

**PROJECT MANAGEMENT IN THE BUILT ENVIRONMENT: THE NEED FOR  
INDUSTRY SPECIFIC KNOWLEDGE**

By

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## **Declaration**

I, Michelle Burger declare that:

The thesis hereby submitted by me for the degree Philosophiae Doctor (PhD) at the University of the Free State is my own work and has not previously been submitted at another academic institution. I further more cede copyright of the thesis in favour of the University of the Free State.

Signed: ..... Date: .....  
Michelle Burger



## **SUMMARY**

### **PROJECT MANAGEMENT IN THE BUILT ENVIRONMENT: THE NEED FOR INDUSTRY SPECIFIC KNOWLEDGE**

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The use of project management has expanded and is used in many industries. The generic component of project management across all industries without the necessary technical knowledge has been debated. This study investigates the knowledge base of construction project management and the need for industry specific knowledge.

The study includes a literature and also empirical research section. The empirical study made use of interviews, a case study and questionnaires. A construction project management knowledge model was developed based on the research and research findings. The research findings suggest that a project manager in the built environment requires various types of knowledge – project management knowledge, industry specific

knowledge and knowledge gained through experience. The project management knowledge includes the 13 areas from the construction extension to the PMBOK guide, the industry specific knowledge is divided into four main areas that are knowledge of construction science, knowledge of construction processes, knowledge of design processes and knowledge of financial cost factors and the knowledge through experience is gained through time spent working in the industry.

The construction project management knowledge model aims to contribute to improving the project management environment, aiding in awareness of the various knowledge areas and subareas that are important and the NQF level that is suggested. This could contribute to sufficient education by creating awareness of the level of education a project manager in the built environment requires. Organisations could use the model as reference to determine which areas their project managers could improve on in order to develop and increase project management maturity in the organisation. The project management construction model also offers tertiary institutions a framework for syllabus planning of constructions project management courses. Further research is welcomed and may include improving the model, or using the model as foundation to develop a measuring instrument to determine the knowledge of a construction project manager.

## **OPSOMMING**

### **PROJEKBESTUUR IN DIE BOU-OMGEWING: DIE BEHOEFTE VIR INDUSTRIE- SPESIFIEKE KENNIS**

deur

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Vir die graad Philosophiae Doctor (PhD)

Projekbestuur het ontwikkel en word in baie industrieë toegepas. Die generiese aard van projekbestuur, om tussen industrieë gebruik te word sonder tegniese kennis van die industrie, is al baie bespreek. Hierdie studie ondersoek die kennisbasis van konstruksieprojekbestuur en die behoefte aan industrie-spesifieke kennis.

Die studie bestaan uit literêre en empiriese navorsing. In die empiriese studie is van onderhoude, 'n gevallestudie en vraelyste gebruik gemaak. 'n Konstruksieprojekbestuur kennismodel is na aanleiding van die navorsing en navorsingsbevindinge ontwikkel. Die navorsingsbevindinge het aangedui dat 'n projekbestuurder in die bou-omgewing die volgende tipes kennis benodig – projekbestuurkennis, industrie-spesifieke kennis en

kennis wat deur ondervinding opgedoen word. Die projekbestuurkennis sluit die 13 areas van die konstruksie-aanhangsel van die PMBOK gids in. Die industrie-spesifieke kennis is in vier dele verdeel – kennis oor konstruksiewetenskap, kennis oor konstruksieprosesse, kennis oor ontwerpprosesse en kennis oor finansiële kostefaktore. Kennis deur ondervinding word verkry deur in die industrie te werk.

Die doel van die konstruksieprojekbestuur kennismodel is om 'n bydrae te lewer tot die bevordering van die projekbestuuromgewing, deur bewustheid rakende die verskeie kennisareas en sub-areas te kweek asook van die aanbevole NKR-vlak. Deur die vlak van kennis waaroor 'n konstruksieprojekbestuurder moet beskik aan te toon kan bydra tot effektiewe onderrig. Organisasies kan die model aanwend om te bepaal watter areas van projekbestuur verbeter kan word om sodoende die projekbestuur in die organisasie te verber as ook die projekbestuur volwassenheidsvlak. Die model bied ook 'n raamwerk aan wat deur tersiêre instellings gebruik kan word in terme van leerplanbeplanning van kursusse in konstruksieprojekbestuur. Verdere navorsing word verwelkom. Dit mag die model insluit of die model as grondslag gebruik om 'n meetinstrument te ontwikkel waarmee die kennis van 'n konstruksieprojekbestuurder bepaal kan word.

## ACKNOWLEDGEMENTS

Numerous institutions and persons were involved directly or indirectly in this study. If I exclude persons who contributed to my studies from my list of acknowledgements, this was not my intention. I dedicate this thesis to:

My parents

Poen Burger, as mentor and specialist in the built environment, for your intellectual and progressive outlook, debates, discussions and support; Renee Burger, for your undying faith in your children, fantastic educational platform laid, for love and support;

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My fantastic husband and best friend Charl Peter Johnson, for your camaraderie, sacrifice and support. And for living through years of PhD study with me...;

To the highest power of all

## **The Man Who Thinks He Can**

If you think you are beaten, you are;  
If you think you dare not, you don't.  
If you'd like to win, but think you can't  
It's almost a cinch you won't  
If you think you'll lose, you're lost,  
For out in the world we find  
Success begins with a fellow's will;  
It's all in the state of mind.  
If you think you're outclassed, you are.  
You've got to think high to rise.  
You've got to be sure of yourself before  
You can ever win a prize.  
Life's battles don't always go  
To the stronger or faster man;  
But sooner or later the man who wins  
Is the one who thinks he can.

Walter D. Wintle

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## **KEY WORDS DESCRIBING THE TITLE**

Built environment  
Project management  
Knowledge  
Industry related

## **CHAPTER 1**

### **INTRODUCTION AND BACKGROUND TO THE STUDY**

#### **1.1 INTRODUCTION**

Throughout history many famous projects were completed, such as the Egyptian pyramids and the Great Wall of China (Burke, 2001:11; Shenhar, 2008: 2). Project management as a discipline had undergone major changes during World War One and in the course of time evolved into modern day project management. It was supported by the aerospace, defence and construction industries (Kerzner, 2006: 35-40). In due course, project management matured and became a professional discipline with its own body of knowledge regulated by the Project Management Institute.

The use of project management has expanded and is used in many industries. It is controlled by project managers where a project based approach is followed (Dinsmore, Kloppenborg & Opfer, cited in Morrison, Brown & Smit: 2006:39; Cooke-Davies, 2003: 471-478; Shenhar, 2008: 2). The organisational benefits resulting from incorporating a project-based approach, is widely accepted (Trebilcock, 2007: 40).

Many project managers working in an industry were promoted to a managerial position due to their initial technical expertise, thus receiving the title of project manager (Burke, 2001: 4). These project managers have industry-specific knowledge. The level of competency is a debate that is currently taking place in the construction and built environment industry and within the profession, and forms part of this research study.

There are many routes that may lead to a qualification in project management. This includes certificates, diplomas or academic degrees in project management. In South Africa there are numerous programmes in project management. Some offer a generic project management syllabus, while others offer industry specific programmes. A few examples of some of the courses or programmes are the Higher Certificate in Project Management presented by Damelin Education Group, the Intensive Project Management Programme (IPMP) presented by the University of the Free State (Construction Economics Association, 2011: Online), MSc-degree in Project Management presented by the University of Cape Town (Construction Economics Management, 2011: Online), Programme in Project Management (PPM) by the University of Pretoria (Continuing Education University of Pretoria, 2011: Online), MSc Construction Project Management by the University of Westminster (School of Architecture and the Built Environment, 2011: Online) and the MSc (Built Env: Project Management) by the Nelson Mandela Metropolitan University (Nelson Mandela Metropolitan University, 2011: Online). Some of the qualifications offer a course syllabus on generic project management for example the Damelin Higher Certificate and the University of Pretoria PPM, while other qualifications are industry specific, such as the MSc Built Environment Project Management offered by the Nelson Mandela Metropolitan University and the IPMP offered by the University of the Free State.

Some believe that project management is transportable across all industries without the necessary technical knowledge. The importance or non-importance of industry specific knowledge in project management is discussed and debated (Cadle & Yeates, 2001: 358; Webb, 1994, 55; Wirth, 1996:10).

Various textbooks on project management distinguish between generic project management and industry specific project management. A number of construction project management textbooks are available. The Project Management Institute published the Project Management Body of Knowledge

(PMBOK) guide that focuses specifically on the construction industry, which is known as the Construction Extension to the PMBOK guide.

The South African Council for the Project and Construction Management Professions (SACPCMP) lists tasks that a project manager in construction should be able to fulfil. Tasks – such as monitoring and reviewing construction progress and programme updates – demand certain knowledge of the construction industry. Due to the probable importance of industry specific knowledge, construction project management forms part of this study.

## **1.2 TITLE**

Project management in the built environment: the need for industry specific knowledge.

## **1.3 PROBLEM STATEMENT**

Organisations have managers that manage in order to get the work done. General management includes management skills such as leadership, communication, organizing and staffing. Internationally organisations started using a project driven approach, hence the increase in project management in the organisation (Burke, 2006: 1-6) . After the development and standardisation of the project management profession, a school of thought developed that believed project management to be generic and that a project manager will be able to manage a project in any industry. This school dismisses the importance of industry-specific technical knowledge as prerequisite for a project manager. According to another view the project manager requires a certain degree of industry specific knowledge to increase project effectiveness as an indication of successful project management (Cadle and Yeates, 2001: 358; Webb, 1994: 55). The study aims to establish the importance and need for industry-specific

knowledge in construction project management by analysing the knowledge and skills required by a project manager.

#### **1.4 MAIN PROBLEM**

Traditionally, many project managers had technical knowledge at their disposal due to the fact that they were promoted from a technical position to a managing position (Burke, 2001:1-6). A certain school of thought regards project management as generic and believes that no industry specific knowledge is required.

The study aims to determine the need for industry specific knowledge, especially in the built environment. The type of knowledge and levels of knowledge needs to be determined. The question therefore is whether industry specific knowledge is a requirement for successful project management in construction.

#### **1.5 SUB-PROBLEMS**

The sub-problem relates to the effectiveness of a project. Does a project manager with industry specific knowledge increase the probability of the success of a project?

#### **1.6 PURPOSE OF THE STUDY**

The purpose of the study is to gain insight into the knowledge required by a project manager and by doing so, to add to the effectiveness of project management in the built environment. The aim of the research is further to add to the knowledge base of project management in general and project management in the built environment specifically.

## **1.7 HYPOTHESIS**

### **1.7.1 PRIMARY HYPOTHESIS**

The primary hypothesis states that construction project management requires industry specific knowledge, specifically when managing projects in the built environment industries.

### **1.7.2 SECONDARY HYPOTHESIS**

The study aims:

- To establish the importance of knowledge for a project manager working on built environment projects.
- To establish and propose NQF levels for the required knowledge
- To develop a construction project management model.
- To increase the effectiveness of the project and probability of project success.

## **1.8 LIMITATIONS**

The study mainly focuses on the built environment, project management and specifically the construction project manager. It is limited to project management in the construction industry. The theoretical literature is an overview on project management, the South African built environment and project management within the built environment.

The empirical section focusses on South Africa. The case study is a South African project; the interviews are with persons working in the built environment within South Africa and the questionnaires completed by respondents working on projects in South Africa.

## 1.9 ASSUMPTIONS

It is assumed that there are two schools of thought: those who regard project management as a generic discipline and on the other side of the scale, those who believe that industry specific knowledge is a necessity in project management.

## 1.10 DEFINITIONS

- **Project Management** is the application of knowledge, skills, tools and techniques to project activities in order to meet stakeholders' needs and expectations from a project (PMBOK, 2004:5).
- **Project** is a temporary endeavour undertaken to create a unique product or service. Temporary means that every project has a definite end. Unique means that the product or service is different in some distinguishing way from all similar products or services.
- **Built environment** includes disciplines involved in the science of designing and constructing physical structures such as buildings, bridges and roads.
- **Generic** is a characteristic relating to a class or group, thus not specific.
- **Industry specific knowledge** refers to the range of information about the industry people work in, and the understanding of that subject.



### **1.11 LITERATURE STUDY**

The sources used in the literature study include journal articles, magazine articles, books, seminar/symposium, internet, project Management standardizing models such as the PMBOK and PMI maturity models and previous research. These sources support the literature study and highlights and discusses main themes supporting the research. These themes are an overview of project management, organisational factors and project management, the built environment and project management in the built environment.

### **1.12 METHODOLOGY**

This literature study is supported by empirical research. The research was conducted and completed within a specific period. The interviews were conducted in a two week period and the questionnaires sent out and returned within a two-month period. The target population was from the built environment. The research is a combination of a quantitative as well as a qualitative approach, the quantitative research being mainly deductive and the qualitative research being mainly inductive.

The data was gathered by distributing a hard copy questionnaire, conducting interviews with leaders who have substantial experience in the property environment and researching specific projects as case studies. These studies ensured that a wide range of areas, theory and opinions were covered and avoided that deductions are from a single set of data. The range ensured confirmation of theory.

The questionnaire was tested on a group of ten individuals that were regarded as qualified experts with adequate experience. They were asked to complete the questionnaire. After the pilot study had been conducted, the feedback was gathered, processed and changes to the questionnaire were made where

necessary. Thereafter, the questionnaire was distributed to 70 research participants of which 40 were received back. In order to study the effect of specific organisational factors on project management, a number of organisations were used in the sample.

### **1.13 CHAPTER LAYOUT**

The research design is presented in Chapter 1. Chapters 2 – 5 contain the literature study including both South African and international research findings as knowledge base. Chapter 2 reflects on project management and gives an overview thereof, chapter 3 covers organisational factors and project management, chapter 4 discusses the built environment and chapter 5 looks at project management in the built environment,

The theory serves as a sound basis for the empirical study. The empirical study focuses on the South African context and forms part of Chapters 6 – 8. Chapter 6 covers a discussion of the research design and methodology. The research findings of the empirical study are presented in Chapter 7, followed by suggestions and conclusions based on the findings and the literature study in Chapter 8.

## **CHAPTER 2**

### **PROJECT MANAGEMENT: OVERVIEW**

#### **2.1 INTRODUCTION**

Chapter 2 presents an overview of current project management theory in order to support the research of the title 'Project management in the built environment: the need for industry specific knowledge'. In this chapter project management in general is reviewed from the history of project management to defining project management specifically related to the importance of knowledge of project management. The project management process review is based on the Project Management Institute's Body of Knowledge framework. According to this process there are nine knowledge areas, five project management process groups, and forty four activities in total, as well as the construction extension to the Project Management Body of Knowledge (PMBOK) guide with the added four knowledge areas. This is explained in further detail in Chapter 5. Regulation and standardisation are also discussed. Attention is paid to the attributes, skills and competencies of an effective project manager. The benefits of effective project management are outlined.

#### **2.2 ROOTS OF PROJECT MANAGEMENT**

In order to understand project management as a discipline, some attention needs to be given to its roots. Throughout history many well-known projects still in existence today were completed, such as the Egyptian pyramids and Great Wall of China (Burke, 2001:11; Shenhar, 2008: 2). It is referred to as projects because it meets the definition of a project as presented by the Project Management Institute (PMI) that states that a project is a temporary endeavour undertaken to create a unique product, service, or result (PMBOK, 2004: 5). Project management has undergone important developments since the time of the

Egyptian pyramids and the Great Wall of China. Project management as a discipline started mainly recently. Aerospace and engineering brought along changes and development in project management. Project management combined elements from various other disciplines one area being general management. General management has knowledge areas such as staffing, planning, monitoring, controlling, communications, team building, co-ordinating and organising that were adopted within project management (Burke, 2001: 1-6; Wirth, 1996:7-11).

The project management knowledge base has developed and broadened over the years to what it is today. Modern day project management uses various tools and techniques. Important developments influencing the practice of project management took place during World War One. This was specifically the case in the USA and UK during the 1950s and 1960s (Wirth, 1996:7-11; Burke, 2001:13). Project management as a discipline mainly developed in the USA in the 1960's, in the UK in the 1980's and in South Africa during the 2000's. The skills were derived from such fields such as management, operations and research (Kerzner, 2006:2-5). It is a professional discipline that has developed and was standardised through the ages and is continuously standardised by project management institutions.

### **2.2.1 Gantt chart**

The bar chart, as an important project management tool, was developed by Henry Gantt during World War One to serve as a visual aid for planning and controlling projects. The implementation of this technique significantly reduced the time needed to build cargo ships during the war. Today the Gantt chart is still used as an effective method to manage projects, seeing what is happening at a glance and noting the sequence of the tasks to follow. Many managers use the bar chart method for planning and controlling projects. This forms part of the

general project management knowledge area (Burke, 2001:13-14; Burke, 2011: 52).

### **2.2.2 The development of project management**

During the 1950s and 1960s project management techniques were developed that ensured growth in the body of knowledge of the project management profession. The defence and aerospace industries in the USA developed techniques that are still used today, such as the programme evaluation and review technique (PERT), the earned value, configuration management, value engineering, and work breakdown structure (WBS). The construction industry contributed to project management by expanding the knowledge base through developing the critical path method (CPM), the precedence diagram method (PDM), and the network diagrams and network smoothing (Burke, 2001:13-14). Project management uses tools such as PERT and Gantt charts, calendars, complex schedules, financial data and various reporting systems. A variety of techniques and approaches to planning and executing a project is revealed in the literature on project management written by numerous authors such as Kerzner (2006) and Burke (2001). The use of these tools and techniques in project management has led to the de facto definition for project management as 'the use of a set of tools and techniques to manage a combination of time, money, people and work. Within some organisations they fail to realize that time, money and people will not automatically result in a successful project.' (Longman & Mullings, 2005: 5). The project management techniques are important as they assist in the planning process and also help with cost and budget establishment. They also enable tracking of time, cost and performance. The tools and techniques discussed above form an important part of the project management knowledge base. They also cross-influence and assist each other. For instance the critical path method can only take place after the work breakdown structure (WBS), not before. The WBS is a communication tool that communicates important detailed information to management (Kerzner, 2006: 414-420).

The tools and techniques produce charts and schedules. The objectives of charts and schedules are to coordinate activities to complete the project within the best time, at the least cost and with the least risk. It offers the opportunity to study alternatives, communicate, provide optimal scheduling, use resources effectively, refine the estimating criteria and provide easy revisions (Kerzner, 2006: 437).

According to Longman and Mullings (2005:10) good project managers use traditional project tools and techniques to reveal important project management data to use in order to effectively manage projects. Project managers understand that the tools and techniques are useless without clear thinking to ensure that data is relevant to the project and meaningful in that it can add to the project's effective completion and success.

Project management is a profession that is growing fast (Mulcahy, 2005: 22). Work in defence procurement and also the construction industry was traditionally regarded as projects. Currently, management-by-project is applied in a larger field and has spread to many industries (Burke, 2001: 2; Shenhar, 2008: 2). Project management is used as general practice in organisations today. In the IT industry, more organisations are turning to project management to create successful projects. Project management adds to the potential of gaining project success as it is a discipline that offers a methodology that enables effective project planning, management and control. This in turn helps to realise project completion within time, cost and to the expected quality (Chordas, 2008: 66-69; Kerzner, 2006: 2-10). Project management is increasingly recognised as an important component in every organisation's work (Rod & Levin, 2006: 1) and many organisations are using projects to meet organisational objectives (Trebilcock, 2007: 40). It is used in organisations to produce better products, speed up the operational process, upgrade information systems and change product technology (Morrison & Brown, 2004: 73-74). The project management techniques are used to ensure successful completion (Burke, 2001: 2).

## **2.3 PROJECT MANAGEMENT – AN OVERVIEW**

A review of the basics of project management is seen as important for this study. Project management is about managing projects successfully. A review of what is regarded as a project, project management and a project manager is therefore necessary.

### **2.3.1 Understanding a project**

Project management is a structured approach to managing projects (Burke, 2001: 1) from initiation through to completion (Burnet, 1998: 8). To gain a clearer understanding of project management, one must begin with a definition of a project (Kerzner, 2003: 2).

#### **2.3.1.1 Defining a project**

The Project Management Body of Knowledge (PMBOK) defines a project as follows: 'A project is a temporary endeavour undertaken to create a unique product, service, or result' (PMBOK, 2004: 5; Zwiłcael & Bar-Yuseph, 2004: 137).

The PMBOK defines a project as follows (PMBOK, 2004: 5):

'Temporary means that the project has a definite beginning and a definite end. A project creates unique deliverables, which are products, services, or results.

Projects may create:

- A product or artefact that is produced is quantifiable and can either be a component or an end item in itself.
- A capability to perform a service, such as business functions, supporting production or distribution
- A result, such as outcomes or documents. For example, a research project develops knowledge that can be used to determine whether or not a trend is present or a new process will benefit society.'

