# CRITICAL FACTORS FOR PROJECT SUCCESS IN AN ENGINEERING ENVIRONMENT

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# ABSTRACT

Not every project deserving of success achieves it. Conversely, not every project heading for the scrap heap arrives. The journey to project success is long and hard and does not happen overnight.

To understand the journey to project success we need to understand what makes a project successful. A successful project can be classified as a project of which the costs did not exceed 25% of the agreed capital approved with a less than 25% schedule slip and with all the operational problems being sorted out in less than a year. Project success potential, can be increased by focusing on the critical factors listed in this study, namely:

- **Project Front End Loading (FEL)**
- **High calibre project teams**
- **People skills/soft skills of project management**

The success of a project can be increased when the project has high calibre project teams starting the project with very effective Front End Loading (FEL) and keep project team members continuity based on the fact that the project is managed by a project manager understanding people who have the soft skill to lead and influence the project team, rather than managing the team.

The research was conducted by means of a literature and empirical study. The literature study documents the critical factors for project success. Knowledge gained from the literature study formed the basis for the empirical study to test critical factors for project success in practice and the recommendations can be read in chapter four.

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# CHAPTER 1 NATURE AND SCOPE OF STUDY

## 1.1 INTRODUCTION

Imagine it is late at night and your car is the only one left in the parking lot. It is there because you are still in the office, shoulders slumped, your palm pressed to your forehead, deep in thought. You are in the middle of a project, consumed with worry, and the fact that you have barely seen your bed in the past week is one indication that things are not going so well. Your project is a little bit out of control; you are not sure you will meet your deadline. Too many loose ends still need to be tied. Moreover, your manager has expressed reservations about how things are going. You feel isolated, the clock is ticking and you are uncertain about what to do next. (Nokes, 2004:3).

This out-of-control project scenario is often played out in companies, large and small. Halfway into a project, Critical Success Factors (CSF) that should have been apparent much earlier, start to emerge.

The Independent Project Analysis, Inc. (IPA) is a company which does international benchmarking on project success of most of the international corporate companies across the world and provides recommendations to improve the outcomes of their projects. According to IPA most projects fail due to the following:

- Poor Front End Loading (FEL);
- Poorly developed basic data;
- Poorly developed teams;
- Poor project definition;
- Poor contracting strategies; and
- Poor project controls.

IPA deems a project to be a failure if one or more of the following criteria occurred: If costs escalate by more than 25%, if the schedule slipped by more than 25%, if the absolute measure is overspent by more than 25% and if severe and continuing operational problems occur for more than one year after completion.

From research done, IPA has found that a 56% failure rate in projects, based on the criteria of cost, schedule and operability as mentioned above:

- 42% failed on one criterion
- 32% failed on two criteria
- 21% failed on three criteria
- 5% failed on all criteria

There are thus no short cuts in project management. In order for a Project Manager (PM) to be successful he/she must be able to integrate all the skills from many different disciplines, including business needs, business case, scoping out and defining a project, scheduling tasks and project planning, effectively allocating and evaluating resources and personnel and managing a workforce.

As per Levine (2002:45), the above list does not even begin to address the demands required by

- budgeting and cost control;
- risk management;
- contingency planning;
- project scope creep; and
- communication with stakeholders.

Only a few project managers ever accomplish the mammoth task of successfully completing a project. The most successful project managers deftly adapt to changing circumstances and aggressively push the project to a close.

To understand why all the CSF exists in a project, the definition of a project should be explained – projects and businesses are not alike. Businesses in general produce the same thing over and over and have, according to Heldman (2005:56), no completion date.

The Project Management Body of Knowledge (PMBOK) (2000:4) states: "A project can be defined in terms of its distinctive characteristics – it is a temporary endeavour undertaken to create a unique product or service. Temporary means that every project has a definite beginning and a definite end. Unique means that the product or service is different in some distinguishing way from all other products or services.

According to Chase *et al* (2006:73), project management can be defined as planning, directing and controlling resources (people, equipment, material) to meet the technical cost and time constraints of the project.

## 1.2 PROBLEM STATEMENT

There is a growing need for the management of projects in various business organisations. Increasingly, companies are making use of projects as a vehicle in their everyday work to achieve their strategies, goals and objectives. The literature consulted on project management is surprisingly still somewhat unclear and undefined on what ensures a successful project.

The concept project success has not been well-defined in project management literature. Using the word failure is also an imprecise and ill-defined term, often used in project management literature, without profound meaning, according to Rae & Eden (2002:38). Shenhar and Wideman (2000:45) concluded that there does not seem to be any agreed-upon understanding of the concept of success in either business or project management literature. Decades of individual and collective efforts by project management researchers since the 1960s have not

led to the discovery of a definite set of factors leading to project success, as is noted by Cooke-Davies (2002:125).

Critical success factors for project success have become increasingly important to project managers. Project success factors are usually mentioned in either very general terms or very specific terms affecting only particular parts of projects.

Identifying the critical factors for project success, with the understanding of how these factors interact and affect the outcome of projects being successful or not, is of extreme importance to every project manager.

This study will therefore identify the critical factors for project success, the understanding of each and the importance of these factors on project success.

## 1.3 RESEARCH OBJECTIVES

The primary objective of this study is to do a theoretical and empirical study to identify the critical factors that will lead to more project success in an engineering environment.

In order to realise the primary objective, the following secondary objectives must be met:

- What makes projects successful?
- Establish a clear understanding of the critical factors for project success.
- Identify and research these factors with recommendations to increase the success rate of projects.

## 1.4 DEFINING THE SCOPE OF THE STUDY

The theoretical and empirical research on the critical factors for project success will be focused on projects in the engineering environment.

An overview of the subject project management will be covered in chapter two as an introduction to the study.

Business owners and project managers executing projects in an engineering environment will be used as the target population of the empirical research.

The theoretical research on the critical factors for project success will be used to establish a good understanding of these factors and to identify the most critical factors to increase project success. The literature used to do the research will be in the form of published articles, published presentations, books, magazines and the internet.

## 1.5 RESEACH METHODOLOGY

Research can be defined according to Page and Meyer (2000:14) as a carefully planned process, designed to manipulate influences systematically, while holding other influences constant, in order to observe and measure the outcomes in relation to the theory. Research involves the application of various methods and techniques in order to create scientifically obtained knowledge, by using objective methods and procedures as indicated by Welman and Kruger (2002:2).

This dissertation, however, will be focused on selected literature regarding projects, project management, project implementation and critical success factors of a project. The available literature will be in the form of published articles, published presentations, books, magazines and the internet.

The following research methods will be used:

- Theoretical research will be done to determine the critical factors for project success. This information gathered will be used to form the basis of this research in order to achieve the research objective.

- Empirical research will be conducted in the form of audits, interviews and questionnaires, with business owners, project managers and the team members of projects.

The questionnaire will be divided into the following sections:

- Section 1: Project management information & demographic information of target group
- Section 2: Critical factors for project success
- Section 3: Project success information

## 1.6 LAYOUT OF THE STUDY

This study consists of five chapters, and the relationship between these five chapters is schematically shown in Figure 1.

The layout of this study can be described as follows:

### CHAPTER 1: NATURE AND SCOPE OF STUDY

This chapter provides an overview of the study and gives an introduction of the study. The problem statement, research objectives, the scope of the study, research methodology, limitations and the layout of the study will further contribute to this chapter.

### CHAPTER 2: PROJECT MANAGEMENT

The concept of project management will be theoretically researched in this chapter to have a better understanding of the importance of project success.

### CHAPTER 3: CRITICAL FACTORS FOR PROJECT SUCCESS

In this chapter the critical success factors are identified to illustrate the importance of each factor in relation to the implementation of successful projects, together with the theory of successful projects in the engineering fraternity.

## CHAPTER 4: EMPIRICAL STUDY: RESEARCH RESULTS, RECOMMENDATIONS AND CONCLUSIONS

The methods which will be utilised in this study are described in this chapter, and the information and results from the empirical study will be transformed into useful information.

## CHAPTER 5: STUDY OVERVIEW AND FINAL CONCLUSIONS

In this final chapter recommendations and conclusions were made, based on the literature study from chapters two and three, as well as the empirical study conducted in chapter four. The questionnaire results were utilised to compare the relation of the critical factors for project success in theory and in practice. Conclusions were drawn from the literature study and the empirical study (theory and practice).

Figure 1 depicts the layout of the study and gives an overview of how this dissertation could be read. Chapter 5 can be read to gain a quick summarised overview of the whole study.

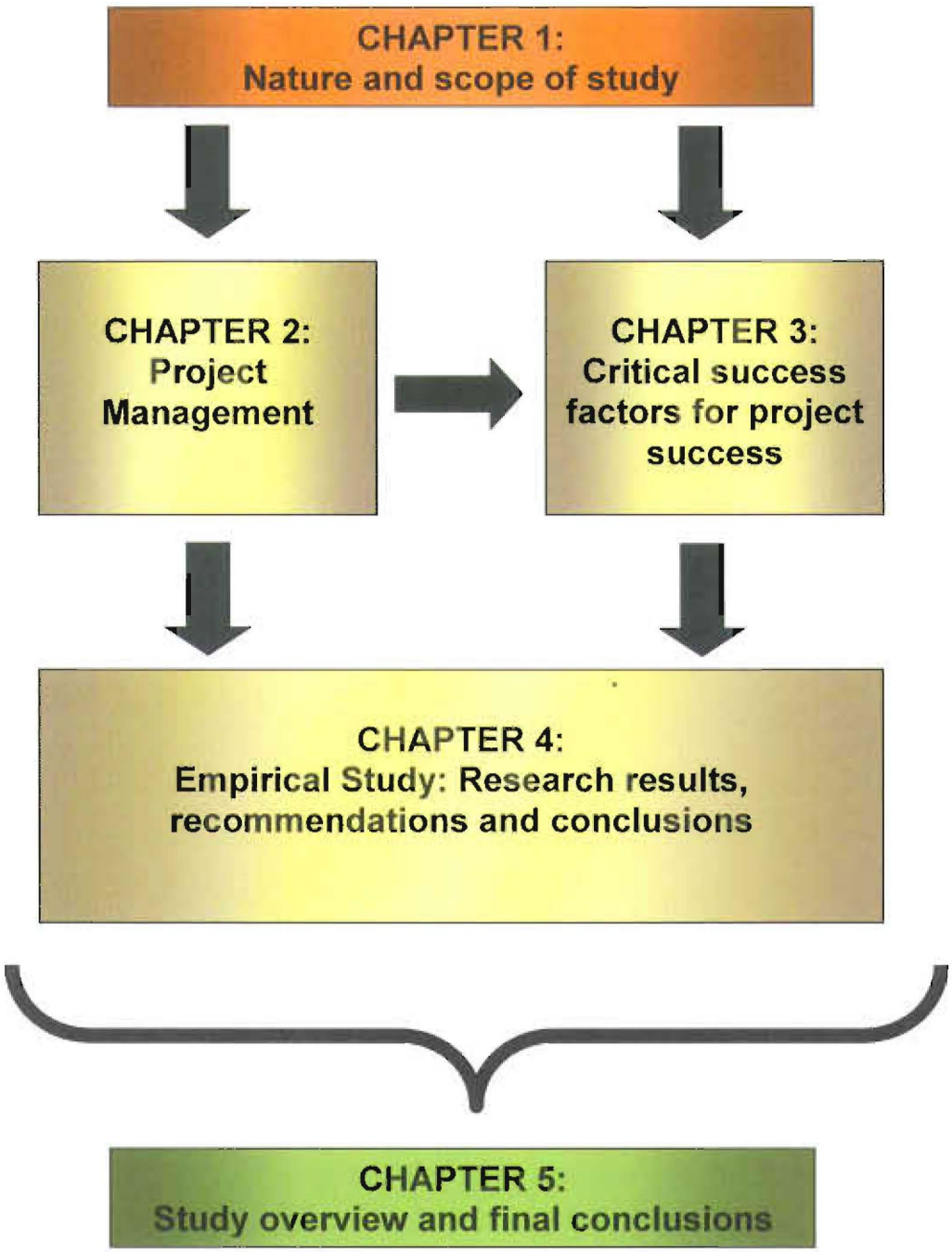



Figure 1: Layout of the study

## 1.7 CONCLUSION

Chapter 1 gives a brief overview of why project success is closely linked to the critical success factors in an engineering environment. The objectives of this study and the method of research were also briefly touched on which will be used where discussed.

Finally the layout of this dissertation was given in the form of a picture.

# CHAPTER 2 PROJECT MANAGEMENT

## 2.1 INTRODUCTION

A successful project manager, as defined by Levine (2002:6), is a person who is able to integrate all the skills from many different disciplines, including basic needs, business case, scoping and defining a project, scheduling tasks and project planning, effectively allocating and evaluating resources and personnel and managing the workforce. As per Levine (2002:45), the above list does not even begin to address the demands required by:

- Risk management;
- Budgeting and cost control;
- Contingency planning;
- Project scope creep;
- Communication with stakeholders;
- Achievement of stakeholders' objectives.

The Project Management Body of Knowledge (PMBOK) (2000:6) defines project management as the application of skills, tools, knowledge and techniques to project activities in order to fulfil the requirements of the project.

Kloppenberg and Petrick (1999:9) suggest that successful project management will depend on more than just technical competence; it also requires the ability to manage a team. The skill to manage relationships is critical to achieve stakeholder satisfaction throughout the whole project's life-cycle.

There is an increasing acknowledgement that different types of projects will have different approaches to their management. According to Crawford *et al.* (2005)

the need for each project to fulfil the project's objective will require management procedure to be tailor made per project.

It can thus be said that project management is the use of a combination of knowledge, tools and techniques, together with the very important, very often overlooked "soft skill" of managing relationships and the project team, in order to achieve the objectives of the project.

From this brief introduction it is evident that project management needs to be understood in order to benefit from having the critical factors for project success.

This chapter will thus cover a theoretical overview of project management with reference to the project life-cycles, project success criteria and the people skill component so often overlooked in project management.

## 2.2 DEFINITION OF A PROJECT

The project management body of knowledge (PMBOK) (2000:4) defines a project as: "A temporary endeavour undertaken to create a unique product or service (outcome or result). Temporary means that every project has a definite beginning and a definite end. Unique means that the product or service is different in some distinguishing way from all similar products or services."

Table 1 below indicates some of the special features of a project.

Source: Adopted from Burke (2007:16)

| | |
|---|---|
| Start and Finish | A project has a clear start and finish. |
| Life-cycle | A project has a beginning and an end, with a number of distinct phases in between. |
| Schedule and Timeline | Projects are often time-limited. This means they must finish by a certain date. |
| Budget | Projects have a clear budget, often broken down to a budget per work package. |
| Non-Repetitive | Activities are essentially unique and non-repetitive. |
| Resources | Resources may be sourced from different functional departments and need to be coordinated. |
| Single Point of Responsibility | The project manager, project leader or project entrepreneur is responsible for the whole project |
| Teams | Project teams are formed to complete the project. |

Table 1: Some of the special features of a project

People are a very important part of a project manager's management skill. Realising this, Turner (1999:28) defines a project as an endeavour where human, material and financial resources are organised in an elegant manner to execute a unique project scope with pre-set specifications, within the triple constraint of cost, time and quality in order to achieve beneficial change defined by quantitative and qualitative objectives.

Cook (2005:125) comes to the conclusion that a project is an undertaking with clearly stipulated starting and ending points with a specific, well-defined set of objectives that, when attained, has reached completion.

