprise, but the projects do not seem to be easily comparable. Afterwards the project selection committee approves the one that benefits most (Meredith and Mantel, 1995: 48).

In addition to the above-mentioned models, project management authors and researchers propose various methods that include the real-option and value, management tools and techniques, derived from operational research models. However most of these proposals are not free from criticism. Of fundamental importance is the establishment of criteria that support the strategic direction of the enterprise and that are recognised and used by every member of the enterprise.

2.4.1.2 Project scope definition.

Whether a project requires a team of hundreds of people working together for five years or three colleagues joining forces for two months, defining the project scope at the inception of the project is a critically important activity. Scope definition entails breaking down the work required to meet the project's interim and long-term goals in detail. With proper scope definition, all work and deliverables are subdivided into clear, manageable units. Lock (2000:53) states, *"Project definition is a process, which starts when the project customer or investor first conceives the idea of the project. It does not end until the last piece of information has been filed to describe the project in its finished 'as built' condition."*

According to Gray and Larson (2000: 61), defining the project scope sets the stage for developing a project plan. Project scope is a definition of the end result or mission of the project, a product or service for the client / customer. Likewise the PMBOK (as cited in Burke, 1999: 95) defines project-scope definition as *"subdividing the major project deliverables in smaller, more manageable components"*.

This will help to improve the accuracy of the cost and time estimates and assign single responsibility to the work package. In addition, the scope definition outlines the content of the project, how the project will be approached and explains how it will meet the client's needs or problems.

In order to guarantee the efficient delivery of a project, one must understand why the project is needed at the early stage of the planning process. *"It is a seemingly obvious statement but project managers are often in the position of not fully understanding what they are being asked to do,"* says Webster (1999:240-241). Adequate project definition is equally important for the user, who should be clear on what he or she expects in return for the financial outlay. This also applies to an enterprise considering an in-house project, in which case the enterprise can be regarded as the user (Lock, 2000: 54).

Project-scope definition is a core project planning process. It involves identifying and describing the processes that are needed to produce the product of the project in sufficient detail to ensure that:

- the project team understands what it must do.
- all of the reasonably knowable project work has been identified.
- appropriate management controls can be applied.

Project scope definition is normally the first step in the project planning process and forms the basis for much of the remaining planning effort. If this process is inefficiently done, it is unlikely that the rest of the project planning will be successfully done (www.pmpartners.com).

According to Burke (1999:6), for scope definition to deliver the needed benefits, it needs acceptance from all stakeholders. But it has to be noted that project scope is not static. It can be changed if there is a

need to do so. Furthermore Gray and Larson (2000: 62) state that a typical project scope checklist includes the following.

- project objectives
- deliverables
- milestones
- technical requirements
- limits and exclusions
- review with customer

2.4.1.3 Project risk assessment

Risk assessment is often one of the most neglected, yet most important areas of project management. This is largely due to the fact that many project managers fail to spend time at the onset of a project to properly assess and manage risk. Proper identification and mitigation of risk can add to the likelihood of project success by assisting the project manager to make better informed, calculated decisions with confidence. The concept risk involves the probability an undesirable event will occur and relates to the consequences of all its possible outcomes (Gray and Larson, 2000:139). When applied to the project environment, risk is the probability of occurrence and consequence of not achieving project goals.

Regardless of its sources, project risk adversely affects the achievement of project objectives of schedule, cost and specification. Since the essence of project management is estimation, this means that just about everything in the project is uncertain. In other words, risk exists throughout all the phases of the project (Jaafari, 2001:89-93). At the initial stage enterprises need to establish a formal method of project planning which is designed to ensure that unforeseen events are reduced and the negative consequences associated with project

risks are minimised. A more detailed explanation of risk will be given in chapter three.

2.4.1.4 Work Breakdown Structure (WBS)

Work breakdown structure (WBS) was originally developed in the 1960s as part of the drive towards improved project definition and it soon became the backbone of planning and control system. A WBS is an excellent tool for quantifying the scope of work as a list of work packages and is essential tool to ensure that the estimate or quotation includes the complete scope of the work. Its main purpose is to subdivide the scope of work packages into manageable work packages, which can be estimated, planned and assigned to a responsible person or department for completion (Burke, 1999:105)

A WBS is a deliverable-oriented grouping of project elements that organises and defines the total scope of the project. Turner (as cited in Burke, 1999: 105) defines a WBS as "*a cascade of deliverables in which the overall product or objective of the project is broken into sub-products, assemblages and components*." Similarly Gray and Larson (2000: 66) describe a WBS as the outcome of a successive subdivision of a project into smaller and smaller elements. It is usually preceded by a definition of the scope and deliverables.

As stated in Kerzner (2003:54), a WBS acts as a vehicle for breaking down the overall project into smaller elements thus providing greater probability that major and minor activity will be accounted for. There is no single best way to develop a WBS. It is acceptable practice to use a WBS template or a WBS from a previous project when developing a project's specific WBS. In fact, this may be preferable in certain enterprises for standardisation and easy understanding. Figure 2.3 depicts a five step indented structure as obtained from Gray and Larson (2000:68).

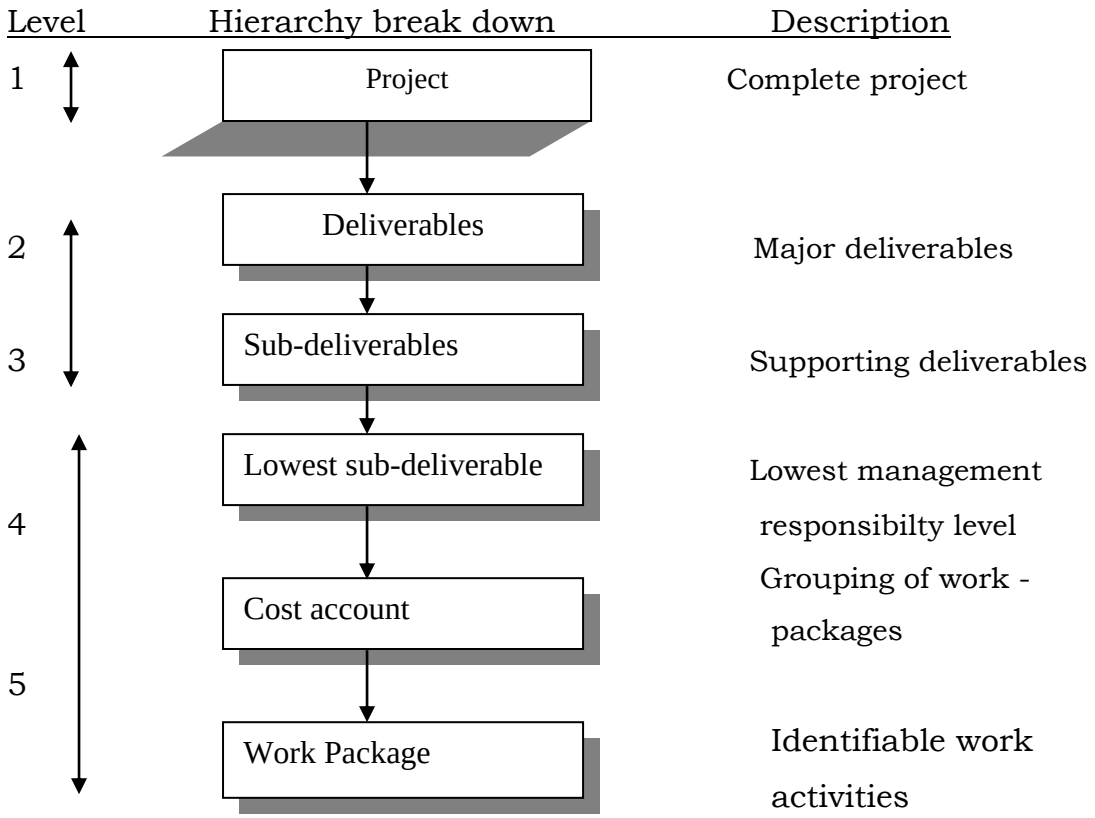

Figure 2.3 Hierarchical Breakdown of a WBS (Source: Gray and Larson 2000: 68)

In figure 2.3, level one represents the total project objectives that would be useful to top management. Level two represents a partial list of deliverables necessary to develop the project. Level three represents the supporting deliverables. Levels four and five represent the lowest deliverables along with the cost account and work packages. The work-package components, which are at the lowest level of the WBS, consist mainly of physical work. For example, the manufacturing of components and subassemblies. Each component of the WBS has its own set of goals and project objectives that must be achieved in order for the overall project objectives to be met.

Project success is assured by managing cost, schedule and quality at the work-package level. To do this, completion of a work-package must be measurable and verifiable. If this can be achieved, then a

WBS provides a solid basis for progress monitoring, cost control and project performance assessment.

2.4.1.5 Project organisation

For most of the 20th century, organisational design concepts were fairly stagnant, revolving around the basic functional organisation design. The key arguments revolved around whether a highly centralised or a decentralised functional organisation was better. During the latter half of the 20th century project organisation gained a great deal of attention as a better way to address the needs relating to the managing of large projects.

A large number of publications address the three traditional organisational types: functional, project, and matrix. Over the past 20 years, however, more has been written about emerging, less-structured ways of leading project-oriented work, such as adhocracy (organising teams ad hoc, as new projects demand) and team-centered teamocracy - movements away from the more conventional bureaucratic approach toward project management.

When an enterprise succeeds, it tends to grow requiring additional resources including workers, which dictate the nature and design of the organisational structure. As long as the organisational structure is capable of handling the organisational processes of the enterprise, the structure tends to persist (Meredith and Mantel, 1995:150). When projects are initiated, two important decisions require attention. Firstly, a decision must be made about how to incorporate the project into the parent firm. Secondly, a decision must be made about how to organise the project.

The project organisation details the resources to be used and how the project team should be organised i.e. whether it is functional, matrix

or a hybrid mix of various types. The organisation breakdown should be constructed on the basis of the required experience and skills specifications of the project members (Lee-Kelley and Loong 2003: 583).

A project management system provides a framework for launching and implementing project activities within a parent enterprise. A good system balances the needs of both the parent enterprise and the project by defining the interface between the project and parent enterprise in terms of authority, the allocation of resources and the eventual integration of project outcomes into mainstream operations (Gray and Larson, 2000: 221).

Many organisations have struggled to create a system for organising projects while also actively managing operations. One of the major reasons for this struggle, is the fact that projects are in conflict with the fundamental design principles associated with traditional organisational structure. Firstly, projects are unique, one time efforts, with a discrete beginning and end. Secondly businesses find it difficult to effectively organise projects because most projects are interdisciplinary in nature requiring co-coordinated efforts of a variety of specialists to be completed (Gray and Larson, 2000: 222).

Finally, it should be noted that ensuring the success of projects requires more than just a project organisation chart for the project. It also requires that the organisation outside the project be set up to support the project with sufficient resources and within a framework that ensures that the project manager will be successful (see www.projectauditors.com/Consulting/Organizing.html.)

2.4.1.6 Selecting the project manager

A typical project can be described as a complex system of a large number of interrelated and interconnected elements, various organisational units and a wide variety of workers. It is due to the diverse and complex nature of the project system that selecting and appointing the right project manager is regarded as one of the two or three most important decisions concerning a project. This decision is usually undertaken at the early stage of the project initiation phase (Meredith and Mantel, 1995:128).

According to Gray and Larson (2000:261) one of the keys to being an effective manager is building co-operative relationships among different groups of workers to successfully complete projects. Similarly, Rosenau (1995:177) states "…*although the project manager is clearly involved in all phases of the project and is ultimately responsible for satisfying the triple constraints, his or her interaction with the project and support teams is a key to the people management phase".*

The project manager is responsible for creating and integrating activities across multiple functional lines. In order to succeed, the project manager needs strong communicative and interpersonal skills, should become familiar with the operations of each line of organisation, and should a have general knowledge of the technology being used (Kerzner, 1998:10).

The major quality attributes of a project manager in general and IT project manager in particular will be explained in detail in the next chapter. However, at this stage it is essential to list some of the popular attributes, skills and qualities that have to be sought when selecting project managers as stated by Meredith and Mantel (1995:128). These attributes include, technical know how, maturity,

established relationship with executives, team leadership and risk taking.

2.4.1.7 Selecting the project team

One of the unique characteristics of a project is its interdisciplinary nature, where different workers with different skills and expertise from different departments participate. Management, or the steering committee responsible, needs to exercise great care when selecting a project team. The magic and power of teams are captured in the term "synergy", which is derived from the Greek word suergos, meaning working together (Gray and Larson, 2000:297).

A well-rounded team includes a mix of workers and skills. In selecting a project team, management should consider the following elements:

- overall team composition
- team selection criteria
- team size
- process for the selection of team members

The process of selecting and recruiting the project members will vary across enterprises. Two important factors that affect the selection and recruitment are the importance of the project and the management structure being used to complete the project. Often for higher priority projects that are critical to the future of the enterprise, the project manager is given virtual Carte Blanche to select whomever he/ she deems necessary.

In matrix structures, the functional manager assigns to the project, while the project manager has to liaise with functional managers to obtain the necessary team members. Even in a project structure, the project manager should be sensitive to the needs of all role players.

"*There is no better way to create enemies within an organisation than to be perceived as unnecessarily robbing other departments of essential personnel"* state Gray and Larson (2000:298).

Experienced project managers stress the importance of requesting volunteers. However, this desirable step is often outside the manager's control. As stated by Gray and Larson (2000:298), in addition to the major quality attributes of individual team members such as experience, knowledge and technical skills, the following less obvious considerations need to be factored into the selection process:

- problem-solving ability
- availability
- technological expertise
- credibility
- political connections
- ambition, initiative and energy.

2.4.2 Project Planning

The wise man bridges the gap by laying out the path by means of which he can get from where he is to where he wants to go. For a project to be completed successfully on time and within the approved budget, it must be planned in advance. It is now time to consider how to plan the processes of the project, the duration and the resources needed to accomplish the project. Project planning and scheduling are complex activities with demanding information needs and communication requirements. Gray and Larson (2000: 5) define the planning process as "….*a process by which the major components of the project schedule time, project beneficiaries, project quality level and the budget required are determined."*

Amongst other things, a project plan serves as a framework to: (1) eliminate conflicts between functional managers; (2) eliminate conflicts between functional management and programme management; (3) provide a standard communication tool throughout the lifetime of the project; (4) provide verification that the project manager understands the objectives and requirements of the client; (5) provide a means for identifying inconsistencies in the planning phase; (6) provide a means for early identification of problem areas and risks so that minimum unforeseen events occur downstream; and (7) develop all the project schedules as a basis for progress analysis and reporting (Kerzner,1998: 516-537).

Whenever any job has to be accomplished according to a time or date deadline, it is advisable to have at least some idea of the relationship between time allowed and the time needed. This is true for any project whether it be the preparation of dinner or the construction of a motorway. In the first example one would be ill advised to tell guests "dinner" is at seven, but the potatoes will only be ready by 7:30 (Lock, 2000: 157).

The following statements by Rosenau (1995, 49) highlight aspects of project planning.

"The planning activity for the management of a project is crucial. Plans are the simulation of a project compromising, the written description of how the triple constraints will be satisfied. Therefore project plans are really three plans: one for the performance dimension, one for the schedule dimension and one for the cost dimension. Plans aid co-ordination and communication, provides a basis for control and are often required to satisfy requirements and help avoid problems".

Successful project management, whether it is in response to an in-house project or a customer request, must utilise effective planning

techniques. From a systems point of view, management should utilise resources efficiently. Efficient utilisation of resources over several different types of projects requires a systematic plan in which the entire enterprise is considered as one large network subdivided into smaller ones (Kerzner, 1998: 522-523).

For a better understanding of the project planning stage and its main activities, the following sub-sections will present some of the activities and techniques of project planning.

2.4.2.1 Project networking

The WBS explained earlier in this chapter provides a structured breakdown of the scope of the work into manageable work packages, which can further be developed into a list of activities. The project network diagram is then the graphic presentation of the project activities used for establishing the logical relationship between the activities and showing the planned sequence of work in the form of a graphic flow chart.

The role of a project network in the successful completion of a project can never be overlooked, as it is the tool for planning, scheduling, and monitoring the project's progress. The project network diagram, also called the precedence diagram, is a development of the activity-on-node (AON) concept where each activity is represented as a node or box (Burke, 1999: 120).

The most common networking techniques used by the project management practitioners are PERT and CPM. The Program Evaluation and Review Technique (PERT) was developed by the U.S Navy in co-operation with Booz Allen Hamilton and the Lockheed Corporation for the Polaris missile/ submarine project in 1958. The critical path method (CPM) was developed by Dupont Inc, during the

same period. The two methods are closely related and are often combined for educational presentation (Meredith and Mantel, 1995: 336-337).

PERT assumes that each activity's duration has a range that follows a statistical distribution (Gray and Larson, 2000, 101). PERT is strictly oriented to the time element of projects and focuses on determining the probability that a project could be completed by some given date. CPM on the other hand, uses deterministic activity time estimates and is designed to control both the time and cost aspects of a project, in particular cost/ time trade offs (Meredith and Mantel, 1995: 337).

Gray and Larson (2000: 89) identify the following benefits that can be derived from project networks:

- it is very easy to modify or change when unexpected events occur as the project progresses
- it provides a basis for scheduling labor and equipment
- it enhances communication that melds all managers and groups together in terms of meeting time, cost and performance objectives of the project
- it provides estimation of project duration
- it gives the basics for budget and cash flow of the project
- it identifies activities that are critical
- it minimizes the occurrence of unforeseen events by getting the plan out early and allowing corrective feedback

Although it seems a bit exaggerated, there is a popular hear say statement from practitioners that the project network represents three quarters of the planning process. This signals the importance of the network to project managers in the field. In developing the project network, the project manager or any body responsible for planning, needs to follow the following rules for developing a network:

- networks flow typically from left to right
- an activity cannot begin until all preceding connected activities have been completed
- arrows on networks indicate precedence and flow; arrows can cross each other
- each activity should have a unique identification number
- an activity identification number must be larger than any activities that precede it
- looping is not allowed
- conditional statements are not allowed
- experience suggests that when there are multiple starts, a common start can be used to indicate a clear project beginning on the network

Figure 2.4 depicts a typical network developed for a software development project. In the network all activities are flowing from left to right, and each activity has its own alphabetical identification number.

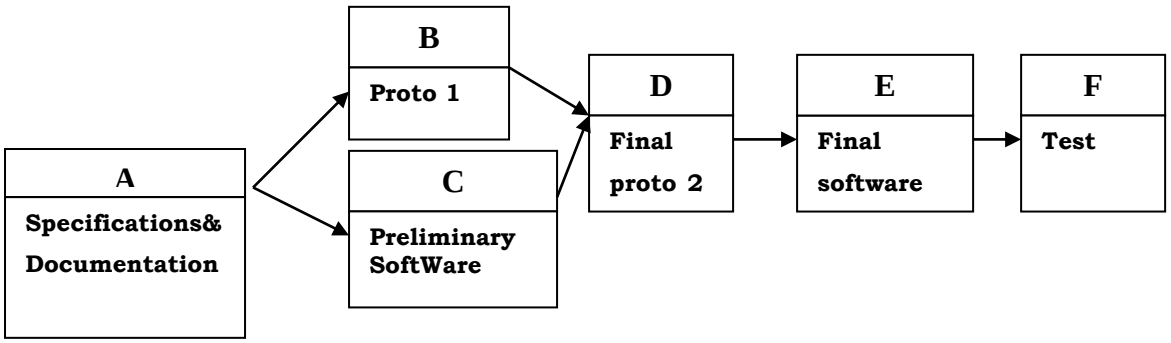

Figure 2.4 Activity network for circuit board work packages (source: Gray and Larson, 2000: 91)

2.4.2.2 Bar charts (Gantt charts)

One of the oldest and still the most useful tool for planning and monitoring a project's progress is the Gantt chart developed by Henry

L. Gantt, a pioneer in the field of scientific management. The Gantt chart shows planned and actual progress for a number of tasks displayed against a horisontal time scale. It is a particularly effective and easy-to-read method of indicating the actual current status for each of a set of tasks compared to the planned progress for each item of the set. As a result the Gantt chart can be helpful in expediting, sequencing, and reallocating resources among tasks, as well as in the valuable but mundane job of keeping track of how things are going (Meredith and Mantel, 1995: 354).

Frequently used in project management, a Gantt chart provides a graphic illustration of a schedule that helps to plan, coordinate, and track specific tasks in a project. Essentially the bar chart is concerned with two major tasks. Firstly, it visualises the time flow of the individual processes for all project workspace members. Secondly, it provides the project manager with maintenance functionalities for individual processes (http://bscw.gmd.de/V4proflow.html#2.).

Despite its popularity and simplicity, a bar chart has its own weaknesses, of which the absence of dependency relationships among project activities is the major feature. Therefore bar charts should be used with a network (Gray and Larson, 2000: 108).

2.4.2.3 Cost estimation

The fact that project cost overruns occur so frequently implies that setting a realistic cost estimate is a crucial activity in project management theory. The budget is not simply one factor of a plan, nor is it merely an expression of organisational policy: it is also a control mechanism. The budget serves as a standard for comparison, a baseline from which to measure the difference between the actual and planned use of resources.

Budgets play an important role in the entire process of management. Unless the budgeting procedures capture the association of resource use and the achievement of goals, planning and control become useless. In order to develop a budget, an accurate cost estimation is not only essential but also a pre-requisite. Time scale planning, pre-allocation of project resources, the establishment of funding, manpower and cost control, all demand provision of sound estimates (Meredith and Mantel: 1995, 289).

According to Kerzner (1998: 713), estimates are not a matter of blind luck. They are well thought out decisions based either on the best available information, some type of cost estimating relationship or some type of cost model. The quality and accuracy of the estimate should be seen as the best approximation based on:

- time available
- technique employed
- information available and
- expertise and experience of estimation

Regardless of the estimation model that the project manager uses, or plans to use, the project manager should be acquainted with the following project cost terminologies that would help him in estimating the overall project cost (Lock, 2000: 77-80).

Below line cost: a collective name for the various allowances that are added once a total basic cost estimate has been made. These may include, allowances for cost escalation, exchange rate fluctuation, etc.

Cost escalation: an increase in any project cost element, when the cost of that element is compared over two different dates.

Fixed cost: cost is said to be fixed when it remains virtually unchanged and must continue to be incurred even though the work load might fluctuate between zero and the maximum capacity.

Indirect cost: The provision of facilities and services such as office accommodation, management, personnel, and welfare services, training costs and management accounting, lighting and so on that cannot be directly allocated to an activity or a project but are required to keep the company operational.

Labour burden: the labour burden is an amount, usually expressed as a percentage of wages or salaries, which is added to the basic hourly or weekly rate for employees to allow for non-working time and various additional expenses.

Material burden: materials for a project, which are themselves chargeable as direct cost, are typically marked up by contractors to recover their administrative and handling costs.

Prime cost: the sum of all direct costs (material and labour) needed to accomplish a particular job or project.

Time-related costs: CPM was originally developed to address the time cost trade off. Thus, an extension or reduction in project duration will definitely have an impact on the overall project cost.

2.4.2.4 Resource scheduling

The project manager is continuously confronted with the economic principles (such as scarcity of resources) and should therefore execute tasks to accomplish the desired quality standards to the project utilising the minimum possible time, cost and other resources. The planning techniques mentioned in the prior sub-sections fail to deal

with resource usage and availability as they assume an unlimited supply of resources when estimating the time for work packages and network times. However in reality this is obviously not the case.

Lock (2000:160) clearly distinguishes between a plan and a schedule, although few professionals recognise that. He explains it as follows: *"A plan is considered as the listing or visual display that results when all the project activities have been subjected to estimating, logical sequencing, target timing, and the determination of priorities. A schedule is obtained by doing additional work on the initial plan, so that resources needed to carry out all the project activities are taken into account."*

Resource planning addresses the effective scheduling of the skills and resources necessary to deliver the project outcomes. Resource aggregation, levelling and smoothing refer to techniques that jointly ensure that the project use of the available resources optimally. In project management terms, resources incorporate the staffing requirements, money and physical objects that the project will utilise. Resource planning ensures that the project is accomplished efficiently, by keeping the dedicated project resources optimally utilised (http://www.gantt-chart-explained.com.)