### **2.3.1.2 Project features**

There are many features that enable projects to be classified as projects. Projects have a start and a finish (Newell & Grashina, 2004: 1) and a life-cycle (Nicholas, 2001: 4) from beginning to end, with a number of distinct phases in between (Burke, 2001: 3). It has a budget with an associated cash-flow (Burke, 2001: 3). Projects have activities that are essentially unique and non-repetitive (Burke, 2001: 3). The use of resources, which may be from different departments and need coordination, takes place (Burke, 2001: 3). Projects allow one to utilise the most appropriate skills (Young, 2004: 9-11) and is a single point of responsibility (i.e. the project manager) (Burke, 2001: 3). There are team roles and relationships that are subject to change and need to be developed, defined and established (team building) (Burke, 2001: 3). A project must have a specific objective to be completed within certain specifications (Kerzner, 2003: 2) and can be readily defined (Young, 2004: 9-11). A project may vary in size, duration (Young, 2004: 9-11) and level of complexity (Dinsmore, 1993: 16).

For a project to be successfully completed, it needs to be effectively managed. Project management is linked to the successful outcome of the project and is therefore reviewed.

### **2.3.2 Project management**

Project management is defined by the Project Management Institute (PMI) guide in the Project Management Body of Knowledge (PMBOK, 2004: 8) as follows:

‘Project management is the application of knowledge, skills, tools and techniques to project activities to meet project requirements.’



The objectives of project management can be condensed to completion on time, within cost budget and to a technical or performance standard which satisfies the end user (Lock, 1987: 6).

### **2.3.2.1 Various projects and programmes**

Analytical contemplating emphasises the importance of the knowledge that is required and considers that the level of proficiency does perhaps vary depending on the project's complexity.

Projects differ in size and complexity and require different levels of proficiency. Cagle (2005: 111-116) and Kerzner (2006: 3) state that there are different skill sets.

In organisations that run various projects simultaneously, project and programme management is applied (Burke, 2006:4). The PMBOK (2008:16) defines programme management as 'the centralized, coordinated management of a group of projects to achieve the program's strategic objectives and benefits.'

There are various factors that characterise the different programmes and project types. These factors are tasks, customers, duration, risk level, complexity, contract type, number of people, disciplines, schedule tools, accounting base, accounting tools, organisation type, project manager's report line, materials and subcontracts, quality, effectiveness, facilities and equipment, team training, international or local project and applicable skill set (Cagle, 2005: 111-116; Woodward, & Humphreys, 1998: 335-341).

These factors are explained in Table 2.1 in order to better understand the subject matter and to gain answers regarding the proficiency required for a project.

Table 2.1 Factors influencing project type

Factors	Explanation
Tasks	Project tasks differ in complexity and value.
Customer	Type of customer that could be expected on a specific level.
Value	Monetary value ranges from low costs to hundreds of millions.
Duration	Longer or shorter durations .
Risk level	Generally, the higher the risk of a project, the higher the classification level.
Complexity	Complexity can be either technical or programmatic.
Contract type	Such as Firm Fixed Price (FFP), Cost Plus Fixed Fee (CPFF), Award Fee (AF) and provisions and incentive fee (IF).
Number of people	Number of people assigned to a project differs.
Disciplines	The specialty or crafts required to perform a task on a project.
Schedule tools	To maintain the project timeline throughout the project. Can vary from handwritten notes, to a software package.
Accounting base	The base that is used for the collection and account for costs.
Accounting tools	The accounting tools to account for expenditures and budget.
Organisation type	Mainly function in matrix or projectised organisation.
PM reports to	Line manager, director, project management office manager.
Materials and subcontractors	Identifying, procuring and verifying the materials required.
Quality	The source of the quality functions for a specific project level or type.
Effectiveness	Includes combinations of reliability, availability, maintainability, human engineering, configuration management, and safety.
Facilities and equipment	The responsibility to define and provide facilities and equipment.
Team training	Different levels of team training required depending on the level of classification.
International or local project	International project demands different planning and may involve special considerations
Applicable skill set	Project manager required skill set to successfully manage and prosecute the type or level of project.

(Cagle, 2005: 111-116 & Woodward & Humphreys, 1998:335-341)

These 19 characteristic factors of a project that can be regarded as the skill set of the project, affect the proficiency needed to manage the project. This gives rise to a further question relating to the research topic, dealing with the need for industry specific knowledge. Does the specific project dictate the level of knowledge that is needed and also the type of knowledge that is required? In

addition to the 19 factors that can be regarded as the crux of project characteristics, the size of a project may have an effect on the knowledge or proficiency that is needed. The size of a project generally dictates the skill set that is required (Cagle, 2005: 111-116).

Projects and programmes can be grouped as a small project, an intermediate project, a large project, a programme, a virtual programme, international programme or large scale programme. The size of a project is based on the complexity, amount of work and cost of a project. In order to effectively manage a project, a small project requires a basic skill set, an intermediate project requires an advanced skill set and a large project requires an advanced skill set. A programme requires an expert skill set, a virtual project requires a specialty skill set, an international programme requires a specialty skill set and a large-scale programme requires a principle skill set (Cagle, 2005: 111-116).

From the above it becomes clear that the type of project and the skill set needed indicate that the level of knowledge or proficiency is not constant and similar for all projects. A strong possibility therefore exists that the need for industry specific knowledge may vary and the level may differ depending on the project.

### **2.3.3 Essential knowledge in the built environment**

An effective project manager needs to have general management and interpersonal knowledge, project management knowledge (Declerk, Eymery & Crener, cited in Pettersen, 1991: 100; Pacelli, 2004: 54) technical knowledge and experience (Kerzner, 2003: 9-1; Lee & Sweeney, 2001:16; Petterson, 1991: 99). A combination of these knowledge areas is essential in order to effectively manage a project.

### 2.3.3.1 General management

Though the research investigates the need for industry specific knowledge, an overview of other relevant knowledge is not excluded. Many sources support the view that not only project management knowledge is needed, but general management knowledge is also required (Wirth, 1996:7-11; Burke, 2006: 1-6).

According to Burke (2001: 4) a project manager must be competent in a wide range of general management skills such as staffing, leadership, instructing, planning, monitoring, controlling, implementing, communication, team building, co-ordinating and organising. This also includes knowledge of disciplines such as legal contracts, personnel and human resources, computer systems and accounts and salaries.

Briner, Hastings and Geddes (1996:29) state that a group of project leaders were asked to explain the competencies that define a good leader. The project leaders mentioned general management aspects such as to explain complicated matters in simple understandable language, to stay calm, to face up to problems, to keep team members, senior managers and customers informed and to stay focused on the big picture. Leadership is one of the factors required to lead to a successful project (Knipe et al, 2002: 14). Further explanation of leadership and specifically leadership in project management is discussed in Chapter 3.

Technical abilities without human skills are undesirable (Kapp, 1998: 30). A project manager needs project management knowledge, general management knowledge and also industry specific knowledge (Knipe *et al.*, 2002: 21).

Hamilton (1997: 212) states that project success or failure can be found within the technical and human competencies of the manager as well as the manager's ability to see the big picture.

It is essential that the project manager has a balanced mix of these competencies (Knipe *et al.*, 2002: 14). The successful project manager combines these three competencies. The distribution of each of the competencies depends on factors such as the positional authority of the project manager and the size and nature of the project (Hamilton, 1997: 213).

### **2.3.3.2 Technical knowledge**

Petterson (1991: 99) says that project managers need a solid basic experience in the relevant field. Technical aspects of a project need to be managed (Burke, 2001: 4). This view supports the research on project management and suggests the need for industry specific knowledge (Kerzner, 2003: 9-10).

Cadle and Yeates (2001: 358) state that a project manager must have an accurate understanding of the technical requirements of the project so that business needs are addressed and satisfied. The suggested level of understanding is debated in Section 2.3.4.2. Webb (1994: 55) shares the same opinion and states that some technical knowledge is needed. According to Webb (1994: 55) current products are complex, therefore it is not expected that project managers understand all aspects of the technology and do not have to generate technical solutions. However, the project manager needs sufficient technical understanding in order to communicate with the project's technical staff members on their terms and also understand the implications of what is being said in technical terms. Turk (2007: 25) states that project managers need to know what questions to ask and should be able to judge when they are not getting the full story. A blend of technical knowledge and project management knowledge is therefore required. In future, increasingly more technical expertise will be required.

Whittaker (1995: 9) states that it is generally expected that a project manager in the process industry needs to understand what the technical experts are doing.

In order to understand what the technical experts are doing, a certain level of industry specific knowledge is required. There is a difference between knowledge and understanding. Knowledge may be defined as:

'The fact or condition of knowing something with familiarity gained through experience or association' (Mirriam-Webster, 2011: Online).

'Facts, information, and skills acquired through experience or education; A person's range of information' (Oxford, 2011: Online).

Understanding may be defined as:

'Perceive the intended meaning of (words, a language, or a speaker)' (Oxford, 2011: Online).

'Perceive the significance, explanation, or cause of' (Oxford, 2011: Online).

'The power to make experience intelligible by applying concepts and categories' (Mirriam-Webster, 2011: Online).

'Mental grasp' (Mirriam-Webster, 2011: Online).

Therefore, with regard to the built environment, knowledge entails having built environment related information, whereas understanding refers to being able to apply that information; making intelligible deductions by applying the concepts.

The reason why a project manager needs knowledge and understanding is to interpret what the team needs to do in terms of how they should do it and be able to make informed judgments without needing an interpreter.

Different projects demand different levels of technical expertise. Many projects do not require true technical expertise, but simply an understanding rather than a command of technology. However, in projects where line managers are present, they generally perform the role of the technical expert (Kerzner, 2003: 155-158). In certain cases, such as on smaller projects, the project manager may be expected to be the project manager as well as the technical expert (Burke, 2001: 4). The understanding and level of industry specific knowledge a project manager needs may differ depending on the project complexity or size.

Kerzner (2003: 13-14) depicts the reporting relationships between project manager, line manager and employee in table form. It reveals that employees take technical direction from line managers, project managers or both. In tiger teams, that have strong matrix structures, employees take technical direction from the project manager.

Table 2.2 Authority giving technical direction to project team.

<b>Type of Project Manager</b>	<b>Type of Matrix structure</b>	<b>Employees take technical direction from</b>
Lightweight	Weak	Line managers
Heavyweight	Strong	Line managers and project managers
Tiger teams	Very strong	Project managers only

(Kerzner, 2003:13-14)

It may be deduced that project management, definitely in certain situations, requires a project manager that has technical knowledge relating to the work that is done by the technical team members (Lewis & Welsh, 2002:554). The level of knowledge that is required may vary from one project to the next.

The South African Council for the Project and Construction Management Professions published a document that identifies the work and scope of services for construction project managers. This document lists the technical competencies essential for a project manager in the construction industry

(SACPCMP, 2011: Online). Knowledge of construction science, construction processes, design processes, financial and cost factors are listed as the technical competencies that a project manager in construction requires.

The SACPCMP further indicates the main items under each of the four technical areas listed above.

This provides an indication that a construction project manager needs to have some industry specific knowledge. The industry, through the standard bodies, thinks that they need to understand and have knowledge of the built environment. The required level of knowledge is debated in Section 2.3.4.2.

### **2.3.3.3 Project management in various industries**

Project management is not confined to only the built environment. The discipline is implemented and used in various industries such as IT, pharmaceutical, and engineering to name a few. Further review regarding industry specific knowledge is required.

Dvir, Sadeh and Malach-Pines (2006: 36) state that studies reveal that a universal approach with regard to the management of projects may not be the most successful way to manage projects. Different types of projects should be managed in different ways.

Cooke-Davies and Arzymanow (2003: 471-478) present the results of an investigation between the project management practices in six different industries. The findings reveal that project management developed differently when it was fostered and formed in different environments. The researchers suggest that alternative project management models could be developed for the different industries, which will present 'habitable' ways of managing portfolios and projects in different industries. Stating that different project management models



could be developed for different industries implies that industries differ. This supports the view that project management is not similar in all industries but is industry specific.

Lester (1991: 114) states that there is a difference in project managers between industries and between organisations, therefore it is difficult to give the exact definition of a project manager. The industry specific nature of project management is indicative when viewing industry specific textbooks covering project management. A few examples are IT by Cadle and Yeates, (2001), Pharmaceutical industry in the book by Brown and Grundy (2004), the process industries is covered in the book by Whittaker (1995: 15) and the engineering industry in the book by Ruskin and Estes (1982: 1). This underlines the industry specific nature of project management.

The impact of change on the management of projects reveals the differences between industries. Elbeik and Thomas (2000: 22-23) state that in order to understand how a project needs to be managed, the industry that the project is in needs to be known. Rapid change governs how projects are managed. The two types of changes that need to be considered are technology change and requirements. These changes differ in the construction, research and development, and IT industries.

Project management has a generic component, but also differs in certain instances from one industry to the next (Besner & Hobbs, 2008: 16-33). This seems to be due to the industry specific nature of project management. Project management practice was studied in the engineering and construction industry, the IT industry and business services, by investigating which project management tools and techniques were generally used in each industry. The tools and techniques in the toolbox are generic project management methods. However, certain tools are used more often in certain industries than in others.

The research found that the way scope and requirements are managed, differ between the IT and engineering and construction industries.

The reason for this can be found when studying project characteristics. Certain differences are evident between the industries – the project characteristic varies between industries. Engineering and construction projects generally have a higher project cost, IT projects are usually of shorter duration and engineering and construction projects are more often for external customers while business services generally has internal customers (Besner & Hobbs, 2008: 16-33). Project management in the built environment specifically is reviewed in Chapter 5.

### **2.3.4 Project manager**

‘Organisations rely heavily on the expertise of skilled project managers’, states Orr (2004: 1). The right project manager is an important factor contributing to successful projects (Awani, 1983: 103). This is of importance to the question asked in this research study: Does a project manager with industry related knowledge, increase the probability of the success of a project? The skills a project manager needs are discussed. It is important to have a project manager as well equipped as needed, because, as stated above, the right project manager is one of the most important factors of a successful project.

#### **2.3.4.1 Attributes and skills**

It is important that a project manager possesses certain attributes. A project manager should have the ability to integrate the project stakeholders (Burke, 2001: 9-10), to get things done, negotiate and persuade (Burke, 2001: 9-10), anticipate and solve problems (Macdonald, 2005: 185; Struckenbruck, cited in Pettersen, 1991:100), have operational flexibility (Mantel, Meredith, Shafer & Sutton, 2008: 4) and to keep the client happy. Customer expectations and

problems change, therefore it is beneficial for the project manager to understand the customer and the customer's expectations and to build credibility (Briner, Hastings & Geddes, 1996: 21). There is a greater probability that the expectations will then be met (Graham & England, 1997: 163-164).

A project manager needs to have the ability to review, monitor and control (Burke, 2001: 9-10), and to evaluate and make decisions (Cadle & Yeates, 2001: 358). Project managers need to be excellent communicators (Hamilton, 2004:2-26; Spitz, cited in Pettersen, 1991: 101), promote the project (Cobb, 2006: 121-123), have integrity (Burnett, 1998: 14), and be enthusiastic (Graham & England, 1997: 163-164), and optimistic (Dolfi & Andrews, 2007: 681). Encouraging and standing up for the team is essential (Gray & Larson, 2001:279) as well as lateral thinking and using both the right and the left hemispheres of the brain, thereby having a whole brain approach (Hartman, 2008: 258-267; Webster, 1994: 22-31).

Industry specific knowledge should not be without the necessary personal attributes and skills (Knipe *et al.*, 2002: 20-22). Stickney and Johnston (cited in Pettersen, 1991: 100) used Katz and Kahn's model that suggests three skill groups. Firstly, skills that relate to human relationships such as communication and to maintain a harmonious working group. Secondly, conceptual skills that requires one to regard the project as a system and maintain a global perspective and not thinking of only one aspect at a time. Lastly, technical skills, with the ability to apply knowledge in a specific field, for example engineering are essential.

Technical understanding is important so that the technical requirements of the project are understood and the business needs are addressed and satisfied (Cadle & Yeates, 2001: 358). The project manager needs to understand the environment within which the project is being managed and also the business of the organisation. Many decisions by project managers will have an influence on

the organisation, therefore they need to understand the effect of certain decisions and actions (Graham & England, 1997:163-164).

Pettersen (1991: 99-104) did an analysis of nearly thirty publications on the requirements profile of an effective project manager. A summary on the work of some of the authors mentioned in Pettersen's paper is presented next.

Martin (cited in Pettersen, 1991:99) divided the qualifications required by a project manager in order to be effective in two main groups: personal characteristics and skills. Leadership, honesty and integrity are placed at the top of the list of personal characteristics. Further characteristics that are needed are communication with top managers, customers and project team members, planning, management and follow-up skills, energy and robustness, both physical and mental, quick thinking and speed that includes flexibility, listening and information gathering and lastly imaginative versatility in other words the project manager must be able to anticipate the future and adapt to it. The skills required include planning, financial control, compiling work schedules, contract and knowledge of behavioural sciences, supervision and organisational procedures. Equally important is an understanding of the technical aspects of the project.

Spitz (cited in Pettersen, 1991: 101) conducted empirical research on project managers in the petrochemical industry, consisting of individual interviews followed by a questionnaire which respondents completed a year later. According to the qualitative analysis of the interviews, seven major types of skills that a project manager should possess were identified. These are interpersonal skills (communication), skills to synchronise different technologies, expertise (technical knowledge related to the product or market), information-processing skills (allowing the manager to collect, use and disseminate information), capacity for handling complexity (assimilate the views of different team members and make adequate decisions), negotiation skills, and boundary-maintenance skills (resist pressure or unrealistic demands from top management.) The analysis of the

questionnaire revealed that, according to the subjects' perception, skills vary in importance, depending on the project life-cycle phase. For instance, content expertise is regarded as very important in the first phase, decreasing in importance as the life-cycle progresses. Communication as a skill is regarded as equally important in all phases. It is believed that the more complex a project, the more uncertainty exists, and therefore more communication is needed to reduce the uncertainty.

Spitz (cited in Pettersen, 1991: 101) pointed out that interpersonal skills are important. Many project managers have no formal authority over the team members. It is important for an effective project, that the team members regard the project manager as credible. Credibility of the project manager is brought about by five factors. Firstly, to be recognised in the practical field, inspire customer confidence, have a good reputation in his/ her dealings with others, success within the organisation and an overall view of the different parts of the organisation. Briner, Hastings and Geddes (1996:21) state that one of the aspects that make a good leader and which is undervalued, Pacelli (2004: 54) state that project managers must be knowledgeable about project management. The field, in which project management is then applied, can vary. The authors also suggest that a project manager should be a specialist in a field, for example finance, construction or electronics. Today's world focuses on being a specialist rather than a generalist.

Sears, Sears and Clough (2008: 15) state that the project manager needs certain attributes to be successful. This includes a considerable background of practical construction experience, a good team with experience and expertise, the ability to step back from the details and look ahead, and good interpersonal skills. Four attributes as quoted from Sears, Sears and Clough, (2008: 15) are:

- '...must have a considerable background of practical construction experience so that he is thoroughly familiar with the workings and intricacies of the industry. Without such a

basic grounding in construction fundamentals, the project manager would be completely unprepared to carry out his responsibilities

- ... have available persons with expertise and experience in the application of specialized management techniques to the planning, scheduling and control of construction operations.
- ...project manager needs to step back from the complex details of daily construction operations and look into the future...
- ...the project manager needs to have the personality and insight that will enable him to work harmoniously with other people, often under very strained and trying circumstances.'

Project managers in the built environment thus need a blend of certain interpersonal skills, knowledge of the industry, knowledge of project management and experience in the field to contribute to successful project management.

#### **2.3.4.2 Project manager competencies**

In order for project management best practices to be performed in the organisation, the project manager's competency needs to be assessed (Bolles & Hubbard, 2007: 142).

Steyn et al (2010:246) define competency as follows:

Competent refers to individuals or groups having the appropriate knowledge, skills and behaviours to perform their roles and responsibilities in accordance with the project goals.

The Project Management Institute (PMI) sponsored a project management competency project in 1998, from which the Project Management Competency

Development Framework (PMCF) was compiled. This framework helps to describe the necessary knowledge, performance and behaviour of a competent project manager (PMCF, 2001: 1). The industry specific knowledge areas that is essential for a project manager in the construction industry is set out by the SACPCMP and will be reviewed in chapter 4.

Competency is seen as a cluster of skills, attitudes, other personal characteristics and related knowledge that affects a person's job, correlates with performance on the job, can be measured against well-accepted standards and can be broken down into dimensions of competency (PMCF, 2001: 2). In relation to this study, knowledge refers to knowledge with regard to project management and also knowledge with regard to the industry (Kerzner, 2003: 9-10; Lee & Sweeney, 2001: 16; Pacelli, 2004: 54).

Dinsmore (1999: 156-157) explains competence as having sufficient skills and abilities to perform a job. Competency is very important in a project (Awasi, 1983: 104). Applying competency to project management can be described as three separate dimensions. Firstly, project management knowledge that refers to a project manager's personal understanding and knowledge of project management. Secondly, project management performance that refers to a project manager's ability to successfully complete a project and project activities. Thirdly, personal competency that refers to the project manager's core personality competence (PMCF, 2001: 2).

The project management profession consists of different areas such as the project manager, the project administrator and the programme manager. The project management competencies of these areas differ. Dinsmore (1999: 156-157) compares project management competencies to a driver's license. Different knowledge and skills are needed for drivers' licenses such as a learner's license, a regular license, a truck license and a pilot's license. Similarly, the project management knowledge level regarded as being competent differs. Dinsmore

(1999:156-157) states that the project manager must have a higher level of competence in project management than the team members because project management is the core skill that a project manager needs to apply. An executive needs enough project management knowledge in order to understand and correspond with team members. Hence this project management competence level requirement can be lower than for a project manager (Dinsmore, 1999: 156-157).