Realising that a project is a defined item, this study has to draw attention to the fact that projects are different from business, which produces the same thing over and over, and has no completion date. The term "project" can be summarised from the above definitions as temporary, producing a designated product, using

designated resources, and having a beginning and an ending. Not all proposed projects merit time, effort and investment. Thus a successful project can be classified as achieving or realising the stakeholders' objectives as set out in the beginning of the project.

## 2.3 THE CONCEPT PROJECT MANAGEMENT

Deeprose (2001:3) states: "Project management is using validated processes and tested tools to map a route to a goal and make course corrections as you travel it."

According to Chase, Jacobs and Aquilano (2004:66), project management is planning, directing and controlling resources (material, equipment, people) in order to fulfil the technical, cost and time constraints of a project.

According to Martin and Tate (2001:9) project management is based on a set of tools, techniques and knowledge and when this combination is applied correctly, will help to produce better project results. Van der Walt and Knipe (2007:58) define the concept of project management as planning, organising, co-ordinating, controlling and directing the activities of a project.

Lewis (1999:7) states that project management involves three major categories of activities, namely planning, scheduling and controlling, all aimed at achieving the project's/stakeholders' objectives.

The definition of project management as defined by Cook (2005:126) is by applying skills, knowledge, tools and techniques to project activities to fulfil or exceed the stakeholders' expectations and needs from a project.

Project management is therefore the indication of how projects should be executed within a time constraint, within a pre-agreed budget and according to the stakeholders' expectations to meet the organisation's strategic objectives.

It is clear that project management is constantly involved in the triple constraint, i.e. cost, schedule and quality.

Figure 2 indicates the trade-off between these three parameters.

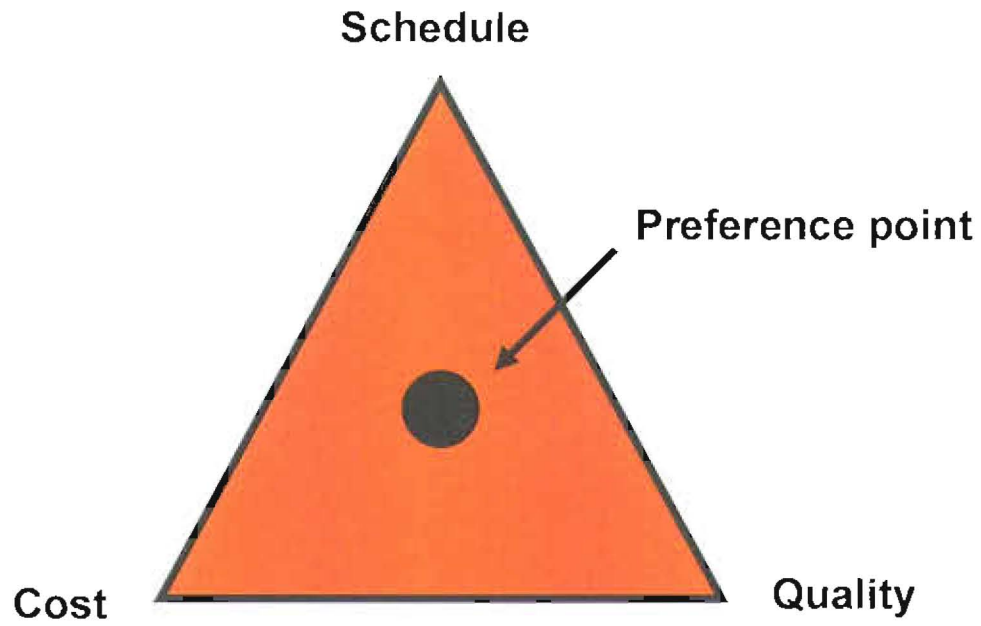



Figure 2: Triple constraint, i.e. cost, schedule and quality triangle

It can be easily derived from the triple constraint triangle that if too much emphasis is placed on the cost side of the triangle, less focus and normally not enough, focus will be placed on schedule and quality. The same is applicable to the schedule and quality sides.

As project management evolved into the concept we know today, the scope of the project and the Organisation Breakdown Structure (OBS), was added to the

triangle as shown below in figure 3, to indicate that the scope of work will be performed by an organisational structure. All these elements must be aligned to achieve the project's purpose of meeting the stakeholders' objectives in alignment with the organisation's objectives.

Successful project management will be measured on how well the stakeholders' objectives/expectations have been met within the budget and schedule to the desired quality.

Figure 3 illustrates that successful project management will look at the bigger picture and consider all the stakeholders' needs and expectations.

Source: Adopted from Burke (2007:35)

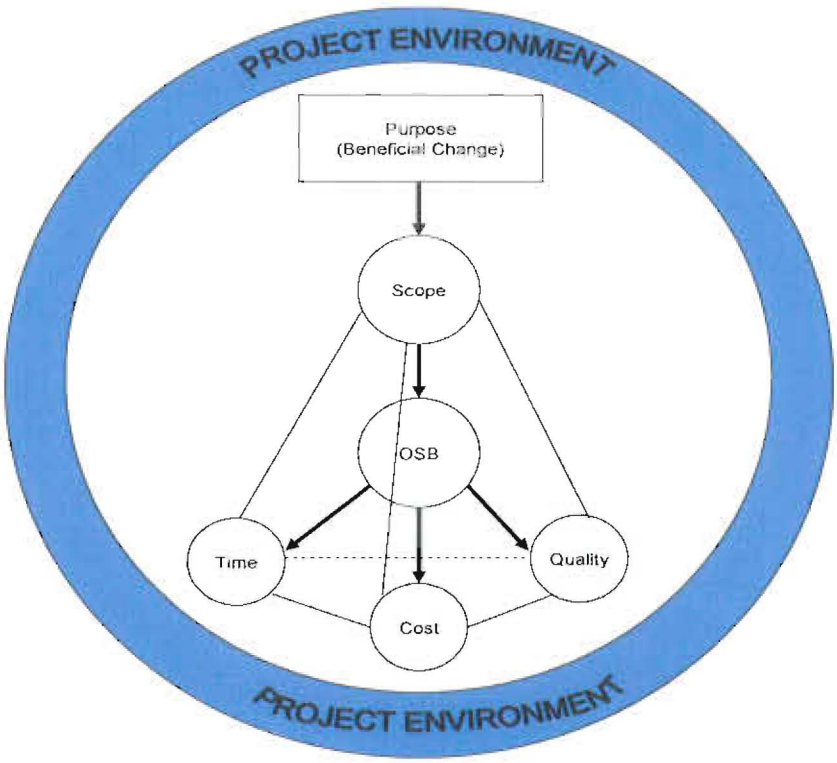



Figure 3: The Project Environment Model

One of the biggest integrated parts of project management which is so often overlooked is the human part in project management which will be explained in section 2.6 of this chapter.

## 2.4 PROJECT LIFE-CYCLES

PMBOK (2003:11) contends that due to the nature and uniqueness of projects, projects will always have a degree of uncertainty which is defined in project management as the risk component associated with a project. Projects are inherently complicated with all the various stakeholders and integration required to fulfil the stakeholders' objectives. To ease the project's complicity, projects are divided into project phases. Collectively the project phases are known as the project life-cycle, according to Knipe *et al* (2002:25).

Depending on within which industry a project is implemented, the phases of the project will vary. In this study the emphasis is on an engineering environment and it is generally agreed that most projects in the engineering environment pass through four distinct phases. These four phases which, according to Burke, (2007:45) form the structure of the project life-cycle, are:

1) Concept and Initiation phase
2) Design and Development phase
3) Implementation or Construction phase
4) Commissioning and Handover phase

Figure 4 will illustrate the four distinct phases with a list of typical activities within each phase.

Source: Burke (2007:49)

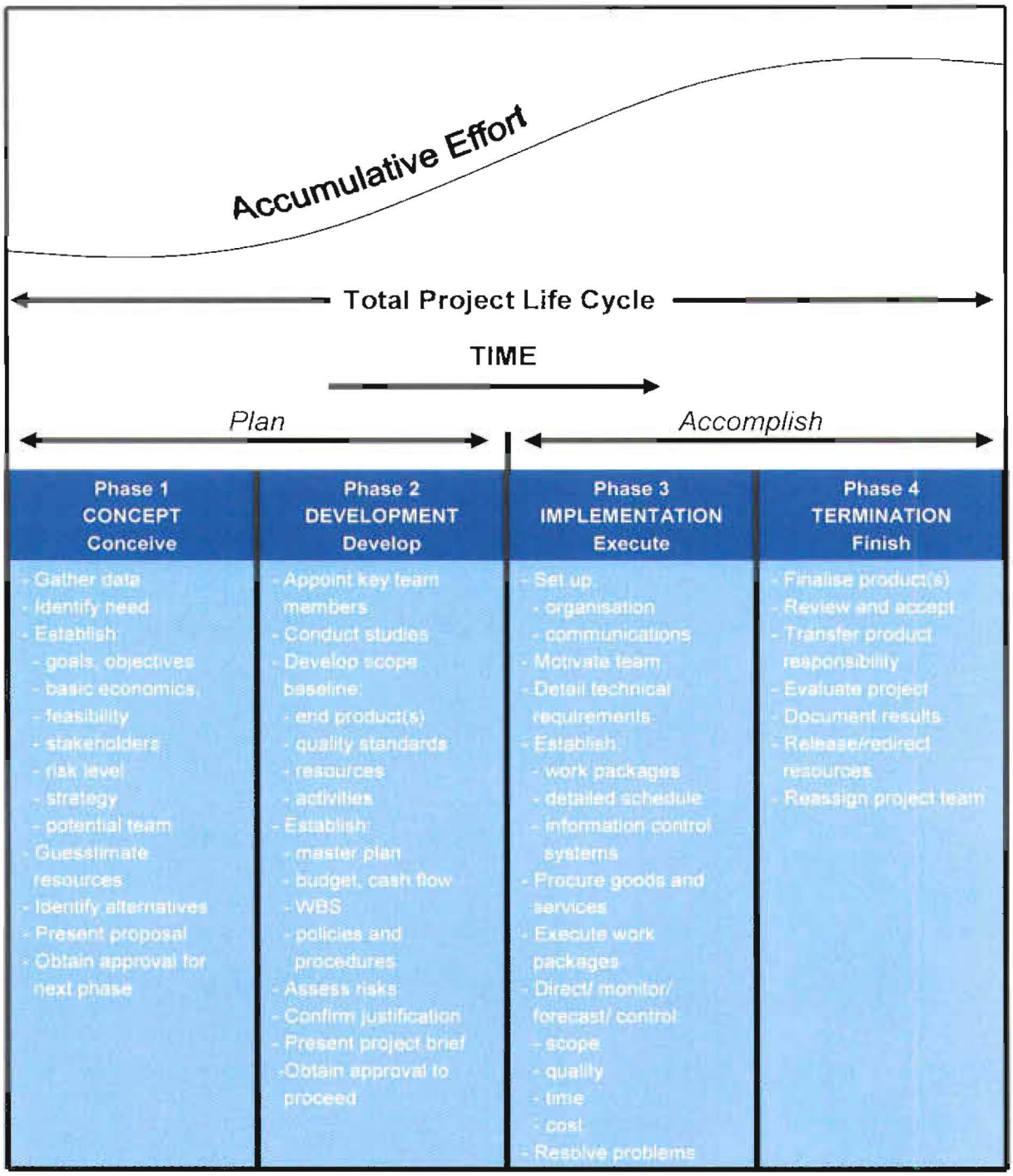



Figure 4: Project life-cycle with a list of typical activities with each phase

Cook (2005:126) provides his definition of a project's life-cycle as a collection of phases through which any project passes. Note that the number of phases and the breakdown are dependent on the methodology being used. His model of the

project life-cycle consists of project initiation, project planning, project control & execution and project close out as depicted in figure 5 below.

Source: Adopted from Burke (2005:3)

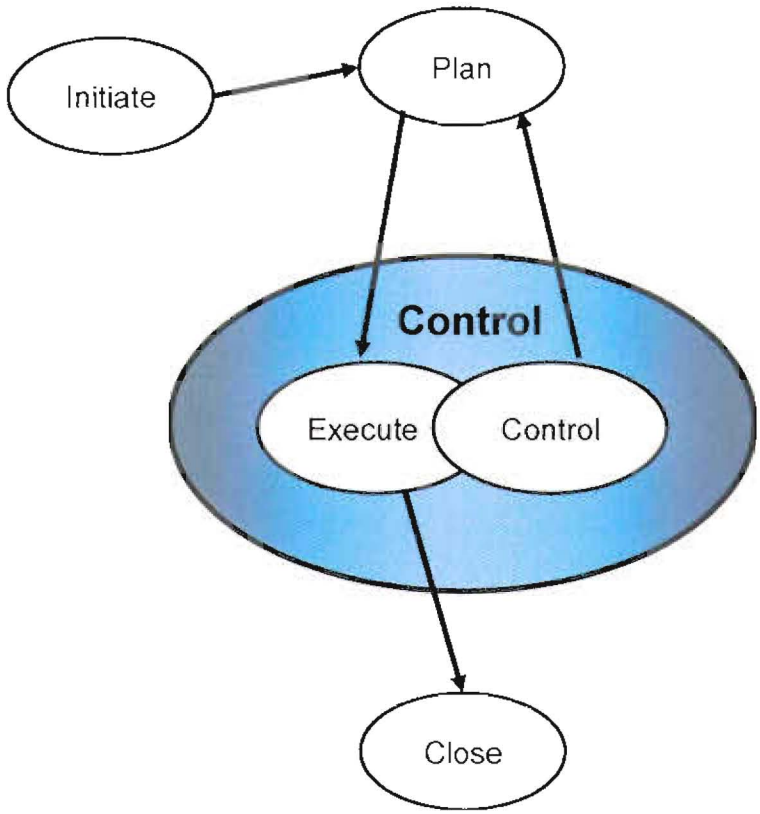



Figure 5: The four project life-cycle phases

According to Heldman (2005:82) projects move through five phases or processes:

1) Initiating
2) Planning
3) Executing
4) Monitoring and Controlling
5) Closing

Each phase has its own set of deliverables per phase to be completed in order to move on to the next phase and this check is normally done with a phase review or a gate review.

One can therefore conclude that each project is broken down into project phases called the project life-cycle. This project life-cycle is imposed upon a project sequence to make it easier to manage the project's sequence. The breaking down of the project life-cycle into project phases is an artificial device used to gain control of the sequence of achieving the objectives of the project. The majority of the reviewed literature appears to break a project down into four to five distinct phases namely:

1) Conceptual phase
2) Planning and Design phase
3) Implementation phase
4) Close out phase
5) Control phase

## 2.5 DEFINING PROJECT SUCCESS AND FAILURE

According to Hyvari (2006:31) there is an increased need for the management of projects in various business organisations. Companies are now more than ever using projects in their daily work to achieve their objectives. It is surprising that in project management literature it is not clearly defined what makes a successful project in general. Failure is also an inexact and not well defined term often used by practitioners and in the literature, without profound meaning as indicated by Rae & Eden (2002:12). Because project success and failure are not really clearly defined, the Independent Project Analysis Inc. (IPA) reviewed projects across the world and came to the conclusion that project success and failure can be defined by five steps of project results.