Highlighting the fact that more project proposals exist than the correspondingly available resources, Gray and Larson (2000: 191) mention the importance of prioritising projects and selecting projects that best contribute to the enterprise objectives, within the constraints of resources available.

It should be noted that all the planning techniques such as networking diagrams, bar charts and procurement schedules could also be utilised when scheduling resources. Discussing the scarcity of resources and their impact on the project success would benefit no

one, unless he or she knows what the resource constraints are, added Gray and Larson (2000:193).

When a project participant attempts to allocate the project resources he/she should recognise the following situation.

Time constrained project. one that must be completed by an imposed time.
Resource constrained project. one that assumes the level of resource available cannot be exceeded. If the resources are inadequate, it will be acceptable to delay the project but as little as possible.

2.4.3 Project execution

The development of a project plan or baseline plan completes the first phase of the planning and control cycle. Project execution and control use the baseline as a means of achieving the project objectives. Needless to say that planning is a pointless exercise unless execution of the plans are tracked and controlled through accurate reporting on performance (Burke, 1999:191).

Once authorisation has been received, the project ceases to be merely an object for planning and speculation and becomes instead a live entity, to which the project team is fully committed. For the purpose of achieving all the project objectives, whether technical, budgetary or timescale, the appropriate project organisation has to be setup. All the participants must be fully informed of the particular role they will be expected to play (Lock, 2000:457). During the execution stage, a major portion of the work takes place in both the physical and the mental contexts. The physical product is produced (a bridge, a software program). Time, cost and specification measures are used to control the progress of the project. Leading the team, meeting with

team members, communicating with stakeholders and resolving conflicts are among the major activities of a project manager during the execution stage.

2.4.3.1 Getting work started

When the newly appointed project manager has collected his or her wits and observed the contents of the project specification (which will probably entail some candle burning), the most urgent job is to mobilise all the project resources and tell the key participants what is expected of them.

The process takes place in different stages and by a variety of methods. The first executive action of the project manager is usually to call an initial meeting on "the kickoff" meeting. This gives the project manager an opportunity to outline the main features of the project to managers whose departments will participate in the project, and to the most senior design staff and other key people. This task will be simpler for the project manager if the organisation of the project is a dedicated team rather than a matrix organisation (Lock, 2000:475).

Whatever the circumstances, the skilled project manager should make every possible use of the initial meeting to get the project off to a good start. Everyone who attends the meeting, should leave with a clear picture of the project objectives, the part that they are expected to play in achieving them and a sense of keenness and motivation to get the job done. If there exist differences in attitude and commitment within the team, the project may be crippled at the start (Gray and Larson, 2000: 299).

2.4.3.2 Progress monitoring and management

One pre-requisite for any control system is a method for measuring the effect of any command given. The information so derived can be used as feedback to the command source so that any errors can be corrected by modifying the original command. If no use is made of the error signals, the system is said to be an open loop. When the error signals are linked to the point of input, the loop is closed. For every piece of information, which is sent out, a resulting feedback signal should be generated (Lock, 2000: 482).

Project monitoring comprises the collecting, recording, and reporting of information concerning those aspects of project performance that the project manager or others in the organisation wish to know. Monitoring should be distinguished from control (which uses data supplied by monitoring to bring actual performance into congruence with planned performance), as well as from evaluation that assesses quality and effectiveness of project performance (Meredith and Mantel, 1995: 441).

While declaring the need for high care in progress feedback in order to avoid ambiguity or undue complication, Lock (2000: 483) divides progress data collection into two categories: routine and non routine. Routine data collection gathers information through a two-way communication process between the project manager and every departmental manager. The progress report is also prepared against the tasks listed as benchmarks for control. All progress data should be given with reference to next 'time-now' which is a date chosen to serve as a reference point.

Unlike in routine data collection where there is a two way formal communication process between two parties, in non-routine approach

the senior management makes his or her own observation. This could either be by walking around and consulting some statistical reports.

2.4.3.3 Control and evaluation

The word “control” has a negative connotation, implying oppressive power, domination or authority. Thus many project managers (specially the new ones) tend to avoid controlling procedures on projects. The purpose of project control can never be overemphasized. It helps to measure and monitor progress towards objectives, evaluate what needs to be done to reach the objectives and takes corrective action to achieve the objectives.

Control is the last element in the implementation cycle of planning and controlling. Information is collected about system performance, compared with the desired (or planned level). Action takes place if discrepancies occur between actual and desired performances. The degree of intervention depends on project manager’s commitment to decrease the difference (Meredith and Mantel, 1995: 508).

Furthermore Meredith and Mantel (1995: 509) state that control is focused in three elements of a project; namely performance, cost and time. The fundamental objective of the control is to regulate any discrepancies against plan in light of these three elements.

According to Gray and Larson (2000: 360) the control process required in terms of measurement and evaluation of project performance consists of the following four steps:

Step1. Setting a base line.
Step2. Measuring progress and performance.
Step3. Comparing planned against actual performance.
Step4. Taking action.

2.4.3.4 Project control and evaluation techniques

Milestone analysis. This is one of the simpler methods which managers use throughout the project life cycle to compare the actual costs and progress experienced with costs and progress planned. Compared to other methods, this method is less effective and less detailed but it has the merit of requiring a relatively modest amount of management efforts and setup.

Gantt chart. The Gantt chart described in the planning section of this chapter can be drawn from the networks schedule derived WBS. Hence it can serve as a tool to compare the base line against the actual performance. It is a preferable method for communicating project time schedule status.

Earned value analysis. The earned value approach is a development of the PERT/ cost and schedule control systems criteria (CSCS) introduced in the1960s by the US DOD (Department of Defense), to fully integrate cost and control. Lock (2000: 564) agrees that earned value analysis can be regarded as the missing link between cost reporting and cost control. The successful use of earned value as an evaluation method depends greatly on the existence of a sound framework for planning and control. This framework includes:

- a detailed work breakdown structure
- a corresponding detailed cost-coding system
- timely and accurate collection and reporting of cost data
- a method of quantifying the amount of work done including work in progress.

The project manager and the user of the report need to understand some of the terminologies and concepts used in earned-value calculations.

2.4.4 Project Termination and Closure

Just as a formal document of authority is needed to start a project and allow expenditure to begin, the end of the project should be marked by a formal announcement. As the project approaches the end of its life cycle, workers, and equipment are directed to other activities or projects. As a result, the careful management of the closure is as important as any other phase of the project.

The termination of a project is inevitable, but how and when it is terminated may have a profound and long-lasting impact on the organisation and its employees. The success of future projects may depend on not only the success of past projects, but also on how unsuccessful projects were treated by the organisation and the stakeholders (Amir, Robert and Okeleke, 2000: 45).

Before a project is closed, it must pass through the post-project audit that would include the following three major tasks:

- Evaluate if the project delivered the expected benefits to all stakeholders. Was the project well managed? Was the customer or client satisfied?
- Assess the areas of failure and what contributed to successes
- Identify changes to improve the delivery of future projects.

According to Gray and Larson (2000: 422) the major activities found in project termination are:

Staffing refers to re-assigning the project participants to their respective departments. It is not a significant issue if the termination is not a sudden hatchet job.

Communicating the plan. Communicating the termination plan and schedule allows the project team to accept the psychological fact that the project will end and prepares the team to move on.

Implementing the close out plan includes several wrapping-up activities. Preparing lengthy lists for closing projects is very helpful and ensures that nothing is overlooked. Implementing close down includes the following five major activities:

- getting delivery acceptance from customer
- shutting down the resources and releasing them to new uses
- re-assigning project team members
- closing accounts and seeing that all bills are paid
- evaluating the project team members, and the project manager.

Lock (2000, 586) states that the formal closure notice need only take a very simple form, but should contain the following information:

- project title.
- project number
- the effective closure date
- reasons for closure
- any special instructions
- closure authorisation
- distribution, which at least includes all those who received the authorisation notice when the project was opened.

2.5 CONCLUSION

This chapter outlined a number of concepts in project management. Firstly, the inadequacies of traditional functional management were exposed. Secondly, it highlighted how modern project-oriented

management can help in coping with the demand of a rapidly changing business environment. Project management is no more limited to a few engineering and construction industries but is widespread to all enterprises from all industries. The next part of the chapter (the greater part) focused on activities and tasks included in the project throughout its five-lifecycle phases. Furthermore, the chapter highlighted the importance of management support in each of the phases for successful completion of a project. The rationale behind the chapter was to meet some of the objectives of study. Among the objectives, increasing awareness of project management techniques and tools was one. The chapter was used as basis in preparing the questionnaire.

CHAPTER THREE
INFORMATION TECHNOLOGY (IT) PROJECTS

3.1 INTRODUCTION

Information technology (IT) management is a strategic component of any business enterprise today. At a macro level, it is one of the driving forces behind the globalisation of world economies and at an enterprise level, it plays a crucial role in the re-engineering and restructuring of business processes in response to increased competition. Information systems play a vital role in the success of business enterprises.

Information technology (IT) can provide the information, which an enterprise requires for efficient operation, effective management, and the achievement of competitive advantage. As a result, IT has become an integral part of modern business. The fact that not all enterprises follow the modern approach "managing by projects" implies that they differ in the ways through which they implement IT projects. However, knowingly or unknowingly, all enterprises initiate IT projects that would consume a substantial amount of their resources, both financial and human. Therefore managing information technology projects for optimal value and contribution is crucial.

The main objective of this chapter is to describe the theoretical factors that could lead to failure in IT projects. In addition, the overall nature of IT/IS projects and the prevailing failure rate will be highlighted. By the end of the chapter readers (or users) will have a complete awareness (if not, at least a degree of understanding) of the factors leading to IT project failures.

3.2 THE NATURE OF IT PROJECTS

It is often argued that conventional project management techniques cannot be used in information technology systems because IT projects are different. The following are some of the arguments that emanate from IT specialists and IT project managers who possess more technical expertise than soft skills.

In a construction project it is easy to visualize the finished product in terms of the architect's design. There are well-tried formulas and techniques for determining the material, sizes, and strengths required and there are specialised ways of performing the estimation using the stable norms for productivity of various resources. Information systems practitioners claim that their objectives are fuzzy, that they change during construction, that they do not have the norms for calculating requirements and that they cannot be accurately estimated, because the range of productivity levels is vastly different across their resources (Mcleod and Smith, 2001:7).

Admittedly, that there is little validity in the information systems practitioners view, McLeod and Smith (2001:7) contend that the required information will never be available unless the professionals apply some rigor to the process, collect statistics and start building a database, with the required models and norms. Mcleod and Smith (2001) state further that information systems projects are in many aspects the same as other operational projects. Therefore, project management principles can be applied with the result that IT projects will achieve the same level of professionalism as other construction and engineering endeavors.

Information technology is subjected to a high turnover of personnel, turbulent work environments and rapidly changing technology. As a result, there is a high level of uncertainty with respect to time and

cost. Despite this more volatile environment, project management principles, which are applicable to operations management, can often be transferred to the information environment. Like other projects, information system projects involve output from a variety of resources and they come in all shapes and sizes (Olson, 2001: 2).

In his classification of projects into four broad types, Lock (2000:7) classifies IT projects as management projects. He further adds that such projects may not result in a visible, tangible creation but most of the aspects of managing enterprises depend on their successful outcome. Projects management can then be as important for IT projects as it is for the largest construction and manufacturing projects.

IT project management is a specialist field that urgently requires people with wider horisons because it involves seeing functions through the eyes of those who may have a very limited knowledge of IT. Consequently, working with support functions such as documentation, human resources and finance, becomes inevitable. These challenges can lead managers to greater responsibilities and better awareness of the revolution in both technology and management practices (Doss, 2001: xxiv).

An IT project has two main dimensions of activity: engineering and project management. The engineering dimension deals with building the system and focuses on issues such as how to design, test, code, and so on. The project-management dimension deals with proper planning and controlling of the engineering activities to meet project goals for cost, schedule, and quality. For a project, the engineering processes generally specify how to perform engineering activities such as requirement specification, design, testing, and so on. The project management processes, on the other hand, specify how to set

milestones, organise personnel, manage risks and monitor progress and so on.

3.3. IT PROJECT TYPES

There are various possible information-system projects that are applicable to the business environment. McLeod and Smith (2001:5) classify IT into the following different types:

- **System development**. A custom-written system is developed from scratch.
- **Package implementation**. A pre-written application package is implemented possibly with modifications.
- **End-User computing**. The target users of the system participate significantly in its development. This is common for decision support or modeling systems.
- **Prototyping**. This can be used where unknown technology is applied, or where requirements are unclear.
- **Rapid application development (RAD)**. Techniques are used to compress the life cycle. These may include joint application development (JAD), use of computer aided software engineering (CASE) and time-box methodologies. In the case of the latter, the deadline is fixed and the scope of the work is scaled to allow the deadline to be achieved.
- **System architecture projects**. Projects that are part of the strategic systems plan for the enterprise, supporting its business strategy.
- **Projects that involve an iterative lifecycle**. Tasks are performed repetitively to approach a goal more exactly. Common for RAD, prototyping and object-oriented projects.

- **Business re-engineering (BPR) projects**. Projects that seek new ways of handling the business process to enhance efficiency.
- **Technology implementation projects**. The installation or intranet.
- **Component assembly projects**. Advocated in object-oriented (OO) environments. Systems are built from predefined components bought in class libraries and "snapped together" with a minimal amount of custom coding and modification to form complete applications.

Olson (2001:98) further states that each of these implementation categories could be found in the following project types:

- **Maintenance projects**. These are the most common type of IT projects. They can arise from the need to fix errors or to enhance a system or they may involve major enhancements. The way in which maintenance work is treated depends a great deal on the effect of the system in question on the enterprise's master plan.

- **Conversion projects**. Conversion projects involve changing an existing system. This does not have to be currently computerised. Managing conversion projects depends largely on senior management support.

- **New systems development**. There are many ways in which technology can be used to enhance the information system flow, as well as accomplish needed work. New systems development involves different management characteristics in terms of the type of system. Some of the systems include:
  - transaction processing
  - managing control

- decision support systems
- data warehousing and data mining
- group-support systems
- executive-information systems
- enterprising-resource planning
- internet commerce

It must be noted that the study has limited itself to the IT application projects that could be initiated in all enterprises.

3.4 IT PROJECT LIFE CYCLE

As with all operational projects, IT projects comprise several phases. Each phase has a set of tasks, expected results and quality checks. There are also some activities that are performed over the whole project life cycle, such as people management, risk management and quality management. Traditionally IT/IS projects were managed almost entirely within the IT function in the organisation, with user involvement only by way of interviews conducted by an analyst. The fact that different types of IT projects exist proves that there is no unique life cycle model that is available for all projects. The IT project life cycle can be separated from systems development, sometimes also called software development. However, all projects share the following phases: initiate, determine feasibility, plan and estimate, execute and terminate.

For a system-development project, these may be the relevant specification, design, programming, system, testing and installation. Be it system development or other kinds of IT projects, the methodology will specify the tasks, deliverables (components that are produced/delivered) and quality standard for each phase. The project life cycle is thus a container for all types of IS/IT projects. Figure 3.1

depicts a generic project life cycle suitable for all kinds of IS projects (McLeod & Smith, 2001:14).

In figure 3.1 activities that are stepped, initiate and determine feasibility and have dependencies; the latter cannot proceed until the former is completed. Tasks that may occur in parallel can be shown below each other, indicating that they occur during the same period. The bracketed set of activities represents a phase within a project. Having a closer look at the project life cycle, reveals the fact that the project life cycle mentioned in the previous chapter resembles this IT project life cycle.

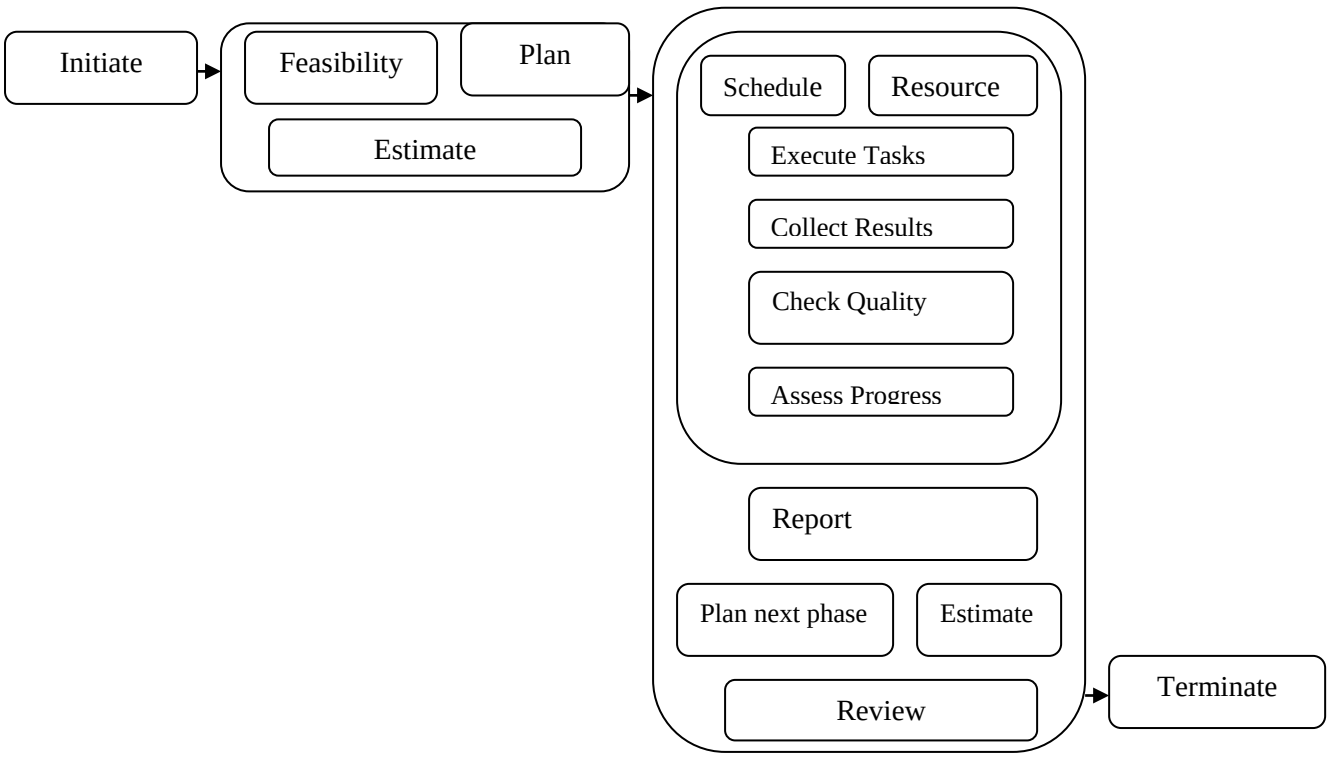

Figure 3.1 IT/IS project Life Cycle (Adapted: McLeod and Smith, 2001: 14).

3.5 IT PROJECT FAILURE

Controversies exist regarding how to define the IT project success and/or failure. Shenhar, Dvir, Levy and Maltz (2002:700) maintain that there is still no fully accepted framework for assessing project success. However, this study adopts the most commonly used and widely accepted definitions of project success and failure. According to these definitions, a project can be considered successful if:

- outcomes are realised
- project outputs are delivered on time, and to the agreed quality
- costs are within those budgeted and
- the current requirements of stock holders are met

On the other hand a project is said to be a failure if:

- it is cancelled because it has not delivered the planned benefits or
- it suffered a budget or schedule overrun.

"*Consultants are often called to help turnaround IT projects gone awry. Companies continue to invest heavily in IT solutions in the hope of improving operating efficiency and combating the effect of downsizing. Yet all too often the actual project benefits are at great variance with the expectations set during the soft ware procurement cycle*" (David, 2000:1). Maggie (2000:70) state that "*.....technology may be evolving fast at a lightening speed, but project success rates are improving at snail's pace."* Similarly Thite (1999:235) confirms that there is a widespread dissatisfaction with the performance of IS/IT projects.

Although investment in information technology and information systems continues to increase, projects continue to fail. Words such as "astounding", "alarming", and "devastating" are very commonly used to describe the higher failure rate of IT projects. The effects of the

situation are manifested in the frequent reports of IS project failures. Zhang, Keil, Rai and Mann (2003:115) state *"…. while escalation (the word that describes troubled projects) of commitment to a questionable project is a general phenomenon that occurs with any type of project, IT projects may be more susceptible to this problem."* Many reports and statistical figures released by research professionals and national governments support this viewpoint.

Project failure is endemic to all industries. A study performed by KPMG information technology (as stated in David, 2000:1), a Toronto-based professional services company, showed that 85% of all projects fail to meet all their critical measures of success. 87% of the failed projects went more than 50% over budget, 45% failed to produce the expected benefits, and 86-92% went over schedule. Similarly, figures collected by the UK's industrial society in the early 1990s showed that 77% of the projects in the UK failed while the US figure of 83% is even worse.

According to a survey conducted by the Standish Group (2000:2) only 16.2 % of respondents reported that their projects were on time, within budget and contained all the functionality required. A much larger 52.7 % reported that their projects were often impaired by cost overruns, increases in the time needed to complete the effort, or the need to slim down the functional requirements. Furthermore, 31.1 % said their projects failed completely.

South Africa is no exception to the international findings. Obsurn and Harris (1996:27) reported that only 9 % of IT projects in large enterprises were viewed as successful; more than 30% were considered outright failures and 61% were challenged (schedule or cost overrun). Bateman (2002:20) alleges the prevalence of a higher rate of IT project failure in South Africa than overseas though the exact figure is not declared. The bottom line is that there is an

astonishing waste of money. The real message of this study is however not that projects fail, but rather addressing why they fail and what can be done to reduce the likelihood of failure. The subsequent sections of the chapter deal with the factors that contribute to the failure.

3.6 FACTORS LEADING TO IT PROJECT FAILURE

Understanding why projects fail and the various roles of the participants in those failures, recognising ways to reduce the likelihood of failure through changes in the ways people involved in IT projects deal with their responsibilities, set the base line for the improvement of IT projects. Many of the causes of IT project failures are universal. Analysis of project failures both publicised and unpublicised show that the factors listed below are largely contributing to IT project failure (Maggie, 2000; Murray, 2001:25-30; Boyd, 2001:430; Whittaker, 1999:23):

- poor planning (failure to have a comprehensive plan with viable milestone dates
- inadequate project oversight, monitoring and controls
- lack of customer focus and end-user participation
- trying to take the big-bang approach instead of breaking the project into manageable phases each with clear goals and visible benefits
- lack of corporate (senior management) support
- failure to implement and apply project management techniques and tools
- failure to integrate a TQM approach in managing your project
- lack of efficient communication
- assignment of inexperienced and unskilled project managers for complex projects

- project team dynamics (assignment of inexperienced or over-committed staff to the project team)
- poor project estimation
- unavailability of training scheme both for the end user and the employees
- unclear weighting criteria
- infighting and inadequate change management.
- new technology problems
- vendor-related problems and
- weak business case.

The above-mentioned causes for project failure can be distilled into three fundamental categories of factors:

- poor project management implementation
- people-related factors
- technical or technology-related factors

3.6.1 Poor project management

Project management is increasingly accepted as an inclusive concept integrated into general organisational endeavor to provide better quality to customers through effective inter-organisational integration and optimal utilisation of scarce resources. Concurrently available empirical evidence indicates that a degree of disorder exists among the existing approaches to management of projects and identifies the significant implications of project failure in terms of the stability and prosperity of affected enterprises (Cicmil, 2000:554).

3.6.1.1 Poor planning and definition of the project

Proper planning is a key project driver for success. Without proper planning, IT project implementation can easily run over budget and

still not provide any measurable benefits to the enterprise. One primary reason for project restart or direct failure is the lack of project mission, which means a careful analysis of the problems or opportunities and the possible impact on the enterprise. A significant portion of the multi-billion losses on software projects stems from projects that should never have gotten past the feasibility stage, which is the most important component of proper planning, says David (2003:3).