Dinsmore (1999: 156-157) states that project managers need to develop their project management skills by attending courses covering generic project related issues. The topics and skills that need to be addressed are project techniques, basic project planning, estimating and risk analysis techniques, behavioural aspects of project management that include team building, motivating team members, developing effective project teams, dealing with upper management, departmental and organisational issues that deal with how to get a project done in spite of the rest of the organisation. Further business fundamentals need attention and cover the fields of business, law and accounting, and marketing and customer issues that deal with defining and developing a market as well as understanding the needs and desires of end-users and customers.

Craig (2005: 42) maintains that due to the competitive nature of the marketplace, project managers cannot count on merely experience to secure their future and ensure promotions. Project managers need to extend their skills beyond their area of expertise. Acquiring further knowledge is of the utmost importance (Peterson, 2008: 38-42). For instance, an architect doing project management needs to have knowledge that extends further than only architecture, including project management skills and interpersonal skills. Having or obtaining qualifications are increasingly important to ensure a positive future for a project manager. This supports the research that investigates the importance of industry specific knowledge in the built environment. It emphasises the importance of knowledge.



In South Africa qualifications are registered through the South African Qualifications Authority (SAQA) and given a certain National Qualifications Framework (NQF) level. Various project management courses have been registered and received a certain NQF level. The table below lists certain courses and indicates the NQF level awarded to the course. The NQF levels were revised, and new NQF levels awarded.

Table 2.3 Project management courses and NQF levels

<b>Qualification Title / Learning Programme Title</b>	<b>Old NQF Level</b>	<b>New NQF Level</b>	<b>Learning Subfield</b>	<b>Field</b>	<b>Originating Provider</b>
Advanced Certificate: Project Management	Not Applicable	NQF Level 06	Project Management	Field 003 - Business, Commerce and Management Studies	Lyceum College
Advanced Diploma: Project Management	Level 6	NQF Level 07	Project Management	Field 003 - Business, Commerce and Management Studies	Cranefield Graduate School
Bachelor of Technology: Project Management	Level 7	New Level Assignment Pending	Generic Management	Field 003 - Business, Commerce and Management Studies	Central University of Technology, Free State
Bachelor of Technology: Project Management	Level 7	New Level Assignment Pending	Generic Management	Field 003 - Business, Commerce and Management Studies	Cape Peninsula University of Technology
Bachelor of Technology: Project Management	Level 7	New Level Assignment Pending	Generic Management	Field 003 - Business, Commerce and Management Studies	Tshwane University of Technology
Certificate: Construction Project Management	Level 5	New Level Assignment Pending	Project Management	Field 003 - Business, Commerce and Management Studies	University of KwaZulu-Natal
Certificate: Introduction: Project Management	Level 4	New Level Assignment Pend.	Project Management	Field 003 - Business, Commerce and Management Studies	Intec College
Certificate: Project Management	Level 5	New Level Assignment Pending	Project Management	Field 003 - Business, Commerce and Management Studies	Lyceum College
Certificate: QS: Construction Management and Project Management	Level 6	New Level Assignment Pending	Civil Engineering Construction	Field 012 - Physical Planning and Construction	University of the Free State
Diploma: Construction Project Management	Level 5	NQF Level 06	Project Management	Field 003 - Business, Commerce and Management Studies	University of KwaZulu-Natal
Further Education and Training Certificate: Project Management	Level 4	NQF Level 04	Project Management	Field 003 - Business, Commerce and Management Studies	
Master of Commerce: Project Management	Level 8 and above	NQF Level 09	Project Management	Field 003 - Business, Commerce and Management Studies	Cranefield Graduate School
Master of Science: Construction Project Management	Level 8 and above	NQF Level 09	Building Construction	Field 012 - Physical Planning and Construction	University of KwaZulu-Natal
Master of Science: Project Management	Level 8 and above	NQF Level 09	Project Management	Field 003 - Business, Commerce and Management Studies	University of Cape Town
Master of Science: Project Management	Level 8 and above	NQF Level 09	Planning Design and Management	Field 012 - Physical Planning and Construction	University of Pretoria
Master of Science: QS: Project Management	Level 8 and above	NQF Level 09	Building Construction	Field 012 - Physical Planning and Construction	University of Pretoria

(SAQA, 2011: Online)

Table 2.3 indicates that the type of qualification, whether a certificate, advanced certificate, diploma, advanced diploma or degree, receives a certain NQF level. For instance, the certificate courses listed in Table 2.3 are an NQF level 4, the advanced certificate courses a level 6, the diploma courses a level 6, the advanced diploma courses a level 7 and the master's degree courses a level 9.

Some of the project management courses presented in Table 2.3 are generic, while others focus more on industry specific project management. In Chapter 5 the industry specific courses and requirements a project manager in the built environment should have are discussed.

#### 2.4 Project management - two schools of thought

There are two schools of thought regarding project management – the generic school and the industry specific school. The difference of opinion is clear when studying the various project management courses offered. Some courses are purely generic while others combine generic project management knowledge together with industry elements.

The generic school believe that knowledge and use of project management systems and processes is enough to effectively manage projects in any industry. Harris (2005: Online) voices the opinion of the generic school of thought stating 'the skill of running a project is more important than industry-specific knowledge because this can ensure the manager does not get too caught up in the details and is able to remain detached'.

The industry specific school of thought says that having technical knowledge, the communication process is improved. A further benefit is that business needs are addressed (Turk, 2007: 25). This is important to enable effective project management. Both schools of thought agree that a project manager requires

solid project management knowledge. Project management is standardised and has an effective knowledge framework (PMBOK, 2004). Further investigation into the regulation and standardization is essential to confirm the validation and the reliability.

## **2.5 REGULATION AND STANDARDISATION OF PROJECT MANAGEMENT**

Project management is a professional discipline and is therefore regulated. The regulation and standardisation are important with regards to the development and the expansion of the project management knowledge base. It is relevant when investigating knowledge in project management. Project management has been regulated and standardised through project management professional bills regarding project management, such as The Project and Construction Management Professions Act, 2000 (South Africa. Project and Construction Management Bill, 2000: 2, 8-9). Councils such as the South African Council for the Project and Construction Management Professions (SACPCMP, 2011: Online) and institutes such as the Project Management Institute (Klastorin, 2004:18). Institutions and organisations have contributed to a project management body of knowledge that has the purpose of identifying and describing the best practices that are applicable to most projects most of the time (Burke, 2006:7).

### **2.5.1 Project management associations and institutions / Councils and future under the Act**

One type of knowledge that is essential for a project manager to have is project management knowledge. For the research to determine whether a certain type of knowledge is needed, it is important to understand the specific type of knowledge. Project management is not managing a project merely on gut-feel and intuition, but is based on a recognised and documented body of knowledge.

It is important in this research to note that project management is a professional discipline that has been standardised and has associations, institutes and councils within the industry. During the past thirty or forty years, various professional associations and institutions were formed promoting the benefits of project management; some developing their own body of knowledge that gives a summary of the skills and competencies needed by project managers and team members (Davis & Pharrow, 2003: 3-4). There are numerous project management associations and institutions such as the Australian Institute of Project Management, the International Project Management Association, British Association of Project Managers, the Project Management Institute, (Dinsmore, 1999: 155) and the South African Council for Project and Construction Management Professions (SACPCMP, 2011: Online). The research investigates the importance of industry specific knowledge by also reviewing other forms of essential knowledge needed for project management. Project management knowledge is standardised through a body of knowledge and a project methodology. This forms part of the knowledge that a project manager requires (Burke, 2011: 22-24; Declerk, Eymery & Crener, cited in Pettersen, 1991:100).

#### **2.5.1.1 South African Project and Construction Management Professions Bill (Act No. 48 of 2000)**

This study focuses on the built environment; it is therefore of value to note that a bill was passed covering construction project and construction management. A distinction is made between industries, referring specifically to the construction industry. Project management in the construction industry falls under The Project and Construction Management Professions Act of 2000. The Bill has four main aims. Firstly, it aims to provide for the establishment of a juristic person to be known as the South African Council for the Project and Construction Management Professions. Secondly, it aims to provide for the registration of professionals, candidates and specified categories in the project and construction

management professions. Thirdly, to provide for the regulation of the relationship between the South African Council for the Project and Construction Management professions and the Council for the Built Environment. Fourthly, to provide for matters connected therewith (South Africa. Project and Construction Management Bill, 2000:2, 8-9).

The Act determines in Section 18 that the categories a person may register for are as professional, candidate or specified categories prescribed by the Council. Professional is divided into professional construction manager or professional construction project manager. Candidate is divided into candidate construction manager or candidate construction project manager. A person may only practice in one of these categories if they are registered with the South African Council for the Project and Construction Management Professions (South African Project and Construction Management Bill, 2000:2, 8-9).

#### **2.5.1.2 South African Council for the Project and Construction Management Professions (SACPCMP)**

Applications for the registration of the South African Council for the Project and Construction Management Professions are assessed and based on both theoretical knowledge and experience. A report is required portraying the applicant's work experience, successes achieved on projects (incorporating the nine knowledge areas of project management) as well as the challenges, frustrations and failures faced (incorporating the nine knowledge areas of project management) (SACPCMP, 2011: Online). This relates to the research question. The question may be asked that if knowledge in the industry was not important, why does it form part of the application for registration of the South African Council for the Project and Construction Management Professions? Hence, it may be deduced that because the South African Council for the Project and Construction Management Professions includes experience as part of the

application process, experience and knowledge within the industry forms part of the required knowledge base of a project manager.

The South African Council for the Project and Construction Management Professions (SACPCMP) is a statutory body established by Section two (2) of the Project and Construction Management Act, 2000 (Act No.48 of 2000) and is one of the six built environment Councils (SACPCMP, 2011: Online).

SACPCMP (Online: 2011) states that it was established in order to provide statutory professional certification, registration and regulation of project and construction management professions, to protect the public's interest and advance construction and project management education.

### **2.5.1.3 Other project management institutes**

#### **2.5.1.3.1 Australian Institute of Project Management (APM)**

There are various international institutions that offer certification. One such institute, The Australian Institute of Project Management (APM), has a certification system available in and outside of Australia. The certification system was founded in 1997 and was driven by a government initiative to establish competency standards for all professions in Australia. Project management competencies are classified into three groups. Firstly, input. This is knowledge that is tested by the PMI or similar tests or qualifications. Secondly, process competencies. This includes the attitudes and behaviour as tested by the personality profile test. Thirdly, output competencies. This is the result of work projects as performed by the individual and formally documented and attested by an appropriate professional body (Burke, 2006: 7; Dinsmore, 1999: 163-164). By assessing the competencies that APM requires in order to be certified, it is clear that APM includes interpersonal abilities that are tested in the personality profile test, real world performance of projects within the industry and knowledge of

project management. The competency criteria of APM correlate with the research that investigates the importance of industry specific knowledge.

#### **2.5.1.3.2 Project Management Institute (PMI)**

The Project Management Institute (PMI) was founded in 1969. It is a non-profit professional organisation dedicated to project management and promoting project management (Klastorin, 2004: 18).

It is dedicated to gathering and disseminating an official body of project management knowledge, known as the PMBOK (Hamilton, 1997: 10).

PMBOK is an inclusive term that describes the sum of the knowledge within the profession of project management. Project Management practices have been divided into nine areas of knowledge (Hamilton, 1997: 112).

The APM and PMI are used as examples to illustrate that institutes are available through which project managers can do accreditations or certifications. Project management is a standardised discipline. This is important to bear in mind when discussing the competencies, because, as mentioned previously project management, management and technical skills are essential skills and knowledge needed by a project manager.

#### **2.5.1.3.3 Certifications**

The Project Management Institute (PMI) has a certification programme (Harrison & Lock, 2004: 34) that has achieved ISO 9000 certification. It is known as the Project Management Professional (PMP) and is recognised and respected by organisations worldwide. Many organisations use the PMP as a baseline prerequisite when appointing project managers.



The PMP certification requires skills and knowledge that are not industry specific but generic. It focuses on the processes, tools and techniques that are laid out in the PMBOK. Many organisations recognise that the generic project management knowledge needs to be complemented by industry specific knowledge. Hence internal programmes usually include both PMP certification as well as additional industry specific training in the application of project management practices (Bolles & Hubbard, 2007: 145).

Another project management certification is PRINCE. It is the standard project management methodology used for UK government departments and also many industrial and commercial organisations in the UK (Yeates, 1991: 39). Where PMI is concerned with breaking a project down into pieces and scheduling, PRINCE is concerned with finding the right people to do the job (Harris, 2005: Online).

## **2.5.2 Project Management Body of Knowledge**

A project management body of knowledge was built up, with the purpose of identifying and describing the best practices that are applicable to most projects most of the time. It is built around project management tools, skills and techniques. The body of knowledge is available in several of the project management institutions and associations. This includes the APM's BOK, Association of Project Management (UK), IPMA's BOK, International Association of Project Managers and PMI's PMBOK and the Project Management Institute (USA) (Burke, 2006: 7).

### **2.5.2.1 Project Life Cycle**

Kerzner (2003: 69-74) states that all projects can be divided into phases of development. These phases are collectively known as the project life cycle and contribute to better project control for project managers and executives. Each

phase has certain deliverables that need to be completed before the phase is complete. A phase may start before the preceding phase has been completed and in some projects overlapping of phases does occur. It is then controlled by an application of the schedule compression technique called fast tracking.

Burke (2006: 30-32) states the generic project life cycle phases as the concept phase, the design phase, the implementation phase and the commission phase. The conceptual stage, that takes place at the beginning of a project, is important as the decisions made during this phase, can greatly impact on the success of a project. Delaying the decisions until later will only cause confusion and possible disaster later on (Burbridge, 1989: 115).

The life cycle phases vary among organisations and also among industries (PMBOK, 2003: 20). A discussion of life cycle phases in different industries follows next, with special reference to the construction industry.

#### **2.5.2.1.1 Life cycle phases**

Kerzner (2003: 72-74) lists the phases generally found in certain industries as there are differences between industries (Wirth, 1996:7-11). In the engineering industry the phases are start-up, definition, main phase and termination phase. The manufacturing industry is divided into formation, build-up, production, phase-out and final audit phase. The computer programming industry has the conceptual, planning, definition and design and conversion phases. According to Kerzner (2003:7) the construction industry has seven phases. These phases are planning, data gathering and procedures, studies and basic engineering, major review, detail engineering, detail engineering/ construction overlap, construction and testing and commissioning phases. In South Africa 6 phases are identified and set out by the SACQSP. These phases are inception, concept and viability, design development, documentation and procurement, construction and close-out (SACQSP, 2012: Online).

Within these industries, the phases may differ depending on the organisation. This reflects the differences of project management between industries, referring to the industry specific elements within project management.

When reviewing the need for industry specific knowledge, the debate touches on the differences between industries, thereby requiring industry specific knowledge. Differences in the life cycle phases among industries are an example that project management is not completely generic and differ in various industries. The project management phases differ among industries, thereby indicating the need to, in project management, review industries separately.

The Royal Institute of British Architects (RIBA) has a plan of work that organises the process of managing and designing building projects and administering building contracts into a number of key work stages. This is suited for projects within the built environment. The RIBA work stages are as follows (RIBA, 2011: Online):

- Preparation phase

The preparation phase consists of two parts – the appraisal and design brief. The appraisal includes the identification of the client's needs and objectives, business case and possible constraints on development. The design brief consists of the development of the initial statement of requirements into the design brief by or on behalf of the client conforming key requirements and constraints.

- Design phase

The design phase consists of the concept, design development and technical design stages. The concept stage is the implementation of the design brief and preparation of additional data, the preparation of the concept design which includes the proposals for structural and building

services systems, outline specifications and preliminary cost plan. The project brief is completed and application for detailed planning permission takes place.

- Pre-construction phase

The pre-construction phase consists of three parts, namely the production of information, tender documentation and tender action stages. The production of information stage deals with the preparation of the production information in enough detail in order to enable tenders to be obtained. The tender documentation stage encompasses the preparation of tender documentation in sufficient detail to enable tenders to be obtained. The third phase is the tender action stage. This includes the identification and evaluation of potential contractors and/or specialists for the project. It also involves obtaining and appraising of tenders and submission of recommendations to the client.

- Construction phase

The construction phase consists of two stages – mobilisation and construction to practical completion. Mobilisation is the letting of the building contract and appointing the contractor. Issuing information to the contractor and arranging the site handover to the contractor. The construction to completion is the administration of the building contract to practical completion, the provision to the contractor of further information as and when reasonably required and the review of information provided by contractors and specialists.

- Use phase

The use phase consists of the post practical completion stage. This entails the administration of the building contract after practical completion and making final inspections. The building user is assisted during the initial occupation period and review of the project performance in use.

The phases as set out by RIBA reflect the construction industry. The pre-construction phase includes the tender process and the construction phase starts with the appointment of the contractor until the practical completion. This requires construction industry knowledge. Knowledge of the tender stage is a requirement for a construction project manager (Ashworth & Hogg, 2007: 379-380).

The South African Council for the Project and Construction Management Professions (SACPCMP) identified the project work stages for typical construction projects. According to them the stages are: project initiation and briefing, concept and feasibility, design development, tender documentation and procurement, construction documentation and management, and project close out (SACPCMP, 2011: Online).

The above information indicates that project life cycle differences exist between various industries. Therefore, the life cycle phases are not accepted as generic but are seen as industry specific, even though there are large similarities. This is important theoretical knowledge for the research study, as it delves into understanding whether project management is generic or not, and whether industry specific knowledge is needed within project management.

### **2.5.2.2 Defining the project life cycle**

A project life cycle generally gives clarity about who is involved in every phase, when the deliverables are to be generated in each phase, what technical work has to be done in each phase and how to control and approve each phase

Even though the life cycle phases may differ among industries, there are similar characteristics. Firstly, the project cost and staffing levels are low during the initial phase, it peaks during intermediate phases and drops during conclusion. The level of uncertainty and risk is highest during the beginning of the project and

declines towards the end of the project. The stakeholders' ability to influence the project and its characteristics are highest at the start of the project and lowest at the end (Kerzner, 2003: 20-21). It is ideal for a project manager to be involved in a project as early as possible, throughout the project, because project managers then tend to be more successful (Muller & Turner, 2007: 298).

### **2.5.2.3 Project management process**

The Project Management Institute divided project management activities in forty four project management processes. These activities are mapped into nine knowledge areas and five project management process groups. The nine knowledge areas are project integration management, project scope management, project time management, project cost management, project quality management, project human resources management, project communication management, project risk management and project procurement management. The five project management process groups are the initiating process group, planning process group, executing process group, monitoring and controlling process group, closing process group (PMBOK, 2004: 39-70).

The Project Management Institute published an extension to the PMBOK guide, called 'Construction Extension to the PMBOK guide'. The construction unique project management knowledge areas are project safety management, project environmental management, project financial management and project claim management (Zack, 2004). These are reviewed in-depth in Chapter 5.

### **2.5.2.4 Project management process groups**

Kerzner (2003: 3) states that project management involves project planning and project monitoring. The project management process groups are important as they touch on the project actions that need to take place in order for a project to be as effective and successful as possible. Irrespective of what knowledge is

held by the project manager, they still need to involve the process groups for effective project management.

A project manager needs various forms of knowledge. Project management knowledge is required. The Project Management Institute gives a structured clarification of the knowledge needed. They divide it into knowledge areas and process groups. For effective project management, it is essential that a project manager applies the process groups in their work (PMBOK, 2004: 39-70).

- **Initiating Process Group**

The Initiating Process Group defines and authorises the project or a project phase (PMBOK, 2004: 44).

- **Planning**

Project management differs from general management (Frankel, 1990: 38-39). Project management methodology exists. One prominent difference is that the planning process is emphasised within the project management discipline and there is structure and methodology that supports this. Due to project management following an unknown path, thinking ahead takes place all the time. Therefore it is important to think ahead, communicate proposed methods, timing and strategy and ensure that it is understood (Reiss, 1992:16-21).

Sears, Sears and Clough (2008: 64) states that 'Planning is the process of devising of a workable scheme of operations that, when you put it into action, will accomplish an established objective.'

Project planning includes the definition of work requirements, the definition of quantity and quality of work and the definition of resources needed. A project does not always go according to plan, therefore it is important to monitor the

project (Reiss, 1992: 16-21). Monitoring a project's performance throughout the project life cycle is important to ensure project success (Shaughnessy (1994: 155). Buttrick (2000: 28) states that the companies he interviewed regarded the early stages of a project as fundamental to success and that good work in these stages would reduce the probability of change later on.

- **Executing Process Group**

The Executing Process Group integrates people and other resources in carrying out the project plan (PMBOK, 2004: 55-56).

- Monitoring

Project monitoring includes tracking the progress of the project, comparing actual outcome (what is happening) to predicted outcome (what should happen), and then analysing the impact of the outcome and making adjustments to the project if necessary. Monitoring enables proactive adjustment and corrective action (Steyn *et al.*, 2010: 247). In order for a project manager to effectively fulfil his duties and monitor a project, certain knowledge and basic construction fundamentals are needed (Burke, 2001: 4; Sears, Sears & Clough, 2008:15).