**PREDICTABILITY:**

- Cost growth
- Schedule slip

**ABSOLUTES:**

- Cost competitiveness
- Schedule effectiveness
- Production attainment

According to the Independent Project Analysis, Inc (IPA) Institute, a project can be deemed a failure if one or more of the following occur:

| | |
|---|---|
| The project cost grew | 25%+ |
| The project schedule slipped | 25%+ |
| Overspent (absolute measure) | 25%+ |
| Severe and continuing operational problems (1 year or more) | Yes |

Agarwal and Rathod (2005:361) contend that project success is not that often achieved. Their statement is based on a difference in the perception of the meaning of success in the minds of the stakeholders evaluating the project's performance. A successful project can be considered as a project that meets the technical performance specification and/or objectives set out, together with a high level of satisfaction overall of the project outcome, according to Agarwal and Rathod (2006:361).

A successful project can thus be defined as one in which cost escalation was not more than 25% of the agreed capital approved, with a less than 25% schedule slip and with all the operational problems being sorted out in less than a year.

## 2.6 PEOPLE SKILLS AND PROJECT MANAGEMENT

The job of the project manager is demanding, complex and varied, requiring the juggling of several issues concurrently. Strang (2003:18) argues that in order to manage projects successfully, a combination of skills is required, including interpersonal ability, technical competence, a cognitive aptitude, along with the capability to understand the situation and people and then dynamically applying appropriate leadership behaviours.

Successful project execution thus rests on people skills, conceptual skills and technical skills. EL-Sabaa (2001:3) is of the opinion that the people skills of project managers have the greatest influence on project management and technical skills the least. Realising the importance of people management skills, Turner (1999:3) has reframed his definition of a project to recognise its human aspects. He defines a project as an: ". . . endeavour in which human, financial and material resources are organized in a novel way to undertake a unique scope of work of given specification, within constraints of cost and time, so as to achieve beneficial change defined by quantitative and qualitative objectives."

In the context of the above it is clear that project leadership definitely requires more than just technical competence but also encompasses the ability to manage a team. The effectiveness of hard technical skills is complemented by relationship skills, because the outcomes of projects are achieved through people, and by utilising their knowledge and creativity, not through the mere use of techniques or hardware.

The people skills / soft skills of project management will be researched in more detail in Chapter 3 as one of the critical factors of project success.

## 2.7 CONCLUSION

Project management and project management tools and techniques are the art of integrating a combination of skills from various different disciplines throughout all the phases at a project, also called the project life-cycle, from defining the project right through to the commissioning and handover phase. Understanding the fact that a project manager must be task focused, he must realise that real project success comes from knowing how to get things done through others. Whilst some may see managing the human issues within a project as a soft option, the fact is that people skills are neither soft, nor an option. For a project manager to be successful requires his people skills to be on the same level as his hard technical skills, but preferably higher.

# CHAPTER 3 CRITICAL FACTORS FOR PROJECT SUCCESS

## 3.1 INTRODUCTION

From as early as the 1960s researchers on projects and project management have been trying to discover which factors lead to project success and have widely reflected this in project management literature.

In spite of the extensive research and miles of words written on project management, despite the years and years of experience in managing projects and despite the fact that we are implementing more projects than ever, project results continue to disappoint stakeholders.

The question thus remains: What are the critical factors responsible for project success?

Cooke-Davies (2002:185) stated: "Two distinctions must be drawn at this stage.

**Firstly, project management literature distinguishes between:**

1) **Project Success** (measured against the overall objectives of the project).
2) **Project management success** (measured against the widespread and traditional measures of performance against cost, time and quality).

**The second distinction is also important: it is the difference between:**

1) **Success Criteria** (the measures by which success or failure of a project or business will be judged).
2) **Success Factors** (those inputs to the management system that lead directly or indirectly to the success of the project or business)."

Keeping the above in mind, this study will focus on the critical factors that lead to project success.

In this chapter the identification of the critical factors for project success will be combined with a literature review on these factors.

## 3.2 CRITICAL FACTORS FOR PROJECT SUCCESS

The Business Roundtable (1997:11) defines the factors for project success as being:

- Very good cross functional teams to develop projects
- Proper Front End Loading on projects with business owner involvement
- The quality of the organisation's resources
- The business owner must be involved in and committed to managing the project process

Ferratt *et al* (2006:460) argues that in order to achieve project success the following factors are required:

- Well-defined project
- The correct resources to accomplish managerial and technical tasks (soft skills)
- Commitment and support from top management
- The correct mixture of skilled personnel/teams
- Clear communication
- Customer satisfaction

Project success is dependent on some critical factors which, if correctly and properly managed, will lead to more successful project outcomes. Some of these factors as noted by Shatz (2006:97) are:

- Level of stakeholders' satisfaction

- Meeting the project objectives and requirements
- Team performance and satisfaction
- Added-value requirements

For each organisation and/or project team, project success will vary. This is related to the level of skill and experience fostered in the organisation. Certain companies may have perfected the ability to properly define the project from the start while this same factor might be listed as the most critical factor why projects in another organisation fail. Müller and Turner (2007:301) identify their project success criteria as:

- Self and well defined project criteria
- Customer satisfaction
- Project team satisfaction
- Reoccurring business
- Project achieved its purpose

Project success as contended by Shenhar and Dvir (2007:27) is illustrated in figure 6 below.

Source: Adopted from Shenhar and Dvir (2007:27)

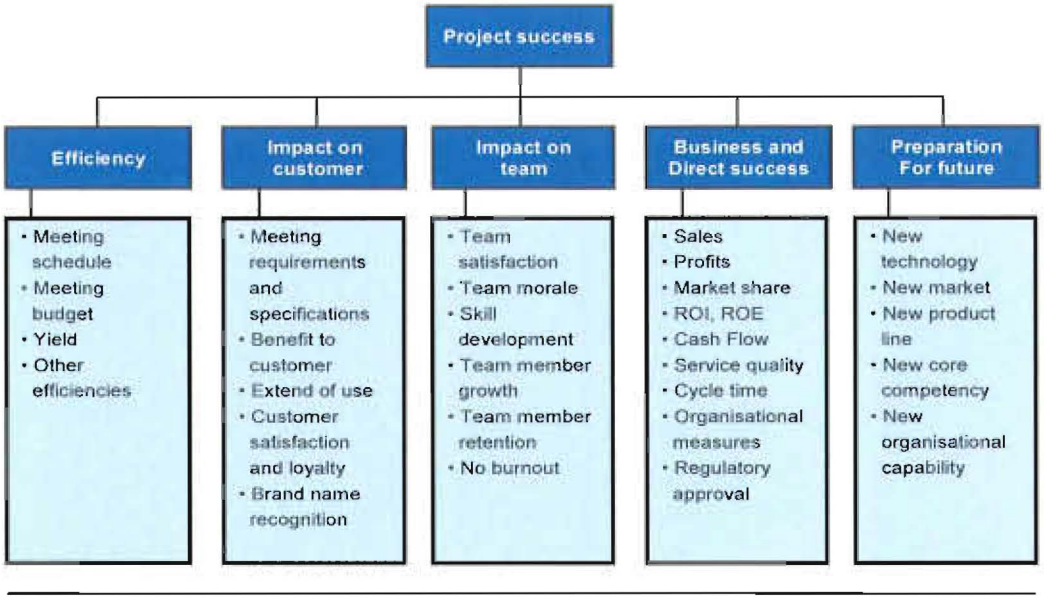



Figure 6: Specific success measures

The Independent Project Analysis, Inc (IPA) list of factors critical to project success is as follows:

- Excellent project framing
- Very well developed project teams
- Well defined project definition
- Well developed basic data
- Good and sound contracting strategies
- Excellent project controls

It can thus be said that the critical factors for project success vary from project and organisation due to various different factors contributing to it. There is, however, a very important portion of common ground to be found in these factors. The duplication of these factors from literature to literature indicates that several factors relate to general project success and the rest can be classified as organisation/nature of the project specific.

This study will identify the factors which indicate a trend through the literature and go into detail of each listed factor in this chapter. Figure 7 below schematically

indicates the critical factors leading to project success which will be researched in more detail in this chapter.

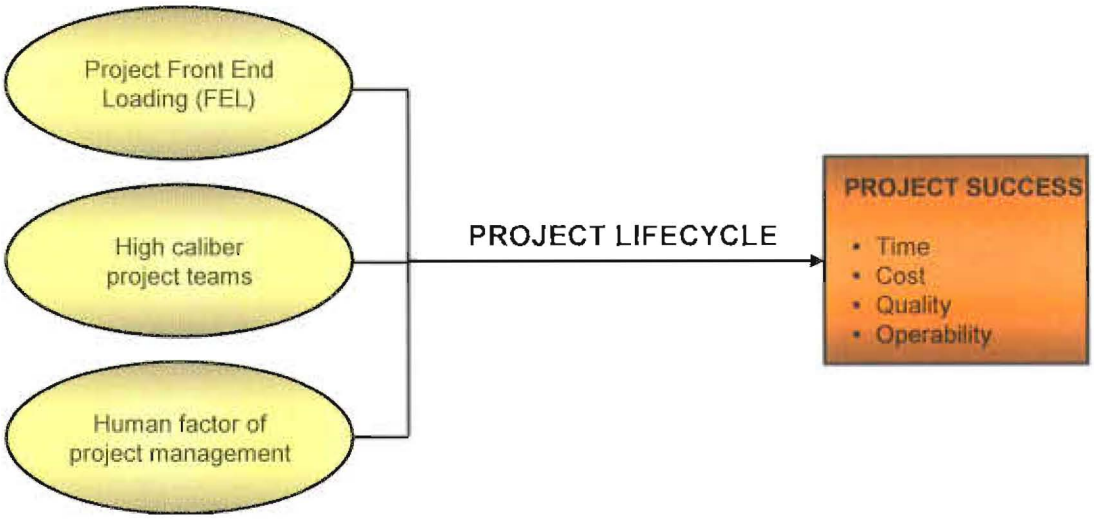



Figure 7: Critical factors for project success

Each of these factors will now be described in more detail below together with the influence of these factors on project success.

### 3.2.1 PROJECT FRONT END LOADING

It is natural to plan in phases. If you want to plan effectively for a year, you should "begin with the end in mind" and first decide what you want to accomplish during this year. Planning a project follows a similar pattern. Projects are broken up into phases called the project life-cycle as discussed in section 2.4 of this study. You still have to start with the end in mind. Understanding clearly what the project should achieve is a key aspect, but you should not be too concerned that you cannot see all the details right to the end of the project. You cannot plan in detail a few years ahead. In order to best achieve the desired outcome of a project, the more detail you do per phase, the more there is to build on during the next phase.

This first/initiation phase of a project in different literature has many names. Here are some of the most common names used for the initiation phase of a project:

- Front End Loading (FEL)
- Front End Engineering Design (FEED) = FEL
- Conceptual phase and Basic Engineering = FEL
- The early phase of a project = FEL


Pre-feasibility + Feasibility + Basic Engineering = FEL

FEL1 + FEL 2 + FEL 3 = FEL

The various names as listed above are provided purely for better understanding of the literature to follow as different literature attach different names to the phases of projects.

Kolltveit and Gronhaug (2004:547) define the boundaries for this first phase of the project as "... the early phase of the project starts before the decision to start the main project has been taken and lasts until the activities and processes immediately following the decision to execute the project are completed".

**Now that the boundary definition for the FEL phase and the most common names used have been set, the typical activities during this phase and the importance thereof on project success will be discussed.**

**The objective of FEL** is to have a clear understanding of turnaround goals and dates in sufficient detail to minimise costly late changes during the detailed planning, execution and start-up phases, according to Hoshi (2003:3).

The typical FEL activities as defined by Burke (2007:49) are listed in table 2 below.

Source: Adopted from Burke (2007:49)

| CONCEPT DEVELOPMENT | |
|---|---|
| 1. Gather data | 8. Appoint key team members |
| 2. Identify need | 9. Conduct studies |
| 3. Establish: | 10. Develop scope baseline: |
| - goals, objectives | - end product(s) |
| - basic economics | - quality standards |
| - feasibility | - resources |
| - stakeholders | - activities |
| - risk level | 11. Establish: |
| - strategy | - master plan |
| - potential team | - budget, cash flow |
| 4. Guesstimate resources | - WBS |
| 5. Identify alternatives | - policies and procedures |
| 6. Present proposal | 12. Assess risks |
| 7. Obtain approval for next phase | 13. Confirm justification |
| | 14. Present project brief |
| | 15. Obtain approval to proceed |

Table 2: Typical activities during FEL

The Front End Loading (FEL) primary engineering deliverables as noted by Smith (2000:98) are listed in table 3 below.

Source: Adopted from Smith (2000:98)

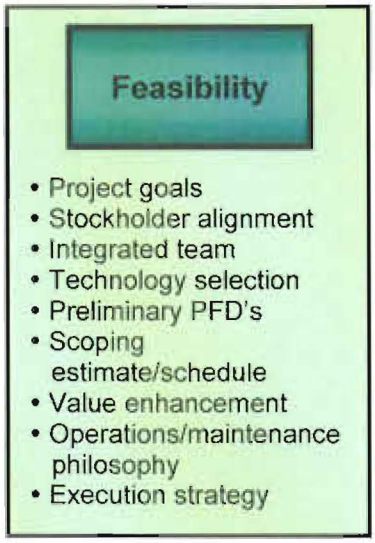



Table 3: Primary engineering deliverables for FEL

Certain literature breaks the FEL phase down even further into components to better manage the outcomes of the FEL phase to ensure a higher project success rate. One of this breaking down of the FEL phase into components can be seen in figure 8 below.

Source: Adopted from Joshi (2003:4)

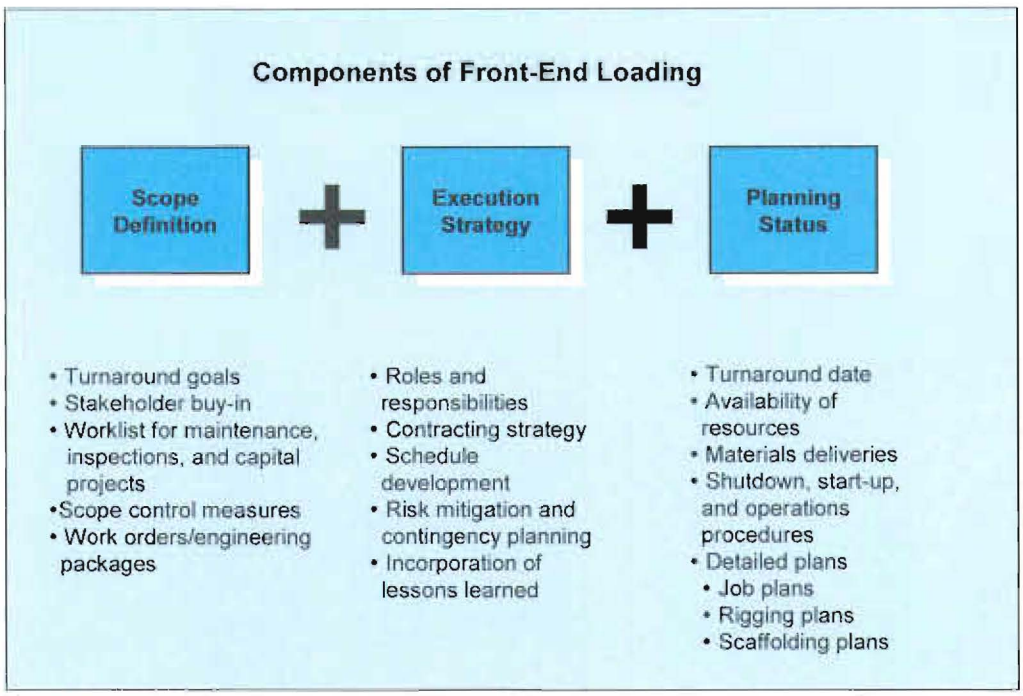



Figure 8: Components of Front End Loading

It can thus be stated that FEL is the process followed by an organisation to translate its marketing and technology opportunities into capital projects. The objective of FEL is to get alignment of the project objectives with the business needs and to develop the most efficient process design and execution plan to achieve the overall objectives of the project. FEL continues until the best project or "right" project has been selected and only finishes when a full design-basis package has been completed together with a cost estimate with an accuracy of ± 25% - 30% and an overall execution program normally level 1 or 2. Towards the end of the FEL phase an Engineering Contractor (EC) gets involved to further ensure that overall alignment happens earlier rather than later, for the remainder of the project.