David further states that the success or failure of a project could be decided very early. Unless management provides the answers to questions such as: What am I building? Why am I building it? What are my requirements? Who is my customer? Who is in charge of the project? Who are the required or the key staff? What are the benefits? What are the major milestones and target dates for each? And of course what your project is not, project success cannot be achieved. Olson (2000:13) supports this idea by saying that the difference between successful and failed information system projects lies in planning and implementation.

Approaching experienced consultants during the first phase of a project assists in identifying the causes and overcoming the problem (Murray, 2001:31). Another common mistake that occurs during planning is approval of a project that does not fit in with the firm's IT strategy or overall company strategy. This disrupts not only the IT project but also the other projects as well. A group of users or perhaps a practice group or an office may insist on buying its own system, something that is inconsistent with the firm's overall strategy. There might not even be an IT strategy in place.

It is seldom that project managers are given the opportunity of setting up a process from the beginning says Webster, a founder partner of the center for project leadership based in Kent, UK. Webster

(1999:241) added that there is a temptation to move away from this big picture thinking to "how" something can be done -before the "why" and "what" are properly understood. According to Kelly and Stalnaker (2002:14), the business objectives of the project must be clearly defined and measurable in terms of outcomes. The core of the project plan is the WBS.

Another type of "undesirable" project is an ill-scoped project. An overly ambitious team may take an overall encompassing, fully integrated system in a single two- or three-year project instead of breaking this into several subprojects. By contrast, an under-scoped project can be equally problematic. Restricting the scope of implementation in order to provide only what the old system did can lead to unimpressed users and skeptical management. After all, the reason the firm bought the system is to take advantage of its new features, such as electronic forms automation, improved management report and browser-based inquiry (Kelly and Stalnaker 2002:14).

It has to be noted that a carefully prepared plan can fail if it is poorly communicated to the project participants or if it fails to explain the responsibilities of the project team members. Tsia, Moskowitz and Lee (2002:167) coin the importance of human-resource project planning. They further mention that IT project failure is a result of inadequate human resources project planning. Such planning involves determining what task is to be done by whom, and the time line of developing and implementing the IT projects.

3.6.1.2 Failure to apply the project management and tools and techniques.

Project management can be applied to any set of activities and is no less than a universal management tool when it is considered in its generic form. *".....perhaps the most pervasive benefit for those*

contemplating a project management culture is the immediate access to the tools of project management. Project management has marvelous tools to play with. They come complete with their own acronyms and labels producing a pithy language understood only by the initiated. CPM, WBS, PERT, Gantt, MBO, MBE, NPV, BAC, BCWS, PRINCE, and so on. They all have a structured, logical sequence in their application concentrating as they do on the task element of the project" (Webster,1994:22).

One of the project management tools, EV, improves the analysis and performance of a project by providing a uniform unit of measure for project progress; enforcing a consistent method for analysis and reporting; and providing a sound basis for the analysis of cost performance. Failure to implement some of the techniques and tools may result in an over ambitious estimation of costs and schedules (Cule, 2000:68).

In their attempt to explain the importance of project management tools in achieving project excellence, Kelly and Stalnaker (2002) state that developing the WBS can be a daunting prospect for a project lasting many months and involving many different departments and people. But, there is no substitute for getting to grips with the detail. Likewise, Addison (2000:27) states that the application of rigorous project management methods makes a modest contribution to reducing the gap between planned and actual completion dates. He adds that one of the advantages of project management is that we can get early warnings of slippage and then the challenge becomes one of searching for methods to get the project back on track.

Similarly Barkley and Saylor (as cited in Tukel and Rom, 2001:401) point out the need to integrate project management tools and techniques with a broad customer-driven process. "Project management tools such as Gantt chart, CPM and PERT are crucial in

the development of milestones." The milestone together with the status report in turn help to ensure that the project manager and client can track a project and take timely action if necessary, to modify a project (Loo, 1999:13). In addition to the above authors, Wirth (as cited Kelly, 2002:584) pointed out that project management theory, practice and accompanying tools are really quite transportable between different types of projects and it is the specification application in the context of each project that is different.

However, IT professionals are usually reluctant to use the project management techniques and methods. While describing ineffective monitoring as one of the major factors leading to IT failure, Mahaney and Lederer (2003: 7) maintains the fact that enterprises do not sufficiently employ the tools and techniques, or the tools and techniques do not facilitate the identification of project problems early enough to solve them.

These tools and techniques have been developed continually since the First World War, often in the context of avoiding further costly mistakes already made in one project or another. This context is important because it brought to light the constant problem of the project manager not knowing what was going on and not knowing exactly what state of progress the project was at any given time. This often results in projects running over time, over budget and being under quality. Unlike the view of some general management practitioners of the project management as a barrier to scientific management approach, project management compliments scientific management and should not be regarded as a substitute.

3.6.1.3 Inaccurate cost and time estimation

The widely perceived IT crisis is partly based on the premise that too many IT projects end up being substantially over budget and behind

schedule. The implicit assumption is that, given a typical project, the original budget and schedule are probably reasonable, but the project has not progressed as smoothly as it should have. However, the fact is that predicting the cost and time of completion for a software project is often little more than guesswork, especially for large projects that involve a degree of innovation. What's more, in the field of software production most projects *do* involve a degree of innovation, due to rapid advances in technology, tools and techniques (Bush, 2003:1).

An important issue in IT cost estimation is the precision of the tools it proposes. Estimation methods may produce totally misleading results. Despite the efforts of many researchers to improve software estimation through calibration of cost methods and by taking into account the peculiarities of software organisations, estimates still involve uncertainty for various reasons. One of the reasons is unclear requirement and project implication in the early phases (Stamelos and Angels, 2001:759).

Stamelos and Angels (2001) further identified four sources of estimation uncertainty, namely: measurement error, model error, assumption error and scope error. Any inaccurate project management that is used for estimation causes measurement error. Model error is caused by the inherent inability of any estimation model to capture all the factors that contribute to project cost. Assumption error is caused by wrong assumptions about the context of the estimation. Scope error is caused when a model is applied to projects outside its domain. Relying blindly on a point estimate given the error magnitude associated with the cost estimation techniques may result in erroneous managerial decisions and project failure.

Although the prediction of the cost and time-scale for developing a new software product can be extremely difficult, it is unavoidable. In practice, predictions are often influenced by politics – for example a

supplier's main concern might be to undercut his/her competitors. Failure of the team members from the IT department to protest against flawed design, too tight schedule and inadequate budget, results in unrealistic project expectations and finally project failure.

Another big challenge facing a project manager is the need to control the scope of a project. Following the project management triad of schedule, budget and scope, any change in the scope of a project can affect the schedule and budget and therefore constitutes an overall risk for the project's success. However, little attention is given to the change in the scope during the initial planning and estimation phase of a project.

3.6.1.4 Inadequate project monitoring and controlling

According to Mahaney and Lederer (2003:4) project managers revealed that monitoring was performed to track project progress as well as to observe the work of the developers in IT projects. The fact that IT projects are very technical in nature makes it hard for project managers to monitor the progress and to do something about it. Mahaney and Lederer (2003:5) coin this problem as "privately held information". According to Mahaney and Lederer (2003:5) half of the project managers studied said that developers rely on privately held information to exaggerate the percentage completed on tasks. Developers practice over reporting and exaggerate the status of performance to appease a project manager.

Zhang, Keil, Rai and Mann (2003:118) confirm that when project progress is not monitored well by those in charge, budget and schedule overruns might go unnoticed, as may performance problems associated with software being developed. Control activities are undertaken after monitoring has uncovered problems in a project. The goal of control is to get the project back on track. When there are poor

control mechanisms in place, management may fail to take action in response to problems that are detected, or management may take actions in ways that are ineffective.

3.6.1.5 Failure to analyse and manage risks

Risk analysis is one of the ingredients of project management. It focuses on an uncertain set of circumstances and their effect on the performance of a project. Unless risk is handled better and incorporated in both planning and capital budgeting decisions the variability between actual and estimated value will be substantial (Akalu, 2003:359).

As stated in Cule (2000:68), many authors have sought to propose ways of managing IS (IT) project risks. Subjective prescriptions have been offered but such prescriptions smack somewhat of the "Silver bullet." However, one thing these authors have in common in their suggestions is that if risk is to be managed, it must first be identified.

Risk identification and analysis should not be viewed as a separate planning and response operation. According to the project management body of knowledge (2000), risk management forms one of the so-called nine functions of project management (the other eight being integration, communication, human resources, time, cost, scope quality and procurement management). However scant attention has been paid to proper modeling and quantifying risks. To some planners and project managers quantitative modeling is impractical and that all that is required is to develop a first column listing all the likely risks, classifying these for example as low, medium and high. The second column will present a few words on actions to be taken to mitigate the corresponding risk. While these practices are certainly better than ignoring risk variables together, these will seldom produce the correct results.

The reality of the situation is that projects are subjected to the shifting forces and constant changes of external factors, changing objectives and poor methods for project realisation. Thus the process of risk and uncertainty management should be continuous, holistic and conducted in real time in order for it to be off any help to project managers.

A close look at most IS/IT project failures reveals the seeds sown earlier in the project and they mature in the soil of ignorance (Cule (2000:72). He maintains further that this ignorance comes from the inability to identify and then manage all the project risks. As stated in Kumar (2000: 64), research has examined uncertainty in the context of managing IT projects. These risks include specification uncertainty (due to uncertain business conditions or lack of knowledge), incorrect understanding of specifications, overlooked specifications, unrealistic schedules and budgets, shortfalls in externally furnished components or services, real-time performance shortfalls, and technical uncertainty due to the innovative nature of the project.

Other common risks that occur in IT projects are the so-called client risks. Risks classified as client risks are risks that cannot be controlled by the project manager but can exert some influence over them.

3.6.1.6 Organisational structure

The importance of examining the impact of organisational structure on effectiveness can never be overstated. Applied to IT project management, Gobeli and Larson carried out a survey (as stated in Belout and Gauvreau, 2003:3) that revealed the fact that each organisational structure in project management has its strengths and weaknesses. According to Gobeli and Larson, the type of structure chosen will significantly affect the success of the project.

Project parts are not just hardware and software parts but also down stream and upstream business systems and activities, such as marketing, operation and finance, environmental and management plans etc (Jaafari, 2001:97). As a matter of fact, the influence of organisational structure on delivery effectiveness is an area that is often discussed by senior executives. Organisational structure is not just a skeleton of pictures and relationships but it has far more value and meaning to management. It determines the relationship between division heads and staff and between the middle management and top management. Organisational structure reveals the reporting systems and the flow of data within a project in particular and in the whole business in general.

One fundamental departure from traditional project management structures is that of the project team organisation. The traditional hierarchical structures are not suitable to life cycle objective-based project delivery systems. Concurrent project management is the correct organisational structure for strategy-based project management. On the other hand radical change in the existing organisation and unnecessary project start-ups from scratch jeopardise the natural and already functional communication and decision channels, which should be exploited by the project (Bachy and Hameri, 1997:216). Therefore, management should ensure that sound leadership skills in addition to technical and administrative competence are present.

3.6.2 PEOPLE-RELATED PROBLEMS

It has become clear that people and process have greater effect on project outcome than technology. As a matter of fact, many researchers agree that the human resource function is one of the most crucial elements in determining an enterprise's success. Project

success cannot be reached without qualified and motivated personnel. In IT project environment, managing people can also have a significant impact on the results of a project since most major project failures are related to social issues. Similarly Maggie (2000:70) confirms this by stating…. *"One might conclude that the high rates of failure could be attributed to issues associated with implementing new and immature technologies; however, most research shows that the major causes of project failure continue to be people related issues."*

All projects involve at least one person. People can constitute extremely valuable resources and using the appropriate approach could make the difference between success and failure. Pinto and Millet (as stated in Thiry, 2002:221-222) confirm the fact that failures in large IT/IS projects are due to the failure to address people related issues. Some of the people related factors are:

3.6.2.1 Assignment of unskilled and inexperienced project managers.

The project manager must manage the stakeholders' expectations throughout the process. He should constantly look for opportunities to create win–win relationships by negotiating work that must be accomplished. A study by Todryk (as stated by Belout and Gauvrea, 2002:2) reveals that a well-trained project manager is a key factor linked with project success because as a team builder, he/she can create an effective team. On the other, KPMG's Kelly (as stated by David 2003:2) states, that *"the management of a project is still treated in a very amateurish way"*. Although some of the blame can be placed on the software development process, the primary place to "point the finger" when a poor project comes into play is a failure by the project manager to "manage the project."

Project managers also show considerable reluctance to seek clarification from senior managers about what exactly it is that they are being asked to do. Historically, the responsibility for the information system failure has been laid squarely on the shoulders of the IS project manager. The project is defined and the project manager is charged with the responsibility of delivering a system that meets the requirement on time and on budget (Cule, 2000:66; Webster, 1999:240).

Among the people-related risks, risks in the self-category concern the project manager's abilities, capabilities and knowledge regarding the management of IT projects (example lack of project management skills). The project manager needs to continuously assess his/her capabilities against the project needs (Cule, 2000:70). *"It is generally recognised that technical/scientific employees lack leadership skills to effectively manage people"* claims Thite (2000: 235)

Although others may be largely responsible for project failure, raising those concerns once the project has drifted into serious difficulty represents a failure on the part of the project manager to appropriately manage the project (Murray, 2001:27). If the project manager willingly obscures or hides project related problems, he or she is remiss. Hence the problem gets worse which ultimately leads to failure. For projects like IT projects which are complex, the assignment of the project manager should be seen as a full-time position. "*When a project manager is given project responsibility as an adjunct to other duties, something is going to be neglected,"* adds Murray (2001:29). He further maintains that any IT project that suffers from neglect is a project that is likely to drift into difficulty.

Bachy and Hameri (1997:216) state that *".....during the building of the project management plan the active involvement of the participants is necessary, which is more or less a democratic process. Once the*

implementation phase commences the management should act increasingly in authoritarian manner to ensure that the plan is executed in a goal-directed manner. This requires leadership skills from the project management team in addition to technical and administrative competence".

3.6.2.2 Lack of end-user focus and participation

User involvement is a key driver in a successful project. If the end-user focus is lost or if the end-user is never fully engaged in the project, then the project is faced with a situation where the project deliverables will most likely not meet the client's expectations. Customers and users are among the stakeholders of IT projects and the criteria they consider as essential for the success of the project should also be included in assessing projects (Atkinson, 1999:340). Belout and Gauvreau (2002:9) confirm the importance of management approaches in which the client is at the center of organisational dynamics.

In a report that highlights communication as the main factor for IT project failure, Maggie (2000) contends *"…perhaps one of the biggest failure points is introduced when there is a lack of input from end-user or clients"*. Without complete understanding of what your clients or customers need and without communicating those needs throughout the project cycle, the finished product is highly unlikely to match expectations. Conclusions reached from the KPMG survey (2000:55), indicate that if a project manager does not include the end-users of the IT, then he/she may not achieve the buy-in to the new system. Lack of buy-in by the true users causes the system to be "shelved." The system may satisfy every requirement, pass every acceptance test procedure and receive signoff by the client's project manager; however, it could fail to pass the most important test user acceptance.

According to Sevaried (as quoted by Culp and Smith, 2000:162), it is human nature to tend to alter your customer's needs to more closely match your perceptions of what their needs or the solution to their problem should be. Sevaried also maintains that there is a danger that the project manager and/or team will apply their favourite solution to customer's needs, whether this solution is appropriate or not. In this process, the project objective becomes distorted.

Another common mistake in IT projects is the use of jargons. Thus the project team fails to take into consideration that the customer is most likely not an expert in their field. On the contrary Drucker (as quoted by Culp and Smith, 2000:163) states how important it is for IT project success not to depend solely on what the customer says. The end-users of the project (usually the customer) are not fully aware of their needs. Often, end-users come with new ideas after the completion of the project.

Cule (2000:71) defines clients as the project manager's market. A key marketing philosophy propounded by both practitioners and academics is that of relationship marketing or relationship management. This philosophy espouses building and maintaining long-term relationships with clients (customers) regardless of any current sales activity. For a particular project, top management commitment and user involvement are easier to obtain if there has been a strong relationship between the parities built up over time.

In his attempt to explore the five maxims of project satisfaction, Boyd (2001:427) states that *"….. from the customer's perspective, high profile IT project focus can be very frustrating, creating the illusion that the IT department does not do anything (at least not to serve their needs)".* To add insult to injury, chief technical officers often have no reason to consider customer satisfaction in decision-making. Boyd (2001:427) maintains further that software development performance is measured

through the use of statistics such as mean time to failure (MTTF) and errors per lines of code, not on the basis of customer satisfaction scores.

When developing IT application projects for an enterprise, workers assigned to the project from the business unit, must take their responsibilities seriously. End-user involvement must start at the onset of the project. Failure of project charter to adequately present the goals of the project and participants' failure to challenge the assumptions in the charter, leads to a delivery of a project that does not meet enterprise's needs (Murray, 2001:30). Glass (as cited in Boyd, 2001:423) contends that "*user involvement is the single most important element of project success.*"

3.6.2.3 Lack of management support

It is crucial for executives to be involved throughout the complete project life cycle and to advise project leaders and managers when business requirements change. Executives can help increase project success rates in other ways as well. The project team struggle with continuing changes in technology and business process. These factors also increase the failure rates. Developing a strategy to help IT cope with these learning curves will improve the odds (Maggie, 2000:71). Maggie further maintains how important it is to have management support throughout the IT project life cycle as confirmed by successful project leaders. Olson (2000:13) confirms that it is very difficult for projects to succeed if they are not "fostered" by top management.

An IT project that lacks the full co-operation and the support of corporate management is likely to be doomed to cancellation or cutbacks. Managing the risk of losing top management commitment requires that the project manager work actively to maintain support. It is worthwhile mentioning the importance of an enhanced

relationship between project managers and senior managers by sharing information and the establishment of a bond of common interests. Cule (2000:71) states that the act of sharing is not solely the responsibility of the project manager. It also requires the active participation of the investing executives, as well as the user management to assure that the project is fully cognisant of the effects that the changing environment is having on the enterprise as a whole, and the resulting potential impacts on the needs the system is supposed to fulfill.

Success cannot be achieved unless those with whom the project manager should relate are willing to actively participate in that relationship. There may be a temptation for the executive to turn over the responsibility to the IT project manager with an attitude of "leave it to the nerds." It does happen that members of senior management take the view that an IT project is simply too technically dense for them to grasp. As a result, senior managers often adopt what can only be described as a hands-off policy when it comes to IT projects (Murray, 2001: 30). Top management can further contribute to IT project failure by making unfulfilled commitments and inadequate funding.

Any lack of upper management teamwork reverberates throughout the enterprise. If senior managers do not model desired behaviours, there is little hope that the rest of the enterprise will do it on their behalf. A lack of senior management cooperation will be reflected in the ineffective behaviour of IT project teams, something that IT project managers alone cannot resolve on their own. Many managers involved in failed projects confirm this.

Top management involvement alone, however, does not guarantee success. There are many instances where top management plays an

active role in IT project failure. Apart from the above mentioned aspects, the following could be causes for IT project failures:

- Not providing accurate and firm information to project and programme managers.
- Being too optimistic regarding potential strategic and operational benefits that can be derived from projects initiated by them.
- Mismatching budget expectations and actual project costs.
- The inability of top management to create a trust, support and cohesion culture that is so important for relational management and the creation of positive perceptions that motivate team members.
- Top management's pushing for unrealistic time-frames to complete projects, impeding conceptualisation and sowing seeds of failure.

Management, therefore, needs to provide appropriate support and involvement throughout the life cycle of the project in a way that nurtures a positive team culture. Furthermore, management should ensure that the project members know the goals and objectives of the IT project, otherwise IT project failure will be unavoidable.

3.6.2.4 IT project team dynamics (ineffective IT team)

The importance of a team within IT projects can never be overemphasized. Teams are essential for tackling complex work requiring a variety of knowledge skills, stimulating creativity and innovation, empowering workers, and providing other positive influences. Unfortunately both project managers and project management literature have neglected to mention the important factor of team climate as a contributor to team effectiveness (Loo, 2003:1). According to Sommerville and Dalziel (1998:165) whilst there has been a considerable amount of work done in the field of creating teams,

observing their function and monitoring their performance, little is known about how workers behave and what makes a good team.

Another mistake is selecting incompetent team members on the project. Lack of freedom and time is also a common problem experienced by the project team members. Laszlo (1999: 157) confirms that project managers often prevent people from exercising freedom to be themselves instead of dealing with wrongly selected decisions promptly. The team cannot set and maintain direction if key positions are left unfilled or inadequately filled for a long period.

A study made by Gent and her colleagues (as cited in Loo, 2003:1) revealed that high co-operation teams had improved communication, more positive feelings about participating in the project teams, and clearly understood project objectives. All of these are characteristics of a positive team climate, which is built on the following three conditions:

- individuals must interact
- individuals must have some shared common goal, which predisposes the team towards collective action
- there should be sufficient task interdependence to develop a shared understanding.

Not all teams enjoy a positive team climate. Teams often experience frustrations and setbacks at the start of a project that can lead to the disintegration of the team and project failure (Loo, 2003:5). In his effort to come up with a new and modern organisational structure, the so called “concurrent organisational structure”, Jaafari (2001,98) says that the pooling of expertise and information, as well as unhindered communication, will no doubt aid greater project integration and reduce the risk of failing to meet the project’s strategic objectives.

Similarly, Murray (2001:26) contends that it is not easy to successfully manage IT projects. A lack of attention and commitment on the part of the various project team members often increases that management difficulty. A team member's ignorance of his/her responsibility can jeopardize the success of the project.

IT projects often face the problem of declining interest in the project on the part of business unit representatives. If this occurs, one of two situations arises; the project comes to halt, or members of IT begin to do the business unit work to keep the project moving.

Another wrong decision that can delay IT projects is the adding of manpower to an IT project that is behind schedule. According to Addison (2000:27) "*adding manpower to a late project makes it later*". This "*outrageous oversimplification*" is based firstly on additional communication line, which is necessary for every new team member introduced. Secondly such actions delay the project while new team members are trained and become accustomed to their roles. Experts claim further that additional conflict is introduced into the team environment when new members are added.

In addition to the above-mentioned problems within the project team, loss of key staff members could have a significant negative impact on project schedules and costs. There is an inevitable learning process for the new staff member and a corresponding loss of experience that disappears with the old staff member. There is also the effect on the team that has adapted to working together as a group and will now have to go through the process again. The lost productivity is reflected in longer schedules and higher costs (McLeod and Smith, 2001:85).

The final but perhaps most serious team problem that affect IT projects is the conflict of goals that exists between the project manger and the developers in the team. Developers appear to have two

predominant goals: to remain marketable and to create a high-quality system. Project managers on the other hand want to deliver a project on time and within budget. The different goals can produce the scenario where developers spend too much time making themselves marketable and crafting a high-quality product, thus resulting in a time and budget overrun.

3.6.2.5 Ineffective communication

The purpose and goals of an IT project must be effectively communicated to all those who contribute to its implementation. *"There is no substitute to providing knowledge about the overall objectives to enhance buy-in favour of ideological leadership*" Muller (2003:355). The need for communication will thus be acute, both at team-to-team and the discipline level. The team-to-team interactions are for proposing IT project parts/products and receiving endorsements or comments on these. The interaction at discipline level are for systems' integration, such as ensuring that the system elements relating to a number of parts, will form a coherent and whole system in compliance with the relevant codes (Jaafari, 2001:98).

"Often, political or cultural issues may inhibit open communication, leading to unpleasant surprises. Sub-teams can be reluctant to admit they are having problems," claim Kelly and Stalnaker (2002:16). The project manager should report the project status to the steering committee or project sponsor periodically.

Findings of an empirical research on communications in IT project management (Muller, 2003:345) show that IT projects often lack effective communication beyond the boundaries of the project team. Emphasis is placed on communication with the members of the project team formed for the implementation of the project, rather than

on customers and other organisations external to the enterprise in question.

Another communication problem that prevails in IT projects is the use of languages that are not understandable by all team members. Kumar (2002:63) suggests that for the project management team members to communicate well with each other and with project sponsors, business-oriented concepts (as opposed to IT-oriented ones) should be used. Presenting risk management in IT projects requires the use of a business terminology that senior executives can understand.

A well-designed project communication system minimizes the risks of project failure caused by variables so often referred to as "fatal external factors beyond the control of the project team". Ultimately it closes the gap between the unique project goals on the one hand, and multiple sources of factors that influence project performance, on the other (Cicmil, 2000:554).