A project requires planning and monitoring. Control can take place once there is planning (Lewis, 1996: 17). When a project is monitored and managed in order for deviations from the plan to be detected and controlled in time for the objectives to be met, on time and in budget, the project was controlled (Ruskin & Estes, 1982: 3).

- Control

Project control implies that there are expectations of what should happen, measurement of what is happening, comparisons between expectations and



what is happening, and timely corrective actions designed to meet the objectives, schedule or budget. This is needed to practice control of a project (Ruskin & Estes, 1982: 3). Project control minimises the gap between project planning and project execution in order to obtain the project objectives (Rozenes, Vitner & Spraggett, 2006: 5).

To monitor and control a project a control system such as using reports and control charts are necessary. It is, however, not sufficient without incorporating effective people skills. Controlling a project depends less on the technical ability of the control system, and more on the way the project manager uses the information and relates to the team. There are many systems available that for instance control the staff hours, task interrelationships, and track costs. These systems organise the information. People plan, control and implement the project used (Culp & Smith, 1992: 180-181; Kerzner, 2006: 855-868).

- **Closing Process Group**

The Closing Process Group formalises acceptance of the product, service or result and bring the project to a formal end (PMBOK, 2004: 66-67).

To make appropriate and accurate judgments regarding the status of a project and also apply adjustments that may be needed, the project manager needs technical expertise, experience, cost and schedule information and communication skills. Project managers need to report numbers and manage people. Communication and contact with the project team builds rapport and gives the project manager the opportunity to assess and discuss the status of the project. Team members can often be over optimistic about the time frame needed to complete the work. Therefore it is important for the project manager to focus on the people doing the work, discuss the work with them and then form an independent opinion about the status of the work (Culp & Smith, 1992: 181; Kerzner, 2006: 229-236). This supports the research regarding the importance of

a project manager to have industry specific knowledge. Without it, forming an independent opinion about the status of the work will be difficult.

## **2.6 NINE PROJECT MANAGEMENT KNOWLEDGE AREAS**

Project management is regulated by professional bodies. One such body is the PMI. The PMI has published a knowledge guide known as the PMBOK guide. Hence it is essential to explore it in this study as knowledge in project management needs to be explored. Project management knowledge is essential knowledge for a project manager to have. The PMBOK (2004: 9-11) specifies nine generic project management areas, which are now discussed. The four construction industry specific areas are discussed in Section 5.7.1.1 to 5.7.1.4. Due to the importance of the project management knowledge areas in this study, the nine areas are discussed below.

### **2.6.1 Integration management**

Project integration deals with inputs from several knowledge areas that are brought together integrating the three main project management processes namely planning, execution and control. Integration among the various knowledge areas is required to bring about effective project management.

### **2.6.2 Project scope management**

Project scope management defines what activities are in scope and what are out of scope. The process tries to determine what items are necessary to do the work without including unnecessary items. It consists of authorisation, scope planning, scope definition, scope management and scope verification. Determining and managing scope is required in order to contribute to effective project management (PMBOK, 2004: 103-122). The construction extension to the PMBOK adds contract documents as part of scope planning. The primary input

document for a construction project is the contract. It is conducive to the research study that investigates the need for certain knowledge in the built environment, as it contributes to effective project management through effective knowledge utilisation (PMBOK, 2004: 103-122).

### **2.6.3 Project time management**

Project time management includes the processes required to ensure that the project is completed on time. It includes activity definition, activity sequencing, duration estimating, establishing the calendar, schedule development and time control. Time management contributes to effective project management. In construction project management activity weights are allocated within time management. This entails evaluating each activity characteristic and attributes to assess the contribution of each activity to overall project progress. In order to do this, expert judgment is needed. Expert judgment involves specialists within the industry (PMBOK, 2008: 48-49). Project managers need construction industry specific knowledge in order to follow what the experts are saying and to deduce whether the information they are receiving is accurate (Turk, 2007: 25).

### **2.6.4 Project cost management**

Project cost management includes the processes needed to complete the project within budget. It includes resource planning, cost estimating, cost budgeting, cash-flow and cost control. Cost management contributes to effective project management. Project managers need project management knowledge regarding cost, and also industry specific knowledge to be able to deal with cost in the construction environment.

### **2.6.5 Project quality management**

Project quality management includes the process required to ensure that the project will satisfy the needs for which it was undertaken. It consists of determining the required condition, quality planning, quality assurance and quality control (PMBOK, 2004: 179-198).

Ashford and Spon (1989: 4-8) state that quality refers to compliance to defined requirements. The requirement that is spoken about refers to time, cost and customer satisfaction. Hence, by implication what knowledge is needed to ensure that a project conforms to the expected quality standard.

Quality contributes to effective project management. It is conducive to the research study that investigates the need for certain knowledge in the built environment to result in project effectiveness, as it contributes to effective project management.

### **2.6.6 Project human resource management**

The project human resource management includes the process that organises and manages the project team. It consists of organisational planning, human resource planning, acquiring a project team, developing a project team and managing a project team (PMBOK, 2004: 199-219). Project managers require people skills (Macdonald, 2005:165; Burke, 2001: 4). Human resource management in the construction industry differs from most other industries. Construction project locations are almost always unique to the project. The project team often works on the construction site (PMBOK, 2008: 71). Project managers need project management knowledge regarding human resource management, and also industry specific knowledge to be able to deal with human resource management in the construction environment.

### **2.6.7 Project communications management**

Project communications management is the process that has to ensure timely and appropriate collection and dissemination of project information. It consists of communication planning, information distribution, performance reporting, administrative closure and managing stakeholders.

Communication is very important to ensure effective project management (Chiocchio, 2007: 97). Construction projects have many project team members that work on site or on various remote locations. The construction industry has many unique construction requirements involving layout, legislation to protect workers and the environment. PMBOK suggests that in the construction industry a project documentation requirements checklist should be compiled and added to the communications plan (PMBOK, 2008: 86-87). Project managers need project management knowledge regarding communication and also industry specific knowledge to be able to deal with communication in the construction environment.

### **2.6.8 Project risk management**

Project risk management is the process that has to identify, analyse, plan and respond to project risk. It consists of risk identification, risk quantification and impact, response development and risk control.

Steyn *et al.* (2010:335) defines risk as 'A measure of the probability and severity of adverse effects.'

By identifying risks and preparing back-up plans early, the project manager can respond quickly when something goes wrong (Buckler, 2004: 17). Risk management includes identifying the risk. Generic project management tools and techniques used to identify risks are discussed in the PMBOK guide and those

that coincide with construction project management risk identification are documentation reviews, checklist analysis and assumptions analysis. The Construction Extension to the PMBOK guide states that during documentation review the industry demands that extra documents need to be reviewed. In construction project management, it includes layout drawings, plant location and access and equipment erection specifications (PMBOK, 2008: 98; PMBOK, 2004: 246).

Effective risk management contributes to the successful control of costs on a project (Astley, 1998: 31-39). Project managers need project management knowledge regarding risk, and also industry specific knowledge to be able to deal with risk in the construction environment.

### **2.6.9 Project procurement management**

Project procurement management includes the process to acquire goods and services from outside the performing project team or organisation. It consists of procurement planning, solicitation planning, solicitation, source selection, contract administration and contract closeout (PMBOK, 2004: 9-11).

Procurement management is essential to contribute to effective project management. It is conducive to the research study that investigates the need for certain knowledge in the built environment, as it contributes to effective project management through effective knowledge utilisation.

Zack (2004: 4) states that in 2003, the Project Management Institute released the Construction Extension to the PMBOK® 2000. This guide has four additional knowledge areas for construction projects – safety, environmental, financial and claim management. The publication of a project management guide, specifically for the construction industry, indicates that there are inherent differences between the generic PMBOK guide and a guide that is best suited for the built environment. The extension is an industry specific guide and further attention is

given in Chapter 5, that focuses on project management in the built environment. The difference between the PMBOK guide that is generic project management and 'The Construction Extension to the PMBOK guide' will assist in revealing possible differences between generic project management and construction industry specific project management.

The forty four project management processes will vary from one project to the next. Some projects will not utilise all forty four activities. The forty four activities mapped by PMI serve as a framework for project management that can contribute to the effectiveness and success of the applied discipline.

## **2.7 BENEFITS OF EFFECTIVE PROJECT MANAGEMENT**

The aim of an organisation is to attain goals and to be as efficient as possible (Daft, Kendrick & Vershinina, 2010: 8-12). This study explores the importance of knowledge in order to obtain effective project management. Therefore some attention needs to be paid to the benefits of effective project management.

Project management ensures that a project can be tracked and controlled and therefore, that project objectives can be met. The additional money that is spent on management through proper planning far outweighs the costs due to poor management decisions, overrun, reworking and mistakes made (Lewis et al, 2002:546-564; Burke, 2006:10).

Project success ensures that a project is completed within cost, time, at the desired performance/technology level, improving quality, utilising the assigned resources effectively and efficiently and accepted by the customer. The reason for striving for effective project management, is because there are many benefits. Some of the benefits that follow from effective project management may include limiting the scope overlap and scope under lap (Kerzner, 2003: 3, 47; Vrecko, 2006: 23-26). This contributes to better control of scope changes. Knowing when

objectives cannot be met or will be exceeded. Through effective management more work can be accomplished in less time. A product can then be put to market faster than the competitor by using fast tracking. This creates the probability of increased profitability.

Project management enables the measurement of accomplishment against plans. If there are problems, they can be identified early enough, to enable corrective action. Project management is an effective way of solving a strategic crisis. A strategic crisis can be defined as a crisis that does not cause any disturbances at the moment, but holds the possibility of causing fatal consequences in future (Vrecko, 2006: 23-30)

Project management, correctly and effectively applied, has great benefits to offer the organisation. Therefore, knowing what knowledge is important for a project manager in the built environment to have and whether it will improve the effectiveness and success of a project is important. It may contribute to effective project management and greatly impact organisations. The research sets out to determine this.

## **2.8 CHAPTER SUMMARY**

The research question 'Project management in the built environment: the need for industry specific knowledge' aims to gain insight into the knowledge required by a project manager in the construction industry and by doing so, to add to the effectiveness of project management in the built environment. In this chapter the need was reviewed and it is evident that some construction industry knowledge is required together with general management abilities and project management knowledge in order to be fully equipped to effectively manage projects.

Project management has existed since the earliest times, but was formalised and structured over the past few decades. Together with the regulation and



standardisation of project management, came the establishment of associations, councils and institutions. This includes the Project Management Institute (PMI), Association of Project Management (APM) and International Association of Project Management (IPMA).

The South African Project and Construction Management Professions Bill was published in 2000. This led to the establishment of the South African Council for the Project and Construction Management Professions. The Council published a document 'Identification of work and scope of services for construction project managers'. This lists the minimum competencies required for the effective execution of identified work for the construction project manager. It includes technical competencies comprising of construction science, construction processes and design processes and states that this knowledge is needed to contribute to effective and successful completion of a project. Project management conducted in the correct manner by a competent project manager has large benefits for effective and successful project completion.

## **CHAPTER 3**

### **ORGANISATIONAL FACTORS AND PROJECT MANAGEMENT**

#### **3.1 INTRODUCTION**

Projects are typically part of an organisation (PMBOK, 2004: 27). There are various factors that influence an organisation. These factors include organisational maturity, organisational structure, organisational culture, leadership, communication and trust. The organisation has an influence on a project. Therefore, organisational factors need to be explored when studying project management. An overview on project management was presented in Chapter 2. Organisational factors and their effect on project management, specifically in the built environment, are investigated in Chapter 3. This chapter reviews the factors and explains the relevance to project management.

#### **3.2 RELATIONSHIP BETWEEN ORGANISATIONAL FACTORS AND PROJECT MANAGEMENT**

The ultimate purpose of a company and project is to be successful. Project success from a project manager's perspective is about project deliverables (Burke, 2011: 27). Projects aim to be as effective as possible, completing within time, cost, scope and according to the expected quality (Burke, 2006: 8). Project management is not an isolated discipline but influenced by many factors. Typically, projects are part of an organisation. Therefore there are organisational influences such as organisational systems, organisational cultures and styles and organisational structures that impact on project management and influence the project (PMBOK, 2004: 27). This chapter reviews the contribution and influence the organisational factors such as leadership, communication, trust, organisational maturity and structure have on project management in the built

environment and how it contributes to effective and successful project management.

### **3.3 ORGANISATIONAL MATURITY**

#### **3.3.1 Background**

The level of project management maturity varies among organisations. Similarly, the level of maturity varies among organisations. Project maturity is defined by Kerzner (2006:56) as follows: “Maturity in project management is the implementation of a standard methodology and accompanying processes such that there exists high likelihood of repeated successes.” An organisation that is mature will implement these elements of project maturity in the organisation. This study investigates project management in the built environment and the need for industry specific knowledge. However, all projects within the built environment are not managed from identical organisations. The organisations and their maturity differ from each other. It is possible to determine the maturity of an organisation.

A maturity model can be used in order to assess the maturity level of an organisation and assist a company to develop. This consists of a conceptual framework that defines the maturity of a specific area of interest. Organisations are increasingly becoming aware of the benefits of project management, and are subsequently adapting a positive view towards project management. In order for organisations to determine whether the project management processes are adequate, they need to compare it to their competitors or to best practices. Maturity models and benchmarking assist in this (Hillson, 2003: 299).

Hillson (2003: 298) states that a maturity model sets a generic benchmarking framework that is applicable to any project-based organisation, in any type of industry and it does not presume any prior project management capabilities. It

indicates the sophistication and experience of an organisation in managing projects (Burke, 2011: 364). The maturity model can be used by an organisation as a benchmark to determine whether project management processes in the organisation are adequate and to compare itself to project management best practices. It sets an acceptable benchmark for organisational capabilities. The purpose of a benchmark is to assess current capability, diagnose strengths and weaknesses and identify areas that can be improved (Hillson, 2003: 298).

Organisational project management maturity reflects the degree to which an organisation practices project management (PMI, 2003: 13). A maturity model gives a framework with a number of defined levels of capability against which the current position of the organisation can objectively be assessed. After the assessment the organisation can aim for the next level of capability (Hillson, 2003: 300).

### **3.3.2 Project management maturity models**

There are over thirty project management maturity models in the market (Cooke-Davies, Schlichter & Bredillet, cited in Hillson, 2003: 299). In this study the Project Management Maturity Model (ProMMM) and the Organisational Project Management Maturity Model (OPM3) are briefly reviewed. It was decided that these models would be used as they are well known and recognized in the industry. The OPM3 was established by a professional body – the PMI.

#### **3.3.2.1 Project Management Maturity Model**

Hillson (2003: 298-305) reviews the Project Management Maturity Model (ProMMM). This particular model describes four levels of project management capability (naïve, novice, normalised and natural), with each of these levels described in terms of four attributes namely culture, process, experience and application.

The four levels of capability are in turn divided into four levels (Hillson, 2003: 301). The first level is the naïve project management organisation. The organisation that is classified on this level is unaware of the value project management holds for the organisation. There is no structured approach to the project management processes and no system of learning from the past to improve project management in the organisation in future.

The second level is the novice project management organisation. The organisation that is classified on this level is aware of the benefits of project management, but has not yet implemented processes in order to gain the full benefits of project management.

The third level is the normalised project management organisation. The organisation that is classified on this level implements project management processes across the business. Processes have been formalised and widespread and the benefits are understood although there is still room for improvement.

The fourth level is the natural project management organisation. The organisation on this level follows a best practice approach and has a fully project-based culture. As organisations mature they formalise their methodologies (Burke, 2011: 87). This includes built environment knowledge and also project management knowledge. Organisational maturity is therefore important as it indicates that the organisation understands project management methodology and the methodology that is used on the project. It contributes to project success, which is the aim of all projects. If the correct knowledge and practices are followed, it will improve the effectiveness and efficiency of construction projects (PMI, 2008: 4).

The ProMMM defines each level of capability in terms of four attributes. The four attributes are culture, process, experience and application (Hillson, 2003: 301-302).

Culture refers to the belief structure and mind-set of the organisation that impacts the reactions and the assumptions made. The process refers to the methodology and tools and techniques to support project management. Experience refers to both corporate and the individual in the organisation. Experience determines how well project management is understood by both the organisation and the individual. Application refers to how project management is put into practice. This is one of the main measurements of organisational maturity.

According to this maturity model, the assessment and classification of the maturity of an organisation is done by using a questionnaire. Each question is scored from one to four, relating to the maturity level. The data that are gathered from the questionnaire are then entered into a database. Each attribute (culture, process, experience and application) is calculated and scored. The organisation is also scored and placed on an overall maturity level of one to four. In addition to the questionnaires, structured interviews are often conducted. There is a relation between a company's maturity and the implementation of a companywide project management methodology system (Burke, 2011: 87).

### **3.3.2.2 Organisational Project Management Maturity Model**

The Project Management Institute (PMI) developed the Organisational Project Management Maturity Model, known in abbreviated terms as the OPM3. The OPM3 serves as a standard for organisational project management and organisational project maturity. It can be used to determine the level of an organisation's maturity, and should an organisation wish to increase its maturity, the OPM3 can assist (PMI, 2003: ix-6).

The OPM3 was developed through the participation of a group of individuals in the project management industry from 35 countries, across a section of organisations and numerous industries including financial services, information

technology, manufacturing, government agencies and engineering (PMI, 2003: ix-6).

Organisational project management maturity is an indication to which degree an organisation practices project management. The OPM3 reflects it as a combination of best practices. A best practice is an optimal way (currently recognised by industry) to achieve an objective or goal (PMI, 2003: 13). OPM3 describes the incremental capabilities that lead to best practice that they state is a prerequisite to effective organisational project management. The elements of the standard are knowledge, assessment and improvement. The steps to apply the standard are built around these elements.

To improve project management effectiveness organisations need to determine current capability and set targets for future improvement (Hillson, 2003: 309).

The OPM3 describes the steps involved to apply the standard and implement improvement. Firstly, it is essential to understand the contents of the model being used. Secondly, an assessment has to be performed and this involves assessing the organisation's degree of maturity. This is done by comparing the characteristics of the organisation's current maturity with those in the Maturity Model. The organisation then goes into further detail regarding the capabilities that the organisation does or does not have. Thirdly, planning for improvement needs to take place that forms the basis of the plan for improvement. The needed capacities and outcomes will be ranked according to their priorities in the organisation. Fourthly, improvement needs to be implemented and this involves the organisation implementing the changes over time. Finally, the process needs to be repeated. After some improvements are implemented, the process will be repeated by either reassessing the organisation's position on the continuum or return to step three and begin addressing other best practices that were identified earlier (PMI, 2003: 13).

Organisational project management maturity reflects the degree to which an organisation practices project management (PMI, 2003: 13). Therefore, it is possible to improve the level of maturity that will have an impact on the project management of a project and also the efficiency and effectiveness of the project (PMI, 2008: 4).

### **3.4 ORGANISATIONAL STRUCTURE**

#### **3.4.1 Background**

Projects are unique (PMI, 2004: 5). They are influenced by many factors, one such factor being organisational structure. Organisational structures influence projects as projects take place in a certain organisation, and the organisation has a specific structure that in turn affects the project (PMI, 2004: 27-33).

An organisation is defined as a consciously coordinated social unit, composed of two or more people that function on a relatively continuous basis to achieve a common goal or set of goals. The people who oversee the tasks of others and who are responsible for attaining goals in the organisation are managers (Robbins, 1996: 5). This study focuses specifically on the project manager and this chapter reviews the project manager in the organisation in more detail.

A project manager's role is not the same in all organisations. For instance, the authority a project manager has in an organisation is denoted by the organisational structure. A project manager enjoys greater authority in certain organisational structures than in others (Heldman, 2007: 13).



### 3.4.2 Various organisational structures

According to Heldman (2007: 13), organisations are structured in one of three ways, namely functional, matrix or projectised. Variations and combinations are found among these structures such as the projectised organisation within a functional organisation and weak matrix, balanced matrix and strong matrix organisations (Heldman, 2007: 13).

Project-related characteristics such as the project manager's authority, resource availability, control entity of the project budget, project manager's role and the project management administrative staff differ in the various organisational structures (PMBOK, 2004: 28). These project characteristics are reviewed per organisational structure; functional organisation, matrix organisation (weak, balanced and strong) and projectised organisation. The organisational structures are now discussed as team members working on a project in construction may be from different organisational structures (PMI, 2008: 16). Organisational structures influence projects and their effectiveness (PMI, 2004: 27-33). A project in the built environment may therefore be influenced by a few of the following organisational structures as indicated in figure 3.1. (PMBOK, 2004:62). The second to sixth column indicate the various types of organisational structure. Column two is the functional organisational structure, column three the weak matrix, column four the balanced matrix, column five the strong matrix and column six the projectised organisation. The first column lists the various indicators that reflect the differentiation between the organisational structures. Row two reflects the project manager's authority, row three resource availability, row four budget control, row five project manager's role and the last row project staff.

Figure 3.1 Organizational structure

Organisation structure	Functional	Weak Matrix	Balanced Matrix	Strong Matrix	Projectised
Project Manager's Authority	Little or none	Limited	Low to moderate	Moderate to high	High to almost total
Resource Availability	Little or none	Limited	Low to moderate	Moderate to high	High to almost total
Budget control	Functional Manager	Functional Manager	Mixed	Project Manager	Project Manager
Project Managers Role	Part-time	Part-time	Part-time	Full-time	Full-time
Project Staff	Part-time	Part-time	Part-time	Full-time	Full-time

PMBOK ( 2004:62)

From the table it is clear that there are inherent differences in an organisation depending on the organisational structure. Further discussion follows below.