The influence of FEL on project success does not seem that high if you look at the listed activities to be done. The truth is quite the opposite. FEL is one of the most important factors for project success, if not the most important one.

The Independent Project Analyses, Inc (IPA) explains FEL as follows: FEL = FEL1 + FEL2 + FEL3 where

FEL1 = Pre-feasibility

FEL2 = Feasibility

FEL3 = Basic engineering

Uher and Toakley (1999:161) contend that the conceptual phase of a project is the most important phase of a project, since decisions made during this phase tend to always have a significant impact on the final cost and schedule, contributing to project success. It is also the phase of a project having the greatest degree of uncertainty about what can be encountered in the future. In response to this degree of uncertainty, risk management can play a very prominent and important role in controlling the level of risks and mitigating actions on the effects of the risks on the project success.

Abdul-Kadir and Price (1995:387) state that "the conceptual phase has the most influence on the course of the phase to come: the detailed engineering, procurement, construction and start-up phases. The success of these phases very much depends upon the decisions made during the conceptual phase." Figure 9 illustrates that the concept phase of the project presents the greatest opportunity to improve the overall project success.

Source: Adopted from Abdul-Kadir and Price (1995:387)

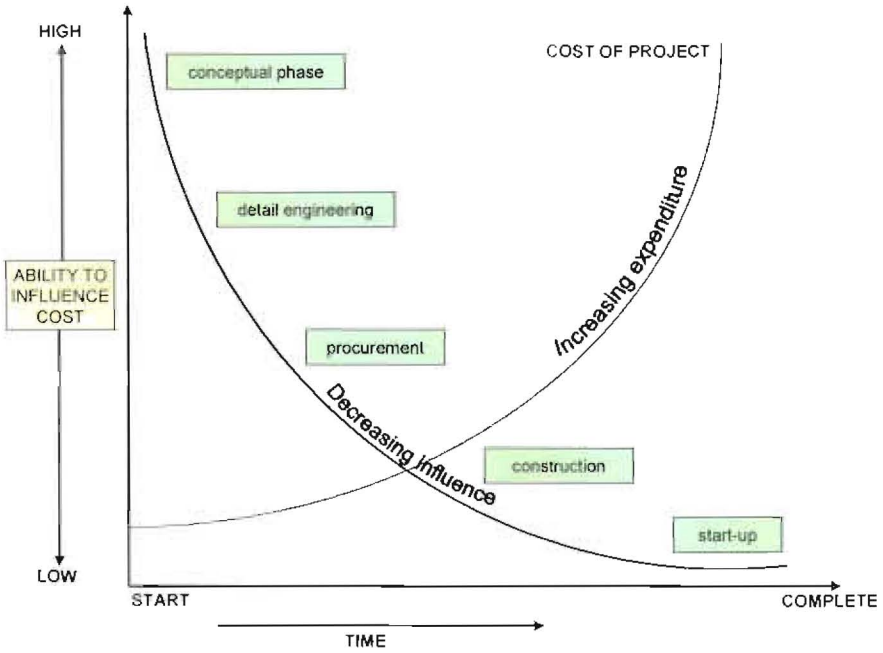



Figure 9: Ability to influence final cost over the project life

IPA describes the importance of FEL on project success in the case of where the basic data during FEL is incomplete or incorrect:

- The start-up of the project and the production attainment are poor
- The probability of major design changes in the implementation phase of the project is very high as the data changes, having a very negative effect on project cost, schedule and quality and thus lowering the project's success rate.
- The probability of outright failure of the project increases dramatically.

The conceptual development phase of a project is one of the most important processes for the successful outcome of any project. It determines the time, cost, quality and resource requirements of a project. The conceptual phase also determines what the scope of the project is, which can be either the work content or components of a project. If this phase is done properly and with the necessary

required skill and attention, a lot of time and cost increases can be prevented once the project is up and running (Knipe *et al,* 2002:76).

One can therefore conclude that the FEL phase of a project consists of what will be done, how it will be done, when it will be done, who will do it and what resources will be needed. If FEL is not the biggest contributor to project success it is among the top two critical factors for project success. The decisions the project team makes during this phase have a tremendous impact on the project's final cost and schedule while having the highest ability to influence the degree of impact. The more focus and detail you accumulate during this FEL phase the smoother flow and control you will have on the outcome of the phases to come and on the project as a whole.

### 3.2.2 HIGH CALIBRE PROJECT TEAMS

During the project's FEL phase, you must source the personnel to fill certain responsibilities or roles. Focusing your efforts on getting the best possible team will greatly contribute to the success of your project.

A typical project team as set out by Westland (2006:3) consists of the following:

**Project sponsor** – The "owner" of the project. The sponsor focuses on approving the project resources, enforces timetables and deadlines, communicates with the project review group/steering committee and clears away any interference or resistance to the project on a high level.

**Project review group/Steering Committee** – This group of people, sometimes includes third parties, who assist in keeping the project on track. The review group or steering committee meets at regular intervals and discusses and evaluates the cost, schedule and quality of the execution of the project. They manage business risks and make high level informed business decisions to make sure the project and business are aligned.

**Project Manager** – The project manager oversees the day-to-day progress. The project manager gets hold of all the project related documentation, makes sure that "right" resources are assigned to the "right" activities at the "right" time. The project manager reports to the review group/steering committee on performance and progress, advises others of escalating risk factors and probably the most important activity, he/she adjusts the project plan when and where necessary because of unexpected obstacles or contingencies.

**Project team members** – These are the employees who do the work. The project manager provides direction to the project team members; they complete the project tasks, report to the project manager as needed, update documentation and inform the project manager of risks creeping to the surface, not visible earlier.

A typical project owner team is illustrated in figure 10 below.

Source: Adopted from Independent Project Analysis, Inc (IPA) (2007)

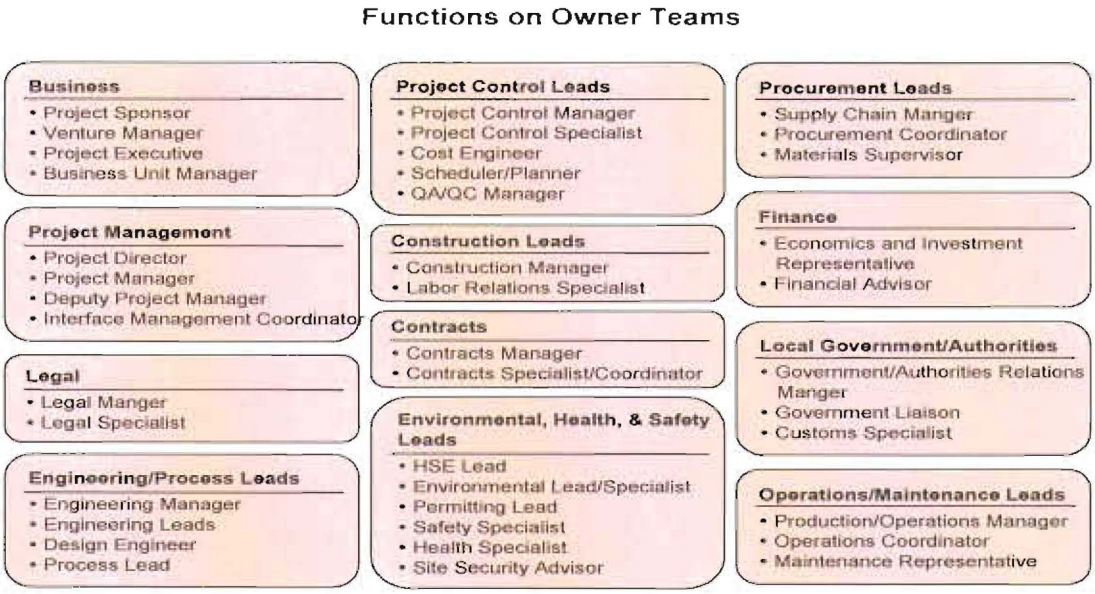



Figure 10: Typical Owner team

The **purpose of project teams** is an efficient and effective way of managing projects, where efficiency implies performing the work well, and effectiveness implies performing the right work, as stated by Burke (2007:234), and illustrated by table 4 below.

Source: Adopted from Burke (2007:234)

| | |
|---|---|
| **Volume of Work** | To achieve the schedule the volume of work must be distributed (shared amongst a number of people. |
| **Range of Skills** | The scope of the project may require a range of skills which any one person is unlikely to have. Consider the orchestra again – this is an excellent example of a set of complementary skills and talents (functional skills) which are required to produce the music. |
| **Ideas** | Brainstorming and discussions are a good example of interactive team work to generate creative ideas and solve problems. |
| **Decisions** | Once a project team has made a collective decision, the team will be committed to support their course of action. |
| **Risk** | Project teams generally take riskier decisions than an individual would on their own. There is a feeling of mutual support. |
| **Motivation** | Project teams enhance self-motivation – each member does not want to let the side down. |
| **Support** | Project teams support other team members when they need help both technically and emotionally. |

Table 4: Purpose of project teams

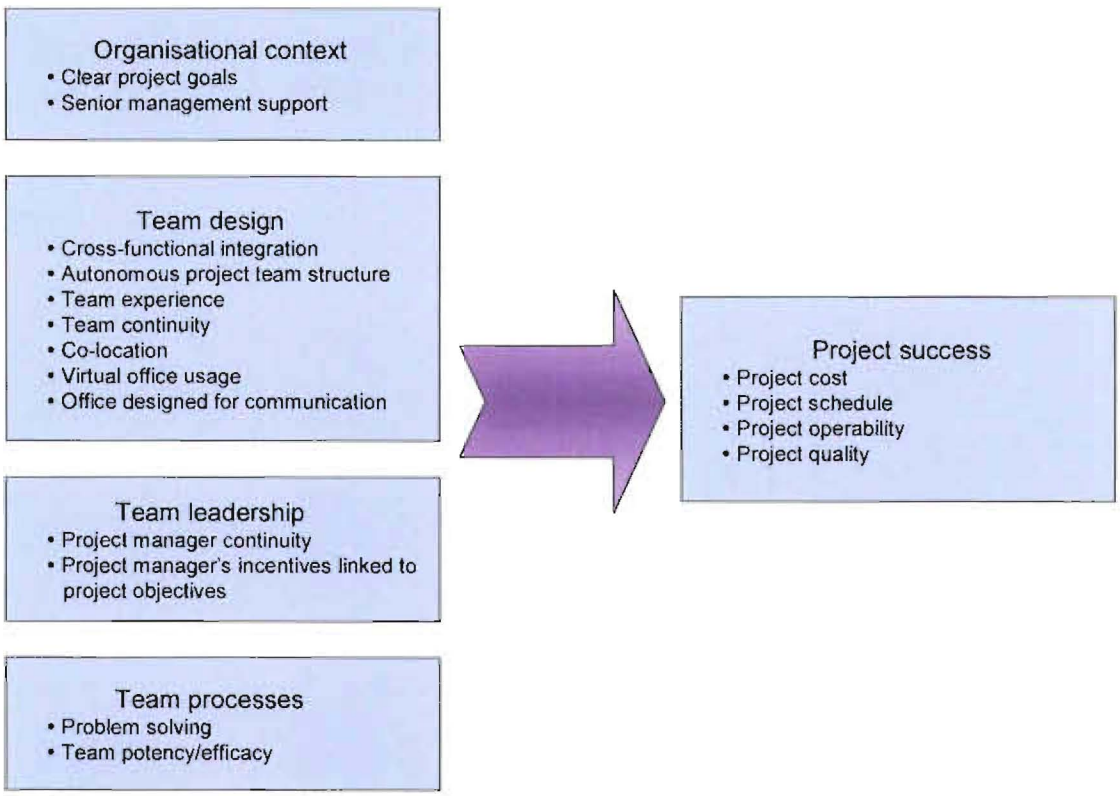
**The success of projects is highly dependent on high calibre project teams as the literature below will indicate.**

Gid and Clements (1999:100) state: "Project success requires an effective project team. An effective project team needs co-operative work by team members to

achieve the common outcomes or objectives of the project. The effective project team is more than just a group of people working on one project – it is an undertaking that assists individuals to develop into a cohesive, effective team working co-operatively to achieve a successful project outcome. **Plans and project management techniques are necessary but people (the project manager and the project team) are crucial to the success of the project.**"

From the literature above it is evident that high calibre project teams contribute greatly towards successful outcomes of projects. There are several project team factors that influence the outcome of projects related to cost, schedule, quality and operability as indicated in figure 11 below.

Source: Adopted from Scott-Young and Samson (2007:1)




According to Knipe *et al* (2002:204) there are a number of characteristics that can be linked to effective project teams which result in project success namely:

**• A clear understanding of the project objective**

The project's scope, budget, schedule and quality of work need to be clearly defined, and each individual project team member must have the same mission and vision of the project outcome.

**• Clear awareness of each team member's role and responsibilities**

The project team members must have a clear understanding of how their work is linked together in the overall project by continuously participating in the development of the project plans and by committing to their section of the project.

**• Results orientation**

The commitment to achieve the project objectives or outcomes must be the responsibility of each project team member.

**• A high degree of co-operation and collaboration**

The norm for all communication must be open, honest and timely. Information sharing, learning from each other and sharing ideas openly must be a daily occurrence. Project team members should act as resources for each other beyond their duties, and assist other members to succeed in their tasks where possible.

**• A high level of trust**

Team members need to comprehend their interdependency and to accept that everyone is needed for the project to be a success.

The above mentioned characteristics of a successful project team that lead to project success highlight the differences between a group and a team, and the importance of a well-aligned team. You can clearly distinguish between a group and a team. A group is basically a collection of people, but a successful project

team is when the output of the team is greater than the sum of the output of its individuals, that is, its creative idea generation is far richer.

Laufer *et al* (1996:194) states: "Projects are not delivered by project managers but by teams. A team composed of all the necessary specialists and experts is able to make integrative decisions based on seeing the picture as a whole, and executes them later on with greater speed." Invariably, behind every project implemented or delivered successfully you will find an excellent team. This excellent team is committed to a common mission and specific objectives resulting in project success.

One can thus conclude that the goal of all project managers is to deliver successful projects, i.e. within budget, on time and to the desired quality which will lead to a satisfied customer. However, the project manager cannot achieve this goal by himself / herself. The success of a project will be achieved by the entire team. The project manager needs to use his influence to get the whole project team motivated and working hard towards the goal of achieving project success. High calibre project teams are critical for project success, and to achieve this success the project manager must match the skill, experience, expertise and qualifications of the project team to the requirements of the roles they play in the project.