3.6.2.6 Lack of vendor support and commitment

When vendors promise more, either in terms of the capacity of their products and the level of project support from their staff, or in their commitment to the success of the project than they are wiling to deliver, they disappoint the end-user. *"IT history is replete with examples of circumstances in which the delivery promises of vendors were never kept and, as a result, such IT projects, if they did not fail, became much more difficult to manage*" states Murray (2001:31). In addition Murray (2001:31) maintains that project managers' failure to recognise the status of the vendor representative as any of the other team members, hinders the vendor from adding value to the project.

"It is quite difficult, if not impossible, to conceive projects that do not depend on some sort of input from at least one source," claims Laszlo (1999: 159). The project manager and the project can enjoy the same benefits as any enterprise in establishing synergistic linkages with suppliers, who are contributors to the project outside the core project team.

Some IT is so new that its vendors lack the sufficient experience to support it. Even when they provide support, the level may be inadequate. Similarly a multi-vendor environment can constitute a difficult setting in which to determine the particular vendor whose IT was causing a problem. The IT enterprise can be caught between squabbling vendors who prefer to neglect the problem and accuse one another of being responsible for it (Lederer,John, Benamati and singh, 1997:281). Software vendors are notorious for selling features that a client will find highly desirable but which are not yet available.

3.6.3 Technical (IT related) problems

The very nature of the software project contributes to this riskiness in that it consists of intellectual concepts without physical substance, claims Cule (2000:65). Similarly Brooks (as stated in Cule, 2000: 66) describes the output of the IT project, as "pure thought stuff, infinitely malleable" and "invisible," which increases the failure rate.

IT projects like a project for constructing an automobile, must have an orderly set of steps for transforming a concept in someone's mind to a real product that is usable by the client. Without a sound software development process, IT projects can easily run astray. Many enterprises that undertake IT projects, do not fully embrace a defined, repeatable and predictable software development process. The consequence of this behaviour is usually a significantly increased risk

to the project in predicting and controlling the critical factors of schedule, cost, scope and quality.

According to Whitten (1995:10) an enterprise may have currently defined processes, but these processes are often ineffective for one or more of the following reasons:

- not comprehensive enough: they do not already define all the activities that apply to all new projects
- overly complex: they require too much time and skill to comprehend
- not "owned": they are not easily tailored to meet the unique needs of new projects,
- not continuously improved: lessons learned from the past projects are not used to improve the current processes, and
- not enforced: the guidelines are there, but the project leadership lacks the discipline to enforce them.

Even worse is the situation where a software development process is not followed because the process has never been defined and documented fully. *"Reasons for information systems implementation failure have been identified to be features of the information system, the development process, and aspects of the IT environment"* claim Lyytinen and Hirschheim (as stated in Mone and Vadapalli, 2000:127).

3.6.3.1 Absence of change management

Project conceptualisation, planning and implementation is a complex, dynamic and evolving process. It should be managed on the basis of strategic objectives, which themselves would be subject to change (in response to the project's shifting environment), on a fully fluid and flexible basis. Further a holistic and integrative framework is needed in which not only planning and proactive management of technical

and financial factors receive attention, but equally the social, environmental, political and community aspects are placed at the center of the decision-making process (Jafari, 2001:90).

Having mentioned that every enterprise invests significant resources in developing its performance through the introduction of new technology and processes, Dooley and Sullivan (1999:483) demonstrated that investments in enterprise's IT development often have less than a 50% chance of success. *"The difference between success and failure depends on how the change is managed,"* maintain Dooley and Sullivan. When a company rolls out a new application, there is only one opportunity to make a first impression. The user's first impressions will be very difficult to change. If the budget for training and support is inadequate, users will never embrace the new technology (David, 2000:4).

3.6.3.2 New and immature technology

There are cases where performance of new IT failed to meet expectations. Poor performance also includes the ineffective use of resources such as computer time and storage. *"People are often tempted to include new technology without being sure that customers are interested or will get value from the investment"* (Englund and Graham, 1999:59). From the perspective of the project team members, a project may be successful if the developers were able to overcome some technical limitation or if they learned from that experience, regardless of the schedule, budget, or level of system quality.

According to Whittaker's (1999:24) findings, new and unproven software were problems that contribute to IT project failure. Thus the purchased application was not developed (too many bugs). The product was relatively new; therefore, no track record could be established.

Management's failure to understand that the "best" software is not necessarily the best for each business is another reason for failure. *"Acquiring a sophisticated application simply because another enterprise in your industry has done so can be a prescription for disaster"* says David, a consultant with the Gardner associate consulting. David (2000:4) further adds that acquiring an application that a company can "grow into" could also be problematic. Every software company bases its product design on its built-in beliefs about how businesses ought to be run. These assumptions may come to light only after the software has been purchased and implemented.

3.6.3.3 Mismatch between technical expertise and the technology used

Human resources in a software project require a high level of individual intensity devoted to project design tasks, which then need to be integrated collaboratively among the software designers to complete the project. Projects also fail for lack of appropriate number of technical resources. The key here is to accurately evaluate how many resources are actually needed and to allocate internal staff or locate outside help when necessary. If the project is truly important, then the budget should accommodate allocating enough talent to get the job done. "…..one of the common problems with internet projects for example, is that the hardware capacity required to handle the processing once the system goes live is underestimated" said Murray (2001:30).

Another factor that could contribute toward the failure in IT projects is a lack of communication links between system components. These can comprise missing links, inadequate links or links that are not used. Information overload describes situations where so much information is provided that no understanding is obtained. Thus the

user interfaces may be too complex and there are no standard interfaces for communication (Olson, 2000:77).

Resistance to change is another problem that most often occurs in IT projects. New IT has always generated resistance and today's rapidly changing IT is no exception. In a turbulent IT environment, this problem perhaps affects IT staff more than it did before. IT staff resistance to new development tools can hamper the enterprise's ability to deliver products and services to users. Fear of the new technology by both IT professionals and the end users could result in resistance that would keep the new IT from being used to the fullest" (Lederer et al, 1997:281).

Another problem that can be classified as a technical factor is the developers' overoptimistic attitude about their abilities. As stated in Mahaney and Lederer (2003:6), one project manager summed it up as follows "*Developers are procrastinators. They always believe that no matter what, they can end up getting it done. They do not have realistic understandings of their abilities. They underestimate the amount of work required to get the job done.*"

Acquiring the "state-of-the-art" application can easily overwhelm your staff with its complexity. It is important in any decision making process to take into account the experience and comfort level of the people who will have to manage the application on a day-to-day basis. "Sell the project to the troops, not just to senior management" claims David (2000:3). The decision makers are not the people to use the system day in and day out. Too many applications have been deployed in which the people using the application cannot tolerate it because it does little or nothing to help with their actual business needs. This result is chalked up to "resistance to change." Senior executives may purchase the software for political rather than suitability reasons.

3.7 LEARNING FROM IT PROJECT FAILURES

Participation in an unsuccessful project can have a positive learning outcome for the participants. It provides the participants with a chance to learn from their mistakes in projects and thus minimizes the risk of making similar mistakes in the future. “The fastest way to success is to double your failure rate” said Watson, the first CEO of IBM (Sims, 2003:1). The idea is to create a positive return on failure (ROF) in order to prevent failures from destroying your entire project. Return on Failure (ROF) is measured by how quickly your enterprise can identify its mistakes, learn from those mistakes, and disseminate that knowledge to others. If used consistently, improved ROF can make a huge impact on the success rate of information technology (IT) projects (Sims, 2003:1).

Sims (2003:2) added that the idea seems counter-intuitive. People who work on information technology where 70-80 % of all major projects fail to be delivered on time, within budget, on scope, or at all, will need a massive mindset change. They certainly are not interested in advertising failures. However, IT is the area that can profit the most by using an organised effort to learn from its failures.

In order to be more successful, professionals should learn from their experiences and be able to rethink and improve their practice. Failing projects are considered a success when the participants learn something that can be applied to future projects. But, it should be acknowledged that it is often problematic to learn from mistakes and past experience (Oz, 1994:30). Learning from a failing project is costly. However, the same learning experience can be gained from a simulated failure project.

Sims (2003:5) suggested After Action Review (AAR), a process developed by the US army after the Vietnam War. AAR is a way to

gather information about a project while the project is "in action." In AAR lessons learned are identified after the action is completed. The idea is to learn quickly from the mistakes and move forward to use them in the next "action." Lessons learned are captured and disseminated to all teams involved in the project.

The technology base and infrastructure available to an enterprise, either from within or from outside sources, needs to be critically assessed before embarking on a systems development effort. Kotnour (2000:395) divided the project learning process into two categories: inter-project learning cycle and intra-project learning cycle. Inter-project learning is the combining and sharing of lessons learned across projects to apply and develop new knowledge. Intra-project learning cycle is the creation and sharing of knowledge within the project. Kotnour (2000:396) further highlights the need for producing lessons learned as tools for learning. Project management planning and control tools support project learning practices by facilitating the plan- versus-actual comparison to determine project status and define corrective actions.

3.8 CONCLUSION

Information technology/ systems play a very vital role in the business success of a modern enterprise. Information technology can provide the information that the business requires for efficient operation, effective management and the achievement of a competitive advantage. Despite the management's growing interest in IT as a decision-making tool, IT projects are falling at an alarming rate. Consequently IT project management is gaining more and more attention both in learning institutions and management practitioners. The factors that contribute to the failure have been classified into three broad categories:

- poor project management,
- people-related and
- technical-related.

Poor project-management related factors included; poor planning, inaccurate cost and time estimation, lack of monitoring and control, lack of risk management, failure to implement project management techniques and tools, and project organisation. People-related factors include; inexperienced and unskilled project managers, lack of support from top management, lack of end-user participation, team dynamics, ineffective communication and lack of vendor support and commitment. Technical-related factors include; new and immature technology, mismatch between technical expertise and technology, and an absence of change management. Each of these factors has been explained in detail. In addition to these factors, the need for learning in the project environment was highlighted. In addition, the chapter intended to meet some of the research objectives by:

- presenting the prevailing failure rate as found in the secondary data, hence will be used as a basis for comparison against the practical findings
- describing the theoretical foundation of the reasons for failure
- providing concepts that are useful in preparing the questionnaire and gathering practical data.

CHAPTER FOUR

RESEARCH DESIGN AND METHODOLOGY

This research investigation is aimed at determining the factors that lead to failure in IT projects. The questionnaires were constructed based on the theoretical background of the study described in prior chapters. Although the study is descriptive and qualitative in nature some quantitative analysis was made.

4.1 Population size

Information technology is a strategic component of every enterprise today. The researcher believes that the JSE-listed companies are all categorised as high-profile companies. For this reason it was appropriate for the researcher to deal with companies registered on the Johannesburg Stock Exchange. Therefore the target population size for the study consisted of all Johannesburg Stock Exchange (JSE) listed companies based in Johannesburg City. The exact population size was two hundred and eighty five companies as of January 2003. The list of the total population appears in Appendix II.

4.2 Sample size

For the purposes of this research, only enterprises within the geographical areas of: Park Town, Rosebank, Sandton, Houghton, Illivo, Bryanston, Woodmead and Randburg, were selected to compile the sample.

Determining the sample size was not an easy task, as the investigation requires precise statistical estimate and reliable data to be collected. The desired confidence level is 95; and researcher's desired acceptable

level of error (the statistical precision desired by the researcher) has been set at 8%. Using these parameters the following formula (as stated in Joseph, Bush and Ortinau, 2000:340-41) was used to calculate the necessary sample size:

$n= (Z^2B,CL)([PxQ]/\alpha^2)$

Where

$Z_{B,CL}$ = the standardized Z-value of the desired level of confidence

P = estimate of expected sample population proportion having desired characteristics based on intuition or prior data

Q = 1-P

α = acceptable level of error

Since no prior information exist on the ideal percentage of the total population that best suited the survey, the researcher took 50% as a convenient proportion for the sample. These figures were applied to Joseph, Bush and Ortinau's formula as follows.

Sample size(n) = (1.96^2) $([50*50]/8^2]$

= 150 enterprises

The required sample size for the study therefore was 150 companies, which is 53 % of the total population making it statistically acceptable.

4.3 Sample selection

Academic and nonacademic research done in South Africa revealed that more than half of the enterprises in South Africa do not have formalised project management as a separate functional department within the business enterprise. Thus, the need for IT project management unit within the IT department has been neglected for a considerable time. Instead most enterprises initiate and manage their

IT projects through the IT managers. Nonetheless, almost all enterprises initiate IT projects as a tool towards improved efficiency. In order to achieve the objectives of the study, the IT managers and/or IT project managers of the high-profile enterprises based in Johannesburg were defined as the target population.

However the population was too large for a census study. The researcher therefore, drew a sample from the target population. The sampling method used was convenience sampling, where the researcher carefully clustered companies according to their geographical location within metropolitan Johannesburg. The enterprises represent almost all types of industries included in the Johannesburg Stock Exchange. Therefore as non-probability sampling method the sampling technique has an inherent limitation of bias as for it was based on geographic convenience and proximity not on random.

4.4 Research instruments

Researchers can observe behaviors, survey respondents, or conduct experiments. Success in collecting data is more a function of correctly designing and administering a survey instrument (Joseph et al, 2000:253). In this case an empirical survey method was done, which is the mainstay of business research and is normally associated with descriptive and casual research situations. The survey was done on April to May 2004. The researcher has put in a lot of time and effort preparing the data collection instruments. A questionnaire was constructed based on an extensive review of the literature in the areas of project management and information technology. The questionnaire has been sent to a language expert for technical editing and language improvement. The type of survey implemented was a self-administered survey, drop off survey, where the respondents read and indicate their

own responses without the presence of the researcher or the interviewer. The questionnaire is reproduced in appendix I.

The questionnaire was prepared in a way that would allow the researcher to elicit the information relevant to the study. The final questionnaire consists of three major sections. The first section involved demographic questions designed to solicit information about the respondents and their projects. In the second section the respondent had to indicate the frequency of potential problems encountered on IT projects that might have possibility contributed to their failure. In addition, the respondent also had to indicate the frequency of failure occurrences in light of the three measurement dimensions; time, budget and performance. In the third section the respondent had to indicate the practice of project management in his/her enterprise and the use of project management tools and techniques in their projects. All responses in the second section were measured on five point Likert scale, where 1 represents 'never' and 5 represents 'always'.

The researcher hand-delivered the questionnaires to the respondents. The respondents were given a week to fill in the questionnaires before the researcher collected them. Only 26.7%(40) of the sample filled and returned the completed questionnaires to the researcher within the required time frame. Another 23%(34) of the sample enterprises were collected through fax messages. In an attempt to improve the response rate enterprises were reminded of the survey deadline by telephone. A total of 74 questionnaires were eventually returned.

Some of questions included in the questionnaire were taken fully or partly from the surveys and reports done locally and internationally.

4.5 Coding, editing and preparing data for analysis

In order to ensure that the questionnaires were property filled, the questionnaires were validated. Based on the screening and careful validation, nine of the 74 collected questionnaires were discarded. Amongst the discarded questionnaires were questionnaires for which respondents filled only 20 % percent or fewer of the questions. Afterwards, the questionnaires were edited to eliminate possible mistakes. In order to avoid data entry errors, the questionnaire was prepared in a way suitable for coding and data preparation. All responses were labeled with numeric codes and were summarised in the boxes outlined for research use on the questionnaire pages.

4.6 Data analysis

The responses obtained from returned questionnaires were classified as follows:

- Demographic information: data collected in response to these categories will be presented in the form of pie and bar charts.
- Cause and effect (relationship) analysis. The basic analysis of relationship will be done through basic statistics and cross tabulation. In addition the factors that lead to failure in IT projects will be summarised.
- Project management practice and implementation. Responses to the questions relating to the use of project management tools and techniques will be presented and analysed.

Both quantitative and qualitative analysis techniques will be applied in analysing the survey findings. Some of the techniques include correlation co-efficient, analysis of variance, mean, and standard deviation, tabulation, graphical and percentage analysis.

4.7 Limitations of the study

The first and foremost limitation of the study is that the empirical data greatly depends on the self-administrative survey. This implies that there is an inherent limitation that originates from the selection of the methodology. The fact that the respondents had complete control over the questionnaires prevented the use of probing questions and controlling the timeliness of the study. In addition it is impossible to determine the truthfulness of the respondent's answers.

The second limitation of the study is the sampling technique. The subjects were determined by the personal judgment and convenience of the researcher. Hence it is difficult to measure the representativity of the sample. The research also deals with IT project managers and project managers managing projects within the enterprises. However it could have been more complete if users had been included in the study although this proved to be very expensive and difficult.

Testing was the third limitation of the study. Thus the questionnaires were not sent to selected respondents to ensure understandability before it was finalised.

4.8 Conclusion

This chapter is the backbone of the study. It provides the frameworks and techniques with which the empirical data presented and tested for reliability. Some of the aspects presented in this chapter include:

- the target population,
- the sampling technique and sample size,
- the research instruments implemented and
- technical aspects of coding, editing and preparation of data for analysis.

CHAPTER FIVE

DATA PRESENTATION AND ANALYSIS

5.1 INTRODUCTION

The response rate for this survey was 47 percent. The distribution and collection technique contributed to the higher rate of response as the researcher was dropping off and physically handing over the questionnaires. A week after distribution time 60 questionnaires were collected personally. The rest of the responses were collected through faxes from the respondents. Responses came from a wide range of industries represented on the Johannesburg Stock Exchange. Nine questionnaires were discarded due to omissions and technical errors.

This chapter analyses the responses using quantitative and qualitative methods mentioned in the prior chapter. By the end of the chapter, readers will be able to have some sort of understanding of the major factors leading to failure in IT projects and the relationship between different variables.

5.2 DEMOGRAPHIC SURVEY ANALYSIS

This section presents the demographic information. Some of the demographic variables include: gender, age, industry, number of years of experience and type of projects mostly involved. A more in- depth or detailed analysis exceeds the scope of this section.

5.2.1 Distribution of respondents by gender

As described in the previous chapter, the questionnaires were distributed to IT Managers and/ or Information technology project

managers in selected companies. 77% (50) of the responses came from male managers while the rest 23% belong to female counterparts. The following chart shows the distribution of the respondents by gender in terms of percentages.

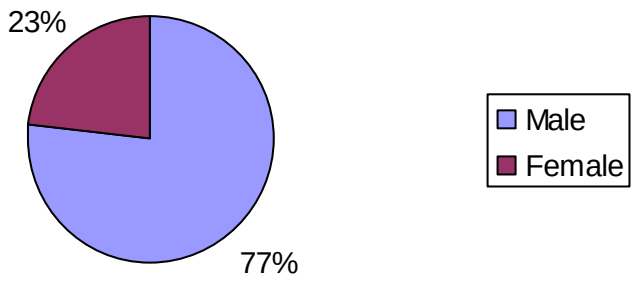

Figure 5.1 Distribution of respondents by gender

There was no significant difference in the failure occurrence between male IT managers and their female counterparts. More analysis will be presented in the next sub-sections of the chapter.

5.2.2 Distribution of respondents by age

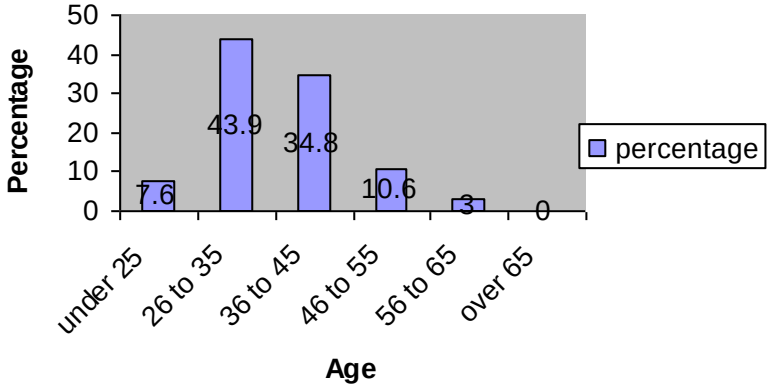

Figure 5.2 Distribution of respondents by age

The majority of the respondents were between 26 and 45. 10.6% belong to the age group ranging from 46 and 55. The less represented groups were those under 25 and above 56.

5.2.3 Distribution of respondents by industry

Figure 5.3 shows that three industry-sectors account for almost half of the total responses, 40% in total. The IT industry itself accounts for 15%, manufacturing 14%, with banking making up a further 11%. In total the other industries not mentioned below account for 17% of all responses. No other industry group accounts for more than 10% of the total. In fact most other sectors represent between 5% and 7% of the total. This indicates that outside the three industry sectors, the response rate is broadly of the same level. The fact that the response rate is dominated by two IT project intensive industries; IT and banking, makes the information more objective and reliable for the drawing of conclusions.

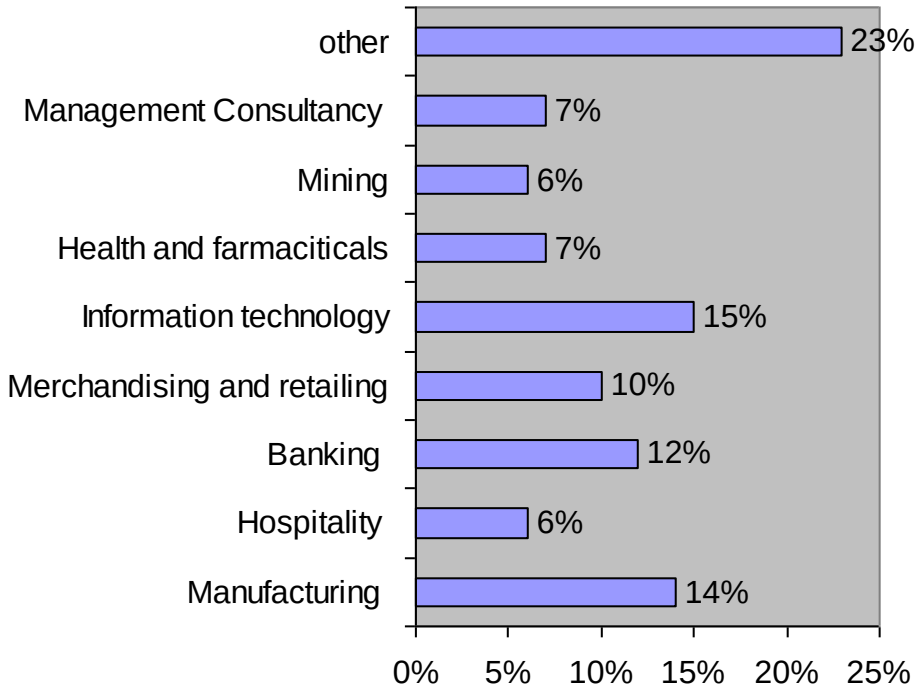

Figure 5.3 Response distributions by industry

5.2.4 Distribution of respondents by the number of years of experience in IT projects.

Participation in projects whether they succeed or fail adds more value to the participants' confidence and enables them to better prepare for the next projects. That is why management stresses the importance of experience in achieving work excellence. Related to this, the respondents were asked to check the category that best fits their experience in the IT projects.

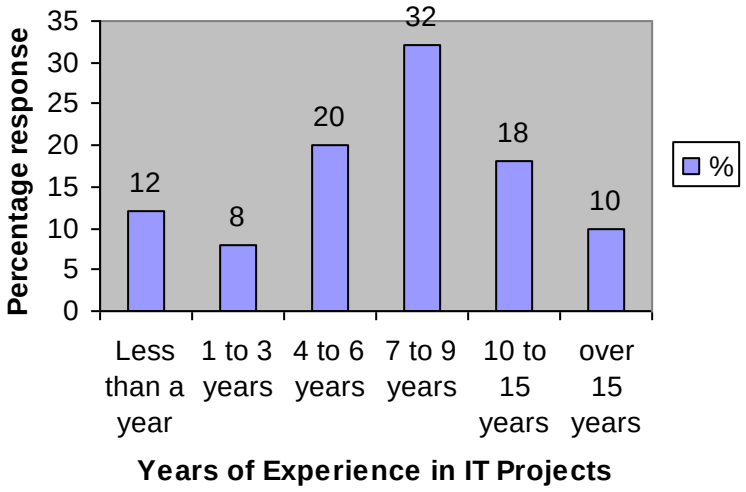

Figure 5.4 Distribution of respondents by their number of years of experience in IT projects.