### 3.4.2.1 Functional organisational structure

The functional organisation is also known as the traditional approach, as it is one of the oldest organisational structure forms. Functional organisations are centred on specialities and grouped by function (Heldman, 2007: 14).

According to the PMBOK (2004: 28) the project characteristics of a functional organisation are as follows: the project manager has little or no authority; there is little or no resource availability; the functional manager controls the project budget; the project manager has a part-time role on the project; and the project management staff works on the project part-time (PMBOK, 2004: 28).

### 3.4.2.2 Matrix organisational structure

The matrix organisation is seen as a blend of both the functional organisation and the projectised organisation (Heldman, 2007: 19). The project manager shares the responsibility with the functional manager (Brown & Labuschagne, 2000: 37). The matrix organisation can either be a weak matrix structure, a balanced matrix structure or a strong matrix structure (Heldman, 2007: 19).

Kerzner (2006: 113) states that the strength of a matrix is based upon the person who has more influence over daily performance; the line manager or the project manager. If the project manager has more influence than the line manager, then the matrix is stronger. If the line manager has more influence than the project manager, the matrix is weaker. An important differentiator between weak and strong matrixes is the level of technological command by the project manager. Command is to give a formal order or to have authority or control over something (Oxford, 2011: Online). Thus technological command refers to the authority and control over the technical work aspects on the project. If the project manager has a high level of technological command he has the authority and control to give the workers technical direction on the project. The more technical direction the workers take from the project manager, the stronger the matrix structure. If the project manager does not have a high level of command, the workers will take direction from the line manager. Therefore, the project manager will have less authority in a weak matrix than in a strong matrix (Kerzner, 2006: 113). Large engineering firms often use a matrix organisation (PMI, 2008: 16; 18).

Matrix organisations are not all similar in strength (Kerzner, 2006: 113). A strong, a balanced and a weak matrix structure can be distinguished (Kerzner, 2006: 113).

According to the PMBOK (2004: 28) the project characteristics of a weak matrix organisation are as follows: the project manager has limited authority; there is

limited resource availability; the functional manager controls the project budget; and the project manager's role on the project is part-time. The project management administrative staff works part-time on the project (PMBOK, 2004: 28).

The balanced matrix structure lies between the weak matrix and the strong matrix (Heldman, 2007:21). The project characteristics of a balanced matrix organisation are as follows (PMBOK, 2004: 28): the project manager has low to moderate authority; there is a low to moderate availability of the resources; both the functional manager and the project manager control the project budget; the project manager has a full-time role on the project; and the project management administrative staff works part-time on the project (PMBOK, 2004: 28).

In the strong matrix structure the project manager is regarded as a technical expert, and workers often take direction from the project manager (Kerzner, 2006: 113). Furthermore, the project manager in such an organisational structure is usually promoted from within the organisation, whereas in a weak matrix structure, the project manager is often appointed from outside the organisation (Kerzner, 2006: 113).

The project characteristics of a strong matrix organisation are as follows (PMBOK, 2004: 28): the project manager has moderate to high authority; there is a moderate to high availability of resources; the project manager controls the project budget; the project manager's role on the project is full-time; and the project management administrative staff works full-time on the project (PMBOK, 2004: 28).

Kerzner (2006: 102) states that the matrix organisation attempts to combine the advantages of the functional structure and the product organisational structure. The matrix organisation is well suited for organisations that are project driven. This may often be ideal in the construction industry (Kerzner: 2006: 102).

### 3.4.2.3 Projectised organisational structure

The projectised organisation is almost the opposite of the functional organisation with the focus on the project itself (Heldman, 2007: 17). The project characteristics of a projectised organisation are as follows (PMBOK, 2004: 28): the project manager has high to almost total authority; there is a high to almost total availability of resources; the project manager controls the project budget and has a full-time role on the project; and the project management administrative staff works full-time on the project (Kerzner, 2006: 99-101).

A competent, knowledgeable project manager is challenged by the environment surrounding the project. Projects are affected by the environment enfolding it. The environment is made up of the cultural and social environment, international and political environment and physical environment. Cultural and social environments include aspects of economic, demographic, educational, ethical, religious and other characteristics of people that may influence the project. International and political environments include factors such as customers, laws and time-zone differences that may affect the project. Physical environments include the physical geography and local ecology that may affect the project (PMI, 2004: 14). Graham and Englund (1997: 5) state that there are certain components of the environment that contributes to the success of projects, such as a change to project based organisations. A project based organisation is team based. It is therefore crucial that the upper management and the project manager also work together as a team. In the construction industry, there are often various organisational structures that need to work together on a project. Large engineering firms often use a matrix organisation while a contractor may be organised more along the lines of a projectised organisation. It is often complex for all parties on a construction project to work together due to different viewpoints and agendas. Construction now uses partnering as a technique to overcome the differences. This technique involves creating a personal commitment among team members. This commitment stretches further than

contract and project requirements to the team members wanting to complete the project successfully for personal fulfilment. Partnering creates a project environment of teamwork and collaboration (PMI, 2008: 16; 31). Project management as a service is provided within a system of interlinked practices and activities incorporating the physical, cultural and resource environment. A systems approach views project management holistically and also takes the interrelated workings between elements into consideration. A systems approach is thus integrated into project management (Burke, 2011: 370).

### **3.5 ORGANISATIONAL CULTURE**

Organisational culture is one of the organisational aspects/components underlining project management. Organisational culture differs among organisations (PMBOK, 2004: 27).

The Construction Extension to the PMBOK guide states that the culture of the organisation doing the work on a project may differ from that of the owner or customer. When employing team members such as architect, engineer, or construction manager as part of the team in construction, it is important to bear this in mind. The different organisational cultures have to be addressed in order for the project to be successful (PMI, 2008: 16). This research reviews how knowledge affects the success and effectiveness of a project. Therefore, the organisational culture has an impact on the effectiveness of a project.

#### **3.5.1 Definition of organisational culture**

Organisational culture refers to a system of shared meaning held by members that distinguishes the organisation from other organisations (Robbins, 1996: 68). Organisational culture is what the employees perceive and how this perception creates a pattern of beliefs and values (Denison, cited in Cooke-Davies, 2003: 473) and expectations (Ivancevitch, 1996: 80-81). It is a set of informal

guidelines (Deal & Kennedy, cited in Morrison, Brown & Smit, 2006: 40) and a form of social agreement to help people to better understand life in the organisation (Wilkens, cited in Morrison, Brown & Smit, 2006: 40). It can be seen in symbols and rituals of the organisation as well as ideologies of management (Pettigrew 1979, cited in Morrison *et al.*, 2006: 40). The impact of the organisational culture is reflected in the organisation's problem solving styles (Schwartz & Davis, cited in Morrison, Brown & Smit, 2006: 40), the organisational structure preference, control systems, reward systems, human resource practice (Pettigrew, 1990, cited in Morrison, Brown & Smit, 2006: 40) culture is one of the aspects/components and perceptions about authority (Pettigrew 1979 & 1990, cited in Morrison, Brown & Smit, 2006: 40).

Robbins (1996, 681-683) discusses the characteristics that capture the essence of organisational culture. Innovation and risk taking influences an organisation. This is the degree to which employees are encouraged to be innovative and take risks. Attention to detail refers to the degree to which employees are expected to exhibit attention to detail, precision and analysis. Outcome orientation refers to the degree to which management focuses on results or outcomes. People orientation encompasses the degree to which management decisions take the people in the organisation into account. Team orientation refers to the degree to which work activities are focused around teams rather than individuals. Aggressiveness denotes the degree to which people are aggressive and competitive. Stability refers to the degree to which organisational activities emphasise maintaining the status quo in contrast to growth (Robbins, 1996, 681-683).

In an organisation, the degree to which these characteristics occur will vary. One organisation will be more open towards innovation and risk taking than another (Robbins, 1996: 681-683). This will influence the project. The culture of an organisation bears relevance to project management within an organisation (PMBOK, 2004: 28).

### **3.5.2 Organisational culture and project management**

PMBOK identifies nine knowledge areas of which project risk management is one. The PMBOK (2004: 240) states that persons and by extension organisations, have attitudes towards risk that affect the accuracy of the perception of risk and the way they respond. Risk responses reflect an organisations' perceived balance between risk taking and risk avoidance. Hence, the way a project's risk is managed will vary between organisations.

Another example of project management that varies between organisations can be given when comparing the knowledge area of project human resources management to the characteristics of organisational culture. The characteristic 'team orientation' dictates that there is a degree to which work activities are focused around teams or rather individuals. The project human resource management knowledge area consists of four processes, namely human resource planning, acquiring the project team, developing the project team and managing the project team (PMBOK, 2004: 199-225).

The organisational culture impacts on a project. Certain cultures may have a negative impact on a project, in which case the project team needs to address the culture and try to change it (Cooke-Davies, 2003: 473), although it may be difficult and complex to do (Cooke-Davies, 1990 as cited in Cooke-Davies, 2003: 473). Organisational culture is influenced and created by various elements, one being leadership and role modelling (Ivancevich & Matteson, 1996: 88).

## **3.6 PROJECT MANAGEMENT AND LEADERSHIP**

### **3.6.1 Project managers as leaders**

Project managers need various skills and abilities, of which interpersonal skills and specifically leadership and communication, are essential elements (PMBOK,



2004: 12-15). The leadership role of a project manager is a critical factor in determining project success (Snow, Davison, Snell & Hambrick, 1997: 99; Snell, Davison, Hambrick & Snow, cited in Iles & Hayers, 1997: 99). All managers have some sort of leadership responsibility. In the selection of project managers, leadership often plays a role in project managers being selected or not, depending on their leadership style (Kerzner, 2006: 216). The question arises whether managers invariably are leaders. Leaders and managers are not synonymous (Heldman, 2007: 12; Newstrom & Davis, 1997: 200). Leaders give vision, establish direction and inspire and motivate others. Managers focus on requirements and getting the job done. Although there is a difference between managers and leaders, it is important for project managers to exhibit leadership skills. The traits of both managers and leaders are used at different times during the project (Heldman, 2007: 347). Even though a manager is not automatically a leader, it is important that a project manager has leadership qualities as leadership is important in determining project success (Kerzner, 2006: 216; Snow, Davison, Snell & Hambrick, Heldman, 2007: 12; Snell, Davison, Hambrick & Snow, cited in Iles & Hayers, 1997: 99). Leadership is important to project management and is therefore included in the study.

A group of people needs a leader; hence a project team needs a leader. The project manager's role is fulfilled by the project leader. For a project manager to be successful, the leadership style is important. It needs to be adaptable. It is important for the workers' morale and productivity and can have a direct impact on the success of a project (Burke, cited in Berry, Verster & Zulch, 2010: 18). It should be the role of the project manager to lead and motivate while commanding the respect of team members, try to complement the attributes of the various team members and to keep conflict to a minimum (Ashworth & Hogg, 2007:382). Construction is a team work that depends on the commitment of all the stakeholders (Leung *et al.*, 2002, cited in Leung, Chang & Cheung, 2004:701; Walker, 1996).

In a project, the purpose is to attain the project objectives (PMBOK, 2004: 7). A leader can make a difference in terms of end-result factors such as performance and goal attainment (Ivancevich, 1996, 412). Leadership is often defined as influencing others and therefore enhancing their contribution to attain group goals (Haslam, 2001: 58). A leader needs to be able to communicate well and a few of the core abilities that are required, as indicated in the communication maturity model, are written and verbal communication skills, and knowledge and industry communication instrument knowledge (Berry, Verster & Zulch, 2009: 12-15). This supports the research, as project managers need to be leaders (PMBOK, 2004: 12-15) and leaders need to communicate well. In order to communicate, knowledge is required. It can be stated that project managers need knowledge in order to be effective.

Barrett (cited in Berry, Verster & Zulch, 2010: 6) presents a leadership communication model that indicates the importance of communication for leadership. A leader needs to communicate effectively (Goetsch, 2004: 66) and ensure that the followers trust the leader. Discussions on communication and trust is discussed in Section 3.7 and 3.8. Leadership is investigated first.

### **3.6.2 Leadership and the project manager**

All managers have some form of leadership responsibility (Kerzner, 2006: 217). It is therefore important to understand what leadership is and what it entails. Leadership is the ability to influence a group to achieve goals (Robbins, 1996: 413). Robbins (1996: 413) refers to research studies that indicate that the traits that are consistently associated with leadership are ambition and energy, the desire to lead, honesty and integrity, self-confidence, intelligence and job-relevant knowledge.

Bennis and Nanus (cited in Bjerke, 1999: 61-62) and Bennis (cited in Bjerke, 1999:61-62) suggest competencies that are evident in all leaders, namely

attention through vision that refers to the ability of leaders to draw others to them through a vision and communicating an extraordinary focus of commitment. A vision needs to be clearly understandable in order for it to be successfully communicated to followers. Furthermore, it should also be inspiring, widely accepted and integrated into others visions, and focus on strategy and long term goals (Avery, 2004: 101). In order to align people with the goals leaders need to communicate their vision. Trust is essential in all organisations and leaders need to know their own skills and deploy it effectively (Bennis, cited in Bjerke, 1999:61-62).

Leaders need to be competent. George Bush said 'Do your homework. You cannot lead without knowing what you are talking about.' Leaders need technical knowledge, interpersonal skills and project management skills (Culp & Smith, 1992: 68-69).

It is important that, as the leader, a project manager maintains a balance between technical and managerial functions. Kerzner (2006: 217) refers to Wilemon and Cicero (Wilemon & Cicero, cited in Kerzner, 2006: 217) who said that the greater the project manager's technical ability, the more likely it will interfere with the managerial functions, as he will over involve himself in the technical side of the project. At the other end of the scale, the lower the project manager's technical ability, the more he over stresses non-technical functions (administrative functions).

The most effective leaders have a never ending desire to grow and learn, constantly increasing their competence (Culp & Smith, 1992: 68-69). Effective project leaders know their own behaviour, traits and skills and select the behaviour, trait or skills that are needed in a specific situation. They have the ability to successfully assess a situation and decide accordingly what behaviour, skills or traits are needed (Strang, 2007: 458). Therefore, as project managers need to have leadership and leaders need to be competent (Culp and Smith, 1992: 68-69) and have the ability to decide what skills are needed, project

managers need to be competent and have the skills needed to manage the project. Project managers need to be leaders and need the required knowledge.

The quality of leadership is important in order to have a successful team (Phillips, Bothell & Snead, 2002: 124). Leadership tasks do arise when people work together in an organisation to achieve common objectives (Guideline, 1989: 122). Leadership is an important topic in project management (Kloppenborg & Opfer, cited in Thomas & Mengel, 2008: 5). Kloppenborg and Opfer reviewed 3 500 journals, articles and papers on project management and found leadership to be one of the main trends. Good project managers are leaders and exert leadership (Amalutti & Hauserman, 2007:40). Leadership in project management within the organisation is important.

All leaders do not lead in a similar fashion – there are various leadership styles. These styles range between democratic, laissez-faire and autocratic (Kerzner, 2006:220). Construction project management works in most situations with experienced and competent team members. Therefore, in most situations, the leadership will tend to lean towards a consensus approach. This approach allows for independence and relies on the contribution of team members (Ashworth & Hogg, 2007:383). Leadership requires using power in order to influence people's thoughts and actions (Zaleznik, 1998: 63).

### **3.6.3 Leadership and power**

Leaders use power as a means to get team members to do activities in a certain way. It helps project managers in attaining group goals. It is important to have knowledge of leadership and power as well as the different forms of power. One of the five sources of power is expert power (Robbins, 1996: 463-467). This power form gathers team support by the leader having knowledge and expertise regarding the subject (Robbins, 1996: 463-467). Hence, it may be that the project

manager's power is also affected by him/her having industry specific knowledge or not. This may be made clearer during the empirical study.

There are various forms of power that leaders use. To understand where power comes from and what gives an individual or group influence over others, attention needs to be paid to the five sources of power. Firstly, reward power refers to when desirable behaviour is rewarded directly or indirectly by offering, for example, incentives, bonuses, salary or future work assignments. The reward is thus the motivation to do the work. Secondly, punishment (penalty) power is gained by threatening team members with penalties that they wish to avoid. Thirdly, expert power is gained by the leader by having special skills, knowledge or expertise regarding the subject. Fourthly, legitimate power refers to when support is gained due to the position that the leader holds. The leader is viewed as officially empowered to issue orders. Lastly, referent power occurs when support is gained because people feel personally attracted to the leader. This happens when the leader has desirable resources or personal traits (Heldman, 2007: 349; Kerzner, 2006: 206-208 & Robbins, 1996: 463-467).

Project managers need to exert leadership. However, all projects do not take place under the same circumstances. The environment differs, the organisation differs and individuals also differ. Some of these differences are due to cultural diversity. A project is affected by cultural diversity (Black & Mendenhall, 1990: 113-136; Simmons, cited in Dunmark, 2005: 82).

#### **3.6.4 Leadership and cultural diversity**

Project managing requires effective leadership skills. Often working environments are diverse, with cultural differences (Black & Mendenhall, 1990: 113-136; Simmons, cited in Dunmark, 2005: 82). Globalisation of projects and project management adds to the diverse and intercultural mix (Muller & Turner, 2004, cited in Muller & Turner, 2007: 298).

Culture determines how a person perceives the world and other people (Black & Mendenhall, 1990: 113-136; Simmons, cited in Dunmark, 2005: 82). Social Psychology indicates that culture has an influence on perceptions, values and behaviour (Wiesema, Bantel & Hofstede, cited in Iles & Hayers, 1997: 107). Culture is not determined genetically, but is created by the social environment and is learnt behaviour (Black & Mendenhall, 1990: 113-136; Simmons, cited in Dunmark, 2005: 82). A project manager who is in charge of a culturally diverse team is faced with even greater demands (Makilouko, cited in Dunmark, 2005: 82). Multicultural teams may experience benefits or losses. Some of the problems may be mistrust, stereotyping, communication problems and stress whereas the benefits are more and better ideas, and less group think (Hambrick & Davison, 1993; Jackson & Adler, cited in Iles & Hayers, 1997: 106-107). A project can experience problems due to cultural diversity. It needs to be handled correctly. On the other hand, there are many examples of successful projects that used cultural differences as an advantage (Ramaprasad & Prakash, cited in Dunmark, 2005: 83). Makilouko (cited in Dunmark, 2005:83) divides cultural diverse teams into three groups. Firstly, team members from different cultural backgrounds working in the same region. Secondly, team members from different cultural backgrounds that are geographically scattered, but meet regularly face to face. Thirdly, team members from different cultural backgrounds that work together regularly but often never meet face to face. The contact is usually through video conferencing and emailing. Meeting face to face is beneficial for good communication and assists in building interpersonal relationships (Makilouko, cited in Dunmark, 2005:83).

Communication takes place both verbally and nonverbally (Barret, cited in Berry, Verster & Zulch, 2010:4-5). There are also differences between cultures as far as nonverbal communication is concerned. Some cultures regard it as important to make eye contact when in conversation while other cultures show respect towards another person and respect for the person's authority by avoiding eye

contact. People have varied distances of personal space that they feel comfortable with. There are various ways to greet. Some cultures shake hands, some do a three phase hand shake and some kiss on the cheek. Body language differs between cultures. The British, for example, hardly uses hand and body movements when talking, while the Latin heritage is known to use a lot of body movements to express themselves (Milosevic, cited in Dunmark, 2005:84). It is important for a project manager to have knowledge of communication (Fogel, cited in Dunmark, 2005:84). The ability to communicate well is the foundation of effective leadership and leadership is part of what a project manager needs (Burke, 2006: 10 & 270).

The empirical study aims to analyse the effectiveness of project managers when completing projects. Whether the project manager has industry specific knowledge is an important factor. Further knowledge about the project manager may be important, as it may affect their ease and effectiveness. This may include other factors such as communication that is covered in the theoretical section below.

### **3.7 COMMUNICATION**

#### **3.7.1 Understanding communication**

Project managers need to be leaders (Black & Mendenhall, 1990:113-136; Simmons, cited in Dunmark, 2005: 82). Effective leaders communicate openly, honestly and positively (Morris, Willcocks & Knasel, 1995: 3-4). A leader needs to communicate effectively. A differentiation can be made between communication and effective communication. Communication occurs when information conveyed is received and understood, while effective communication takes place when the information that is received and understood is acted on in a desired manner (Goetsch, 2004: 66-67).

Burke (2006: 272) states that communication involves sending and receiving messages. The communication model discusses the communication process. The model states that there is a sender who encodes the message, sending it to the person who is referred to as the receiver. The receiver then decodes and interprets the message. Should the receiver answer the message, the receiver will then send a message back, thereby closing the loop. The model explains each element in the model, in order to understand the process (Burke, 2006: 271-273; Watson & Grubb, cited in Ivancevich & Matteson, 1996: 490).

There are various barriers that can hamper effective communication. The barriers are based on people's perceptions, personality, interests and attitudes, emotions and prejudices. Perception barriers occur when individuals view the message differently. This is influenced by factors such as education and experience. Personality and interests also affect communication as people tend to pay closer attention to topics that interest them, and not listen to topics they find boring. Emotions, attitudes and prejudice also affect the communication process as individuals that are fearful, or have strong love and hate emotions may tend to distort the communication process (Kerzner, 2006: 231).