### 3.2.3 HUMAN SKILL / SOFT SKILL OF PROJECT MANAGEMENT

Most employers today expect their project managers to demonstrate and excel in a wider skill base than the traditional technical orientated approach, which includes the many "softer skills", such as team work, group development, team motivation, effective team and external communication and conflict management. Employers are keen to tap into these vital soft skills obtained during their periods of study, work and social experience, rather than focusing on just degree-specific knowledge, Raybould and Sheedy (2005:261).

Belzer (2001:2) identifies soft skills in managing projects as "the missing link" and which is, according to him, critical to project success. Some of the skills identified as "soft" skills include:

- Communication
- Organisational effectiveness
- Leadership
- Problem solving
- Decision-making
- Team Building
- Flexibility
- Creativity
- Trustworthiness

Being a project manager is demanding, complex and diverse, requiring the juggling of several issues concurrently. Strang (2003:18) argues that in order to manage projects successfully requires a combination of skills, including interpersonal ability, technical competence and a cognitive aptitude, **along with the capability to understand the situation and people and to dynamically integrate appropriate leadership behaviours**.

Realising the importance of people management skills, Turner (1999:3), has reframed his definition of a project to recognise its human aspects. He defines a project as an ". . . endeavour in which human, financial and material resources are organized in a normal way to undertake a unique scope of work, of given specification, within constraints of cost and time, so as to achieve beneficial change by quantitative and qualitative objectives".

Successful project execution thus rests on people skills, conceptual skills and technical skills. EL-Sabaa (2001:3) is of the opinion that the people skills of project managers have the greatest influence on project success and on project management while technical skills have the least.

Kloppenberg and Petrick (1999:9) argue that the leadership of projects requires more than just technical competence and encompasses the ability to manage a team. Managing a team requires the so called "soft" skills, managing people and relationships. The skills required for managing relationships are critical to achieve stakeholder satisfaction throughout all stages of the project which leads to more successful projects. Relationship skills complement the effectiveness of hard (technical) skills because project outcomes are not purely based on the project manager. On the contrary, successful project outcomes are achieved through people, and through project leaders using their knowledge and creativity not by the mere use of techniques or hardware.

Halstead (1999:5) contends that: "Whilst a project manager must focus on the task, real project success comes from knowing how to get things done through others. Whilst some may see managing the human issues within a project as a soft option, it is neither soft, nor an option, if a project manager wants the project to succeed."

Thamhain (2004:535) stresses that creating the right relationships with team members and all the other relevant stakeholders is one of the biggest challenges that faces project managers. In order for project managers to achieve project success, a project manager must cultivate both the hard and soft skills.

Through the years it became apparent that the selection of the project manager is a key appointment which can influence the success or failure of the project. The project manager is the single point of responsibility. It is the project manager who integrates and co-ordinates all the contributions from the stakeholders and guides them to successfully complete the project.

The traditional role of project management beginning as a technical expert is depicted in table 5 below.
Source: Adopted from Burke (2007:238)

| | |
|---|---|
| **Technical Expert** | Companies prefer their managers to be technical experts in the field of the project as it enables the managers to confirm technical decisions themselves. This view is supported by the fact that most project management positions advertised require managers to be technically competent in the field of the project. |
| **Judgment** | If project managers know and understand the technical issues of their projects they will be in a better position to apply judgment and forecast problems |
| **Skills** | Project management selection can be based on both the project manager's human compatibility and technical ability. |
| **Feasibility Study** | The project manager can effectively be involved up-front during the feasibility study, estimation and quotation stage of the project. |
| **Respect** | The project manager will be able to gain respect from the team by demonstrating not only good management but also technical expertise. |

Table 5: The role of project management as a technical expert

Burke (2007:239) argues that the modern day approach of project management is more in favour of a project manager being a **generalist**. Table 6 below depicts the generalist approach only, but a successful project manager normally starts off in a technical field and as he progresses, the transition towards a generalist becomes evident.

Source: Adopted from Burke (2007:239)

| | |
|---|---|
| **Co-ordinating** | As a project manager moves up the corporate ladder, the project manager will be concerned more with people, costs and co-ordinating multi-disciplines and less concerned with technical issues. |
| **Expertise** | It could be undesirable to have the technical expert project manager leading the team, as innovation from the other team members could be suppressed, particularly in the project manager's area of expertise. |
| **Non-Technical** | Effective project management requires many non-technical skills such as human resource management, team building, financial accounting, negotiation and co-ordination. |

Table 6: The people skills of a project manager

Steyn *et al* (2003:215) state that the technical side of project management that focuses on equipping project managers to handle complex, pressure-filled project challenges is not the whole story when it comes to implementing successful projects. Much of a project manager's effectiveness and a project's success derive not only from the use of work breakdown structures, costing, risk analysis and scheduling, because these tools constitute only half of the project management equation. The remaining half is the art of managing a project's human resources and carries as much weight on project success as the technical side. This other side, "the human factor", also described as managing the "people side" of projects, includes:

- Planning
- Organising
- Leading
- Motivating
- Controlling the project team

Figure 12 below illustrates how a successful project manager adopts and changes the people skill process during the life-cycle of a project.

Source: Adopted from Steyn *et al* (2003:218)

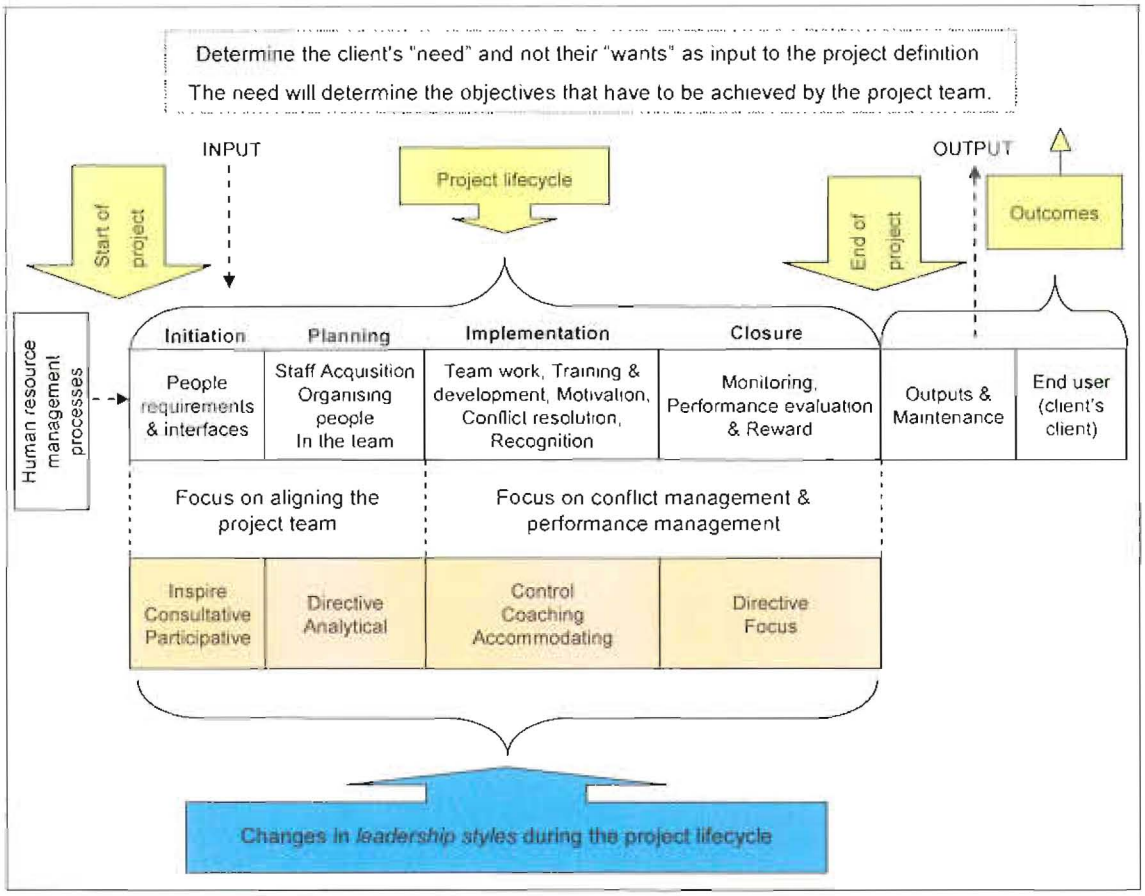



Figure 12: Project human resource management applied during the life-cycle of a project

One can thus conclude that although the traditional project management competencies (technical / hard skills) are very critical for project success, the soft skills like communication between team members and stakeholders, leading, motivating and organising are vital to support a shared understanding of the project's objective which will increase project success. In order to successfully manage projects the project manager requires a mixture of skills including interpersonal ability, technical competence and cognitive aptitude. Project success rests as largely on the hard / technical skills as it rests on the soft skills. The people skills of a project manager leading to project success can be stated as the ability to understand the situation and project team members and then

dynamically integrating appropriate leadership behaviours into the situation or problem. A successful project manager normally embarks on his career in project management with experience in the field of the project, but once the technical / hard competence has been established the project manager will slowly become more of a generalist in project management, focusing on the soft skill. Both the hard and soft skills possessed by successful project managers have an equal weight on project success.

## 3.3 CONCLUSION

This chapter discussed the critical factors for project success. The factors discussed are listed and summarised below:

- PROJECT FRONT END LOADING (FEL)
- HIGH CALIBRE PROJECT TEAMS
- PEOPLE SKILLS / SOFT SKILLS OF PROJECT MANAGEMENT

The FEL phase of a project consists of what will be done, how it will be done, when it will be done, who will do it and what resources will be needed. The project team's decisions during this phase have a very high impact on the project's final cost and schedule while having the highest ability to influence the degree of impact. The effective FEL for a project is a concrete foundation for project success.

High calibre project teams are a critical factor for project success, and to achieve this success the project manager must match the skill, experience, expertise and qualifications of the project team to the requirements of the roles they play in the project.

To successfully manage projects the project manager requires a mixture of skills, including interpersonal ability, technical competence and cognitive aptitude. The success of projects in relation to the soft skills of a project manager carries the same weight, if not more, than the hard / technical skills. The people skills of a

project manager is seen as a critical factor for project success and can be explained as the project manager's ability to understand the situation and project team members and then dynamically integrating appropriate leadership behaviours into the situation or problem.

Without a well-thought-out strategy a project has no direction, but without proper implementation the best strategy is of no value. Bearing this in mind is what this chapter is all about. To have all this literature to increase project success does not carry much weight if not used and implemented successfully.

# CHAPTER 4 EMPIRICAL STUDY – RESEARCH RESULTS, RECOMMENDATIONS AND CONCLUSIONS

## 4.1 INTRODUCTION

The intent of this chapter is to summarise the results of the empirical research, based on the audits and interviews which were conducted and the replies to the questionnaires which were distributed. The empirical research was done by means of a field study using a structured questionnaire.

Chapter 2 and 3 described the theory of the study relating to project management and the critical factors for project success. This literature study forms the basis of the development of the structured questionnaire. These questions were designed on the critical factors for project success which were tested and measured in practice.

The research is conducted to establish what the respondents to the questionnaire from various organisation types and sectors with different experience levels in project management perceive to be the factors that lead to project success.

## 4.2 THE DATA COLLECTION PROCESS

A questionnaire was designed and sent out to selected project managers and program managers to obtain information on what various individuals with different backgrounds feel are the factors that lead to project success. The questionnaire was designed in such a way as to meet the objectives set out in this study.

The targets of this investigation are project managers and program managers working in an engineering environment. The questionnaires were sent via e-mail with exceptions where interviews and audits were conducted.

## 4.3 QUESTIONNAIRE LAYOUT AND DESIGN

The questionnaire is divided into three sections:

- Section 1: Background information
- Section 2: Critical factors for project success
- Section 3: Project success information

### 4.3.1 SECTION 1: BACKGROUND INFORMATION

This section covers questions to determine a demographic profile of the various sectors, organisations and the project managers. The results of these dimensions are important, because a positive result will validate the responses in the next two sections.

### 4.3.2 SECTION 2: CRITICAL FACTORS FOR PROJECT SUCCESS

The objective of this section is to determine what the different respondents see as project success and to determine what influence the various factors have on project success from no positive influence to a clear indication of a positive influence.

### 4.3.3 SECTION 3: PROJECT SUCCESS INFORMATION

The purpose of this section is to test if project success factors are addressed at all and to what level in the various sectors and organisations when implementing projects and whether top management supports the process.

## 4.4 RESULTS OF SECTION 1: BACKGROUND INFORMATION

### 4.4.1 INTRODUCTION

The objective of these questions is to determine:

- The type of organisation in which the respondents work.
- The sectors in which the respondents execute projects.
- The size of the organisation measured by the number of employees.
- The monetary value of the projects executed by the respondents.

- The experience levels of the project managers measured in years of experience.

All the tables below in chapter four represent the questions asked in the questionnaire, which is attached in Appendix 1.

### 4.4.2 RESULTS

Tables 7 to 11 indicate the results of the empirical study on the background information.

| Type of organisation | Frequency | Percent |
|---|---|---|
| 1. Commercial private sector business | 39 | 64% |
| 2. Public sector organisation operating commercial practices | 19 | 31% |
| 3. Traditional public sector | 1 | 2% |
| 4. Charity or Not-for-Profit | 0 | 0% |
| 5. Other | 2 | 3% |

Table 7: Type of organisation

| Sectors | Frequency | Percent |
|---|---|---|
| 1. Government | 1 | 2% |
| 2. Services | 19 | 31% |
| 3. Manufacturing | 18 | 30% |
| 4. Mining and Resources | 4 | 6% |
| 5. Utilities | 1 | 1% |
| 6. Communication | 0 | 0% |
| 7. Other | 18 | 30% |

Table 8: Sectors

| Number of employees employed by your organisation | Frequency | Percent |
|---|---|---|
| 1. <10 | 1 | 1% |
| 2. 10-100 | 0 | 0% |
| 3. 101-1000 | 15 | 25% |
| 4. >1000 | 45 | 74% |

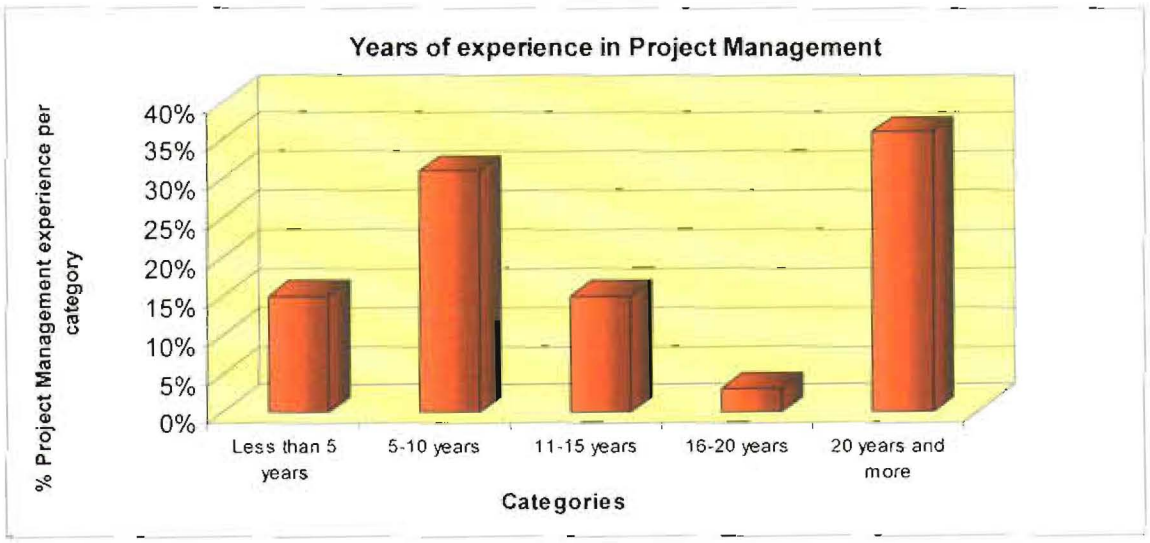
Table 9: Number of employees employed by your organisation

| What is the average monetary value of projects undertaken by you? | Frequency | Percent |
|---|---|---|
| 1. Less than R1 million | 0 | 0% |
| 2. R1 million – R10 million | 0 | 0% |
| 3. R10 million – R100 million | 22 | 36% |
| 4. R100 million – R1 000 million | 13 | 21% |
| 5. Over R1 billion | 26 | 43% |

Table 10: The average monetary value of projects executed by the respondents

| How many years of experience do you have in project management? | Frequency | Percent |
|---|---|---|
| 1. Less than 5 years | 9 | 15% |
| 2 5-10 years | 19 | 31% |
| 3. 11-15 years | 9 | 15% |
| 4. 16-20 years | 2 | 3% |
| 5. 20 years and more | 22 | 36% |

Table 11. Number of years experience in project management




Graph 1: Number of years experience in project management

### 4.4.3 CONCLUSION ON BACKGROUND INFORMATION

The results from tables 7 to 11 and graph 1 clearly indicate a good spread of information gathering from organisation type, various sectors, organisation size and project values to project management experience which validates the responses in the next two sections.