The majority of these respondents have sufficient experience in managing IT projects, with 52% having accumulated between 4 to 9 years experience' and 28%, over 10 years in IT projects. 12 % of the total respondents worked less than one year. The remaining 8 % were in their first to third year in IT projects (figure 5.4).

5.2.5 Distribution of respondents by the type of projects mostly involved in

As mentioned in chapter three, different kinds of IT projects exist. Secondary research data have shown that the rate of failure varies between project types. Some of these projects are highly susceptible to failure whilst others are less so. In order to assist in observing the relationship between the type of a project and failure occurrence, respondents were asked to indicate the type of IT project mostly involved. The extent of the relationship will be analysed in the next sub-section of the chapter. The following figure reveals the distribution of respondents by the type of project involved.

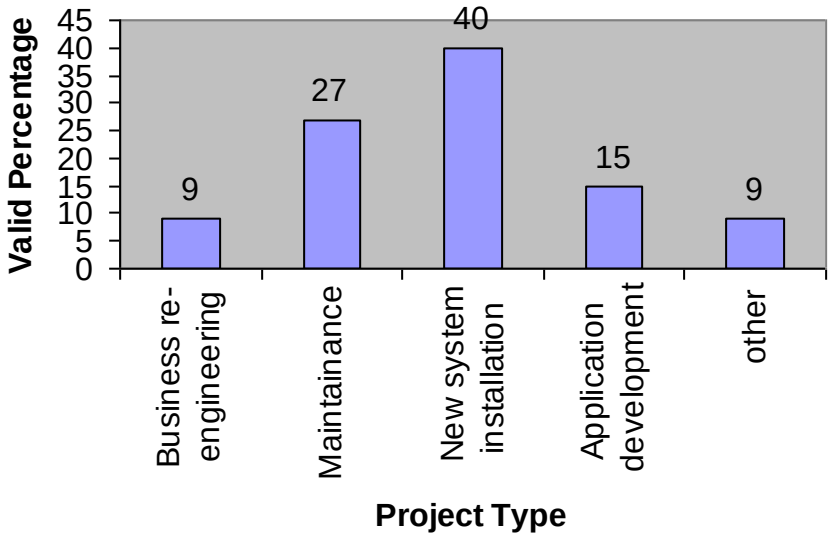

Figure 5.5 Distribution of respondents by the type of project mostly involved in.

New system installation is the type of project in which most respondents were involved. Maintenance, application development, business re-engineering and others can be ranked 2nd, 3rd and 4th respectively in relative to the percentage of occurrences.

5.2.6 Respondents' rating of their skills

Question 11 of the questionnaire focused on the skills required by a successful project manager. Respondents had to rate their skill against the skills required. And table 5.1 summarises the mean average responses and the standard deviation of the ratings on a 5-point Linker scale (1= very poor; 5= excellent). It appears that respondents rate themselves higher at the technical skill level than at soft skills level necessary for the successful completion of a project. Although the mean average response score of each skill was above the average mean score, IT skill has the highest rating of 3.86. Table 5.1 confirms in some ways the views of Bateman (2002:20), who finds that the great majority of project managers lack certain required skills and their weaknesses might have contributed to the problems encountered in many projects.

Table 5.1 Respondents' mean average responses on skills required for a successful IT project manager

Skill	Mean average responses	Standard Deviation
Planning skills	3.379	0.739
Cost and time estimation skills	3.18	0.84
Communication skills	3.74	0.81
Conflict management skills	3.303	0.944
Team-building skills	3.492	0.793
Resources-management skills	3.621	0.78
IT-technical skills	3.864	0.975
Risk-management skills	3.394	0.909
Motivation skills	3.364	0.955
Customer-relationship skills	3.652	0.903

Respondents also had to rank the listed skills according to their importance for success at IT project management (1= the most important and 6= the least important). Table 5.2 presents this ranking according to the respondents.

Table 5.2 Respondents' ranking of skills needed for a successful IT manager.

Rank	Skill	%
1	Project-management skills	37%
2	IT-technical skills	25%
3	Interpersonal Communication	24%
4	Leadership skills	12%
5	Negotiation skill	3%
6	Motivation skills	2%

One of the most significant findings is that there is a mismatch between the skills rating by respondents and the importance attached to them. The highest ranked skills were obviously task oriented including project management, technical skills and interpersonal communication skills. One possible explanation of these findings could be that respondents see themselves as capable of managing IT projects.

The results show that the relative strengths of project managers do not in all respects match the relative importance attached to the different characteristics. Given the variability in rankings, we should be cautious in considering the responses as cast in stone. However, findings proof beyond doubt that there is much to be learned and room for skills improvement as far as IT project management is concerned.

5.3 PROJECT MANAGEMENT PRACTICE

5.3.1 Respondents' usage of project management methods and techniques

Secondary study findings state that the implementation of project management tools and techniques plays a very important role in successful completion of a project. Related to this aspect, respondents were asked to indicate their use of project management tools and techniques (1= No, 2 = Partial and 3= yes).

It appears that budgeting was the most commonly used project management tool. Project managers have also indicated that Gant charts, defining targets with regard to results and progress report were among the commonly used tools. Nonetheless the rate of project managers, who implements the tools fully, remains low.

It is difficult to conclude that there is large difference in the use of different tools, as only an insignificant decimal point difference has been found. Another argument against relying on these rankings is that there exists a mixed response for each tool. This would make it difficult to generalize and draw conclusions. For example tools for managing and supporting projects were ranked on both the top and bottom of the list; the same applies to the tools for problem solving, solution development and project evaluation.

This is an indication that project managers differ greatly from one another in their perceptions and usage of the tools. This might have contributed to the higher rate of failure. Table 5.3 also shows that the majority of the respondents use the tools only partially.

Table 5.3 Ranking of the project management tools according to their usage percentage.

Rank	Instrument	No	Partially	Yes
1	Budgeting	3%	33%	64%
2	Gantt chart	32%	11%	57%
3	Defining clear target with regard to results	10%	34%	56%
4	Progress reports	12%	33%	55%
5	Defining clear targets with regard to time	12%	38%	50%
6	Management by example	21%	33%	46%
7	Project- steering committee	27%	32%	41%
8	Management by walking around	25%	38%	38%
9	Milestones for progress reports	27%	39%	33%
10	Project management software	33%	35%	32%
11	Total quality project management	27%	44%	29%
11	WBS	42%	29%	29%
13	Quality Manual	35%	39%	26%
13	Project manual	30%	44%	26%
15	Critical path method	44%	33%	23%
15	Evaluation forms	53%	24%	23%
17	Baseline documents	39%	40%	21%
17	Risk analysis	12%	67%	21%
19	PERT analysis	62%	21%	17%

5.3.2 Respondents' perception of the importance of project management tools and techniques in the practice of IT project management

Respondents had to indicate their perception of the importance of selected project management tools in managing IT projects. The results portrayed in table 5.4 indicate the positive views of respondents on project management tools and instruments. The mean

responses for all the tools listed were above average of the scale response, PERT analysis being a tool with the low score of 3.091. Nevertheless the results of table 5.3 and 5.4 show a difference between use and perceived importance.

Table5.4 The importance attached to project management tools and techniques in practice.

Rank	Instrument/Tool	Mean	S.D	Mode
1	Defining clear targets with regard to results	4.470	0.638	5
2	Management by Example	4.470	0.769	5
3	Total Quality Project Management	4.394	0.782	5
4	Project steering committee	4.364	0.871	5
5	Budgeting	4.333	0.791	5
6	Risk analysis	4.227	0.873	5
7	Progress reports	4.123	0.857	4
8	Quality manual	3.938	0.916	4
9	Milestones for progress reports	3.900	0.972	4
10	WBS	3.781	1.091	3
11	Project Manual	3.754	0.969	4
12	Critical Path Method	3.515	1.011	4
13	Baseline documents	3.477	1.017	3
14	Management by walking around	3.303	1.347	4
15	PERT Analysis	3.091	1.16	3

The importance attached to the project management tools is less than their perceived importance. A contradiction between the view of the importance of the project management tools and their practice is detected. Thus IT project managers are aware of the project management tools and their importance but in practice these characteristics are less obviously exhibited. It could be inferred that there is some degree of confusion amongst respondents in the ways they approach the management of projects.

5.3.3 Respondents' perception of the importance of IT projects in their enterprise

Respondents had to indicate their perception of the importance of IT projects to their respective enterprises. Figure 5.6 clearly depicts the agreement levels based on the response percentage. It appears that none of the respondents indicated that IT projects are not important, although 7.6% said that they are unsure about it. However the extent of their agreement varies; 6.1 % of the respondents indicated that IT projects are less important, 24.2% indicated that they are important while the majority of the respondents indicated that IT projects are very important.

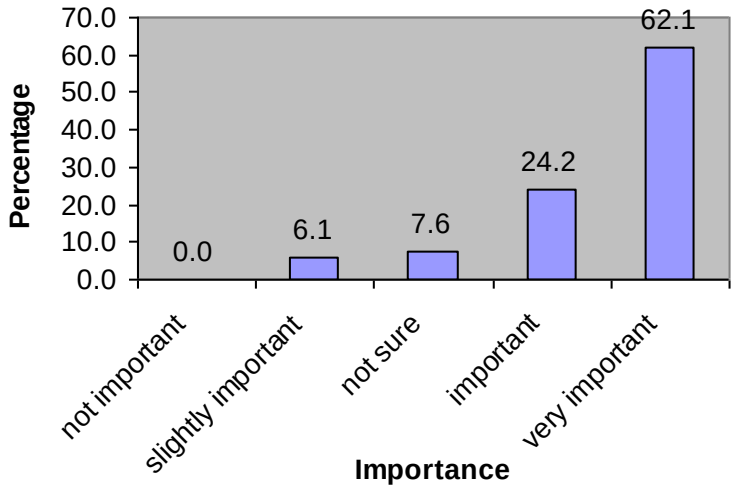

Figure 5.6 Respondents' perception of the importance of IT/IS projects initiated in their enterprises.

5.3.4 Organisational structure for IT projects

Respondents had to indicate an organisational structure that is best suitable for managing IT projects in their respective enterprises. 26% of the respondents believe that a functional organisation structure is

best for their IT projects, whereas 44 % believe that a dedicated project team organisation is best. 22% of the respondents indicated that a matrix organisation structure is best for their enterprise. The remaining 7% believe that organisational structure is not important.

The fact that the majority of the respondents supported a dedicated project team organisation structure tempts the researcher to conclude that dedicated team organisations may be the best alternatives. In addition, respondents had to indicate whether the enterprise's existing organisational structure promotes open communication among the team members and management. 69% of the respondents agreed that the current organisational structure in their enterprise promoted free and open communication while the remaining 31% believe it did not. From the results one can conclude that both senior management and project managers were reluctant to address the structural issues of IT projects undertaken.

5.3.5 Project provision

Table 5.5 reflects the responses as to who delivers a company's IT projects – the company itself or external service providers. 30% of the respondents indicated that IT projects are full done in-house, 52% are partly outsourced and partly done in house and the remaining 18% said their IT projects are fully outsourced. Thus, notwithstanding the rapid growth of the IT services market over the last ten years, in-house project management remains more common than externally managed projects.

Table 5.5 Project Provision Centre.

All done in house	30%
Partly done in house and Partly outsourced	52%
Are entirely outsourced	18%

5.3.6 Project reporting and change identification

Table 5.6 reflects the responses on the frequency of reporting of the project progress and events within a project. It appears that project expenses incurred are reported more frequently among the other items that need reporting. It is promising to observe that the occurrence of changes is the next most often reported item as it prevents from unforeseen risks. However, it must be understood that knowing the changes becomes useful only when top management is willing to react timeously and appropriately. The low average score on rest of the items, however, is an alarming observation.

Table 5.6 Respondents' Average Reporting Scores

ITEM	MEAN SCORE
The progress of the project	2.754
The cumulative expenses incurred	3.601
The occurrence of non conformities	2.894
The level of technical conformance to technical specification	3.045
The level of conformance to customer specification	2.909
The occurrence of changes	3.121

5.4 FAILURES AND FACTOR RELATIONSHIP ANALYSIS

5.4.1 Frequency of problems encountered on the project

For analysis purposes, the problems were classified into three broad categories: Project management related, people related and technical related.

5.4.1.1 Frequency of project management-related problems encountered on the projects

Table 5.7 shows the frequency of project management problems encountered on projects according to the project managers' responses.

Table 5.7 Frequency of project management related problems.

Factor	Item	Item mean	S.D	Factor Mean	Overall Mean
Poor planning and definition	Non-comprehensive plans	3.65	0,906		
	IT projects that should not have passed feasibility	2.68	0.914		
	Projects do not fit the overall company strategy	2.6	1.006		
	Decision-makers were over-ambitious when setting scope of the project	3.515	0.98	3.111	
Failure to Use project management tools	Project management tools were not used	3.303	1.136		
	Difficulties in tracking the progress	2.515	0.965	2.909	
Inaccurate cost and time estimation	IT project costs and time of completion were not estimated correctly	3.25	0.933	3.25	3.12
Poor risk management	Project risks and problems were not identified and analysed early	3.742	0.917		
	Changes were not identified and managed in time	3.03	0.992	3.52	
Poor organisation	The project organisation limits team access to information	2.803	1.011	2.803	

Poor risk management is the most frequently occurring project management-related problem with an average factor mean 3.52, while poor organising is the least encountered problem with a mean of 2.80. Table 5.7 also shows that poor planning and failure to implement project management tools are frequently observed problems. The higher mean score in the overall planning and development of goals implies the widespread reluctance of decision makers during the early stage of a project. Enterprises have to take cognisance of the fact that more needs to be done in order to achieve full implementation project management planning and prioritising of goals.

5.4.1.2 Frequency of people related problems encountered

Human resource is the most important resource utilised by a project. Respondents had to indicate the frequency of people-related problems encountered in their respective projects (1= never; 5= always). The results are reflected in table 5.8.

End-user-related problems represent the most frequently encountered problems with an average mean score of 3.08 while the assignment of unskilled and inexperienced management is the least encountered problem with an average of 2.04.

Table 5.8 Frequency of people related problems encountered

Factor	Item	Item Mean	Item S.D	Factor Mean	Overall Mean
Assignment of unskilled and inexperienced project manager	The project manager lacks soft managerial skills	2.215	0.944	2.04	2.554
	The project manager fails to produce a status report	1.864	0.944		
Lack of management support	The project lacks support and commitment from senior managers	2.750	1.039	2.650	
	No agreement between managers on the skills and time to utilise	2.682	0.862		
	Top management approves non feasible IT project due to organisational politics	2.515	.965		
Team dynamics and Problems	Wrong people are selected for the team	2.455	0.768	2.615	
	Team members are not given enough time and freedom	2.924	0.997		
	Team members change requirements	2.636	.905		
	The team members' conflict of goals	2.258	1.027		
	We lose key staff from the team	2.803	.980		
End users related	Lack of end-user involvement	2.636		3.08	
	End Users failure to know and explain their need and expectations	3.515			
Poor Communication	The IT Team members' use of excessive jargon is not understood by other team members	2.364	1.118	2.385	

The statistics of people-related problems encountered continues----

	The IT project suffers from two lines of communication	2.406	1.019		

5.4.1.3 The frequency of IT technical problems encountered in the projects

Table 5.9 reflects the frequency with which IT projects managers encounter problems related to technical aspects. The results show that vendors' exaggeration is the most frequently experienced problem with an average score of 3.758. The training demands due to the complexity of IT ranks second at 3.364. Acquisition of new and immature technology was found to be another common problem. This is an alerting message to the participating enterprises that there is a need for a thorough acquisition process when purchasing IT. This could be done through careful refinement of IT products and by having a project-steering committee that would assess all sides of IT throughout the stages of a project.

Table 5.9 Frequency of IT related problems enountered

Factor	Item	Item Mean	Item S.D	Factor Mean	Overall Mean
New and Immature Technology	The technical terminology was not understood by users	2.970	1.081	2.967	2.89
	The IT was incompatible	2.606	.892		
	Vendors exaggerate the capability of the new product	3.758	1.138		
	The project involves new and unproven software	2.621	0.780		
	The soft ware performance fails to meet the expected benefits	2.879	0.869		
Mismatch between New IT and the available expertise	The IT suppliers do not have complete knowledge on the product	3.242	0.842	2.799	
	The training demand increased project cost	3.364	1.1017		
	The organization lacks expertise to run the IT	2.242	1.009		
	The staff resist to new IT development tools	2.348	1.015		

Another objective of the survey was to determine whether there is significant correlation between the demographic characteristics of a project manager and the frequency of problems that he/she encounters. The results showed no significant correlation. While table 5.10 reflects some positive correlation between respondents' ages, level of training, experience in IT and the frequencies of problems encountered, it is not statistically significant. Therefore it could be

concluded that decision makers should be less concerned about a manager's demographic characteristics in the selection of IT project managers. However, decision-makers should always remember that human subjective inferences and judgments are preferable to the reliance on statistical results.

Table 5.10 Correlation between independent demographic variables and overall average frequency of problems encountered.

	Frequency of problems		
	Project Management-related	People-Related	Technical-Related
Age of Managers	0.0606	0.097	0.061
Level of training	0.2144	0.067	0.1722
Experience in IT Projects	0.1916	0.1446	0.0366

* p<0.05
**p<0.01
***p<001
N.B There is no *,*, or***, next to correlation co-efficient cells. And that means their relationships were not statistically significant.

Irrespective of the above findings and conclusion it can safely be said that IT projects have been threatened by problems that could cause failures.

5.4.2 Project performance

Until now very little information is available on the performance of IT projects in South Africa. For this and other reasons, respondents had to indicate the overall project percentage that requires rework, the frequency with which IT projects run over budget, behind schedule or completely fail and cease to operate. The results of the responses appear in table 5.11.

The findings indicate that the IT project performance is improving slightly. An average of 25% of IT project work was non-confirming and required reworking. Budget overrun and behind schedule problems are among the most frequently encountered, both with an average of

3.2, while project outright failure is the least encountered problem with a mean score of 1.9. An alarming observation of the findings is that 40% of the respondents, who encountered budget overrun, admitted that it was a very familiar phenomenon.

Table 5.11 Summary of frequencies of IT project failure occurrences

Item	1	2	3	4	5	Mean
Our IT project falls behind schedule	2%	21%	34%	32%	11%	3.293
Our IT project runs over budget	3%	25%	27%	40%	5%	3.185
Our IT project fails to provide expected benefit	7%	46%	23%	18%	5%	2.662
We incur outright failure	31%	49%	17%	1%	2%	1.938

The information portrayed in table 5.11 should not be negatively interpreted because of the higher frequency of occurrences of project over budget and projects fallen behind schedule have improved to previous surveys conducted. Another trend that revealed by the data in table 5.11 is that most of the projects are challenged (fail to meet one or more of its budget, schedule or scope targets) while only a few are abandoned or have failed outright. This could signal that enterprises are becoming less decisive in ending troubled projects, rather than allowing them to worsen. Alternatively, it could mean that senior managers are more discriminating in their initial projects. There could have been a situation where pursuing the challenged projects proves to be the best alternative.

5.4.2.1 Factors affecting performance

The study investigated whether certain differences in project context in particular and in the enterprises in general are related to different levels of performance. Correlation analysis between the independent

variables (frequency of problems encountered) and dependent variables (project outcome) was undertaken. Table 5.12 shows the results.

Table 5.12 Correlation between the frequencies of problems encountered and overall project failure.

Overall Average frequency	Overall failure Occurence **S5**	Sig. **P**
Project mamagement-related problems **(S2)**	0.4856***	0.0001
IT technical-related problems **(S3)**	0.4434***	0.0001
People-related problems **(S4)**	0.4717***	0.0001
Communication and Reporting **(S8)**	0.026	0.837

* P<0.05

**P<0.001

***P<0.001

S2 = The Grant Mean of project management-related problems

S3 = The Grand mean of People-related problems

S4 = The Grand mean of technical-related problems

S5 = The grand mean of the overall failure occurrence

S8 = The grand mean of the frequency of communication and reporting

Three of the independent variables were very significantly related (P<0.001) with project failure outcome. This confirms a strong link between the frequency of the problems encountered and the failure occurrence. It seems that communication and reporting is not as a significant predicting factor as the rest of the factors when considering the causes of the overall project failure.

Once a correlation among these variables was established, a multiple regression analysis was applied to evaluate the impact of each variable. The results as reflected in table 5.13 show that human-related problems were the first significant predictors of project failure ($\beta = 0.314$, $p<0.05$, followed by project management-related problems.

Table 5.13 Test of collinearilty through multiregression coefficient analysis.

Coefficients				
	Unstandardized Coefficients		**Standardized Coefficients**	**Sig.**
	B	**Std.error**	**Beta**	
Constant	0.592			0.163
S2	0.316	0.143	**0.303**	0.031
S3	0.370	0.138	**0.314**	0.009
S4	0.121	0.166	**0.104**	0.470
Dependent variable : S5				

5.4.2.2 Investment in project manager - training and development

One area within an enterprise where senior management can indirectly affect project performance is through the training and development of project managers. Respondents had to indicate the availability of the IT project management-training scheme within their enterprises. Broadly speaking, the results paint a discouraging picture of the extent to which enterprises take the key elements of the human resource management of their project managers seriously and the development of the enterprise's capability. Indeed, in no other part of the questionnaire were responses so uniformly negative. Fig 5.7 shows that in 21% of the enterprises a project management-training scheme is in place while in the other 79% that there is no training program in place.

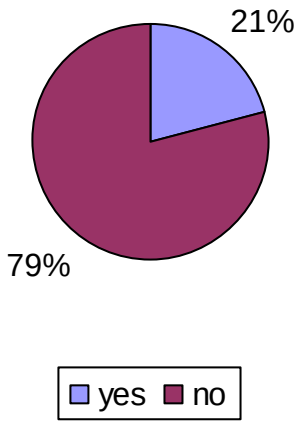

Fig. 5.7 Availability of Project Management training schemes within enterprises.

5.4.2.3 Project provision: In house Vs Outsourced

Figure 5.8 indicates that there is no significant performance advantage to be gained from IT projects conducted by external service providers compared to in-house managed projects. Thus all projects experienced failures frequently. Some advanced ANOVA procedures do require that the experiment be balanced by having equal or minimum difference between the sample sizes. Instead of running the ANOVA test, the study squashed the project-provision types into two categories. A t-test was used to determine the effect of project provision on the project performance. The results show no significant difference between the two categories (Mean difference = 0.294, t= 0.840 p= 0.869).

An important aspect that managers need to consider when deciding either to run the project within an enterprise or to hire an external provider is the availability of resources (both human and material) to implement the projects within the company. 70 % of respondents perceived a shortage of necessary resources to run and implement IT

projects. Therefore, outsourcing proved be the best option for the current decision makers.

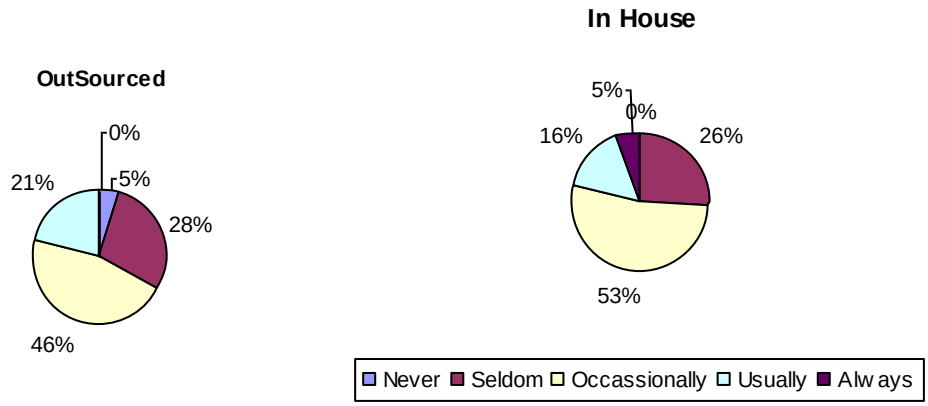

Fig.5.8 Comparison of the frequency of project failure-occurrences between in-house and outsourced projects.