Source credibility also acts as a barrier in effective communication. It refers to the trust, confidence and faith that the receiver has in the words and actions of the communicator (Ivancevich & Matteson, 1996: 501).

Some of the barriers are as follows (Robbins, 1996: 387-388): filtering, which involves the manipulation of information so that it will be seen more favourable by the receiver; selective perception constitutes what people hear and see and is affected by what their needs are, their motivations, experience, background and personal characteristics; emotions which is an indication of how the receiver feels at the time of receiving the message and which affects how he or she interprets it; language that has an effect; and different words that mean different things to different people. These may affect the interpretation of a message.



Kerzner (2006: 231) stated that there are various barriers that affect the encoding and decoding process. The following factors may affect the encoding process: communication goal, communication skills, frame of reference, sender credibility, interpersonal sensitivity, personality and interests, needs, attitude, emotion and self-interest, position and status, assumptions (about receivers) and existing relationships with receivers.

Typical factors that may affect the decoding process are (Kerzner, 2006:232): communication skills, evaluative tendency, preconceived ideas, frame of reference, lack of responsive feedback, existing relationship with sender, needs position and status, emotions and attitudes, assumptions about sender and selective listening.

People communicate through mediums such as verbal, nonverbal and written forms (Burke, 2006: 272-273). Berry, Verster and Zulch (2009:12-14) refer to the maturity model with regard to the communication ability of the professions within the built environment. The verbal, written and contractual abilities were investigated. Important elements for verbal communication in the built environment are integrity, self-confidence, convincing methods, appearance, language ability, extravert conduct and knowledge. Elements for contractual communication ability are contractual validity, efficiency, trustworthy, not being ambiguous, not being contradictory and being reasonable. Important elements for written communication are quality, neatness, professionalism, general impression, scientific, task orientation and language (Berry, cited in Berry, Verster & Zulch, 2009: 12-13). In project management, project communication can be formal or informal, planned or ad-hoc (Burke, 2006: 272-273).

Communication is not only the spoken word, but also appearance, manner, personality and conduct (Sieff, cited in Berry, Verster & Zulch, 2010: 4-5). Body language also forms part of communication (Andila, cited in Dunmark, 2005 84:). Nonverbal actions include eye contact, facial expression, body posture, hand

movements and use of interpersonal space. Saying yes or no can be communicated without verbally saying a word by nodding for yes and shrugging for no (Milosevic, cited in Dunmark, 2005: 84).

Manning (2004: 50) states that communication should be a leader's work and should not be the responsibility of the public relations staff members, the human resources department or secretaries. The planning of communication is important to ensure that each stakeholder or team member receives the correct information at the right time and this is necessary for effective coordination and managing of a project (Emmitt & Gorse, cited in Berry, Verster & Zulch, 2009: 10-11; Phillips, Bothell & Snead, 2002: 277)

### **3.7.2 Communication and project management**

Communication is a key factor in team performance, successful project completion and effective project management (Chiocchio, 2007: 97). Effective project communication ensures that the right information is sent to the right person at the right time and in a cost effective manner (Kerzner, 2006: 229). Communication is one of the Project Management Institute's (PMI) Project Management Body of Knowledge (PMBOK) knowledge areas (PMBOK, 2004: 221-236). The knowledge area states that communication management is the area that includes the processes required, ensuring the timely and appropriate generation, collection, distribution, storage, retrieval and ultimate disposition of project information. The project manager needs to spend enough time with all the stakeholders and everyone on the team needs to understand how communication affects the project as a whole (PMBOK, 2004: 221). The study investigates whether knowledge is needed in order to successfully and effectively manage a project in the built environment. The aim is to effectively and successfully complete a project. Communication is important for effective project management (Chiocchio, 2007:97).

In project management, the communication plan is very important. It covers who (lines of communication), what (scope of communication), how (meeting, email, presentation), when (schedule), feedback (confirm message received and that it was understood) and filing (storage and retrieval) of a project (Burke, 2006: 274-275).

The 'who' of a project refers to the sender and receiver, responsibility and authority and the lines of communication. The lines of communication are between people, stakeholders, departments, companies, suppliers and contractors. It is important to include all key people in the lines of communication (Burke, 2006: 274-275).

In the project plan, the scope of communication is important. This refers to what should be communicated. There should be a balance when communicating to team members, not giving too much but also not too little information. All the role players on the project should not receive all the information, as this will cause information overload and team members will most likely not read everything, possibly resulting in missing out on critical information. The objective should be to supply sufficient information that the recipient can solve problems, make decisions and feel part of the project (Burke, 2006: 274-275).

According to Kerzner (2006: 229) ninety percent of a project manager's time includes communicating. This may be spent in providing project directions, decision-making, authorising work, directing activities, negotiating, reporting, attending meetings, overall project management, marketing and selling, public relations and records management that includes minutes, memos, letters and newsletters, reports, specifications and contract documents. Proper communication is very important for the success of a project. In the built environment certain communication instruments are used to communicate. These instruments include feasibility, estimates, final accounts, cost reports, cost planning and payment advice (Berry, Verster & Zulch, 2009: 8-9). The project

manager needs knowledge of communication instruments. This supports the study's investigation with regard to project management in the built environment and the need for industry specific knowledge. The communication process and ensuring that information is conveyed on time, is key to the effective coordination and managing of a project (Emmitt & Gorse, 2003).

Communication is a key factor in team performance, successful project completion and effective project management (Chiocchio, 2007: 97). Industry specific knowledge of industry communication instruments is important in order to effectively communicate in the industry and effective communication is essential in order to effectively manage projects (Berry, Verster & Zulch, 2009:12-15; Chiocchio, 2007: 97). Therefore, knowledge of the industry instruments is essential for project managers working in the built environment. It is essential for a profession to have successful communication knowledge (Berry, Verster & Zulch, 2010: 5). Knowledge is therefore essential for project managers in the built environment in order to communicate effectively.

### **3.8 Trust**

Trust is an essential element of a project and impacts on a project's success. It is therefore important to understand how it develops and where it comes from (Romahn & Hartman, 1999: 1).

Robbins (1996: 357) states that high performance teams are characterised by mutual trust among members. The concept of trust is based on five dimensions (Schindler & Thomas, cited in Robbins, 1996: 356). The first dimension is integrity that includes honesty and truthfulness. The second dimension is competence that includes technical and interpersonal knowledge and skills. The third dimension is consistency that includes reliability, predictability and good judgment in handling situations. The fourth dimension is loyalty that includes willingness to protect and save face for a person. The fifth dimension is

openness which means that there is a willingness to share ideas and information freely.

Robbins' second dimension of trust highlights the importance of technical knowledge in the case of the project manager, the need for built environment specific knowledge, in order to be trusted. Trust is essential in project management in order to effectively manage projects. Therefore it can be deduced that industry knowledge is essential.

Trust often takes a while to build and can be shattered quickly – it is fragile. It is important that management pays attention to trust (Sonnenberg, cited in Robbins, 1996: 356). Trust among team members and management can be built through team members' need to demonstrate that they are working for others' interests as well as their own; by being a team player; being open and fair; speaking about feelings; showing consistency in the basic values that guide decision-making; maintaining confidence and demonstrating competence (Bartolome & Pascarella, cited in Robbins, 1996: 357).

According to Mai and Akerson (2003: 90) further attributes that strengthen trust and commitment are admitting uncertainty when leaders are not fully informed or do not know, selectively exposing weaknesses – areas where they can't claim expertise and expressing interest in analysing failure, rather than ignoring it.

Trust is important in an organisation, as business needs to take place within trust, and trust has an influence on effective communication and teamwork. Together, this can reduce transaction and control costs (Romahn & Hartman, 1999: 1). As trust has an influence on effective communication (Romahn & Hartman, 1999: 1) and communication is essential for successful project management (Chiocchio, 2007:97) it is very important to have trust within a project to ensure a successful project. It is important for a project manager to

improve the ability to communicate, organise, build teams and provide leadership (Posner, cited in Birkhead, Sutherland & Maxwell, 2000: 101).

The two dimensions that rank highest in determining trustworthiness in another, is integrity and competence (Butler & Cantrell, cited in Robbins, 1996: 357). Butler and Cantrell's statement (cited in Robbins, 1996:357) that competence is one of the most important elements to ensure trust, underlines the importance of knowledge in project management. Trust is an important component in project management. A project manager needs to be a leader and a leader needs to be trusted. As competence is an important element of trust, it can be deduced that a leader needs to be competent.

### **3.9 Management**

Organisations attempt to deliver good performances which can be defined as attaining organisational goals by using resources in an effective and efficient manner. Management aims to attain organisational goals through planning, leading, organising and controlling (Deft, Kendrick & Vershinina, 2010:8-12).

#### **3.9.1 Planning**

Planning involves developing a program and choosing a course that needs to be followed. There are various types of plans (Bedi, 2009:46-57):

- **Strategic plans**

Strategic plans are long term plans of approximately three to ten years. It involves the setting of the overall direction of the firm. Top management uses strategic planning to answer the following questions. What is the environment the organisation is operating in? Where is the organisation heading?

- Contingency plans

Contingency plans are alternative plans that are developed that may be implemented in the wake of drastic changes in the environment.

- Tactical plans

Tactical planning is medium term planning. It focusses on how to implement the activities in order to obtain long term goals.

- Operational plans

Operational planning is also referred to as functional plans. They are very focussed and specific and are usually for a timeframe of hours, days or weeks. It pertains to functional departments such as marketing, HR and IT.

### 3.9.2 Control

Control in an organisation is about taking action to adjust operations to predetermine standards. Therefore it is necessary to have knowledge about performance standards and the actual performance (Daft & Marcic, 2001:504). Employees' activities need to be monitored and adjusted to keep organisations on the right track and towards the set goals (Draft, Kendrick & Vershinina, 2010:9)

### 3.9.3 Motivation

Motivation is beneficial to an organisation. It entails the 'willingness to exert high levels of effort towards organisational goals'. There are various motivational theories that explain the process of employee motivation – how and why it takes place. Such theories are Maslow's need hierarchy theory, McClelland's need theory, theory x and theory y, motivation-hygiene theory, equity theory and expectancy theory.

Frederick Herzberg proposed a two-factor theory also known as the motivation-hygiene theory. He distinguished between motivators and hygiene factors. Motivators are factors such as challenging work, recognition, responsibility and job satisfaction. Hygiene factors are job security, salary and status. If motivators are present, job satisfaction can be experienced. Hygiene factors are indicators that if not present, would lead to dissatisfaction (Bedi, 2009:146-149).

### 3.9.4 Leadership

Leadership is the ability to influence people so that they willingly strive towards the accomplishment of organisational goals (Daft, Kendrick & Vershinina: 2010:564-592). There are various forms of leadership (Bedi, 2009:132-147).

- Autocratic leadership

An autocratic leader makes decisions on his own without consulting his subordinates.

- A democratic leader

A democratic leader involves subordinates and stakeholders in decision making.

- Laissez-faire

This leader leaves subordinates to decide and do work without any interference.

- Bureaucratic leadership

A bureaucratic leader leads 'by the book'. There are many controls that may be demotivating for subordinates

- Charismatic leadership

Charismatic leaders have charisma to influence followers to following them willingly and wholeheartedly.

- Servant leadership

Servant leaders start out wanting to serve and then move towards aspiring to lead. There is collaboration, trust and empathy involved.



General management forms part of project management. Project management does for instance involve project planning and project monitoring that are general management skills that a project manager requires (Kerzner, 2003:3). Project planning includes the definition of work requirements, of quantity and quality of work and the definition of resources needed.

In an organisation operations need to be planned, organised, staffing needs attention, and there has to be execution of work and control. General management has certain disciplines that are relevant to project management such as financial management, IT, health and safety practices, procurement, contracts and commercial law, and marketing. There is also logistics, personnel administration, compensation, benefits and health and safety practices. These general management skills are essential for a project manager to have in order to effectively manage a project (PMBOK, 2004:15).

### **3.10 CHAPTER SUMMARY**

Projects typically take part within an organisation. Organisations differ in organisational maturity, organisational structure, organisational culture and the amount of trust between team members in the organisation. The project management maturity of an organisation has an impact on the project management and specifically the processes followed. By using project management maturity models an organisation can benchmark their current capabilities and diagnose areas that are strong versus areas that need improvement, thereby improving project management. The organisational structure in an organisation has an impact on the project managers' authority, resource availability, determining who is in control of the budget and the project manager's role.

A project manager needs various skills and abilities of which leadership is one. A leader has to be knowledgeable; this includes technical knowledge about the

industry. Leadership is important in determining a project's success. A leader needs to communicate effectively. A communication maturity model for the professions in the built environment suggests the essential elements of communication maturity as written communication, contractual communication, supportive documentation ability, leadership, knowledge of communication instruments, verbal communication, knowledge and technological ability. Effective communication should be harboured in a project to ensure team performance and efficient project management. High performance teams need mutual trust among team members. Trust is essential in order to bring about effective communication and communication is needed for effective project management. Therefore trust is needed in project management.

Organisational elements such as leadership, communication and trust are many elements that influence the effectiveness and success in project management. Knowledge is essential in communication, leadership and trust. As these elements are needed for project success, it indicates that knowledge is essential for effective and successful project management.

## **CHAPTER 4**

### **THE BUILT ENVIRONMENT**

#### **4.1 INTRODUCTION**

In Chapter 4 the built environment as an important element to the study is reviewed. It is important to review the industry and to understand what the industry entails and how the industry operates in order to support the research. The importance of specific knowledge of the industry is reviewed in this chapter. Therefore, it is essential that a closer look at the built environment, the structure thereof, organisations in the built environment and the role players such as employers, contractors, subcontractors and professional consultants is taken. It is within this environment that the project manager needs to manage projects and aim to be as effective as possible.

#### **4.2. BACKGROUND**

The environment may be divided into either the built or natural environment. The world is not fixed and unchangeable. Change is evident by just looking at the new buildings, roads, reservoirs, bridges, etc. being constructed on a daily basis (Seeley, 1997: 3). When development takes place it involves changes to the physical environment (Collier, 1995: 96-98). In many countries, such as South Africa, a distinction can be made within the built environment, dividing it into building and civil engineering construction (Hauptfleisch & Sigle, 2009: 1). Fundamentally the building industry and civil engineering use the same technology. However, the intensity and scale of the use of different technological components vary greatly (Walker, 1998: 4). The following definitions provide some clarity on these two areas (Hauptfleisch & Sigle: 2009:1):

'The building industry is that operational sector which constructs buildings to the requirements of an employer (client) by making use of the built environment professions, main contractors, subcontractors and a variety of allied resources.'

'The civil engineering construction industry is that operational sector which constructs civil engineering structures (dams, roads, bridges, pipelines, etc.) to the requirements of an employer (client) by making use of consulting engineers, civil engineering contractors (main contractors), subcontractors and a variety of allied resources.'

'The construction industry is the collective name for the building and civil engineering construction industries' (Hauptfleisch & Sigle: 2009: 1).

These two areas often complement each other, with one including elements of the other. Developments occur due to specific reasons. It generally takes place in order to fulfil the needs and demands of society or due to speculation by the developer (Collier, 1995: 98). Collaboration and sharing of knowledge is essential in the construction industry. It improves a person's ability to complete the activities they are busy with (Belkadi, Bonjour, Camango, Troussier & Eynard, 2013: 110-129).

### **4.3 SYSTEMS THINKING**

Systems thinking can be described as thinking while thinking. It offers a systematic approach and decreases the influence of emotion and confusion that may hamper thinking (Boardman & Scuser, 2008: 2). A systems approach may be applicable to an organisation or a larger system. A system is a collection of complex and interrelated components that are dynamic. It is characterised as having wholeness and the interrelatedness of a group or set of things. It is the

combination of parts and things with interrelationships among components (Sharif & Adulbhan, 1978:1-5).

A systems thinking may be applied to the built environment while investigating the role players. It investigates the idea of a wholeness and the involvement of the specific role players and also the development process that is at play. There are various role players in the industry such as quantity surveyors, town planners, engineers and clients that are all essential to the effective functioning of the industry (Burke, 2011: 370).

In order to determine what knowledge is needed in construction project management, the built environment as a system needs to be investigated and understood. By implication, the role players, the knowledge and qualifications involved also need to be understood.

#### **4.4 DEVELOPMENT PROCESS**

A project manager in the built environment is usually involved throughout the development process. For project success, the whole process needs to be managed as effectively as possible. Cadman and Austin-Crowe (cited in Collier, 1995:100) describe the following processes as part of the development process. The initiative for development may come from the landowner, the occupier, the local authority, the developer or the agent. A development starts off with seeing the potential for development. The development potential is then evaluated. This involves the physical site inspection, the legal assessment and the financial assessment. Site acquisition then takes place where it is determined whether enough finance will be raised, whether the rights will be granted and whether there is enough support for the scheme. Designing and costing the scheme follows. Once there is certainty regarding the go-ahead of the scheme, an increasing amount of detail will be paid to the design and cost of the scheme. In order to develop, consent is needed and has to be obtained. This requires

planning approval, building regulations, fire regulations, health and safety regulations and listed building or other conservation consent. Signing of various interrelated contracts follows. This includes finance, site acquisition, materials, subcontracts and legal issues. The construction programme is implemented. This includes the management and controlling of the project.

The Royal Institute of British Architects set up a suggested design process for the preparation and implementation of a building project. They divide a project in preparation, design, pre-construction, construction and usage phases (RIBA, 2012: Online). The preparation phase consists of the appraisal and design brief; the design phase consists of the concept, design development and technical design; the pre-construction phase consists of production information, tender documentation and tender action; the construction phase consists of mobilising the construction process and the construction of the project through to practical completion; and the usage phase focuses on assisting the building user during the initial occupation period and the review of the project performance in use.

Project managers working in construction need to have industry specific knowledge (Ashworth & Hogg, 2007: 381-384). It is important for a project manager in the built environment to be aware of the phases and processes of building projects, as they are involved throughout the process. The South African Council for the Project and Construction Management Professions gives a broad guideline of identified work for the construction project manager (SACPCMP, 2011: Online). This list of identified work clearly indicates the need for a project manager in the built environment to have knowledge of the processes and procedures used in the built environment, in order to manage the project as effectively as possible.

Seeley (1995:51-62) describes development from inception to completion and feedback. Development is discussed next, based on the framework used by Seeley.

#### **4.4.1 Inception**

This stage focuses on providing a general outline of the requirements and planning future action. The requirements need to be determined and the architect appointed. Often clients are not completely certain about what they want. People involved with the client's interests and the architect are involved in this stage.

#### **4.4.2 Feasibility**

This stage focuses on all the technical, functional and financial aspects of the project and advises the client on the feasibility of the development. A detailed survey of the site, the size, the adjoining buildings and the position and capacity of adjoining services is done. Consultations with necessary councils and bodies are held, for example with town planning and the fire authority. People involved in this stage are the client's representatives, architects, engineers and quantity surveyor according to nature of project.

#### **4.4.3 Outline proposals**

The feasibility brief is developed further. The general approach to layout, design and construction in order to obtain authoritative approval of the client on the outline proposals are determined. The project manager is involved in facilitating the development of a clear brief (SACPCMP, 2011: 14-15). It is important to determine the essential activities and their sequence. The parties involved are the client's interests, architects, engineers, quantity surveyor and specialists as required.

#### **4.4.4 Scheme design**

This stage features the broader aspects of the design to outline the specification and the preparation of a cost plan, considering which construction method to use,

looking at the proposed distribution of costs over the various elements of the building. All approvals will be submitted and obtained. The engineers will develop their work to such detail as is necessary at this stage and the information that the architect needs will be sent through. The parties involved are the client's interests, architects, engineers, quantity surveyor, specialists and all approving authorities.

#### **4.4.5 Detail design**

During this stage detail is developed in-depth and the final decision is made regarding cost, design, specifications and construction. Architects, quantity surveyor, specialists and contractor (if appointed) are involved during this stage (Seeley, 1995: 51-62).

#### **4.4.6 Production information**

Production information such as the final drawings, schedules and specifications are prepared during this phase and final detailed decisions are made to carry out the work. The drawings at this stage should include architect drawings entailing a site plan, general elevations, general sections, floor plans, selection of main construction details and special components; structural engineer's drawings including below-ground drawings, floor plans, structural details, structural components; and services drawings including site drainage, building drainage and other services. Architects, engineers, specialists and the contractor (if appointed) are involved (Seeley, 1995: 51-62).

#### **4.4.7 Bills of quantities**

During this phase the bills of quantities and the tender documents are completed. The architect, quantity surveyor and contractor (if appointed) are involved at this stage (Willis & Ashworth, 1990: 170). The bills of quantities are documents that



list all the labour and material needed to erect a building. It is accurately given in prescribed units according to a standard method and the circumstance in which it is to be built is fully described (South African Property Education Trust, 1999a: 13).