## 4.5 RESULTS OF SECTION: CRITICAL FACTORS FOR PROJECT SUCCESS

### 4.5.1 WHEN IMPLEMENTING A PROJECT DO YOU:

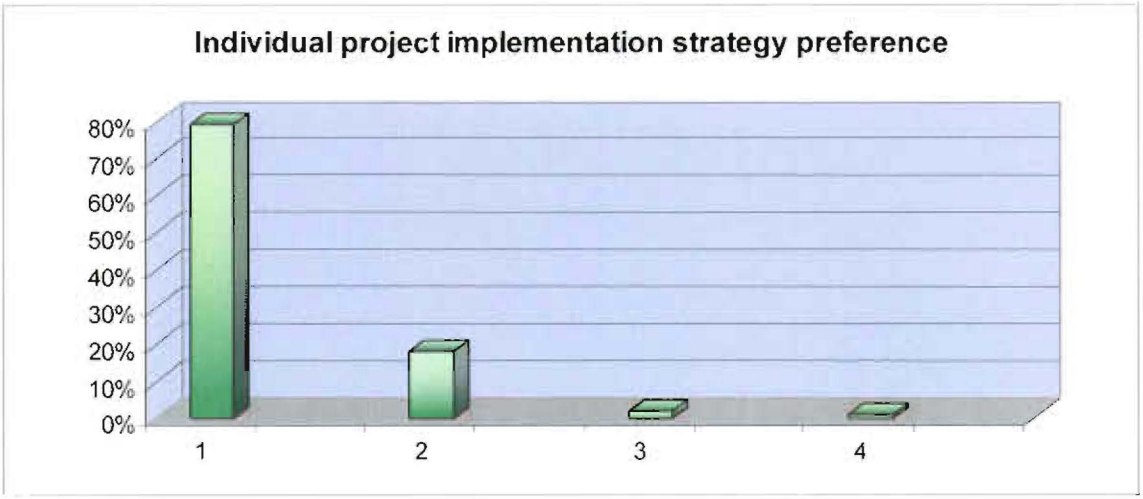
### INTRODUCTION

The purpose of this question is to determine what the focus is when implementing a project with regards to the factors that lead to project success.

### RESULTS

| When implementing a project do you: | Frequency | Percent |
|---|---|---|
| 1. Have a clear understanding of the factors that will lead to project success and focus on these factors? | 48 | 79% |
| 2. Drive the projects cost and schedule to deliver the project successfully? | 11 | 18% |
| 3. Have your own set of rules that has worked for you over the years to deliver projects successfully? | 1 | 2% |
| 4. Take the project head on and make the changes as you go along to have a successful project? | 1 | 1% |

Table 12: Individual project implementation strategy preference




Graph 2: Individual project implementation strategy preference

## CONCLUSION

From table 12 and graph 2 it can be concluded that the majority (79%) of the respondents indicated that they have a clear understanding of the factors that will lead to project success and focus on these factors when implementing a project. These results support the literature study.

### 4.5.2 HOW DO YOU DEFINE PROJECT SUCCESS?

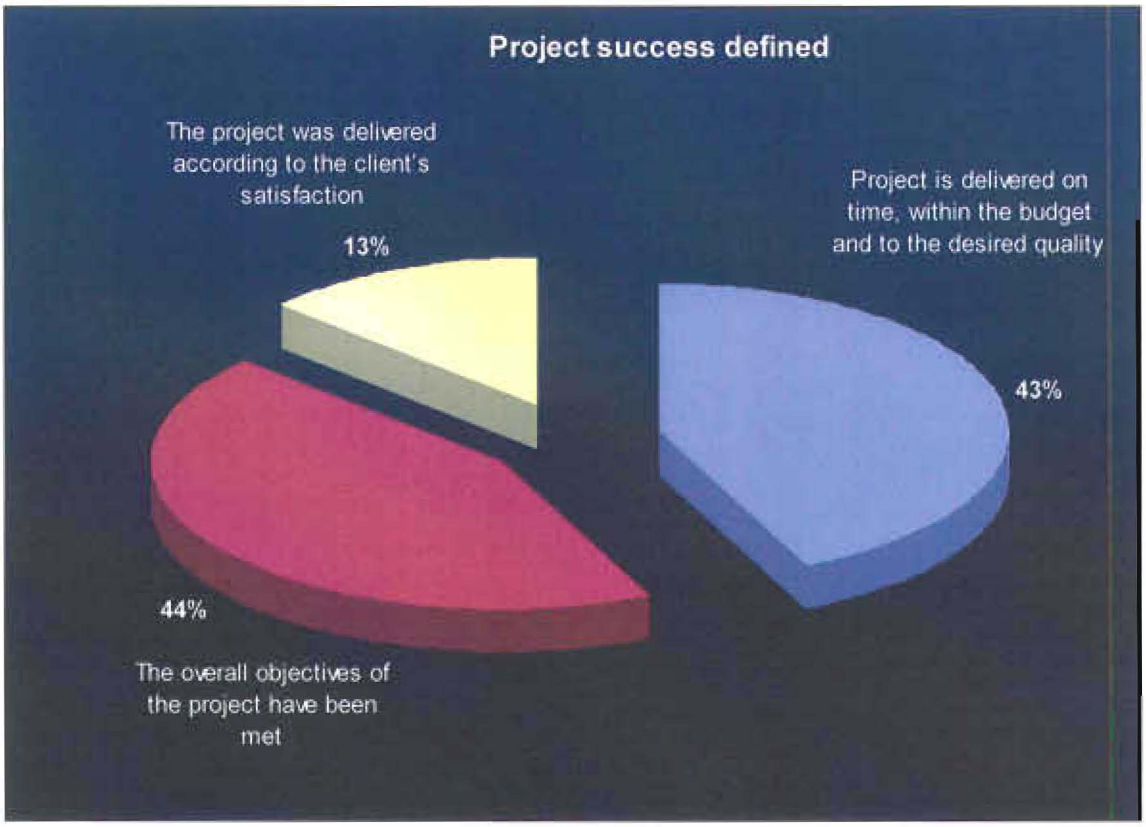
## INTRODUCTION

The purpose of this question is to establish how project success is defined by the respondents.

## RESULTS

| How do you define project success? | Frequency | Percent |
|---|---|---|
| 1. Project is delivered on time, within the budget and to the desired quality | 26 | 43% |
| 2. The overall objectives of the project have been met. | 27 | 44% |
| 3. The project was delivered according to the client's satisfaction. | 8 | 13% |

Table 13: Project success defined




Graph 3: Project success defined

## CONCLUSION

The results from graph 3 indicate that 43% of the respondents define project success as a project delivered on time, within budget, to the desired quality and with operational problems sorted out within one year after completion, which are consistent with the literature study. There is however 44% who define project success as: The overall objectives of the project have been met. This is just because of two different schools of thought. Having met the overall objectives of the project which include cost, schedule, quality and operability, meaning the design intent has been met and the project is successful.

### 4.5.3 WHAT MEASURES DO YOU USE TO DESCRIBE PROJECT SUCCESS?

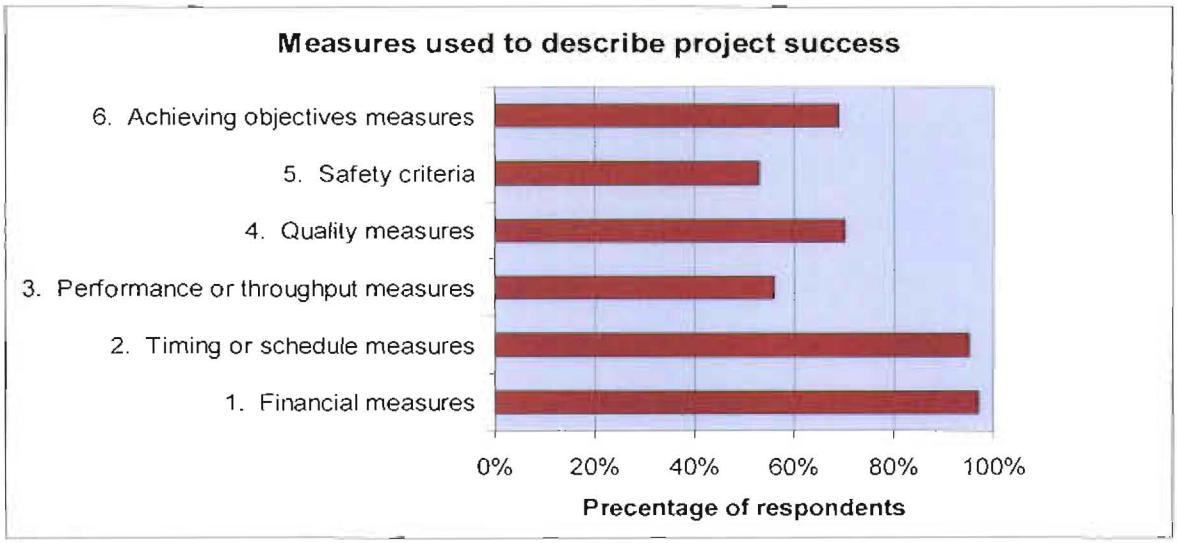
## INTRODUCTION

The aim of this question is to indicate what measures are used by the respondents to describe project success.

## RESULTS

| What measures do you use to describe project success? | Frequency | Percent |
|---|---|---|
| 1. Financial measures. | 59 | 97% |
| 2. Timing or schedule measures. | 58 | 95% |
| 3. Performance or throughput measures. | 34 | 56% |
| 4. Quality measures. | 43 | 70% |
| 5. Safety criteria. | 32 | 53% |
| 6. Achieving objectives measures. | 42 | 69% |

Table 14: The measures used to describe project success




Graph 4: Measures used to describe project success

## CONCLUSION

Graph 4 indicates that different project managers describe project success differently. Project success for the majority can be described as financial, timing and scheduling, quality and achieving objective measures which are consistent with the findings of 4.5.2. A concern highlighted from the results is that safety was rated the lowest for describing project success which needs serious action and attention.

### 4.5.4 WHAT FACTORS PREVENT PROJECTS TO BE IMPLEMENTED SUCCESSFULLY?

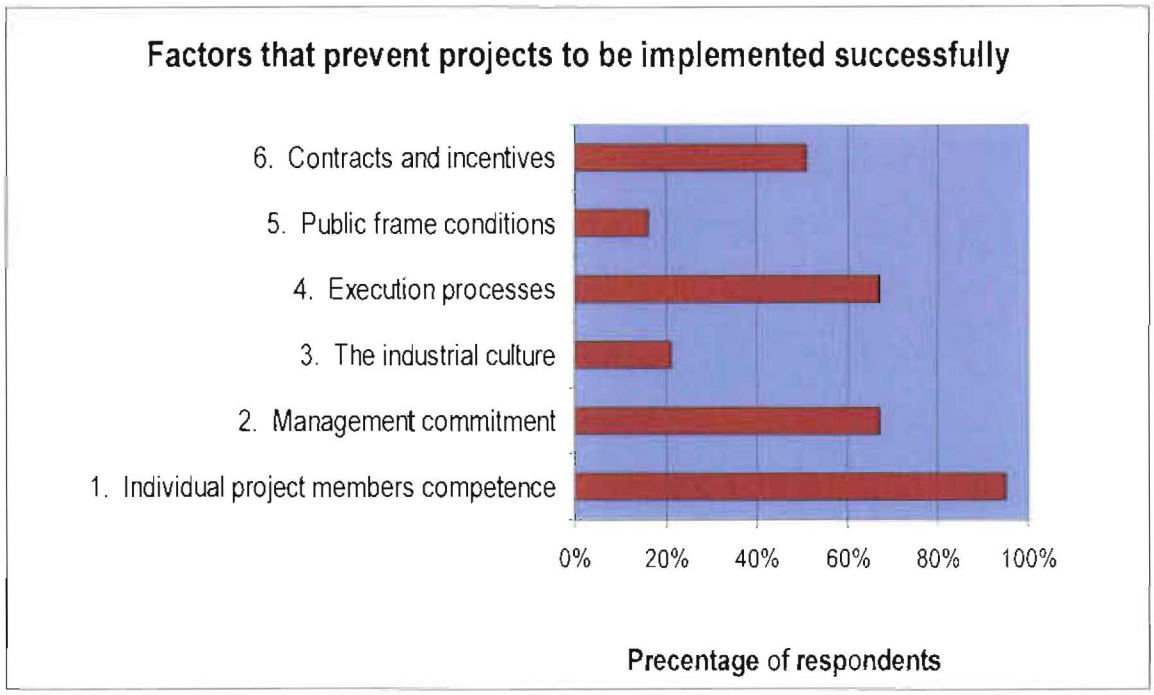
## INTRODUCTION

This question tries to establish the factors that prevent projects from being implemented successfully.

## RESULTS

| What factors prevent projects from being implemented successfully? | Frequency | Percent |
|---|---|---|
| 1. Individual project members' competence. | 58 | 95% |
| 2. Management commitment. | 41 | 67% |
| 3. The industrial culture. | 13 | 21% |
| 4. Execution processes. | 41 | 67% |
| 5. Public frame conditions. | 10 | 16% |
| 6. Contracts and incentives. | 31 | 51% |

Table 15: Factors that prevent projects from being implemented successfully




Graph 5: Factors that prevent projects from being implemented successfully

## CONCLUSION

The majority of the respondents indicated that more than one factor prevent projects from being implemented successfully. Most respondents indicated that the individual project members' competence is probably the biggest factor that prevents projects from being implemented successfully.