5.4.2.4 Personal background of the project manager

Having collected information about age, education, experience and other details, the study checked for any obvious and significant differences. In relation to age, no apparent performance difference between age groups could be found. As there were relatively few under-25's and above 65's in the sample, the most likely explanation for this is a statistical variation rather than a real effect. The data do not support any form of age discrimination in relation to recruitment and retention.

Again, with experience in IT projects, there is no discernible performance effect. This certainly suggests that the selection of managers that have extensive experience in IT from others is not justifiable. However, 19 % of the respondents indicated that promoting IT technicians to the level of project manager was a usual phenomenon within their enterprises. This might have contributed

positively towards the higher rate of IT project failure because the two jobs require different competencies.

The personal characteristic about which a noticeable difference was observed is gender. 44 % of male respondents encountered failure occasionally as against 64 % of the female respondents. On the other hand no female respondent always encountered failure while 2% of the male respondents perceived that their projects always to fail (see table 5.14). Due to the misrepresentation of female project managers and the confusion of results, however, it is difficult to make speculations and to draw conclusions.

Table 5.14 Comparison of the frequency of failure occurrence between male and female project managers.

Frequency of failure occurrence	Female	Male
Never	0%	2%
Seldom	15%	32%
Occasionally	64%	44%
Usually	21%	20%
Always	0%	2%

5.4.2.5 Lack of consensus on the definition of project success.

Fig. 5.9 portrays that the majority of the respondents studied did not experience an acceptable level of consensus between project-team members. 61 % said there was no consensus on the definition of project success while 39% believe there was a general consensus in their enterprise. This could have been one of the factors contributed positively to the highest failure occurrences within IT projects.

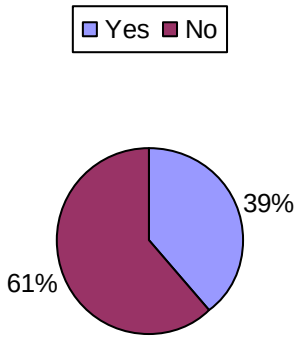

Figure 5.9 Summary of response on general consensus on Project success within their organization.

5.4.3 Project managers' ranking of the risk factors

In chapter three it has been stated that statistical results in general and correlation coefficients in particular are useful and potentially powerful tools that can aid understanding reality but are not substitutes for insight, reason and imagination. Bearing this reality in mind, it was logical for this study to investigate the respondents' perception of the importance of the risks that lead to reduced performance in IT projects. The fact that most of the respondents were greatly experienced in IT projects; leads to believe that their assessment and ranking is based on their real experience rather than on guesses or bias.

Table 5.15 lists the risks and the importance given to them by the respondents. The risks listed have been identified in international research over the last three decades.

Table 5.15 Respondents' ranking of Risk factors

Factor	%	Rank
Poor planning	23%	1
Luck of customer focus and end-user participation	15%	2
Failure to apply project management tools and techniques	14.5%	3
Poor business case	14%	4
Inaccurate time and cost estimation	12%	5
Assignment of unskilled project manager	9%	6
Wrong selection of a team	8.5%	7
New and immature technology	5%	8
Lack of risk management	4.5%	9
Lack of management support	3%	10
Inadequate project control and monitoring	2.5%	11
Changing technology	1.5%	12

Poor planning, lack of customer focus and failure to implement project management tools were among the top factors. However, it is alarming to see that the lack of proper risk management and the lack of management support were among the least ranked factors. It appears that respondents give less consideration to risk management and put less effort into capturing top management support though these factors remain vital for successful project management. These might have contributed positively to the higher failure rate in IT projects.

5.5 CONCLUSION

An empirical data analysis was undertaken in this chapter. And the results of this analysis show that

- There was no statistically significant difference among the responses based on the demographic variable.

- Despite their positive view on project management tools and techniques, project managers hardly use them in practice.
- Project managers possess more technical skills than the soft and managerial skills necessary for successful project manager.
- Project managers admitted that there were not project management training schemes within their enterprises
- There was not significant performance difference between projects undertaken in-house and those that were outsourced.

These and other key findings will be presented in detail in the forthcoming chapter, where the research presents the findings, conclusion and possible recommendations.

CHAPTER SIX

FINDING, CONCLUSION AND RECOMMENDATION

This survey involving 150 IT project managers from 150 firms examined the current use of Project management tools, the current state of IT project performance, frequency of problems encountered by the project managers, the perceived impact of these problems on the project performance and project managers' personal characteristics. In addition the survey found out the variable that predominately affects the IT project performance.

6.1 FINDINGS

The study found out a positive correlation between demographic variables and project performance though it was not statistically significant. The only personal variable where difference was observed was gender, in which case 44% of the male respondents encountered failure occasionally against 64% of their female counterparts (see page116 – 117). Nonetheless it is difficult to conclude that the difference was significant as number of the respondents were not proportional enough to draw conclusion.

Despite the improvement in the overall failure rate from the previously published reports, reports that revealed more than 30 % outright failures, the frequency of problems encountered within IT projects remains high and the project completed on budget, on time and to the specification remains low. On average, 25% of IT project work was non-conforming and required reworking. Even the participating project managers admitted that they have experienced all kinds of problems. Furthermore the study found an association between the frequency of occurrences of the problems and overall project failure.

People related problems were the first significant predictors of project failure followed by project management-related problems (see pages 6, 113 and 114).

It has been found that the relative strength of the current project managers mismatched the relative importance attached to the different skill characteristics. Thus project managers believed to have possessed greater technical skills than the soft and managerial skills necessary for managing projects. On the other hand project managers rated project- management skills as the most important skills for ensuring success of a project. This might have contributed to the failure rate (see table 5.1 and 5.2 of the analysis chapter).

Eighty six percent of respondents acknowledged the importance of the IT projects initiated within their enterprises. It appeared that the IT projects initiated were significant. However, respondents perceived some irregularities and reluctance from the top management when it comes to carefully refining and selecting the software necessary for their enterprises.

Project managers perceived project management tools and instruments positively. However, they hardly use them in practice. Another disappointing finding has been the lack of a formal training scheme, and a lack of investment in project managers within the enterprises. Only 21 % of the project managers indicated that there has been a formal training scheme in their enterprises.

No significant difference in performance between projects conducted in-house and those that were outsourced could be detected. However, project managers perceived a shortage of necessary resources to run and implement IT projects. It has also been found that IT projects suffer from lack of consensus on criterion of project success among

the project team, which might have affected the overall performance negatively.

Finally the project managers ranking of the failure factors revealed that poor planning, lack of customer focus and failure to utilise project management as the tops three factors leading to failure in IT projects.

6.1 CONCLUSIONS

The application of information technology is one of the basic strategic tools used by business enterprises to fight against rapidly changing driving forces and pressures in the competitive global environment. Unlike the past, where IT was known as a means of acquiring necessary information, it is at present the core of a business processes and activities. It is a tool without which businesses can hardly survive. However the performance of IT projects has not been satisfactory. On average 25 % of the IT project work requires reworking in South Africa. Project managers also admitted that they have been encountering problems and risks of all kinds when running their projects.

Although the findings showed a slight improvement in the rate of failure in comparison with the reports published in the past both nationally and internationally where more than 30% outright failures were reported, the results of the survey show that IT projects are still under the threat of failure. It can be concluded that management is still reluctant to develop the organisational capability and to implement scientific managerial approaches when managing projects. This is proven by the fact that 79% of the participants in the survey revealed that no training scheme existed in their enterprises. This negatively affects the performance of IT projects, hence the effectiveness and efficiency within the enterprises.

It can be concluded that project managers view the project management tools and instruments positively, but hardly use those tools and instruments in practice. The reasons for this could be threefold; firstly, the practicing managers might have difficulty in understanding the tools and implementing them in practice; secondly, there may be a lack of formal project management systems within enterprises. Thirdly, a general reluctance by the senior management to develop organisational capability in IT project management.

IT can also be concluded that projects may be outsourced for many of reasons, either by choice or necessity. Outsourcing, however, does not guarantee simplicity nor does it guarantee a successful project completion. No statistical significant difference could be found between the projects that were outsourced and those conducted in-house.

Practicing project managers consider lack of risk identification and analysis among the least significant factors that could lead to failure. This implies that less consideration was given to these aspects, which could have rendered IT projects more vulnerable to failure.

Human resource related problems proved to be the major factors leading to failure in IT project followed by project management related problems.

6.3. RECOMMENDATIONS

Based on the finding of the survey, the researcher recommends for project managers, senior managers and project steering committees if applicable. Collectively viewed, they are not necessarily recommendations for improvement. In some cases they may reflect important aspects that are already addressed by many enterprises.

Align the project goals with the overall business strategy. The survey revealed that projects suffered from lack of consensus among project team members on the goals of the project. Therefore senior managers must stop forsaking IT projects to be dealt with at a departmental level and begin to treat IT at an enterprise level. Projects must have a clear business case, which must involve senior board-level executives. Only senior executives can consider IT projects from a strategic perspective, ensuring their ties with corporate goals and that they are subjected to due diligent scrutiny. Senior management through its involvement should ensure that project teams know these goals.

Ensure good project inception. Many IT projects fail, and in the post mortem many factors are blamed in the aftermath of these expensive and damaging failures. What is seldom realised is that the reasons for failure almost invariably predate the inception of the project. Even the most competent project manager cannot be expected to make an ill-conceived project succeed. Management should therefore ensure that the project requirements and objectives are defined properly. IT projects serve different goals: technical, business and financial. A solid definition of requirements is the backbone of any IT project, clearing a path for efficient project planning and execution. Management should ensure that the following four categories of IT project requirements are defined:

- **Functional requirements:** to determine the appearance, features and operational functionality of the project deliverables.
- **Technical requirements:** to determine the technical elements of project deliverables, including design specifications, operational requirements, compatibility, capacity and performance requirements.
- **Business requirements:** to determine overall project goals and vision, including business goals, objectives, productivity expectation, return on investment and pay-back requirements.
- **Process requirements:** to determine the process requirements, governing the ways that the project is to be managed, project management policies, procedures and optimal practices.

Since requirements define deliverables and build consensus, management should ensure that all stakeholders are involved in the requirement process as is necessary. Once requirements are defined project managers must turn those requirements into concrete objectives and into steps that can be planned, managed, measured and controlled.

Reach a consensus on the definition of project success criteria in your enterprise. As most of the criteria for success are qualitative with the exception of cost and time, they are greatly affected by personal judgment and sometimes by covert objectives. There should be a set of agreed measurable success criteria throughout the course of the project.

Considering the fact that success can be subjective, project managers should not limit themselves to a single definition. The true definition of a project success arises from different perspectives and varies from project to project. Project managers must make sure that any examination of success starts at the very inception and not at the end of the project. Success begins with consensus among participants and

stakeholders on what constitutes project success and on what it will take to make a specific project a success. Above all, success criteria should be simple and attainable.

Have a project management methodology. If project management methodology is in place within an enterprise, it should be fully utilised. If no methodology exists, one should be found and put in place at the outset of a project. One of the advantages of project management is that a project manager can get early warnings about slippage, and then the challenge becomes that of searching for methods to get the project back on track.

Considering the IT project work and its complexity, IT projects benefit from the creation or implementation of some form of standardised project management. For this reason, Project managers should carefully evaluate not only their operational needs for project management, but also their internal capabilities for effectively executing a project management program that provides structure and allows flexibility.

Set a training program. Senior management should establish a training program aimed at developing IT project managers. These would be described as highly skilled people with appropriate experience and talent. IT project managers who are trained can complete a project successfully even if they lack sufficient tools, and process. There should also be a training program that aims at training end-users. Every IT project should include the preparation of a training plan that is formulated by the project team in response to their needs throughout the project life cycle.

Choose the right project provision for your company. Management should carefully analyse the business situation, resources availability and other critical factors. Outsourcing decisions can arise from choice

or necessity. While outsourcing may eliminate certain in-house headaches, it can also add more overhead costs, complexity and layers of responsibility to the internal project manager's situation.

Conducting a project in-house can give in-house programmers the opportunity to develop new skills. However, without prior experience the organisational learning curve and the project time line can lead to architectural mistakes that may involve cost to the project.

To ensure successful project management and implementation, project management and the role of the project manager must be taken seriously. If the function is to be outsourced, then the right IT partner needs to be chosen. An IT service provider must have a proven track record and reputation. They must understand the key business drivers, provide the skills and enable the facilitation of skill transfer. The most important factor when selecting a service provider is the expertise. The decision should not be based on technology as most IT solutions come in packaged form, nor is it determined by cost as this can be easily benchmarked against information that is readily available on local and international IT projects.

Whichever the project delivery chosen, the project manager must apply management standards and best practices with a high level of enthusiasm.

Understand that the best software is not necessarily the best for each business. Decision makers must understand that what is best for many enterprises may be inappropriate for some enterprises depending on the size of the enterprise and the complexity of the operations that are required to be solved by IT. Therefore management should not acquire an application simply because another firm in the industry has done so, nor should it acquire an application which the enterprise can grow into.

Sometimes customers/ end-users do not know exactly what they want from IT projects. Software does not guarantee the improvement of operating efficiency nor does it come equipped with the business processes needed to teach an enterprise how to drive it. Each user or department must learn how to drive the application properly. Therefore it is advisable to hire consultants to assist users with software selection and implementation.

Manage risk. A project fails one day at a time. This failure is dynamic and its opportunities for occurrence are both ever-present and cumulative. The seeds of most IT project that are failed are sown earlier in the project and they mature in the soil of ignorance. This ignorance comes from the inability to identify and then manage all project risks.

Early resolution of a project variable is not often possible as the basic information to make decisions is not available or is fuzzy and changes with time. Risk can also be encountered during the currency of the project and seemingly unimportant risks pose new threats. Therefore risk and uncertainty management should not be seen as a discrete set of activities undertaken at the time of conceptualisation. Rather risk and uncertainty should form a component of all evaluations and decisions made during the currency of the project. In particular, the management of risks and uncertainties should be seen as continuous and part of a real time operation, integrated with other project management operations. Managers should develop risk-management framework capable of quickly re-evaluating the project options against surprises and providing a system for the re-structuring.

For those risks that either the project manager or senior management have no control over or can do little about, such as, industry competition, government action, the emergence of a new product with

more specialised features, both project and senior management should be cognisant of these risks and work to minimise their negative impact.

Management Support. Actively supporting the project manager with technical or project management tasks appears to be beyond the scope of many senior managers. As regards to technical problems they may reflect a rapidly changing technology. However, given senior managers' own significant experience in project management, it is harder to understand why they are not seen as capable of helping. Sometimes an IT project manager sees her/his superior as having operated in a different environment and as therefore having outdated project management skills. However, senior managers need to prove their capability by sharing their wealth of experience in project management.

One of the ways that top management can prevent failure is through intervention at an early stage. Thus top management should consider the issues of a project being expensive, risks, and the real potential of the proposed project. Being uncomfortable with the technology issues can never be a valid excuse for not probing the business issues of an IT project. Senior management should not see a lack of understanding of the technical aspects of a given project as a deterrent to asking questions and challenging assumptions. It is not unusual for IT to intimidate them through the use of technical jargon. When the senior manager does not understand what is being said he/she should push until there is understanding. Doing so may be embarrassing for the individual, but it is better to be momentarily embarrassed than to be forced to deal with a failed project.

Beyond taking an original interest in the project, senior managers should maintain an active interest in the progress of the project. Senior managers should step away from the glamorous thinking of

themselves as strategic proactive leaders, and instead should deal with daily operational problems and drill down into details to ensure their continued existence.

Involve end-users. Users differ in their desire to become involved in projects. Some have a keen desire to be part of the development effort at every stage of the project, requiring frequent updates and a high degree of involvement in the decision-making process. Other customers/ users feel they are paying for a project teams expertise, and only want to be informed when some thing goes drastically wrong or when a major decision is required. Most, regardless of their involvement want to critique and alter the project after the project team considers it to be finished. Communication procedures and expectations need to be set up early in the project by both the project team and the customer/user.

Management should be cognisant that the relationship is not always smooth and productive. In fact under certain circumstances the relationship can turn ugly and adversarial. To prevent this, the end-user roles and responsibilities should be clearly defined and documented. The project manager should set out the following end-user roles and responsibilities very clearly:

- define business needs and requirements
- work with IT to specify deliverables
- work with IT to specify acceptance and success criteria
- follow established change control procedures to minimise unwarranted change requests
- establish communication channels to report issues and change requests
- participate in demonstrations and tests, and
- provide feedback when needed after pilot tests

Manage change. Change is a reality in any project situation. Projects happen over a period of time and with the passage of time underlying circumstance and situations can change. Therefore it is a must for senior managers and project managers to recognise, accept and prepare for the possibility of a change. Given that they can hardly prevent it, they should control it.

This is the essence of project change management- to identify, evaluate and adopt changes so that project results are enhanced. Project managers should manage projects with a structured process to accommodate positive changes and avoid negative ones. Project managers, senior managers or a steering committee need to account for the following elements of change management:

- what types of changes must be allowed?
- how will change be requested?
- how will change be reviewed?
- how will change be approved or rejected?
- how will change be incorporated into project plans and deliverables?

Stop believing in machines and start believing in manpower. The human element of a project is the most important resource that a project should capitalize. Even a very well planned project can fail if the workers cannot get the job done. As the matter of fact the findings is this study indicated human power related problems as the major predictors of failures in IT projects. Therefore the project managers must ensure that the project is properly staffed and the project team has all the necessary resources necessary to deliver success. Once the project manger ensures proper staffing of projects, he or she should start to believe in and empower the human element of the project.

Looking beyond the surface of the people allows the project manager to find undeveloped potential. Seeing them as they cannot, see them

selves as they are, and believing in them tends to make the team members to believe in themselves. Consequently they make an effort to perform according their expectations. Therefore the proper behaviour for a project manager is to avoid being passionate about techniques and machines and becoming passionate about the human power.

Ensuring regular and open communication. Regular open communication is essential at all levels of the project organisation. Often political and cultural issues may inhibit open communication, which leads to unpleasant surprises. Sub-teams or individuals can also be reluctant to admit that they are experiencing problems. The participants in a project should be free from such kind of behaviour. Project managers should develop a habit of reporting the project status to the project steering committee or a project sponsor at least monthly or as frequently as the project circumstances dictate.

Similarly progress reporting by sub-team leaders to the project management is equally important. Project team meetings should be conducted as needed throughout the project. Furthermore project managers should communicate regularly with the end-users.

Learn from experience. Every project is an "experience" in the execution sense but each also provides "experience" in the learning sense. Therefore management and the project team members should consider any project outcome as an opportunity to learn and should use it as a bridge to the next. In order to take full advantage of these lessons, lessons should be viewed from multiple perspectives such as deliverables lessons learned and process lessons learned.

One of the ways to achieve improvement and prepare more adequately for future projects is accepting responsibility for a failed project. Just as every one involved in a successful IT project should accept a

portion of the credit for success, the same must be true with regard to project failure. Therefore an IT project management philosophy that established the idea that a project's success is every one's success and correspondingly, that failure is every one's failure, should be developed. One of the ways to move towards this philosophy is to move away from thinking about the project as "theirs" and begin to understand that as far as project team is concerned, the project is always ours.

However both senior management and project management also need to recognise that the sharing philosophy can also make team members irresponsible. Management should assess the responsibilities and should identify the responsibility for various components, not as a blame-fixing mission. This is fundamentally important to both senior management and team members alike.

A well-designed project management remains to be the best tool for fighting against the alarming failure rate that exists in the IT project environment. Because well designed project management methodology addresses all the above-mentioned recommendations. Therefore the study suggests senior management and IT project managers to take the above-mentioned recommendations seriously in order to have the joy and satisfaction that comes from the achievement of IT project goals.

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APPENDIX I

A . Demographic Information

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1 2 3 [ ][ ][ ]

1. Please indicate your gender. Male [1] Female [2]

2. Please indicate your age category. [ ] 4

Under 25 [1] 26 to 35 [2] 36 to 45 [3]

46 to 55 [4] 56 to 65 [5] Over 65 [6]

3. Please indicate your level of training. [ ] 5

[1] Professional IT specialist

[2] Professional project management specialist

[3] Trained professionally both in project management and IT

[4] Not applicable [ ] 6

3. Please indicate if you were involved in the selection of IT/IS projects.

Yes [1] No [2] [ ] 7

4. Please indicate who in your company have previously been involved in the selection and planning of IT/IS projects for development.

	Yes	No	
Top Management	1	2	[ ] 8
Functional managers	1	2	[ ] 9
IT Project manager	1	2	[ ] 10
IT technical staff	1	2	[ ] 11
End Users	1	2	[ ] 12

Others (please specify)_____ [ ][ ][ ] 13-15

5. Please indicate the box that best describes your involvement in IT projects.

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Less than 1 year [1]

1 - 3 years [2]

4 - 6 years [3]

7 - 9 years [4]

10 - 15 years [5]

Over12years [6]

[ ]16

6. Please indicate your agreement that the lack of a formal steering committee for IT project selection, can lead to IT failure?

Strongly disagree [1] Disagree [2] Uncertain [3] Agree [4]

Strongly agree [5]

[ ]17

7. Please indicate the industry that represents your organisation.

[1] Manufacturing

[2] Hospitality

[3] Banking

[4] Merchandising and retailing

[5] Information technology

[6] Healthcare and Pharmaceuticals

[7] Mining

[8] Management consultancy and accounting

[9] Other (please specify)_____

[ ]18

8. Please indicate if you ever participated in an IT project that has overrun budget, fallen behind schedule or failed to fulfill its expected benefits?

Yes [1] No [2]

[ ]19

9. Please indicate the general percentage of the project total work that is found to be non-confirming and requires reworking? _____%

20-21 [ ][ ]

10. Please indicate the type of project you are most commonly involved in. (Please indicate only one).

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1 Business re-engineering

2 Maintenance

3 New system/Technology installation ☐ 22

4 Application development

11. In the table below, 1= Very Poor; 2=Poor; 3 = Good; 4 = Very Good 5 = Excellent. Please indicate with an X the number that expresses your knowledge and performance.

Item - Skill	1	2	3	4	5	
Planning skills						☐ 23
Cost and time estimating skills						☐ 24
Communication skills						☐ 25
Conflict management skills						☐ 26
Team building skills						☐ 27
Resource management skills						☐ 28
IT technical skills						☐ 29
Risk management skills						☐ 30
Motivation skills						☐ 31
Customer relationship skills						☐ 32

B. FAILURE FACTORS

12. In the tables below, 1 = Never; 2 = Seldom; 3 = Occasionally 4= Usually; 5 = Always. Indicate with an X how often the projects undertaken by your company encounter the following aspects.

Project Management Related Statements:

Item	1	2	3	4	5	For office use only
Plans are not comprehensive enough to include milestone dates						☐ 33
There were projects that should not have passed the feasibility stage						☐ 34
Projects do not fit with the overall IT strategy of the organisation						☐ 35
The decision makers are over-ambitious when setting the scope of the projects						☐ 36
Project management tools and techniques are not in managing IT projects						☐ 37
Project completion time and cost are not estimated correctly						☐ 38
There exist difficulties in tracking the progress and doing something about it.						☐ 39
The shifting forces and constant changes in the project due to external factors, are not managed in time						☐ 40
Project risks are not identified and analysed during the early stage of the project.						☐ 41
The project organisation limits team members access to information and self decision making						☐ 42

People Related Statements:

Item	1	2	3	4	5	
IT project manager has no say when selecting the project team						☐ 43
The project manager fails to inform the team members about the status of the Project.						☐ 44
The project manager lacks managerial and people related skills						☐ 45
No agreement between the project and functional managers on the skill and time to utilise in the IT projects						☐ 46
Users do not involve in the course of the project.						☐ 47
End users do not know or explain their expectation from the IT Project.						☐ 48
The team members change the requirements in accordance with their skill						☐ 49
Top management do not support the project consistently						☐ 50
Top management approves non feasible IT projects due to organisational politics.						☐ 51
Wrong people are selected for the projects.						☐ 52
Team members are not given enough time and freedom to do their jobs						☐ 53

People Related Statements continued:

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Item	1	2	3	4	5	
The team members conflict on the goals of the project.						☐ 54
We lose key staff from the team.						☐ 55
Other team members do not understand the IT team members' use of technical jargon.						☐ 56
The project suffers from lack of two-way communication.						☐ 57

Technical Related Statements

Item	1	2	3	4	5	
The vendors exaggerate the capabilities of the new product.						☐ 58
The technical terminology and the programming language is not understood by the end users.						☐ 59
The IT supplies do not have complete awareness on the product						☐ 60
The project lacks defined and documented development process						☐ 61
The training demand of the new technology increases the overall cost of our project						☐ 62
The IT was incompatible making it hard to maintain communication between system components						☐ 63
We face challenges in integrating the new IT with the existing IT						☐ 64
Implementing new and unproven software						☐ 65
The organisation lacks expertise to run the IT application						☐ 66
The staffs resist to new IT development tools.						☐ 67
The software performance fails to meet the expected benefits.						☐ 68

Failure Occurrences:

Item	1	2	3	4	5	
Our IT project run over budget						☐ 69
We get reports of IT project that has fallen behind schedule						☐ 70
The IT project fails to provide the expected benefits						☐ 71
We incur IT project outright failures that stop the project from continuing.						☐ 72

13. Listed below are a number of attributes (reasons) why IT projects fail with regard to meeting the cost, time and quality constraints. Based on your experience, please rank each attribute from 1to12, with 1 being the most important factor leading to IT project failure, and 12 being the least important.