The bills of quantities offer many advantages. The working drawings and specifications are usually completed in order for the bills of quantities to be drawn up. A specification is a document for quick reference and understanding and accompanies the drawings (South African Property Education Trust, 1999b: 142-143). Thus, the building process is based on completed documentation. The rates reflected are a reliable source to use as basis for cost adjustments that result from variations to the contract. Monthly payments are done based on the amount of work that has been done and the rates in the bills of quantities. Final accounts are also relatively easy to settle, as variations are already known at tender stage. The bills of quantities also provide complete information for financial analysis and control (South African Property Education Trust, 1999a:13). The main purpose of the bills of quantities is for tendering. It offers each contractor who tenders for the project the opportunity to price the work based on the same information (Willis & Ashworth, 1990:170). Projects with bills of quantities attract a large number of competitive tenderers due to the lesser amount of work for the tenderers (South African Property Education Trust, 1999a:13). It is very important for a project manager in the built environment to have knowledge of the tendering process and to manage the process (SACPCMP, 2011: 14-15).

Schedules can be drawn up and are very useful. It brings the parts together, gives a holistic view of the whole and is useful for quick reference (Ashworth & Hogg, 2002:213-214). It can also be used and incorporated in the specification for the clerk of works and site agent. Schedules for internal finishes should be in tabulated form and should include ceilings, walls and floors. Schedules for

windows and doors should include frames, architraves, etc. (Willis & Ashworth, 1990:171).

A schedule of basic rates is often supplied. A building contract with a schedule of rates is the procedure that is often followed when a project needs to urgently get under way, and there is not yet enough information available for a bill of quantities. A schedule of rates is basically a bill of quantities without quantities (South African Property Education Trust, 1999a: 14).

There are various building contracts that can be used for a project. A building contract is basically an agreement between a contractor and the employer. Types of contracts include building contracts with bills of quantities, provisional bills of quantities, a schedule of rates without bills of quantities and a cost-plus building contract. A building contract with bills of quantities can be followed if enough time is available for comprehensive tender documentation, which includes the bill of quantities. A building contract with provisional bills of quantities is usually used if tenders are called for before working drawings, specifications and accurate bills of quantities are completed. A building contract with a schedule of rates is used when tenders need to be urgently called for and there are no bills of quantities or even provisional bills of quantities available. A schedule of rates is then used. A building contract without bills of quantities (lump sum contract) is mainly used on smaller building projects and tenders. It is based on working drawings and specifications only (bills of quantities). A cost-plus building contract is usually used if there is no time for any negotiations or tenders. The plus refers to an amount or a percentage that will be added to the actual cost of the project (South African Property Education Trust, 1999a: 13-20).

The following sections may form part of a contract, depending on the type of contract: contract drawings indicating the work that needs to be done; specification that indicates in words what the workmanship needs to be like and also the quality of material to be used, schedule of model preliminaries, priced

bills of quantities, agreement and schedule of conditions of building contract, tender form, explanatory letters and tender qualifications.

It is very important for a project manager in construction to have adequate knowledge and understanding of contracts (SACPCMP, 2011: 14-15). Levy (1994:27, 37) indicates that the construction contract is usually the trigger to the construction process and carries important legal consequences. Therefore, knowledge about construction contracts is extremely important.

#### **4.4.8 Procurement for building projects**

##### **4.4.8.1 Tender action**

A call for tenders is a procurement method for building projects (South African Property Education Trust, 1999b: 138-139). A distinction should be made between tendering and estimating. An estimate is the preliminary assessment of the net cost of carrying out a specified amount of building work whereas a tender is the final price which is submitted to the client by the contractor (Smith, 1992: 3). Tenders may take place as open tenders or selected or restricted tenders. Open tenders are open to the public and anyone may tender. Selected tenders are obtained through a list of contractors pre-selected for the specific contract on the basis of financial stability (South African Property Education Trust, 1999b: 138-139). It is suggested that a maximum of six tenderers are invited and that the selected tenderers are approached four to six weeks before the tender, supplying adequate information about the contract to them and finding out whether they are interested in tendering. Four to six weeks should be given for the tendering process and the documentation should include two unbound copies of the bill of quantities, drawings, two copies of the form of tender and suitably addressed and labelled envelopes for the return of the tender and priced bill of quantities (if required). The people directly involved are the architect, the quantity surveyor, the engineers, contractor and client (Smith, 1992: 3). Project managers in

construction must understand and be knowledgeable about tenders and must be able to evaluate it (Ashworth & Hogg, 2007: 379-380).

Tendering is one method that is used as part of the procurement process for building work. It is important for a project manager to have industry knowledge in order to be able to be effectively involved in procurement (PMBOK, 2008: 104). Another method that is sometimes used for tendering is negotiation (South African Property Education Trust, 1999b: 136-141).

#### **4.4.8.2 Negotiated tenders**

Negotiated tenders are often considered when there is an oversupply of work in the marketplace, hence the competitive element is not present; when the contract is a difficult type; or when there is already certainty that the contract is going to be awarded to a specific contractor. Competitive tenders may have the disadvantage that sound tenderers may lose the tender to inexperienced, reckless newcomers that are cheaper. Such reckless tenderers may end up in the insolvency court, which is not to the best interest of the project. It is generally accepted that negotiated tenders are in the contractor's best interest. There is no evidence that it is to the advantage of the employer.

Contractors say that negotiated contracts with a reputable firm may lead to a substantial reduction in the contract period. Employers should aim to make use of reputable firms, whether in negotiations or for competitive tendering (South African Property Education Trust, 1999b: 136-141).

#### **4.4.9 Project planning**

The project needs to be planned, therefore a programme for the overall project, incorporating both design and construction, needs to be prepared (Ashworth &

Hogg, 2002: 334). The people directly involved are the contractor and subcontractors (Smith, 1992: 3).

#### **4.4.9.1 Operations on site**

The people directly involved are the architects, engineers, contractors, subcontractors, quantity surveyor and client. This is the construction phase of the project (Burke, 2006: 28-30).

#### **4.4.9.2 Completion**

The people directly involved are the architects, engineers, contractors, quantity surveyors, project managers and clients (Smith, 1992: 3). The project is completed and it is ready to be handed over (Burke, 2006: 28-30).

#### **4.4.9.3 Feedback**

To give feedback, the management, construction and performance of the project are analysed. The people directly involved are the architects, engineers, quantity surveyor, contractor and client.

It is clear that various team members are involved in the project at various stages.

### **4.5. BUILT ENVIRONMENT STAKEHOLDERS**

It is important to have knowledge sharing among team members in the built environment as it adds to effective teams and projects (Zhang, 2012: 1326-1347). Understanding the built environment and knowing who is involved in the building industry and what role they play should be investigated is important.

#### **4.4.1 Stakeholders**

The stakeholders in the development process include the employer, developer, planning authorities, financiers, building contractors and professional advisors (Collier, 1995: 98-99; Fisk & Reynolds, 2010: 1-2; Sears, Sears & Clough, 2008: 3).

##### **4.4.1.1 Employer**

The employer is also called the client and sometimes the building owner. Employers are either private sector employers or public sector employers. (Hauptfleisch & Sigle, 2009: 26; Sears, Sears & Clough, 2008: 4). It may be a person or an organisation. The landowners may work for or against development by promoting or opposing the development (Collier, 1995: 98).

The employer usually does not come into contact with the whole building team but does spend some time with the architect (Seeley, 1997: 36). The employer has a great influence on the construction project (Seeley, 1997: 37) and can be regarded as the core of the construction process (Latham, 1994: Online). The employer often impatiently demands the work to be done and finalised, resulting in the team members making errors. It is important that sufficient time be allowed and that the employer refrains as far as possible from requesting changes. Variations from the original plans often result in delays, cost overruns and disorganisation of the work (Seeley, 1997: 36). Construction clients have an important responsibility towards future generations to commission projects that are well designed. This will affect people that occupy the buildings for many years to come. It will influence their comfort and wellbeing. In the case of commercial buildings, the occupants' performance and productivity are influenced by it.

#### **4.4.1.2 Developers**

Developers aim at making a profit. They may choose to sell the whole development and use the profit to finance a next development or to retain some or all of the development.

#### **4.4.1.3 Planning authorities**

Developments need approval from the local planning authorities before the development can commence.

#### **4.4.1.4 Financiers**

The finance to develop the scheme may come from the developer's own funds, or from financiers such as insurance companies, pension funds, merchant banks, building societies and government grants.

#### **4.4.1.5 Building contractors**

Building contractors can be the main contractors or the subcontractors. The main contractor, also known as the prime contractor, is the entity that has the contract with the owner to construct the project (Sears, Sears & Clough, 2008: 5). Both main and subcontractors are generally organised into line and staff organisational systems. Their workforce usually consists of top management, middle management, lower management and workforce. Top management are directors, managing directors, general managers, area managers and divisional managers; middle management are functional heads of sections, contract managers, project managers, cost estimators; lower management are general foremen and foremen; and workforce are tradesmen, apprentices, operators, labourers (South African Property Education Trust, 1999a: 13-20).

There is a contractual relationship that binds the parties (Collier, 1995: 98-99). Work can be obtained through launching a project oneself by using one's own capital, tendering on invitation or in the open market, negotiating with a prospective employer for a contract or through initiating or participating in the establishment of a syndicate for the development of a property (South African Property Education Trust, 1999a: 13-20).

The contractor may vary from a small firm to a large company with diverse operations of work (Willis & Ashworth, 1987: 7). Subcontractors enter into agreement with the main contractor. The following contractors can be distinguished:

- Subcontractors who are appointed by the main contractor, using his own discretion. This happens after tender submission. Nominated subcontractors are appointed by the main contractor after one of the consultants on the project has nominated them.
- Selected subcontractors who are appointed by the main contractor after agreement is reached between the main contractor and the consultants regarding which subcontractors will be invited to tender.
- Direct specialist subcontractors who are appointed due to their highly specialised skills.
- The main contractor is also usually unable to exercise supervision and control. This type of contractor is paid directly by the employer (South African Property Education Trust, 1999a: 13-20).

Before appointing the subcontractor, the main contractor needs to make sure of the subcontractor's financial stability, integrity, production capacity, quality of workmanship and physical facilities for performing the work. It is the main contractors' responsibility to the owner to complete the work and deliver proper work (Sears, Sears & Clough, 2008: 7).



#### **4.4.2 Professional advisors**

The professional advisors include the architects, engineers, building surveyors, land surveyors, estate managers, quantity surveyors, accountants, tax advisors and planning consultants (Bennett, 2006: 42-43; Collier, 1995: 98-99).

It is important to take a look at the knowledge base of the role players within the industry as this study aims to determine whether knowledge about the built environment industry is needed in order to effectively manage a project. It means investigating the job description and core competencies of quantity surveyors, architects, engineers, town planners and construction managers as project managers in the industry usually come from one of these specialisation backgrounds (Collier, 1995: 98-99).

It is important for a project manager to know the roles and responsibilities of the various professions within the built environment, in order to do effective project planning. Planning is the core of effective project management (Oberlender, cited in Archer, 2011: 29). Part of the planning process is human resources planning that focus on roles and responsibilities, project organisational charts and the staffing management plan. Roles and responsibilities describe what part of the project the individual or team is accountable for, the amount of authority the resource has to make decisions, the work required to complete the project activities and the skills and ability that the individual or team needs in order to perform the project activities (Heldman, 2007: 246-247, 259). Without the required industry knowledge, the project manager will not be able to perform the work as effectively as possible (PMBOK, 2008: 10).

##### **4.4.2.1 Architect**

Ashford and Spon (1989:12) explain the combination of building and architecture as follows:

'The purpose of a building is to provide shelter. The purpose of architecture is to inspire. Sometimes when the two come together, we have a building which not only provides comfort, convenience and security for its occupants, but also excites aesthetic sensations in those who enter or behold it.'

The primary role of architects is that of designing. They are nevertheless involved in the production of buildings from inception stage through to completion (Seeley, 1997: 37-39). Architects document and supervise the erection of the building in order to meet the requirements of the employer (Hauptfleisch & Sigle, 2009: 40). Traditionally the architect was the team leader, but with the development in project management in recent years, that has changed. Architects receive instruction to design and supervise the erection of a building. They most often need input from other experts in the construction field. This may include mechanical and electrical engineers to design the mechanical and electrical services, quantity surveyors for advice on contracts and cost and landscaping experts for advice on landscaping (Seeley, 1997: 37-39). An architect needs to have an overview of the project and is often the person that communicates and is responsible for liaison between parties. The architect often fulfils this role on projects that do not have an exclusive project manager. This may include the owner, local authorities, consultants, specialists and contractor (Seeley, 1997:37-39).

Burston (1982:49) states that the main tasks of an architect are to do the conceptual design, detail design and project coordination. The services provided to the employer are however not limited to this. It normally includes review and description of the project, draft design/conceptual design, design development, technical documentation and approval, contract administration and supervision. The review and description of the project takes place after the employer has provided a broad brief and appointed the consultants. The architect compiles a

report that sets out the design team's evaluation and the implications contained in the employer's brief. This report aids the employer to decide whether to change the project or to continue as per the initial brief provided (Hauptfleisch & Sigle, 2009: 40).

The architect starts with the conceptual design after receiving an instruction from the employer for the design team to proceed with the design (Hauptfleisch & Sigle, 2009: 40). It starts off diagrammatically and then develops into further detail. The drawings consist of plans, sections, elevations and projections. The projections consist of perspectives and metric projections.

The skills needed to do conceptual design are a creative mind, artistic ability and a scientific side such as computer modelling, while knowledge of economics and coordination abilities will also be useful (Burston, 1982: 49). Coordination abilities assist when managing projects. A project manager needs to have coordination skills (Oberlender, cited in Archer, 2011: 31).

Detail design entails information that the builder can use to build from and against which the quantity surveyor can measure each building operation from. It is also the set of drawings that are issued to the authority to gain their approval (Burston, 1982: 26-28). In order to do detail design successfully, knowledge of construction is essential. For this, knowledge and experience of practical ability is essential (Burston, 1982: 50). In the design development phase, the architect compiles a revised report that contains combined proposals of the professional team. This includes the shape and appearance of the building, the structure of the building, the standard of the finishes, the effectiveness of the building in respect of running costs and energy usage, physical welfare and maintenance, recommendations regarding tender procedures and the type of contract to be used, elemental cost analysis, programme for further documentation and a warning to the employer that changes to the design will probably result in additional costs and may also cause delays (Hauptfleisch & Sigle, 2009: 41).

This information is fundamental in project management, as project managers aim to complete a project within budget and within the allocated time (Kerzner, 2006: 7).

The technical documentation and approval stage demands the preparation of technical documentation of the team. This stage starts once the employer gives the instruction.

Contract administration and supervision is initiated once the employer instructs the design team to call for tenders (Hauptfleisch & Sigle, 2009: 43).

An architect also needs to have the ability to coordinate (Burston, 1982: 28). For this communication and writing abilities are essential (Burston, 1982: 50-51).

#### **4.4.2.1.1 Architect's procedure**

It is important for an architect to be a construction expert (Burston, 1982: 28). They are involved in the planning, design and construction phases (Bennett, 2006: 40).

It is important for the project manager in construction to have knowledge of the roles and responsibilities of the project team (SACPCMP, 2011: 14-15) and also the architectural procedures and involvement of the architect. Ashworth and Hogg (2007: 379-380) state various duties of a project manager working in construction. This include being party to the contract, assisting in preparing the project brief, advising on the budget and funding, site acquisition, arranging a feasibility study and report, developing a project strategy and consultant's briefs, preparing a project handbook, devising a project programme, establishing a management structure and co-ordinating the design processes. The project manager also has to appoint consultants, arrange insurance and warranties, select a procurement system, arrange tender documentation, organise contractor prequalification, evaluate tenders, participate in contractor selection and

appointment, organise the control system and monitor progress, arrange meetings, authorise payments and select project team members. The tasks of devising the project programme and selecting team members that are mentioned above require a project manager that has knowledge of what all the team members' work entails. These are some of the essential knowledge aspects that a project manager needs to successfully manage projects in the built environment.

#### **4.4.2.2. Quantity surveyor**

Understanding the function of a quantity surveyor is important as a project manager needs to understand the functions of all the role players in the industry. Furthermore to investigate the relevance of a project managers knowledge base, especially regarding costing, may contribute to improved understanding of project management functions. Quantity surveyors were once looked upon as the measurers of the industry (The Royal Institute of Chartered Surveyors, 1992: 15). The Banwell Report of 1964 defined the quantity surveyor as the 'economist of the construction industry.' This has changed and the role of the quantity surveyor has expanded considerably. Today quantity surveying may even include management, advising on taxation implications and sources of grants (Banwell, cited in RICS, 1992: 18 & 45). Quantity surveyors can also give advice on occupancy cost and the economic life of developments, an area that was once covered by the estate manager, building surveyor and accountant. The client has faith in the quantity surveyor due to the quantity surveyor's knowledge of design and construction of both technical and managerial aspects (The Royal Institute of Chartered Surveyors, 1992: 18).

It is important for a profession to respond to changes that may occur on social, technological, economic and environmental level. A profession needs to develop and adjust accordingly. The future success and expansion of the profession starts with determining the knowledge base and core skills of the profession.

After that, attention can be paid to the nature of diversifications that needs to be made after which education, training and research in the profession can be addressed (The Royal Institute of Chartered Surveyors, 1992: 9).

#### **4.4.2.2.1 Competencies of the quantity surveyor**

When studying core competencies, attention needs to be paid to the knowledge and skill base, the markets and the constraints. In quantity surveying the knowledge base is mostly within the framework through which construction activity is realised and includes areas such as measurement rules and conventions, construction economics, construction technology, financial management, business administration and construction law. The skill base has to do with the individual's skills and also the collective ability of the profession as a whole and includes aspects such as management, measurement, analysis, appraisal, synthesis and communication. The markets are where the services are sold and can refer to the type of service that is sold such as value management or procurement management, the market sector such as the property or construction engineering and also geography for example which town or country. The constraints are set by professional knowledge limits and geography (The Royal Institute of Chartered Surveyors, 1992: 10).

#### **4.4.2.2.2 Core skills of the quantity surveyor**

It is necessary to determine what the core skills of the quantity surveying profession are. It is important to know the distinction between skills and techniques. Techniques refer to the methods that quantity surveyors use to do their work, whereas core skills refer to the ability that a quantity surveyor has to apply the techniques (The Royal Institute of Chartered Surveyors, 1992: 49).

The RICS study of 1992 (1992: 61) indicates that the unique skill-base of the quantity surveyor revolves around cost/value management and procurement. In

1971 the RICS published a report entitled 'The future role of the quantity surveyor' and it defined the role of the quantity surveyor as:

‘ensuring that the resources of the construction industry are utilized to the best advantage of society by providing, inter alia, the financial management for projects and a cost consultancy service to the client and designer during the whole construction process’ (Ashworth & Hogg, 2002:1).

#### **4.4.2.2.3 Knowledge base of the quantity surveyor**

The RICS study (1992:39-45) states that there are different types of knowledge that make up the quantity surveyor's knowledge base. The types of knowledge can be grouped into general or domain knowledge. General knowledge includes knowledge about socio-economic and political climate, geography and climate (weather), language and communication systems, understanding of monetary systems and understanding of transport systems. Domain knowledge covers knowledge about technology relating to processes and products, construction technology, knowledge about sources of information and about information management systems, knowledge about the cultural, organisational and legal frameworks within which the service is provided and knowledge about the economic, business and financial environment within which the service is provided.

Quantity surveyors can give preliminary cost advice on the probable cost of a new scheme, advising on the comparative costs of alternative layouts, materials, components and methods of construction. They can also supply further information regarding maintenance and operational costs (Seeley, 1997: 63).

Cost planning is a service offered by quantity surveyors. It aims to assist all members of the design team to arrive jointly at practical and effective designs

and to remain within budget. Should the employer decide to bring about changes and variations, the quantity surveyor can determine what the cost implications will be (Seeley, 1997:63).

The bills of quantities are compiled by the quantity surveyor and are used for the tendering process. The bills of quantities translate the drawings, schedules and specification notes into a document listing in detail all component parts. This allows all tenderers to calculate their tender on the same basis (Bennett, 2006: 43; Seeley, 1997: 63).

#### **4.4.2.3 Engineers**

It is important to understand the role of engineers in the built environment. Engineering is a profession that has many fields. This includes aeronautics and aerospace, agriculture, architecture, automotive, biomedics, ceramics, chemistry, civil, computer, electrics and electronics, environment, industry, manufacture, marine, materials and metallurgies, mechanics, mining and geologies, nuclear and petroleum. Mechanical, electrical and civil engineers are involved on different schemes (Burghardt, 1991: 54-71). In the built environment, the engineering services involved are mechanical, electrical and civil (Seeley, 1997: 315-318; 40-41). On a construction project, it is the engineer's task to prepare the necessary designs, specification and other relevant documents, receive quotations for the work that needs to be done and report back on it. The engineer will also supervise work that is done on the construction site (Seeley, 1997: 40-41).

The engineering services can be summarised as follows (Hauptfleisch & Sigle, 2009: 51). The study stage includes the evaluation of the project in consultation with the employer and also undertaking the needed studies in order to compile a report. The design stage includes designing the project, preparation of specifications and submission to the employer. The engineer also has to advise



the employer on suitable contractors, obtain the needed tenders and produce reports. During the construction stage of a project, the engineer's services include administrating the planning, programming and co-ordination of contractors. Payments are approved and completed work certified (Career Advice, 2011: Online; Professional Practice Curriculum, 2011: Online).