### 4.5.5 WHAT INFLUENCE DO THE VARIOUS CRITICAL FACTORS HAVE ON PROJECT SUCCESS?

## INTRODUCTION

The purpose of question 2.5 to 2.10 is to determine what influence these critical factors have on project success as perceived by the respondents. These questions are rated from no positive influence to clear indication of a positive influence.

| What influence does more effective execution of the early phase (FEL) of a project have on project success? | Frequency | Percent |
|---|---|---|
| 1. No positive influence. | 0 | 0% |
| 2. Vague indications of a positive influence. | 2 | 3% |
| 3. Clear indication of a positive influence. | 59 | 97% |

Table 16: The influence of effective FEL on project success

| What influence does the competence of the project team have on project success? | Frequency | Percent |
|---|---|---|
| 1. No positive influence. | 0 | 0 |
| 2. Vague indications of a positive influence. | 1 | 2% |
| 3. Clear indication of a positive influence. | 60 | 98% |

Table 17: The influence of the competence of the project team on project success

| What influence does project controls (cost engineering) have on project success? | Frequency | Percent |
|---|---|---|
| 1. No positive influence. | 7 | 12% |
| 2. Vague indications of a positive influence. | 20 | 33% |
| 3. Clear indication of a positive influence. | 34 | 55% |

Table 18: The influence of project controls on project success

| What influence does well-developed basic data have on project success? | Frequency | Percent |
|---|---|---|
| 1. No positive influence. | 0 | 0% |
| 2. Vague indications of a positive influence. | 0 | 0% |
| 3. Clear indication of a positive influence. | 61 | 100% |

Table 19: The influence of well developed basic data on project success

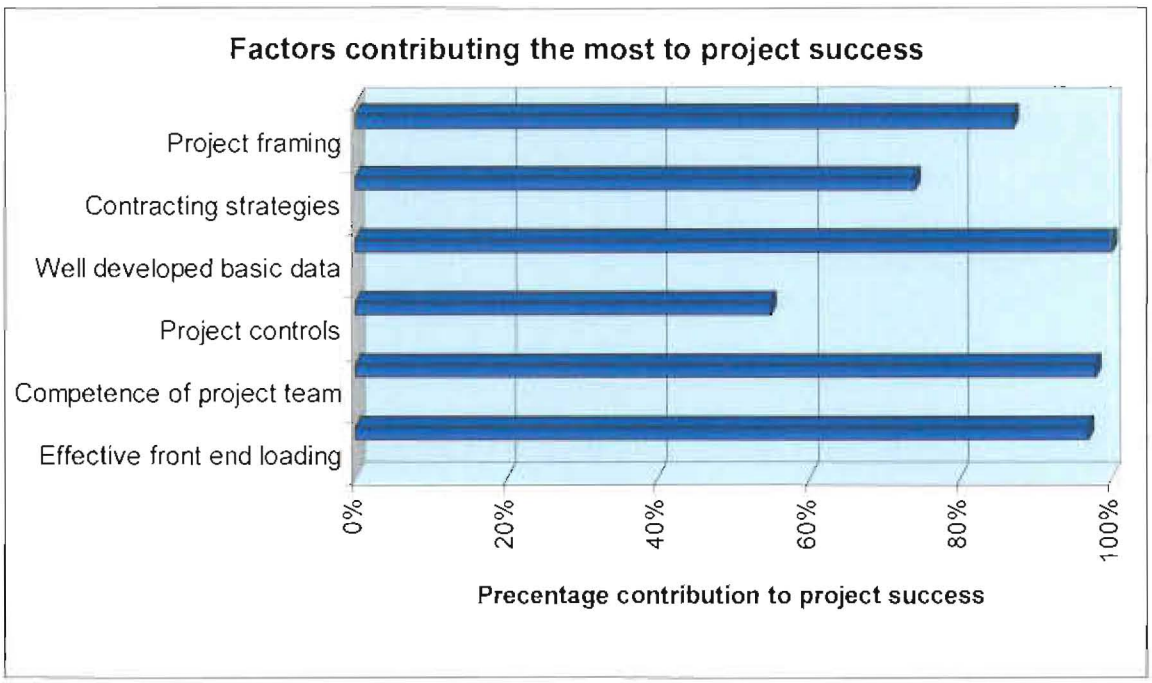
| What influence do contracting strategies have on project success? | Frequency | Percent |
|---|---|---|
| 1. No positive influence. | 0 | 0% |
| 2. Vague indications of a positive influence. | 16 | 26% |
| 3. Clear indication of a positive influence. | 45 | 74% |

Table 20: The influence of the contracting strategy on project success

| What influence does project framing have on project success? | Frequency | Percent |
|---|---|---|
| 1. No positive influence. | 0 | 0% |
| 2. Vague indications of a positive influence. | 8 | 13% |
| 3. Clear indication of a positive influence. | 53 | 87% |

Table 21: The influence of project framing on project success

All the results from table 16 to table 21 can be summarised in graph 6 below.




Graph 6: Factors contributing the most to project success

## CONCLUSION

Table 16 shows that 97% of the respondents indicated that more effective execution of the early phase, Front End Loading (FEL), will definitely have a positive influence towards project success which is consistent with the study. Table 19 also confirmed the importance of well-developed basic data which forms part of FEL as all of the respondents, 100%, indicated that well-developed basic data definitely has a positive influence on project success. The study also indicated that high calibre project teams are another of the critical success factors after FEL and 98% of the respondents indicated that project team competence influence project success, as illustrated in table 17.

Tables 20 and 21 indicate that contracting strategy and project framing also have a clear indication of a positive influence on project success. 74% feels that contracting strategy and 87% felt that project framing greatly contributes towards project success.

Table 18 shows that 56% of the respondents indicated that project control have a clear indication on project success. Although the percentage is less than all the other factors, more than half indicated that they agree but some notes were made on the questionnaire indicating that most companies do project control administration (reporting after problems have occurred) and do not use the correct pro-active approach of project control, as it is intended to be. The various organisations need to give attention to project controls.

### 4.5.6 WHO CAN CONTRIBUTE TOWARDS PROJECT SUCCESS?

## INTRODUCTION

The purpose of this question is to determine how anyone who is concerned with the success of the project is given the opportunity to contribute towards a successful project.

## RESULTS

| How are those concerned with the success of the project in a particular area given the opportunity and how do they keep awareness of development? | Frequency | Percent |
|---|---|---|
| 1. Everyone with a stake in the project or business is expected to take part in identifying, evaluating and dealing with the factors that will increase project success. | 31 | 51% |
| 2. We expect that anyone who identifies or who is able to contribute to the factors for project success to take initiative and make this known. | 12 | 20% |
| 3. Most communication on the success of projects are informal. | 3 | 5% |
| 4. It is not uncommon to find that people who should have been involved in the process are excluded or overlooked. | 15 | 24% |

Table 22: Who can contribute towards project success?

## CONCLUSION

Table 22 shows that 51% indicated that everyone with a stake in the project or business is expected to take part in identifying, evaluating and dealing with the factors that will increase project success. Ideally you would want this percentage to be higher which will then also indicate that proper alignment and overall commitment towards a common goal are achieved.

# 4.6 RESULTS OF SECTION 3: PROJECT SUCCESS INFORMATION

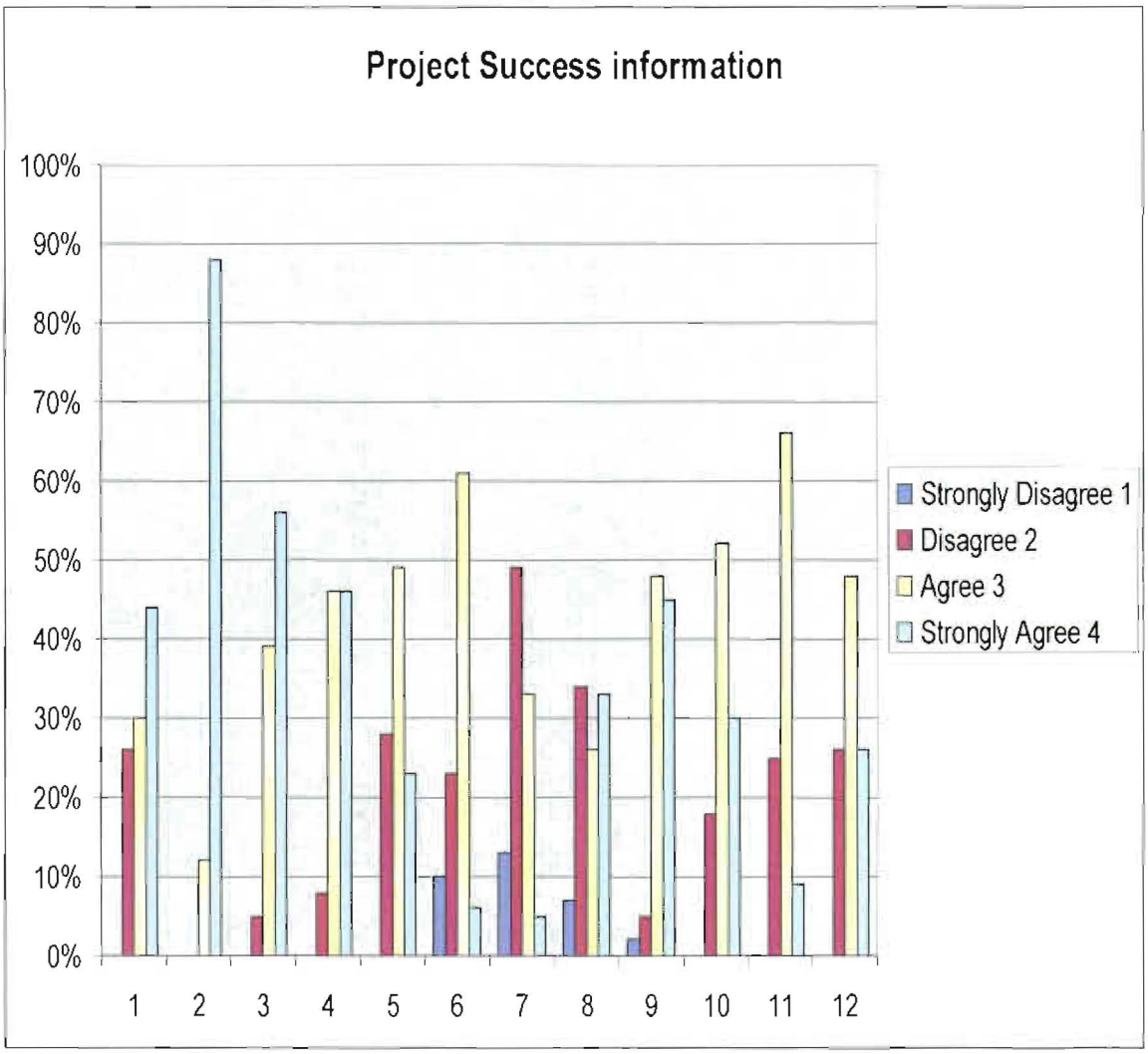
### 4.6.1 PROJECT SUCCESS INFORMATION

## INTRODUCTION

Section 3 of the questionnaire was developed to ascertain whether the respondents agree or disagree with the factors contributing to project success and to determine if their project team or organisation is doing enough with regards to project success.

| | Strongly Disagree 1 | Disagree 2 | Agree 3 | Strongly Agree 4 |
|---|---|---|---|---|
| 1. The project team discuss the factors that influence projects success in project meetings | 0% | 26% | 30% | 44% |
| 2. More effective execution of the early phase (FEL) or basic engineering of a project increases project success | 0% | 0% | 12% | 88% |
| 3. The individual project team member's competence influence project success. | 0% | 5% | 39% | 56% |
| 4. The "soft skill"/human side of the project manager or the ability to influence people to want to be part of the success of the project, increases project success. | 0% | 8% | 46% | 46% |
| 5. The project team formally reports on the factors leading to projects' success to the client/business. | 0% | 28% | 49% | 23% |
| 6. Your company provides training with regards to project success factors. | 10% | 23% | 61% | 6% |
| 7. All the team members are equally committed to the outcome of a project. | 13% | 49% | 33% | 5% |
| 8. The outcome of a project, good or bad, is reflected in your performance rating. | 7% | 34% | 26% | 33% |
| 9. Your company has the required skill to implement successful projects. | 2% | 5% | 48% | 45% |
| 10. Your company have the required systems and experienced project personnel to implement successful projects. | 0% | 18% | 52% | 30% |
| 11. Your project teams consist of the required skills and experience to implement successful projects. | 0% | 25% | 66% | 9% |
| 12. Projects having a greater degree of resource flexibility have higher levels of project execution success. | 0% | 26% | 48% | 26% |

Table 23: Project success information




Graph 7: Project success information

## CONCLUSION

From table 23 and graph 7 the following can be concluded:

1. 74% of the respondents either agree or strongly agree that the factors that influence project success are discussed in project meetings.

2. All the respondents indicated, as proven in the results of section 2, that effective FEL increases project success.

3. The majority (95%) indicated that the project team's competence influence project success as indicated in the literature study.

4. 92% of the respondents indicated that the "soft skill" / human side of the project manager, which is the ability to motivate people to do something, will greatly contribute to project success.

5. Although 72%, which is the majority, agree or strongly agree that the project team formally reports on the factors leading to project success to the client / business, the 28% not formally reporting this to the client, is a concern. All project teams should report this formally to the client as these success factors would have been laid down at the beginning of the project and the project team should be measured against that.

6. The response to question 6 is that 33% of the respondents' companies do not provide training on project success which is a great concern.

7. 62% of the people completing the questionnaire indicated that not all team members are equally committed to the outcome of the project. This is a red flag and must be a focus point to make sure proper alignment and commitment from all the team members are the same to at least some degree.

8. The result / outcome of a project, good or bad, successful or unsuccessful is only captured in just over 50% of the respondents' individual performance rating.

9. The response to question 9 indicates that 93% of the organisations have the required skills to implement successful projects. Some notes on the questionnaires indicated though that this skilled set very seldom works on the same project due to shortage in skills.

10. The majority of the respondents (82%) felt that their organisations have the required systems and experienced project personnel to execute successful projects.

11. 75% of the people completing the questionnaire believe that their project teams have the required skill and experience to implement successful projects but that not everyone on the project team is equally committed to do this, as indicated in the response to question 7.

12. The majority of respondents indicated that the higher the degree of resource flexibility, the higher is the level of project success to be achieved.

### 4.6.2 PROJECT SUCCESS RATE

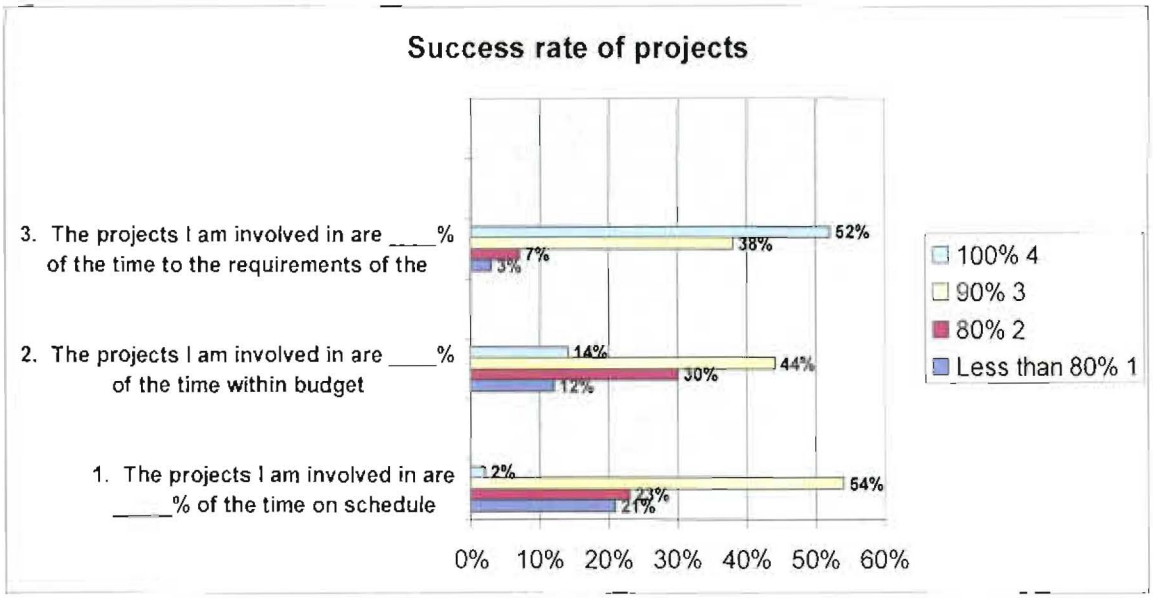
## INTRODUCTION

This section of the questionnaire was developed to determine how project managers rate their projects based on schedule, budget and the requirements of the client.