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- ☐ Poor business case — ☐☐ 73-74
- ☐ Poor planning — ☐☐ 75-76
- ☐ Assignment of unskilled project manager — ☐☐ 77-78
- ☐ Wrong selection of a team — ☐☐ 79-80
- ☐ Lack of customer focus and end user participation — ☐☐ 81-82
- ☐ Lack of management support — ☐☐ 83-84
- ☐ Lack of risk management — ☐☐ 85-86
- ☐ Changing technology — ☐☐ 87-88
- ☐ New and immature technology — ☐☐ 89-90
- ☐ Inaccurate project time and cost estimation — ☐☐ 91-92
- ☐ Failure to apply project management tools and techniques — ☐☐ 93-94
- ☐ Inadequate project control and monitoring — ☐☐ 95-96

C. Project Management Practices

14. In the next table a number of project management instruments/tools are listed. Please indicate whether these instruments are used by your organisation.
1= No 2= Partially 3 = Yes

Instrument/tool	**No 1**	**Partially 2**	**Yes 3**	
Critical path method				☐ 97
Defining clear targets with regard to results				☐ 98
Defining clear targets with regard to time				☐ 99
Budgeting				☐ 100
Quality manual				☐ 101
Project manual				☐ 102
Base line documents				☐ 103

Instrument/tool	1	2	3
Risk analysis			
Progress reports			
Milestones for progress reports			
Evaluation forms			
PERT analysis			
Management by Example			
Management by walking around			
Total quality project management			
WBS			
Gantt charts			
Project management software			
Project steering committee			

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104
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114
115

15. Please indicate with an X your perception on the importance of each of the following project management instruments or tools.

1= Not important at all 5 = Very important

Instrument/tool	Importance 1	2	3	4	5
Critical Path Method					
Defining clear targets with regard to results					
Budgeting					
Quality manual					
Project manual					
Base line documents					
Risk Analysis					
Progress reports					
Milestones for progress reports					
WBS					
PERT analysis					
Management by example					
Management by walking around					
Total quality project management					
Project steering committee					

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130

16. Which of the following categories of project selection criteria are applicable in your enterprise?

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	Yes	No	
Economic and financial criteria	1	2	131
Technical criteria	1	2	132
Organisational and strategic fit criteria	1	2	133
Risk factors	1	2	134
Managerial considerations	1	2	135

17. How do you view the importance of IT/ IS project for your enterprise?

Not important at all 1 slightly important 2 not sure 3

Important 4 Extremely important 5 136

18. Organisational structure, besides other things, determines the power structure and communication lines within a project. Which one of the following structures would you consider best for IT projects?

1 Functional organisation

2 Dedicated project organisation

3 Matrix organisation 137

19. Do you believe that your enterprise has project management training schemes for IT managers?

Yes 1 No 2 138

20. Are there available resources (both human and material) to implement the increasing number IT projects within the company?

Yes 1 No 2 139

21. Which of the following sentence applies to your enterprise?

1 All IT projects needed in our enterprise are done in house.

2 Part of our IT project is outsourced to external enterprises.

3 All IT projects are outsourced to external enterprises. 140

22. How often do good IT technicians get promoted to project managers?

Never [1] Seldom [2] Occasionally [3] Usually [4] Always [5]

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[ ] 141

23. The position of your project managers is well defined in your enterprise?

Strongly Disagree [1] Disagree [2] Undecided [3]

Agree [4] Strongly Agree [5]

[ ] 142

23. Listed below are some of the skills of a project manager important for project realisation. Please rank each skill from 1 to 6, 1 being the most important skill, and 6 the least important.

[ ] Interpersonal communication skills [ ] 143

[ ] Leadership skills [ ] 144

[ ] IT technical skills [ ] 145

[ ] Project management skills [ ] 146

[ ] Motivation skills [ ] 147

[ ] Negotiation skills [ ] 148

24. The IT project team represents members from various departments with in the enterprise

Yes [1] No [2] [ ] 149

25. Do you think that your company remuneration system promotes a project team work atmosphere?

Yes [1] No [2] [ ] 150

26. Do you believe that the users have expertise to implement the IT projects developed in your enterprise?

Yes [1] No [2] [ ] 151

27. Is there a consensus in your enterprise on the definition of project success?

Yes [1] No [2]

[1] 152

28. Does the IT project organisation structure in use in your enterprise promote open communication within the project team members and the management as well?

Yes [1] No [2]

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[ ] 153

29. Please indicate with an X the frequency with which you take corrective action to control the following. 1 = never; 5= always

	1	2	3	4	5
The progress of the project					
The cumulative expenses incurred					
The occurrence of non conformities					
The level conformance to technical specification					
The level conformance to customer specification					
The occurrence of changes					

[ ] 154
[ ] 155
[ ] 156
[ ] 157
[ ] 158
[ ] 159

30. At the end of the project, we produce a lesson learned and tell the truth.

Strongly disagree [1] Disagree [2] Undecided [3]

Agree [4] Strongly agree [5]

[ ] 160

31. We are willing to share lessons about project successes?

Strongly disagree [1] Disagree [2] Undecided [3]

Agree [4] Strongly agree [5]

[ ] 161

32. We are willing to share lessons about project failures?

Strongly disagree [1] Disagree [2] Undecided [3]

Agree [4] Strongly agree [5]

[ ] 162

33. Comments_____

163-164 [ ][ ]

_____

_____

_____

[ ][ ] 165-166

_____

Thank You

Date: March 09, 2004

T.G Ghebre-egziabiher
Department of Business Management
University of Free State

Dear Respondent

Today Information Technology management is a strategic component of any organisation as it plays a crucial role in re-engineering and restructuring business processes in response to increased competition. However there is a widespread dissatisfaction with the performance of information technology projects. Reports and surveys confirm that the IT project failure rate is alarming. South Africa is no exception. In fulfillment of the requirements of the Master of Commerce (MCom) in Business Management, I proposed studying the factors that could possibly lead to IT project failure and to assess the status of project management. The study will have an effect on the way that IT projects are managed.

Your company has been selected in a sample of high profile JSE registered companies convenient for the study. Your opinions in this survey can never be traced back to you, and all data will be treated strictly confidential. The result of the study will provide useful managerial insight into how better to manage information technology projects. For this reason your assistance in completing the accompanying questionnaire is very important. The time required to complete this questionnaire is about 20 to 30 minutes.

Thank you for your assistance.

Yours sincerely
T.G Ghebre-egziabiher

_____

APPENDIX II

No	Listed compay's name	Postal Address	Physical Address	Telephone	Fax
1	ABSA group ltd	P.box 7757, Jbg, 2000	Johannesburg, Absa towers east, 170 Mainstreet,2001	0113504000	0113504928
2	Acuity group holding Lmd	Private bag x5,Gallo Manor, 2052	Johannesburg	0117482800	0117482888
3	Adcorp holdings ltd	P.box 7156,Johannesburg,2000	Cnr. Rustenburg Road and 7th Ave, Melville, 2092	0117129000	0117129004
4	Admiral leisure world Ltd	P.box 6160, Halfway House,1685	Johannesburg	0113144040	0113144041
5	Adonis Knitwear holdingltd	P.box 42086, Fordsburg, 2033	Johannesburg	0118337100	0118365507
6	ADTECH Group	P.box 2369, Randburg, 2125	Johannesburg	0118865100	0118864512
7	AECI Ltd	Private bag x21,Gallo Manor, 2052	AECI place, 24the Woodlands, Woodlands drive, Woodmead Santon, 2052	0118068700	0118068701
8	AFGRI ltd	P.box 3559, Cramer View, ,2060	33Sloane street, KnightsbrigeManor, block, b2 Brayanston2021	0117067897	0114634139
9	African Bank investment limited	Private bag X170, Midrand, 1685	Johannesburg	0112569000	0112569304
10	African gem resources limited	P.box99, Melorse arch, 2076	Johannesburg	0112141000	0112141010
11	African life assurance co Ltd	Pbox 1941, Houghton, 2041	African Life park, 11-13 Weststreet, Houghton,2198	0115397700	0114832495
12	African media entertainment Ltd	P.box540,Northriding,2162	Johannesburg	0117945665	0117945667
13	Afrox oxygen Ltd	P.box5404,Jbg, 2000	23 Webbstreet, Selby, Johannesburg,2001	0114900400	0114931580
14	African rainbow minerals gold	Pbox 786136, Santon,2146	Armhouse,29 Impala Road, Chiselhurston	0118835606	0118835609
15	The afrikander lease Ltd	P.box6253, Flamwood,2572	Empire Park, Block A ,Empire Road, Parktown	0114823605	0114823604
				0184681061	0184685054
16	Afrox healthcare Ltd	P.box5404,Johannesburg,2000	23 Webber Street, Selby, Johannesburg,2001	0114900400	0114900665
17	AG Industries Ltd	P.box 40443, Clevelend, 2022	Corner Kruger Street, and Mimetes Road, Denverextension11, Johannesburg, 2094	0116074500	0116157050
18	Alacrity financial services Ltd	P.box2078, Jbg, 2000	2ndfloor, Pamodzi House,5Willowbrook close, Melrose North Johannesburg 2196	0119127400	0119127499
19	Alexander Forbes Ltd	P.box 787240, Sandton,2146	Johannesburg	0112690000	0112691111
20	Alex white holdings Ltd	P.box825, Florida, 1710	Johannesburg	0114724731	0114724854
21	Alliance Pharmaceticals Ltd	P.box 260759, Exom, 2023	Johannesburg	0113343600	0113344319
22	allied electronics corporationltd	P.box 981, Houghton,2041	Johannesburg	011 645 363(	0114826489
23	Allied technologies Ltd	P.box 153, Bergvlei, 2012	79 Central Street, c/o 11th Avenue, Houghton, 2198	0117159000	0117159048
24	all joy foods Ltd	P.box 2152, Southdale, 2135	Johannesburg	0114961800	0114961596
25	Aludie Ltd	P.box 12857, N1city, 7463	15 Sherborne Rd, Ristone Office Park Parktown,Johannesburg	0118775900	
			Project manager, IT manager	0118775957	01187267496
26	Amalgamated appliance holding	P.box39186, Booysense,2016	29 Heronemere Road, Reuven, 2091	0114909000	0114909115
27	Amalgameted Beverageindu	P.box 76202, Wendywood,2144	ABI house,14 Pongola Crescent, Eastgateextension17, Sandton, 2199	0117191400	0117191472
28	ABM holdings Ltd	P.box786833, Sandton,2146	18 Fricker Road,Illovo, 2196 (011 215 2094 excecutive director)	0112152000	0112686888
29	AMB private equity partners Ltd	P.box786833, Sandton, 2146	Johannesburg	0112152000	0112686890
30	Anbecco investment holding Ltd	P.box 3126, Houghton 2041	Johannesburg	0116162220(	0116132100

31	Anglo American platinum corp.ltd	P.box62179, Marshall town, 2107	28 Harrison street, Johannesburg, 2001or 55 Marhall Street	0113736111 0113735111
32	AngloGold	P.box 62117, Marshal Town.2107	11 Diagonal Street, Johannesburg, 2001	0116376000 0116376624
33	Anglovaal industries	P.box 1897, Saxonwold, 2132	19 Implala Road, Chislehurston, Sandton , 2196	0117792700 0118842334
34	Anglovaal mining limited	P.box 62379, Marshall Town, 2107	56 Main Street, Johannesburg, 2001	0116349111 0116340038
35	ApexHi properties Ltd	P.box 526, Parklands, 2121	8 Arnold Road Rosebank,2196	0114423111 0113273825
36	appliet technology holding(Aplitec	P.box2424, Parkalnds, 2121	4th floor, Northwing, President Place, 148 Jansmuts Avenue Rosebank, Johannesburg, 2198	0113432000 0118807080
36	Aqua online holding Ltd	P.box 742, Parkland, 2121	Johannesburg	0117721700 0117721701
37	Aquila Growth Ltd	Private bag x106, Bryanston, 2021	Johannesburg, USA	0117068928 0117066312
38	Arcay Group limited	P.box 62397, Marshal Town, 2107	Jbg, Arkay HouseIII, Number3 Anerly Road, Parktown,	0115324200 0115324201
39	Argent industrial Ltd	P.box14461, Wadeville, 1422	13Jack Pienaar Street, Germiston Southextesion7, 1411	0118764000 0118737239
40	Arnold property fund Ltd	P.box781611, Sandton, 2146		0118038684 0118071279
41	Aspen pharmacare holding	P.box1587, Gallomanor, 2052	Building 8, Healthcarepark, Woodlandsdrive, Woodmead, Sandton 2196	0112396100 0112396111
41	Assmang Ltd	P.box62379, Marshall Town, 2107	Johannesburg	011634911 0116340038
42	Assore Ltd	Privatebagx03, Northlands, 2116	Johannesburg	0117706888 0112686040
43	Astrapak Ltd	P.box652740, Benmore,2010	1st Floor Wierda Court, Johan Ave, Wierda Valley, Sandton	0117845577/ 0117841569
44	Avasa holdings Ltd	P.box 68396, Bryanston, 2021	Johannesburg	0117482800 0117482888
45	Aveng Ltd	P.box 846, Saxoworld, 2132	Johannesburg	0117792800 0118842315
46	Avgold ltd	P.box 62379, Marshalltown, 2107	56 Mainstreet, Johannesburg, 2001	0116349069 0116340038
47	Avis Southern Africa ltd	P.box 221, Isando, 1600	Johannesburg International Airport	011 9233735/6
48	Barloworld ltd	P.box782248, Sandton, 2146	Barloworld limited, 180 Katherine Street Sandton, 2196	011929000 0114443643
49	Barnard Jacobs mellet holding	P.box62200, Marshaltown, 2107	BarnardJacobs Mellet House2nd Floor 5 Sturdee,Avenue 2196	0112830300 0112830303
50	Barnato Exploration Ltd	P.box61719, Marshalltown,2107	Johannesburg	011 688 5100
51	Barplats Investment Ltd	P.box 61386, Marshall 2107	3rdfloor, old traford 4, Boundary Road, Hougton, 2198	0114813900 0114840254
52	Basil Read Holding Ltd	Private bagx170, Bedforview,2008	Johannesburg	0116207000 0116207041
53	Biege Holding Ltd	P.box 62397, Marshaltown, 2107	Johannesburg	0115324100 0115324001
54	the bidvest Group Ltd	P.box 87274, Houghton, 2041	18 Crescent Drive, Melrose Arch, Melrose 2196	0117728700 0117728970
55	Brandcorp holding Ltd	P.box 1063, Mondeor, 2110	Unit 5 Omni Park, Aerodrome Road, Aeroton	0114943680 0114941526
55	Bridgestone firestones maxiprest	P.box543, Bergevlei, 2012	cnr. Grayston Drive & Katherine Road, Sandton	0114482255 0114482268
56	Bryant technology limited	P.box69557, Bryanston, 20021	Johannesburg	0113147860 0113147861
57	Buildmax Ltd	P.box 1400, Germiston, 1400	Johannesburg	0118733949 0118735051
58	Bytes technology group Ltd	P. box 1770, Rivonia, 2128	Bytes House,The Avenues North, 6 Mellis Road, Rivonia, 2128	0112369500 0118076909
59	Cadiz Holding Ltd	P.box 44547, Claremont, 7723	31 West Street, Lower Houghton, Johannesburg 2198	0114830855
60	Capital alliance holding Ltd	P.box 261813, Excom, 2023	162 Anderson st, Johannesburg, 2001	0113301000 0112204300
61	Capital property fund limited	P.box 2100, Parklands 2121	1st Floor,JHI house, 11Cradock Avenue, Rosebank 2196	0114410123 0114410000
62	cargo carriers ltd	P.box201,Isando,1600	140 North Reefroad, Elansfontein, 1406	0118788300 0118788381

63	Casey investment holdings ltd	P.box 7978, Centurion, 0046	BlockBgreenoax office park,crn Gregoryand bekkerave,Midran	0118059450 0118059452
64	cashbuild ltd	P.box90115, Bertsham, 2013	CornerAerodrome and Aeroton Roads,Aeroton,Johannesburg	0112481500 0114941234
65	Caxtonpublishers and printersLtd	P.box 43587, Industria West, 2042	Johannesburg	0112497000 0114748229
66	CCI Holdings Ltd	P.box 1757, Northcliff, 2115	34 Mankor Drive, Dandpark Ridge, Randburg, 2194	0113405000 0113405051
67	The cementation company	P.box82027,Southdale,2135	48BooysensRoad,Selby, Johannesburg,2001	0114934740 0114931285
68	Cenmag holdings	P.box870,Isando,1600	Johannesburg	0114537690 0114537694
69	centrecity property fund Ltd	P.box 2100, Parklands 2121	2ndFloor, JHI House, 11 Cradock Avenue, Rosebank, 2196	0114410123 011441000
70	chemical services Ltd	Private bag x137, Bryanston,2021	Turnberry Officepark, 48 Grosvenor Road, Bryanston,2021	0115484500 0115484700
71	City lodge hotels Ltd	P.box,782630, Sandton, 2146	Johannesburg International Airport	0118845327 0118833640
72	Clientele life assurance company	P.box1316, Rivonia, 2128	Johannesburg	0113203333 0118849056
73	Comair Ltd	P.box 7015, Benaero Park, 1622	Johannesburg	0119210222 0119731659
74	Comprex Holding	Prvatebagx48,Half wayhouse1685	PQ Park, 789, 16th Road, Ranjespark, Midrand 1685	0112666490 0112266489
75	Compu-clearning out sourcing	P.box89856, Lyndhurst, 2106	7 Drome Road, Lyndhurst,Johannesburg	0118827300 0118827009
76	Confex Holdings Societe	P.box1361,L-1013, Luxembourg	Johannesburg	
77	Concor	P.box8259, Johannesburg,2000	Concorhouse,13Church Street ext, Crown Industria, Jbg,2001	0114952222 0114952475
78	Connection group holdings	P.box 2214, Rivonia, 2128	6 Mellis Road, Rivonia, 2128 jbg	0112588000 0112588094
79	Control instruments group Ltd	P.box 114, Franschhoek,7690	Philips Office Park 195-215 Main Road Martindale, 2092	0113753900 0218763738
80	coronation holdings Ltd	P.box 65643, Benmore,2010	Johannesburg	0117756430 0117756451
81	Corpcapital	P.box 471917, Parklands 2121	Johannesburg	011283000 0112830077
82	Corwil investments Ltd	P.box1370, Johannnesburg,2000	Johannesburg	0114802300 0114841721
83	Crux technilogies Ltd	P.box 3169, Midrand, 1685	Johannesburg	0115411600 0113153971
84	Cs computer services holdings	P.box786691, Sandton, 2146	CS Holding Officepark, Halfwaygardensext104,midrand	0112057000 0118057360
85	CTP holdings Ltd	P.box 43587, Industria West, 2042	Johannesburg	0112497000 0114748229
86	Cullinan Holdings Ltd	P.box2412, Crameview,2060	1st Floor Dunkeld West Centre 277 Jan Smuts Avenue	0117707993 0117707484
87	Cycad financial holdings	P.box 72425 Parkview 2122	20 Glenhove Road Melrose Estate 2196	0115072000 0115072004
88	Data centrix	P.box 74415, Lynnwoodridge pta	Woodmead Office Park 12 Saddle Drive Van ReenansAvenue	0114612000 0123487555
89	Datatec Ltd	P.box76226, Wendwood, 2144	Building 8 HarrowdeneOfficePark, Woodmead 156 Western Service Road, Sandton, Jbg	0112331000 0112333300
90	Decillion ltd	Pbox 1979, Parklands, 2121	Johannesburg	0113281000 0114424456
91	Delta electrical industries	P.box78396, Sandton, 2146	Sandton City Office Tower,Rivonia Road, Sandown,2196	0117834500 0118845398
92	Dimension Data holding Plc	P.box56055, Pinegowrie, 2123	The Campus 57, Sloane Street, CnrSloaneStreet & Main Road Bryanston	0115750000 0117091099
93	Discovery holding ltd	P.box786722, Sandton, 2146	155 Weststreet Sandton,2146	0115292888 0115292985
94	Distribution&WarehousingN.work	P.box 75545,Garden view, 2047	2 Keerom Road, Heriotdale ext10, Cleveland, 2094	0116226680 0116223864
95	DNA supply chain investments	Private bag 27,Gallo Manaor2052	Johannesburg	0118027424 0118027419
96	the don group	P.box 868, Northlands, 2116	3 Cherry, Achter Road, Sunninghill, 2157	0118076600 0118076261
97	Dorbyl Ltd	P.box2392, Houghton, 2041	Johannesburg	0114810600 0114810650

98	Durban roodepoort deep Ltd	P.box 390 Mariasburg	45 Empire Road, Parktown, Johannesburg, 2193	0113817800	0114824641
99	EC-Hold Ltd	P.box 1697, Bramely, 2018	Johannesburg	0116952000	0116952292
100	Edgars Consolidated stores	P.box 100, crown Mines, 2025	Edgars, Press Avenue, Crown Mines, 2092	011495600	0118375019
101	Eerstelling Gold mining company	P.box 587, Johannesburg,2000	Johannesburg	0114472499	0114472554
102	ELB group Ltd	P.box 565, Boksburg, 1460	Founders building, Bartleet Road, Boksburg North	0117721600	0118992850
103	electronic Media networks Ltd	P.box 2963, Pinegowrie 2123	137 Hendric Verwoerd Drive, Randburg, 2194	0116866000	0116866665
104	Elexir technology Holdings Ltd	P.box 1819, Fourways, 2055	156 Kyalami Boulevard, Kyalami Business Park, Kyalami, 1684	0114661301	0114666580
105	Ellerine Holdings	Pbox122, Bedfordview, 2008	BlockE, Gilllooy's View office Park,Osborne Lane Bedfordview	0116071000	0116071400
105	enterprise Outsoursing holdings	Pbox59, Bruma, 2126	1stFloorBlock FGillooly'sView 1OsborneLaneBedfordview2007	0116078100	0116169929
106	**enterprise risk managament**	P.box3382, Randburg 2125	3rd Floor,Oak Place,264 Oak Avenue,Ferndale,Randburg,2194	0118844717	0117872259
107	Enviroserve holdings Ltd	P.box2207, Benooni, 1500	18 Dusseldorf Street, Apex,Benoni	0114222560	
108	Erp.com holdings	P.box 2880, Rivonia 2128	Johannesburg	0112587800	0835567959
109	Eureka industrial Ltd	P.box3331, Johannesburg 2000	Johannesburg	011789 9991	0114586781
110	exellerate Holdings Ltd	P.box 785448, Sandton, 2146	Johannesburg	0114440474	0112620360
111	Explorer Corporation Holdings	P.box 653249, Benomore,2010	2nd Floor, Eastwing, 11Alice Lane, Sandton 2196	0117840120	0117838412
112	Fairvest Property Holdings Ltd	P.box260362, Excom, 2023	Johannesburg	0117280255	0117288921
113	Faritec holdings Ltd	P.box 76784, Wendywood,2144	Faritec House,150 Kelvin Drive,Woodmead	0118007400	0118023814
114	First Rand	P.box 786273, Sandton 2146	17th floor,Merchant Place, Corner Fredman drive and Rivonia Road, Sandton, 2196	0112821808	0112828088
115	Forim Holdings ltd	P.box261269, Excom, 2023	Johannesburg	0113343600	0113344319
116	Forza group Ltd	P.box 1348, Highlands north2037	Johannesburg	0113277007	0113277009
117	Free state development and inv	P.box 11165, Johannesburg, 2000	28 Harrison Street Johannesburg, 2001	0116885100	0118349195
118	Front range Ltd	Pbox 76080, Wendy wood, 2144	No.1Albury Park,Albury Road, Dunkeld West,Johannesburg	0113255600	0113255660
119	Gnecor Ltd	Postnetsuite222, Privatebagx3500	Johannesburg	0116476203	0114841653
120	Glenrand MIB Ltd	P.box 2544, Randburg, 2125	Surrey Place, 291 Survey Ave, Ferndale Randburg, 2194	0113291111	0113291333
121	Global Technology Ltd	P.box62397, Marshall Town, 2107	Arcay House2, Number3 Anerely Road Parktown, 2193	0117976800	0117976801
122	Global village holding	P.box 95464, Grant Park, 2051	Johannesburg	0116481310	0116488680
123	Gold edge holdings	P.box 781696, Sandton 2146	Johannesburg	0118844422	0118844458
124	gold fields Ltd	Postnetsuite252,Privatebagx30500	4 St Andrews Road Parktown, 2193	0116442400	0114840626
125	Gold reef casino resorts	PrivatebagX1890, Gold reef city2159	Johannesburg	0112486800	0112486886
126	Growth Point properties Ltd	P.box78949,Sandton, 2146	100 Grayston Drive, Sandton, 2196	0112867306	0112867682
127	harmony gold mining Company	Suite No 1,private bag x1,Melrose	Firstfloor, 4 the Highstreet, Melrose North, 2196	0116840140	0116841088
128	the house of Busby Ltd	P.box 16647, Doomfontein,2028	Johannesburg	0116272727	0114024802
129	howden africa holding Ltd	P.box 2239,Johannesburg, 2000	Johannesburg	0112404000	0114930545
130	Hudaco industires Ltd	Privatebag13, Elandsfontein,1046	Hudaco Park, 190 Barbara Road, Elandsfontein, 1406	0113458200	0113922740
131	Hyprop Investment Ltd	P.box 41257, Craighall, 2024	Johannesburg	0113254340	0833999977
132	idion technology holdings	P.box 1668, Sunninghill, 2157	IDION House11 Naivasha Road Sunninghill 2157	0115171500	0115171600

133	Ifour properties ltd	P.box 1352, Parklads 2121	JHI House,2nd floor, Cradok Ave, Rosebank, 2196	0114410194	0114410020
134	Iliad Africa	P.box 2572, Honeydew,2040	Johannesburg	0114672891	0114672890
135	Impala Platinum holding Ltd	P.box61386,Marshalltown2107	3rd floor, Old trafford4, Isle of Houghton, Boundaryrd Houghton 2198	0114813900	0114840254
136	imperial hodings	P.box 3013, Edenvale, 1610	Imperial Place 79 Boeing Road East Bedfordview 2008	0113726500	
137	Incentive holdings	privatebag x60, Saxwold,2146	Johannesburg	0113803100	0113803111
138	independent financial services	P.box 32052, Braamfontein 2017	Johannesburg	0113391835	0114031411
139	indequity Group Ltd	P.box 5433,Weldeverden Park1715	Johannesburg	0114750816	0114750877
140	Inmins	P.box5324, Johannesburg, 2000	884 Linton Jones Street, Industries, East Germiston, 1401	0113459800	0113459881
141	Insurance outsourcing managers	P.box 2867, Randburg 2125	Johannesburg	0114496800	0118864938
142	Interconnective solutions Ltd	P.box 2404, Randburg,2125	Johannesburg	0117872127	0117872137
143	Intertrading Ltd	P.box 1720, parklands, 2121	Kuehne & Nagel house,37 Bath Avenue, Rosebank,2196	0117716000	0118805355
144	Investec ltd	P.box 785700, Sandton, 2146	Johannesburg	0112867000	0112867777
145	Iprop holding ltd	P.box27, Crown Mines, 2025	Johannesburg	0114961777	0114961222
146	Iscor Ltd	P.box 450, Pretoria, 0001	Pretoria	0123073000	0123264721
147	Italtile Ltd	P.box1689, Randburg	the italtile Building, CnrWilliam Nicoledrive & PeterPlace,	0115109050	0115109060
148	Jasco electronics holding	P.box860 wendywood,2144	8 Saddle Drive Woodmead Office Park Woodmead 2157	0118028933	0118028931
149	JCI Ltd	P.box11165, Johannesburg, 2000	Johannesburg	0116885100	0114921070
150	Jd group Ltd	P.box 4208, Johannesburg, 2000	11th floor, JD House, 27 Steimens Street, Braamfontien,2001	0114080408	0114080604
151	Jigsaw Holding Ltd	P.box55136, Northlands, 2116	Johannesburg	0118804063	0114471910
152	Johnnic Communications Ltd	P.box 1746, Saxonwold, 2132	Johannesburg	0112803000	0112805000
153	Johnnic holding	P.box 231, Johannesburg, 2000	level3.(westwing),Gallagher House,Gallagher Estate Midrand, 1685	0112663100	0112663120
154	Kagiso media Ltd	P.box 5459, Rivonia, 2128	3rd floor,Kagiso,Mellis Officepark,1-3 Mellisroad,Rivonia,2128	0118032952	0118034860
155	Kelgran Ltd	P.box 1052, Johannesburg,2000	4 Homestead Avenue, Bryanston, Sandton 2196	0114631910	0117067825
156	Kersaf Investment Ltd	P.box 782121, Sandton, 2146	Johannesburg	0117807444	0117837446
157	King Consolidated holding	P.box3301, Pinegowrie, 2123	Johannesburg	0118863228	0117812687
158	Kolosus Hodling Ltd	P.box 1152, Krugersdorp, 1740	Bull Brand Building,3Condale Rd, Krugersdorp,1740	0119532334	011662210
159	Labat Africa Ltd	PrivatebagX09-24, Weltevenreden	Johannesburg	0116751015	0116751020
160	Liberty group Ltd	P.box10499,Johannesburg, 2000	Liberty Centre, 1Ameshoff street, Braamfontein, Jbg 2001	0114083911	0114082020
161	Lonmin plc	P.box 98811, Sloane park, 2152	Northdowns 17 Georgian Crescent (off Sloane Street) Bryanston, East 2152	0115161300	0115161310
162	Lyons financial Solutions holding	P.box 652288, Benmore, 2010	Lyons house, 10 Benmore Road, Morning Side, 2057	0113242000	0113242001
163	Massmart holdings Ltd	Privatebagx4,Sunninghill,2157	MassmartHouse 16 Peltier DriveSunninghill Ext. 6 Sandton 2157	0115170000	0115170020
164	Mathomo group Ltd	P.box 688, Johannesburg, 2000	Johannesburg	0113340238	0113345622
165	Matozi resources Ltd	P.box11165, Johannesburg, 2000	Johannesburg	0116885125	0118385190
166	Maxtec ltd	P.box 69938, Bryaston, 2021	No 1, 8th Avenue, Cnr Wessel Road Rivonia	0118036635	0118037818

167	m cubed Holding Ltd	P.box 41259, Graighall, 2024	Investment Place 10th Road (off 2nd Avenue) Hyde Park	0113402300 0118808844
168	Mercantile Lisbon Bank	P.box 782699, Sandton, 2146	Mercantile Liasbon House, 142 West Street, Sandown, 2196	0113020300 0113020729
169	messina Ltd	P.box,2668, Saxon wold 2132	Johannesburg, Canada	0114426923 0114426993
170	Metair investment Ltd	P.box 2077, Saxonwold,2132	Wesco House, 10 Anerely Road Parktown, 2132	0116463011 0116463102
171	Metboard Properties Ltd	P.box 78949, Sandton, 2146	100 Grayston Drive, Sandton, 2196	0112867000 0112867682
172	Metzie and Ziegler Ltd	P.box 239 Windhoek	Johannesburg	
173	Metrox ltd	P.box2814, Saxonworld, 2132	2nd Floor,Cradock Heights, 21 Cradock Avenue, Rosebank	0118803155 0118803322
174	Metro cash and carry Ltd	P.box 1970, Highlands North,2037	Johannesburg	0118095500 0118095539
175	Mettle	P.box1964, Saxowold 2132	33 Ficker road, Illuvo Boulevard, Illuvo, 2196	0114469200 0114469201
176	MGX holding Ltd	P.box 1697, Bramely, 2018	MGX House,126 14th Road, Erand Gardens, Midrand	0116952000 0113181256
177	Micromega holdings Ltd	Private bag x9966, Sandton, 2146	Cnr. Protea & Impala Roads Chislehurston Sandton	0117834000 0117834455
178	MIH hodings Ltd	P.box 1502, Randburg, 2125	Johannesburg	0112893024 0117897927
179	Millionair charter Ltd	P.box 304, Lanseria, 1748	Johannesburg	0117013627 082 408 8300
180	Moneyweb holding Ltd	P.box102, Parklands, 2121	1st Floor,PresidentPlace,Corner Jan SmutsAve and Bolton Rd (entrance in Hood St) Rosebank, 2196	0113271277 0113271279
181	Moribo leisure Ltd	P.box 784583, Sandton, 2146	Johannesburg	0118025150 0118046932
182	MTN group	Privatebag9955, Sandton, 2146	3 Alice Lane, Sandown, Ext. 38 Sandton, 2196	011301600 0113016111
183	Murray & Roberts Holdings Ltd	P.box1000, Bedfordview, 2008	Douglas RobertsCentre, 22 Skeen Boulevard Bedfordview	0114566200 0114552222
184	Mustek Ltd	P.box 1638, Parkalands 2121	322, 15th Road, Randjespark, Midrand, 1685	0112371000 0113145039
185	Mutual & Federal insuranceCoLtd	P.box1120, Johannesburg, 2000	Johannesburg	0113749111 0113742652
186	Mvelaphanda resources ltd	P.box 413420, Craighall, 2024	Johannesburg	0113255323 0113255320
187	Nambian fishing industries ltd		Johannesburg	
188	Nambian sea products ltd		Johannesburg	
189	Nampak Ltd	P.box 784324, Sandton, 2146	Centre, 114 Dennis Road, Atholl Gardens, Sandton	0117196300
190	Nandos group Holdings Ltd	P.box41840, Caighall park, 2024	Johannesburg	0114424349 0114424357
191	Nedbank ltd	P.box1144,Johannesburg, 2000	Johannesburg	0112940999 0112955555
192	Nedcor Ltd	P.box1144,Johanesburg, 2000	135 Rivonia Road,Sandton, 2196	0112940999
193	Netactive ltd	P.box621, Wendywood,2144	42 Wierda Road West Wierda Valley Sandton 2146	0117190333 0117190444
194	Network healthcare holdings Ltd	Private bag, Benemore, 2010	3rd Floor, Sanlam Parksouth, 9 Fredman Drive, Cnr Bute Lane, Sandown, Santon 2196	0113010000 0113010481
195	New africa Investment Ltd	P.box 782922, Sandton, 2146	1st Floor, Fulham House Hampton Office Park 20, Georogian crescent, Bryanston	0114631744 0114633269
196	Northam platinum Ltd	P.box 37160, Birnam, 2015	KenilworthHouse,RutherfordEstate1ScottStreet,Waverley2090	0114408811 0114405944
197	NU-world Holdings ltd	P.box 8964, Johannesburg 2000	Johannesburg	0113212111 0114409920
198	Oakfields thoroughbreds &	P.box 5252, Rivonia, 2128	Johannesburg	0118808001 0118807955
199	Omnia holdings Ltd	P.box 69888, Bryanston, 2021	Omnia House 13 Sloane Street Epsom Downs Bryanston	0117098888 0114633020
200	Onelogix group Ltd	Postnet suite#10,Privatebagx27	Johannesburg	0113969096 0113969069

201	OTR mining Ltd	P.box 10665, Fourways east, 2055	Johannesburg	0115492940 0114652132
202	Ozz Ltd	P.box 61427, Marshalltown, 2107	Johannesburg	0117286811 0117286871
203	Pangbourne Properties Ltd	P.box 781706, Sandton, 2146	2nd Floor, Pangbourne, 382 Jan Smuts Avenue, Craighall,2196	0118898500 0113262410
204	Paracon holdings	P.box 526, Olivedale, 2158	300 Kent Avenue Randburg	0116860600 0117979464
205	Pasdec resources SA ltd	P.box 67706, Bryanston, 2021	Block G,10 Knighsbridgemanor,33 Sloane Street,Bryaston2021	0114635440 0114635441
206	Peregrine holdings Ltd	P.box 650361, Benmore, 2010	6A Sandown Valley, Crescent Sandown, Sandton, 2196	0117227400 0117227410
207	PhumelelaGaming and Leisure	P.box 82625, Southdale, 2135	PhumelelaGaming & Leisure LtdTurffontein Racecourse Turf Club Street Turffontein2190	0116811500 0116811895
208	pinnacle technology holdings ltd	P.box 483, Halfway house, 1685	PinnacleM icroPinnaclePark 128 15th Road / 269 16th Road Randjespark Midrand	0112653000 0112653074
209	President Steyn Gold mines	P.box6188, Weltevreden Park,1715	Johannesburg	0114753041 0114753894
210	Pretoria portland cement Co	P.box 782248, Sandton, 2146	180 Katherine street, Sandton, 2196	0114881700 0114881905
211	Primemedia Ltd	P.box 652110, Benmore, 2010	Johannesburg	0115063000 0115063185
212	Primegro properties Ltd	Private bagX02, Northlands, 2116	Johannesburg	0117784930 0112680186
213	primeserv Group Ltd	P.box 3008, Saxonwold,2132	Ground floor Venture house,54 Peterplace, Peter Placepark Bryanston, 2021	0116918000 0116918011
214	Prism Holdings Ltd	P.box 901, Witkoppen, 2068	Johannesburg	0114037124 0114037147
215	Profurn Ltd	P.box 32856, Bramfontien	JD House 27 Stiemens Street Braamfontein 2001	0114080408 0114080604
216	PSg Investment Bank Holdings	P.box 987, Parklands, 2121	3rd Floor160 Jan Smuts Avenue Rosebank, 2196	0117211624
217	Putco Ltd	Privatebag 3, Wendywood, 2144	Mimosa park, 5 Mimosa Way, Gallo Manor Sandton, 2199	0118024300 0118043837
218	Putco Properties Ltd	Private Bag 3, Wendywood 2144	Mimosa park, 5 Mimosa way, Gallo Manor Sandton, 2199	0118024300 0118043837
219	Quyn Holdings Ltd	Pbox 1578, Ferndale, Randburg	34 Fricker Road, Illovo,Johannesburg	0113403344 0113403200
220	Randgold & exploration Co ltd	Pbox 82291, Southdale, 2135	Johannesburg	0113096000 0118372396
221	Rand leases Properties Ltd	P.box1 Florida, Roodepoort 1710	Johannesburg	0115049500 0118302715
222	Real Africa Holdings Ltd	P.box 1522, Saxonwold,2132	Johannesburg	0114832142 0114832142
223	Rebserve holdings	P.box 1639, Rivonia, 2128	Hunts End 36 Wierda Road West Wierda Valley Sandton 2196	0112904200 0117830027
224	Redefine income fund Ltd	P.box 471917,Parklands 2121	2 Arnold Road, Rosebank, Johannesburg	0112830000 0112830055
225	Relyant retail ltd	P.box 32466, Braamfontein,2017	Relyant House, 131 Van Beek street,Ellis park, 2094	0114015000 0114015090
226	RentSure Holdings	P.box 4512, Pretoria,0001	106W Rentmeester Park, 74Watermeyer Street, Valdegrace	
227	Resilient Property Income Fund	P.box 582, Johannesburg, 2000	Johannesburg	0114803799 0114801780
228	REUNERT ltd	P.box 784391, Sandton, 2146	Lincoln Wood Office park, 6-10 Woodlands Drive, Woodmead Sandton	0115179000 0115179035
229	RMB Holdings ltd	P.box 786273, Sandton 2146	1 Merchant PlaceCorner Fredman Driveand Rivonia Road Sandton 2146	0112828000 0112828008
230	Sable holdings	P.box 786390, Sandton, 2146	Sableplace,fairway office park,52 grosevenor road Bryanston, 2021	0112675700 0112675710
231	Sabmiller plc	P.box 1099,Johannesburg, 2000	2 Jan smuts Avenue,Braamfontein, Jbg 2000	0114071700 0113392389

232	Sabvest Ltd	P.box 78677 Sandton, 2146	46A Wierda Road West Wierda Valley Sandton 2196	0117847932 0117847941
233	Sage Group Ltd	P.box 7755, Johannessburg 2000	11thfloor, Sage Centre, 10 Fraser Street, Johannesburg, 2001	0113775555 0118342107
233	sallies ltd	P.box 11265, hatfield 0028	Johannesburg	0118808146 0118802221
234	Samrand development holdings	P.box 652063, Benmore, 2010	Johannesburg	0118847457 0116647457
235	Sappi	P.box31560, Braamfontein, 2017	48 Ameshoff Street, Bramfontein 2001	0114078111 0114038236
236	sasani ltd	P.box 89271, Lyndhurst, 2106	Johannesburg	0117194000 0117194092
237	Sasfin	P.box 95104, Grant park, 2051	Sasfin Place, 13-15Scott Street, Waverley,Johannesburg,2090	0118097500 0118872489
238	Sasol Ltd	P.box 5486, Johannesburg, 2000	1Sturdee Avenue, Rosbank,Jbg 2196	0114413111 0117885092
239	Scharring Mining Ltd	P.box 30194, Jet Park, 1469	28 Patric Road, Jet Park Boksburg	0113973850 0113973300
240	Set Point Technology Holdings	P.box 787646, Sandton, 2146	Johannesburg	0112621500 0112621530
241	simmer and jack mines limited	P.box 11165, Johannesburg, 2000	Johannesburg	011373 2271 0114921070
242	S and J Land holdings	P.box 68657, Bryanston, 2021	Johannesburg	0114503856 0114551406
243	Softline ltd	P.box 76182, Wendywood, 2144	Soft LineTechnology Park, 151 Katherine Street, Athol ext 12 Sandton, 2031	0112928200 0112928202
244	Southafrican chrome and alloy ltd	P.box 1677, Northcliff, 2115	Suite106, Block C, Eva Park,Cnr Beyers Naudedrive/judges ave Cresta, 9459	0114781112 0114780125
245	Southafrican eagle insurance Co	P.box 61489, Marshal Town, 2107	Johannesburg	0115404000 0115404444
246	Southern mining co.	P.box 3968, Randburg, 2125	Johannesburg	0117810375 0118867020
247	Spnaijaard ltd	P. box 7294, Johannesburg, 2000	Johannesburg	0117862962
248	Spescom ltd	Pbox 288, Halfway House, 1685	Spescom Park, Cnr. Alexandra Avenue & Second Road,Halfway House, Midrand, 1685	0112661500 0112661532
249	Square one solutions group Ltd	P.Box 1163, Gallmanor 2052	0th Floor Eastgate Park 8 Commerce Crescent West Eastgate Ext 13, Sandton	0113215900
250	Standard bank goup	P.box 7752, Johannesburg 2000	Johannesburg	011 631 9117
251	Steers holdings	P.box 2884 Halfway House, 1685	478 James Crescent, Halfway House, Midrand, 1685	0113153000 0113150059
252	Steinhoff International holdings	P.box 1955, Bramley, 2018	26th street, Wynberg, Sandton, 2090	0114453000 0114453094
253	stella vista technology	P.box 37172, Birnam park, 2015	134 Side Road, West Turffontein, Johannesburg	0114332020 0114333912
254	Stilfontein Goldmining Company	P.box 11165, Johannesburg, 2000	Johannesburg	0114824968 0114824641
255	sun Intrnational Ltd	P.box 784487, Sandton 2146	Johannesburg	0117807444 0117837446
256	super group Ltd	Private bag x9973, Sandton, 2146	Huiston place, Impala Rroad, Christcursoon, Sandton 2196	0117830100 0117849762
257	Supersport international	P.box 4950, Randburg,2125	11Grove Street, Randburg, 2194	0116867640 0116867787
258	Sweets from heaven holdings	P.box87788, Houghton, 2041	Johannesburg	0114440410 0114440413
259	Sycon property fund	P.box4795, Rivonia, 2128	Johannesburg	0117756422 0117756423
260	synergy holdings	P.box 2423, Pinegowrie, 2123	128 4th Street / Corner 1st Avenue,Linden, Johannesburg	0118881044 0118881069
261	Terexko ltd	Private bag x99500,Sandton,2146	Johannesburg	0118848467 0117835333
262	Thabex Exploration	P.box3899,Northcliff,Johannesburg	51 Auston Street,Northcliff, Johannesburg,2115	0116780791 0114763960
263	Tiger Brands	P.box 78056, Sandton 2146	85 Bute lane, Sandtown, Sandton 2146	0113200111 0118842029

264	tisec(sa) ltd	P.box 1962, Rivonia 2128	Johannesburg	0112340109 0118072468
265	Tourism Investment Corporation	P.box 785179, Sandton, 2146	2ndFloor Forum V, 33Hoofdt Street, Braamfontein	0113396044 0113257040
266	Tradec holdings ltd	P.box 628, Newton,2113	Johannesburg	0113701900
267	Transpaco Ltd	P.box 39601, Bramely, 2018	Johannesburg	0118870430
268	UCS Group Ltd	P.box 31266, Braamfontein,2017	20thFloor,208 Smit Street, Braamffontein, 2001	0117121300 0113393421
269	United service technology Ltd	P.box 1915, Kempton Park, 1620	Johannesburg	0117231651 0114562104
270	Unitrans Ltd	P.box615,Northlands,Jbg2116	263OxfordRoad, Illovo, Johannesburg, 2196	0114428551 0114427802
271	Value Group ltd	P.box 778, Isando, 1600	Johannesburg	0119745556 0113921438
272	Vestacor Ltd	P.box 2597, Parkalands,2121	Johannesburg	0113400100 0118800313
273	Vesta technology Holdongs Ltd	P.box 6295, Midrand, 1685	Johannesburg	0113148181 0113148182
274	Viking Investments & Asset mgt	P.box 71337, Bryanston, 2021	Johannesburg	0114638872 0117069108
275	village main Reef gold mining	P.box62379, Marshalltown, 2107	Johannesburg	0116349111 0116340038
276	Wesco investments Ltd	P.box9772, Johannesburg 2000	Johannesburg	0116434801 0114843025
277	western areas Ltd	P.box61719, Marshalltown,2107	Johannesburg	0116885000 0118345764
278	Wetherlys Investment holdings	P.box 617, Northriding, 2162	14A Kramer Road,Wendywood, Sandton	0114443870 0114441715
279	Wilson Bavyly holmes-Ovcon Ltd	P.box531, Bergvlei, 2012	53 Andries Street Wynberg Sandton 2090	0113217200 0118874364
280	winhold Ltd	P.box 5324,Johannesburg, 2000	884 Linton Jones Street, Industries, East Germiston, 1401	0113459800 0113459881
281	Women Investment Prtofolio ltd	Postnet Suite169,Privatebagx2600	61 Central Street Houghton 2198	0117153600 0117153612
282	Y3k Goup Ltd	P.box 142, Randburg, 2125	Unit 8, 152 Hendrik Verwoerd Drive Randburg 2125	0118863757 0118861109
283	Zaptronix Ltd	Posnet 208, Privatebag9,	Zaptronix Limited 3 Eglin Road The Crescent Sunninghill	0118079290
284	Zarara energy Ltd	P.box 837, Northlands, 2116	Johannesburg	0115072860
285	Zeltis holding Ltd	P.box 422378, Craighall, 2024	Johannesburg	0112833900