## RESULTS

| | Less than 80% 1 | 80% 2 | 90% 3 | 100% 4 |
|---|---|---|---|---|
| 1 The projects I am involved in are _____% of the time on schedule. | 21% | 23% | 54% | 2% |
| 2. The projects I am involved in are ____% of the time within budget. | 12% | 30% | 44% | 14% |
| 3. The projects I am involved in are ____% of the time to the requirements of the business/ client. | 3% | 7% | 38% | 52% |

Table 24: Success rate of projects




Graph 8: Success rate of projects

## CONCLUSION

Graph 8 shows that only about half of the projects executed by the respondents are more than 80% on schedule and within budget. The majority (90%), however, indicated that their projects are implemented according to the requirements of the business / client.

## 4.7 RECOMMENDATIONS

- Some of the results of section 4.5.3 indicated that the emphasis on safety as a success was rated very low and need to be part of the overall objective of the projects to stay focused on safety which is a world-wide concern.

- Project team competence needs to be addressed as 97% of the respondents indicated that individual project members prevent projects from being executed successfully. It may be better to implement hands-on training / one-to-one coaching for at least 6 months.

- Project control was indicated as not a critical factor for project success. Independent Project Analysis indicated that project control is a success factor. This indicates that projects are not efficiently controlled and project control people should have some technical background in order to achieve a pro-active approach which is currently not done.

- Not every team member feels that he / she is contributing to the success of the project. To overcome this, each team member should be made aware of his / her impact on the eventual success of the project in order to foster equal commitment to project success.

- Training on project success should be provided, as only 33% of the responses received back indicated that their organisations provide training on project success.

## 4.8 CHAPTER CONCLUSION

The empirical study is discussed in this chapter: from the data collection process, questionnaire layout and design, the approach followed for collecting the data through to the responses processed and the discussion of the results obtained, with conclusions and recommendations.

The following chapter entails conclusions and recommendations as based on the literature study from chapters two and three, as well as the empirical study conducted in chapter four. Opportunities for future studies will be identified and also evaluated as to whether the primary and secondary objectives were met.

# CHAPTER 5 STUDY OVERVIEW AND FINAL CONCLUSIONS

## 5.1 INTRODUCTION

In this final chapter recommendations and conclusions are made based on the literature study from chapters two and three, as well as the empirical study conducted in chapter four. The questionnaire results were utilised to compare the relation of the critical factors for project success in theory and in practice. Conclusions were drawn on the literature study and the empirical study (theory and practice).

From this, recommendations were made on how to increase the success of projects. The realisation of the primary and secondary objectives of this study was evaluated and finally recommendations were made for future research.

## 5.2 STUDY OVERVIEW

The study consists of five chapters. Chapter one discusses the nature and scope of the study. The literature or theory of the study is addressed in chapters two and three. Chapter four discusses the questionnaire's results and draws conclusions on the findings of the empirical study or research. Chapter five provides an overview of the study and final conclusions

## 5.3 EVALUATION OF THE STUDY

The measurement / evaluation of the success of this study is based on the achievement of the primary and secondary objectives as set out in Section 5.3 of this report.

The primary objective of this study is to identify the critical factors that will lead to more project success by means of a theoretical and empirical investigation.

This primary objective was achieved by realising the secondary objectives which are listed below for evaluation purposes.

- What makes projects successful?
- Establish a clear understanding of the critical factors for project success.
- Identify and research these factors with recommendations to increase the success rate of projects.

The first objective was achieved through a detailed literature study as presented in chapter two and three.

The second secondary objective, namely to establish a clear understanding of the critical factors for project success was also achieved. This achievement was made possible by the literature study as conducted in chapters two and three of this study. References are made numerous times in chapter two and three pertaining to the critical factors for project success.

The final secondary objective was to identify and research these factors with recommendations to increase the success rate of projects. This identification was achieved in the literature study – chapter three. Researching these factors leading to more successful projects was achieved by the empirical study conducted in chapter four of this study. Recommendations to increase project success are listed in chapter four.

It can thus be concluded that all the objectives for this study which were set out in chapter one were achieved.

## 5.4 FINAL RECOMMENDATIONS

The main critical factors for project success as listed in the literature study are:

- Excellent Front End Loading (FEL)
- High calibre project teams
- Human factor of project management

There are many other factors contributing to project success, but it is the opinion of the author that most of them are covered by one of the above factors or form part of one of them in one or another way.

It can be noted that the critical factors for project success is nothing new, thus the following recommendations are made based on the literature and empirical study:

- Companies having at their disposal the factors listed above and which do not have a high project success rate, should really go back to the basics of these factors and focus on the basics rather than systems and processes that are just satisfied by making a tick next to one of the hundreds of deliverables set out to be achieved.

- Appoint resource and develop high calibre project team members on a constant basis. Project team members' salaries normally constitute less than 15% of the project cost. Companies should thus rather focus on the 85% of the project cost which has a much more severe impact on the company's bottom line than to focus on small increases causing team members to change companies for better remunerations.

- To keep the high calibre project team members dedicated and motivated to the project from the beginning to the end, organisations should implement project completion bonuses which are worthwhile for the team member to implement a successful project and to have resource continuity. Most organisations today do not have project completion bonuses, so whether the project is a success or not does not really matter to the team member as indicated in the empirical study.

- Organisations using projects to grow and improve should make use of companies like Independent Project Analysis (IPA) to rate them in relation to similar organisations across the globe and implement the recommendations coming forth from the analysis.

## 5.5 FUTURE STUDY OPPORTUNITIES

Since the critical factors for project success listed, researched and tested in practice in this study are deliverables executed by people, it seems that if you have the right people with the relevant experience, you will improve project success. Skill shortage is a major concern across the world today. The opportunity thus exists to research your organisation's skill level and skill shortage to have a proactive approach and to have the required people at the required level of skill and experience when needed.

## 5.6 OVERALL CONCLUSION

Chapter one gave the nature and scope of the study, where the problem was identified and defined, followed by the objectives of this study and the research methodology which were used. Chapters two and three covered the theoretical work and chapter four tested the study in the form of an empirical study. Chapter five provides a study overview and final conclusions.

From the study's five chapters one can conclude that each project has factors influencing the outcome of the project. This study focused on three main factors which will increase project success which was theoretically researched and tested in practice. These factors are listed in chapter three, section 3.2 of this study.

Project success can be achieved by focusing on the critical factors listed in this study if the project has high calibre project teams starting the project with very effective FEL and keeping project team members continuity, based on the fact that the project is managed by a project manager who understands people and who has the soft skills to lead and influence the project team rather than to manage the team.

# APPENDIX 1

## RESEARCH QUESTIONAIRE

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10 May 2008

**SUBJECT: RESEARCH WORK – CRITICAL FACTORS FOR PROJECT SUCCESS IN AN ENGINEERING ENVIRONMENT**

I, Francois Vorster, am currently enrolled at the NWU (North West University, Potchefstroom) as an MBA student. For this course, a thesis needs to be submitted and research work will be undertaken.

The topic under discussion is the critical factors for project success and project management organisations were chosen for research purposes due to the nature of this thesis.

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

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

Please return the questionnaire within five days. If you require any further information please contact me on one of the provided telephone numbers or an e-mail: francois.vorster@sasol.com.

Thank you for your participation in this research.

Yours sincerely

F Vorster

## Questionnaire

## SECTION 1: BACKGROUND INFORMATION

| **1.1 Type of organisation** *(choose the most appropriate)* | |
|---|---|
| ☐ | Commercial private sector business |
| ☐ | Public sector organisation operating commercial practices |
| ☐ | Traditional public sector |
| ☐ | Charity or Non-Profit |
| ☐ | Other<br>*Please specify* |

| **1.2 Sector(s)** *(choose the most appropriate)* | |
|---|---|
| ☐ | Government |
| ☐ | Services |
| ☐ | Manufacturing |
| ☐ | Mining and resources |
| ☐ | Utilities |
| ☐ | Communication |
| ☐ | Other<br>Please specify |

| 1.3 **Number of employees employed by your organisation** *(choose the most appropriate)* | |
|---|---|
| ☐ | <10 |
| ☐ | 10-100 |
| ☐ | 101-1000 |
| ☐ | >1000 |

| 1.4 **What is the average monetary value of projects undertaken by you?** *(choose the most appropriate)* | |
|---|---|
| ☐ | Less than R1 million |
| ☐ | R1 million – R10 million |
| ☐ | R10 million - R100 million |
| ☐ | R100 million - R1 000 million |
| ☐ | Over R1 billion |

| 1.5 **How many years of experience do you have in Project Management?** *(choose the most appropriate)* | |
|---|---|
| ☐ | Less than 5 years |
| ☐ | 5-10 years |
| ☐ | 11-15 years |
| ☐ | 16-20 years |
| ☐ | 20 years and more |

## Questionnaire

## SECTION 2: CRITICAL FACTORS FOR PROJECT SUCCESS

| **2.1 When implementing a project do you** *(choose the most appropriate)* | |
|---|---|
| ☐ | have a clear understanding of the factors that will lead to project success and focus on these factors? |
| ☐ | drive the project's cost and schedule to deliver the project successfully? |
| ☐ | have your own set of rules that has worked for you over the years to deliver projects successfully? |
| ☐ | tackle the project heads on and make the changes as you go along to have a successful project? |

| **2.2 How do you define project success?** *(chose the most appropriate)* | |
|---|---|
| ☐ | Project is delivered on time, within the budget and to the desired quality. |
| ☐ | The overall objectives of the project have been met. |
| ☐ | The project was delivered according to the client's satisfaction. |

| **2.3 What measures do you use to describe project success?** *(tick any that apply)* | |
|---|---|
| ☐ | Financial Measures |
| ☐ | Timing or schedule measures |
| ☐ | Performance or throughput measures |
| ☐ | Quality measures |
| ☐ | Safety criteria |
| ☐ | Achieving objectives measures |

| **2.4 What factors prevent projects from being implemented successfully?** *(tick any that apply)* | |
|---|---|
| ☐ | Individual project members competence |
| ☐ | Management commitment |
| ☐ | The industrial culture |
| ☐ | Execution processes |
| ☐ | Public frame conditions |
| ☐ | Contracts and incentives |

| **2.5 What influence does more effective execution of the early phase (FEL) of a project have on project success?** *(choose the most appropriate)* | |
|---|---|
| ☐ | No positive influence |
| ☐ | Vague indications of a positive influence |
| ☐ | Clear indication of a positive influence |

| **2.6 What influence does the competence of the project team have on project success?** *(choose the most appropriate)* | |
|---|---|
| ☐ | No positive influence |
| ☐ | Vague indications of a positive influence |
| ☐ | Clear indication of a positive influence |

| **2.7 What influence does project controls (cost engineering) have on project success?** *(choose the most appropriate)* | |
|---|---|
| ☐ | No positive influence |
| ☐ | Vague indications of a positive influence |
| ☐ | Clear indication of a positive influence |

| **2.8 What influence does well-developed basic data have on project success?** *(choose the most appropriate)* | |
|---|---|
| ☐ | No positive influence |
| ☐ | Vague indications of a positive influence |
| ☐ | Clear indication of a positive influence |

| **2.9 What influence does contracting strategies have on project success?** *(choose the most appropriate)* | |
|---|---|
| ☐ | No positive influence |
| ☐ | Vague indications of a positive influence |
| ☐ | Clear indication of a positive influence |

| **2.10 What influence does project framing have on project success?** *(choose the most appropriate)* | |
|---|---|
| ☐ | No positive influence |
| ☐ | Vague indications of a positive influence |
| ☐ | Clear indication of a positive influence |

| **2.11 How are those concerned with the success of the project in a particular area given the opportunity to contribute and keep awareness of development?** *(choose the most appropriate)* | |
|---|---|
| ☐ | Everyone with a stake in the project or business is expected to take part in identifying, evaluating and dealing with the factors that will increase project success |
| ☐ | We expect that anyone who identifies or who is able to contribute to the factors for project success to show initiative and make this known |
| ☐ | Most communication on the success of projects is informal |
| ☐ | It is not uncommon to find that people who should have been involved in the process are excluded or overlooked |

## Questionnaire

## SECTION 3: PROJECT SUCCESS INFORMATION

Please answer the following questions on the given scale.

| | | Strongly Disagree 1 | Disagree 2 | Agree 3 | Strongly Agree 4 |
|---|---|---|---|---|---|
| 3.1 | The project team discusses the factors that influence project success in project meetings | ☐ | ☐ | ☐ | ☐ |
| 3.2 | More effective execution of the early phase (FEL) or basic engineering of a project increases project success | ☐ | ☐ | ☐ | ☐ |
| 3.3 | The individual project team members' competence influences project success | ☐ | ☐ | ☐ | ☐ |
| 3.4 | The "soft skill"/human side of the project manager or the ability to influence people to want to be part of the success of the project, increases project success | ☐ | ☐ | ☐ | ☐ |
| 3.5 | The project team formally reports on the factors leading to project's success to the client/business | ☐ | ☐ | ☐ | ☐ |
| 3.6 | Your company provides training with regards to project success factors | ☐ | ☐ | ☐ | ☐ |
| 3.7 | All the team members are equally committed to the outcome of a project | ☐ | ☐ | ☐ | ☐ |
| 3.8 | The outcome of a project, good or bad, is reflected in your performance rating | ☐ | ☐ | ☐ | ☐ |
| 3.9 | Your company has the required skill to implement successful projects | ☐ | ☐ | ☐ | ☐ |
| 3.10 | Your company has the required systems and experienced project personnel to implement successful projects | ☐ | ☐ | ☐ | ☐ |
| 3.11 | Your project teams have at their disposal the required skills and experience to implement successful projects. | ☐ | ☐ | ☐ | ☐ |
| 3.12 | Projects having a greater degree of resource flexibility have higher levels of project execution success | ☐ | ☐ | ☐ | ☐ |

**What is the success rate of your projects?**

Please answer the following questions on the given scale.

| | | Less than 80% 1 | 80% 2 | 90% 3 | 100% 4 |
|---|---|---|---|---|---|
| 3.13 | The projects I am involved in are ____% of the time on schedule | ☐ | ☐ | ☐ | ☐ |
| 3.14 | The projects I am involved in are ____% of the time within budget | ☐ | ☐ | ☐ | ☐ |
| 3.15 | The projects I am involved in conform ____% of the time to the requirements of the business/client | ☐ | ☐ | ☐ | ☐ |

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