#### **4.4.2.3.1 Civil engineers**

Civil engineering work covers highways, bridges, tunnels, buildings, water supply, sewerage systems to name but a few (Burghardt, 1991:61-62). A large part of civil engineering lies within the construction industry, doing structural design and being involved during the construction phase (Burghardt, 1991: 61-62).

Knowledge of the load bearing properties of soil and how to increase the load bearing properties of soil by using piling is needed. Buildings rest on soil, hence proper understanding of soil is essential (Burghardt, 1991: 61-62).

Civil engineering contracts will usually involve a resident civil engineer on site that will supervise the work, certify payments to the contractor, regularly check progress and ensure that health and safety requirements are adhered to (Ballantyne, cited in Seeley, 1997: 44).

#### **4.4.2.3.2 Mechanical engineers**

Mechanical engineering is the application of the principles of mechanics and energy to the design of machines and devices. This may be movable devices such as a lawnmower or thermal designs such as air conditioning systems (Burghardt, 1991: 68-69). This field of study needs to understand motion, the effect of external forces on this motion and also lubrication and new materials (Burghardt, 1991: 68-69).

#### **4.4.2.3.3 Electrical engineers**

Electrical engineering deals with the motion of electrons in metals, such as wires and filaments. To design, develop and manufacture any electrical device, from a dishwasher to an automobile, requires the knowledge that an electrical engineer possesses (Burghardt, 1991: 64-65).

#### **4.4.2.4 Town planners**

Town planning is a profession in the built environment and may be defined in various ways (Keeble, cited in Ratcliffe, 1975:3). Hauptfleisch and Sigle (2009: 54) state that the role of the town and regional planner is to investigate and plan or re-plan the most effective ways for towns, cities and regions to function taking into account and recording factors such as physiographical properties and socio and economic factors. Physiographic properties include the geological structure, soil characteristics, topography, available natural resources and the climate. Social and economic factors include traffic and communications systems, composition of the population, industrial infrastructure and available social and engineering services.

The planner can then evaluate the existing occupational pattern and prepare a suited development programme for the area. The planner has to draw up the necessary control measures by drawing up plans (Royal Town Planning Institution, 2011: Online).

#### **4.4.2.5 Project manager**

Burke (2005:11) defines a project manager as the single point of responsibility, someone who integrates and co-ordinates all the contributions on a project, and guides them to successfully complete the project.

The project manager needs to have a combination of industry knowledge and experience (Sears, Sears & Clough, 2008: 15), managerial knowledge, leadership qualities and project management knowledge. The key duties of a project manager, as stipulated by the RICS Project Management Agreement and Conditions of Engagement are to communicate to the consultants the requirements of the client's brief, monitor the progress of design work, and the achievement of function by reference to the client's brief, monitor and regulate the programme and progress, monitor and use reasonable methods to coordinate the work done by the consultants, advisors, contractors and suppliers working on the project and monitor the cost and financial rewards of the project (Ashworth & Hogg, 2005: 321-331).

Chapters 2 and 5 discuss the project manager in more detail. Chapter 2 refers to project management and the project manager in general, while Chapter 5 discusses project management and the project manager in the construction industry.

It is ideal that a project manager has a construction industry background. It is important for a project manager to have an understanding of the process and the product of construction, and a working knowledge of the structure of the industry. Quite often a project manager in the built environment is a member of one of the construction professions (Ashworth & Hogg, 2007: 381).

#### **4.4.2.6 Contractor**

Seeley (1997:42) defines a contractor as 'the person or firm who undertakes to complete a building project in accordance with the contract documents on behalf of the employer'. All payments of the subcontractors are channelled through the main contractor. The contractor has personnel that has to oversee work on site

and usually has a site manager on large projects and a foreman on smaller projects (Seeley, 1997: 42-43).

#### **4.4.2.7 Subcontractor**

Subcontractors are appointed by contractors. The responsible party on site remains the main contractor. Subcontractors can broadly be classified in three categories namely craft firms, constructional firms and firms specialising in mechanical and electrical building equipment. Craft firms include firms for plumbing, tiling, plastering and painting. Constructional firms include firms for piling, structural steelwork, and reinforced concrete and patent floor construction. Firms specialising in mechanical and electrical building equipment include heating, ventilation, air conditioning, lifts and escalators (Seeley, 1997: 8; 43).

#### **4.4.2.8 Other consultants**

Additional consultants such as interior decorators, landscape architects and acoustic consultants may be involved in some projects. Interior designing is about the harmony between structure, dimensions, finishers and furnishings. Landscape architecture ranges from landscaping of residential development to environmental work alongside a length of motorway or environmental work around a power station. An acoustic consultant has knowledge about sound and noise control design techniques and can advise architects. They have knowledge of acoustic measurement, calculation and prediction (Seeley, 1997: 41-42).

There needs to be collaboration between all the built environment stakeholders and disciplines. A whole systems thinking will contribute to an effective and sustainable built environment (Korkmaz & Singh, 2012: 289-295).

## **4.5 KNOWLEDGE**

The various forms of knowledge are explored in Chapter 2. This includes knowledge about the industry, knowledge gained through experience and knowledge of project management. There are two main schools of thought with regards to project management – generic project management and industry specific project management. Both schools acknowledge the need for project management knowledge. Generic project management is recognised as an integral part of construction project management (Sage et al, 2010: 629-639). The difference between the two schools lies in the need for industry specific knowledge or not. Both generic and industry specific programmes that are offered in project management will be investigated.

### **4.5.1 Project management qualification**

To gain knowledge on project management, courses on the subject can be attended. The type of course may differ and ranges from short courses to degrees. Students may be required to attend classes or may opt for distance education. Hence students need not attend classes but can receive training through e-learning. The e-learning course needs to allow chat sessions with participants and lecturers. Students should also be able to discuss problems with lecturers at any time. Individual monitoring of current studying status needs to be possible and it needs to be integrated with the content of the face-to-face phases (Grau & Vosse, 2006: 23-26). Project managers need to be competent using technology. As part of a project manager's education, the necessary soft skills regarding systems need to be acquired. The importance and use of information technology is far reaching and is also essential for project managers (Taylor, 2010: 79-103).

Some courses cover generic project management while others focus specifically on project management in the construction field. An example of a generic project

management course is the Programme in Project Management (PPM) presented at the University of Pretoria.

#### **4.5.1.1 Generic project management programmes**

- **University Certificate Programme in Project Management (PPM)**

The programme requires attending classes on campus for 20 days, within a period of 6 – 12 months. The eight modules are project management principles, practices and scheduling, project risk management, project procurement and contract management, project quality management, people side of project management, legal aspects for project managers, financial principles and project cost management, and project management in the business context (University of Pretoria, 2011: Online).

The topics covered include advanced project management, general project management, budgeting and forecasting, business analysis, coaching , communication, conflict management, consulting skills, cultural change management, facilitation, governance, leadership, negotiations, portfolio management, problem solving, project accounting, risk management, scheduling strategy, team building and virtual team management.

The PPM course is not an industry specific project management course, but is a generic project management course that caters for people from various sectors. It is offered through the Centre for Continued Education at the University of Pretoria. It is important to note that the Centre offers various project management courses, making a distinction between project management in various industries and generic project management offered for all. The Centre has programmes such as the programme in IT project management and project management for the built environment practitioner.

- **Postgraduate Diploma in Project Management (PGPM)**

The course requires attendees to have a three year Bachelor degree or National Diploma or NQF level 6 as well as three years appropriate experience. The modules covered include principles of project management, project management leadership, project scope and time management, project financial management, project communication and risk management, project quality management, project resource and integration management and project applied technology (Moncosa, 2011: Online).

- **Short course through Monash Univeristy**

The project management short course through the Monash University covers modules in project management framework, strategic project management, development project management, project integration, project time management, project cost management, project quality management, project human resource management, project communication management, project risk management, project procurement management and information technology for project management (Monash, 2011: Online). The course is offered over a ten day period.

The generic project management courses offered range from short courses to degree level. Some courses are more advanced than others. People from all industries are welcome to attend the course, as it is applicable to all industries. This information can thus also be useful knowledge for individuals working in the built environment. However, there are project management courses that cater for built environment practitioners, making project management applicable to that industry. It focuses on areas that are essential to the built environment. The next section discusses a few examples of such construction project management courses.

- **Intensive Project Management Programme (IPMP)**

This course is an intensive project management course offered over the period of five days. It is presented by the University of the Free State and the syllabus consists of time management, introduction to project management, structure of the built environment and procurement processes, planning and scope management, risk management, communication management, cost management, quality management, human resources management, integration management and contemporary issues (University of the Free State, 2011: Online). This course is aimed at built environment practitioners, as it discusses, for example the JBCC, the structure of the built environment and insurance for construction processes as part of risk management.

- **Project Management for the Built Environment Practitioner  
(Continuing Education – University of Pretoria, 2011: Online)**

This course applies the nine areas of the PMBOK guide specifically to the built environment. There is specific coverage of the law of contracts, standard industry contracts for contractors, agreements for consultants, procurement processes and contract administration.

The course consists of four contact weeks over the duration of a year. It is presented by the Centre for Continued Education at the University of Pretoria.

The third form of knowledge that is essential is knowledge that is gained through experience. Petterson (1991: 99) states that project managers need a solid basic experience in the relevant field.



#### 4.5.2 Industry specific qualifications

The school of thought that underlines the importance of industry specific knowledge indicates that technical knowledge needs to be obtained. This study investigates whether project managers need industry specific knowledge therefore understanding how such knowledge can be obtained and what it includes as important. Industry specific knowledge can be gained through a professional qualification such as a degree in quantity surveying, architecture or engineering. Such qualifications can be obtained at many universities.

Chynoweth (2009:301-310) did research on the built environment and presented a model that indicates the knowledge base in the field. He also mentions that there is a flow of interdisciplinary knowledge within the realm of the built environment. The qualifications that form the foundation of technical knowledge for professionals working in the built environment will now be investigated.

The University of Pretoria offers various undergraduate programmes in the built environment. This includes architecture, interior architecture, construction management, quantity surveying, real estate and engineering (University of Pretoria, 2011a: Online). These are professional qualifications that built environment practitioners can obtain. Such professionals may venture into project management in the built environment, thus understanding the knowledge that is offered in the degree highlights the technical knowledge such a professional will have.

- **BSc (Arch) – Architecture**

Architecture involves the design of buildings and the spaces between buildings. It requires a combination of the creative and the rational. BSc (Arch) is a three year course that leads to registration as a candidate senior architectural technologist at the South African Council for the Architectural Profession. In order to register

as an architect, a further two year BArch (Hons) needs to be completed (University of Pretoria, 2011b: Online).

- **BSc Int – Interior architecture**

The study aims to find a solution for design problems in the context of architectural space and related fields of product, exhibition, stage and lighting design. The projects combine knowledge and insight of materials, building technology and man in his environment and also involve capabilities of broader fields of design, communication and management. It is a three year degree.

- **BSc Construction Management**

The discipline involves technical and managerial aspects. The first three years of study touches on some managerial aspects, but the main focus is aimed at equipping the student with hard skills that are based on the technical aspects. The first phase is a three year BSc (Construction Management) degree and the second phase a BSc (Hons) (Construction Management) two year degree.

- **BSc Quantity Surveying**

Quantity surveying studies enable students to gain specialised financial and contractual knowledge. The Royal Institution of Chartered Surveyors (1992: 35) states that education of the quantity surveyor is of great importance. Management skills, business skills and technology skills should all feature in study programmes. The first phase is a three year BSc (Quantity Surveying) degree and the second phase a BSc (Hons) (Quantity Surveying) two year degree.

- **BSc Real Estate**

Real Estate is the study of fixed property and related aspects such as property economics, development, management, valuation, financing, investment and marketing. It is a three year programme.

- **Engineering**

Engineering courses can be followed at The University of Pretoria (University of Pretoria, 2011: Online) or The Tshwane University of Technology (TUT) (Tshwane University of Technology, 2011: Online).

This is a brief description of university degrees available for various built environment professions. These built environment fields also have registered bodies to which professionals can register with after qualification. In South Africa civil engineers can register with the South African Institute of Civil Engineers (South African Institute of Civil Engineers, 2011: Online) or the South African Federation of Civil Engineering Contractors (South African Federation of Civil Contractors, 2011: Online), electrical engineers with The South African Institute, of Electrical Engineers (South African Institute of Electrical Engineers, 2011: Online), architects with The South African Institute of Architects (South African Institute of Architects, 2011: Online), quantity surveyors with The South African Council for the Quantity Surveying Professional (South African Council for the Quantity Surveying Professional, 2011: Online) or Association of South African Quantity Surveyor (Association of South African Quantity Surveyor, 2011: Online). There are still numerous other institutions and associations that professionals in the built environment may choose to register with. The courses vary between three to five year programmes. This research investigates the importance of industry specific knowledge. It discusses whether a project manager should have a solid knowledge base of the built environment in order to increase the success and effectiveness in project management within the built

environment. All these qualifications provide a specific built environment knowledge base.

There are various courses and programmes in the built environment. In South Africa SACPCMP acts as an authority and receiving accreditation through them serves as a benchmark. SACPCMP conducted a programme accreditation of construction management and construction project management courses within higher education institutions in South Africa. Twenty eight programmes were accredited.

The listed institutions are University of the Witwatersrand (WITS), University of Johannesburg (UJ), University of Pretoria (UP), Tshwane University of Technology (TUT), University of the Free State (UFS), Nelson Mandela Metropolitan University (NMMU), Walter Sisulu University (WSU), University of Cape Town (UCT), Cape Peninsula University of Technology (CPUT), Mangosuthu University of Technology (MUT) and Durban University of Technology (DUT). The course range from diplomas to masters of science degrees in construction management or construction project management.

#### **4.7 CHAPTER SUMMARY**

The built environment collectively refers to building (including houses, shops, warehouses and factories) and civil engineering (that includes roads, bridges, dams, railways, harbours and power stations). Built environment projects usually take place according to a development process that consists of inception, feasibility, outline proposals, scheme design, detail design, production information, bills of quantity, procurement phase, project planning, operations on site, completion and feedback. Projects include several stakeholders. There are employers, developers, planning authorities, financiers, building contractors and professional advisors. The professional advisors usually include architects, quantity surveyors, engineers, town planners and project managers. These

professions gain knowledge through professional qualifications that may be a diploma or a degree after which they may register with a professional body within their industry. Project managers may gain knowledge through various courses, ranging from short courses to project management master degrees. Often a project manager in construction is also a member of one of the construction professions.

## **CHAPTER 5**

### **PROJECT MANAGEMENT IN THE BUILT ENVIRONMENT**

#### **5.1 INTRODUCTION**

Project management is a discipline that is applied in many industries. Chapter 2 gives some background on project management in general. This chapter reviews project management in construction. Construction project management is defined, attention is paid to the advantages of project management in the construction industry and the project phases of a construction project are discussed.

SACPCMP, SAQA and the extensions to the PMBOK are reviewed. The South African Council for the Project and Construction Management Professions compiled a list of construction project management knowledge areas essential for a project manager. This underlines the need for construction industry knowledge. The Project Management Institute made a distinction between generic project management and industry specific project management by compiling the Construction Extension to the PMBOK guide with four new knowledge areas. The purpose of the Construction Extension is to improve the efficiency and effectiveness of the management of construction projects. All qualifications, including project management qualifications, need to register through the South African Qualifications Authority (SAQA) and receive an NQF level. The significance to the construction industry and the need for industry knowledge is debated.

## **5.2 PROJECT MANAGEMENT IN THE BUILT ENVIRONMENT**

### **5.2.1 Construction project management**

It is indicative when reviewing the literature on project management that a distinction is made between generic project management and industry specific project management. Management of construction projects is a separate professional discipline as are professions such as engineering and architecture. Traditionally the engineer or architect managed the projects. These professionals were then both principle designer and the manager of the process and had to plan and programme the work of the team members, such as the quantity surveyor, service and structural engineers. Whoever led the team, the architect or the engineer (predominantly it was the architect), attention had to be split between the team leader's design role and management role. This is a function that is very difficult to achieve. If the United Kingdom schools of architecture are to be used as an example, it is clear that the architectural syllabus pays very little attention to management subjects (Ashworth & Hogg: 2007: 375-378). Yet, changes have been seen in what is expected of contractors. An emphasis has developed upon the management of construction (Ashworth & Hogg, 2002: 375-378). Managerial skills are also listed as one of the major skills required by quantity surveyors (Willis & Ashworth, 1990: 170).

Over the years the relationship between client, consultant and constructor has become increasingly strained. The problems are usually based on the increased complexity of construction projects. The design and construction of these projects are more complex. There is a great need for completing the project on time or even for early completion if possible, as well as for acceptable levels of building performance and an increased concern for financial control in its entirety (Ashworth & Hogg, 2007: 375-378). This refers again to the importance of the core elements of a project, known as the project constraints – time, cost and performance. A project needs to be completed within time, cost and to the

desired performance (Kerzner, 2006: 3-5). In recent times the need for improved communications and a closer coordination of the project became evident. That will involve coordination of all team members involved in the design and construction process. Project management involves the person taking responsibility and control for coordinating the activities of various consultants, contractors, subcontractors, processes and procedures for the full duration of the project (Ashworth & Hogg, 2007: 375-378). These needs illustrate that it is important to meet the client's requirements.

There are numerous advantages of project management in the construction industry. The total development costs may be lower as project management may increase the effectiveness and efficiency. The technical, financial and programming skills are fully utilised from the conception stage. There is more specialisation with less fragmentation on a project. This applies to the professions individually and the project as a whole. Efficient time, cost and quality control can formally be applied. Good management is to the benefit of all project parties, but especially to the employer. Construction is fast tracked, as design, documentation and construction work take place concurrently. This saves project time. Time is an important constraint on a project, as the aim is to complete a project within time, cost and to the desired quality and performance (Kerzner, 2006: 5). The employers' involvement is minimised, which saves time (Hauptfleisch & Sigle, 2009: 25).

As Ashworth and Hogg (2007: 377) state: 'Project management adds value by fulfilling the management role within the context of a modern and increasingly complex construction industry and in recognition of client demand'. An effective construction project manager needs technical knowledge, project management knowledge and general management knowledge. It adds to the efficiency and effectiveness of the management of construction projects (PMI, 2008:4-10).



In construction a distinction needs to be made between a project manager working for the contractor and a project manager working for the client. A project manager working for the contractor is primarily concerned with the construction process, while the project manager for the client has a broader role description. A project manager can also work not for a client, but independently. This is discussed in further detail in the next section (Ashworth & Hogg, 2007: 378).

The duties of a project manager working in construction include being party to the contract, assisting in preparing the project brief, advising on budget and funding, site acquisition, arranging a feasibility study and report, developing a project strategy and consultants' briefs, preparing a project handbook, devising the project programme, selecting project team members, establishing the management structure and co-ordinating the design processes. It further entails appointing consultants, arranging insurance and warranties, selecting a procurement system, arranging tender documentation, organising contractor prequalification, evaluating tenders, participating in contractor selection and appointment, organising the control system and monitoring progress, arranging meetings and authorising payments (Ashworth & Hogg, 2007: 379-380).

Project managers working for a client need to do total coordination, including coordination of statutory authorities, issuing health and safety procedures, addressing environmental aspects, monitoring the budget, final account and arrange pre-commissioning, and organising the handover/occupation. The project manager needs to advise on marketing/disposal, organise maintenance manuals, plan for the maintenance period, develop the maintenance programme, plan facilities management and arrange for feedback monitoring.

The above mentioned duties are indicative of the construction industry related activities a project manager in the industry needs to do, and therefore knowledge of the industry is required. To name a few examples, the project manager needs industry knowledge in order to effectively develop a project strategy, to co-

ordinate design processes, to evaluate tenders and to participate in contractor selection.

When project management is carried out independently, the duties are generally the same, with the exception of a few. A project manager is then not involved as a party to the contract, to advise on budget/funding arrangements or site acquisition, grants and planning and with the selection of project team members (Ashworth & Hogg, 2007: 379-380).

The SACPCMP notes that in order to be able to conduct the projects effectively, there are certain competencies that a project manager in construction needs to have. This is divided into project management competencies and technical competencies.

Table 5.1 indicates the project management competencies the project manager, as principal consultant in construction, should have and also the project management competencies the project manager, as principal agent in construction, requires (SACPCMP, 2011: 14-15):

Table 5.1 Principle consultant and principle agent knowledge requirements

<b>Position</b>	<b>Required knowledge and ability</b>
Principal consultant	Facilitate the development of a clear brief.
	Clearly define the roles and responsibilities of the consulting team.
	Prepare letters of appointment for the procurement of the consulting team.
	Time management processes on projects.
	Establish and recommend professional indemnity requirements.
	Monitor and co-ordinate quality management of the design processes.
	Communication management processes including the preparation of agenda, chairing and preparing minutes of all necessary meetings on the project.
	Co-ordinate and monitor cost control by the cost consultant.
	Co-ordinate and monitor the preparation of procurement documentation.
	Facilitate and monitor the preparation of the health and safety specifications.
	Facilitate the preparation of all conditions of contracts
	Manage the pre-qualification, tendering, adjudication, recommendation and appointment processes.
Principle agent	The ability to take responsibility for and perform the role of principal agent on construction contracts.
	Knowledge and understanding of the basic principles of law and contracts.
	Knowledge and understanding of construction contracts.
	Build good relationships (Partnering) between client, consulting and construction teams.
	The ability to establish and implement time management processes on contracts.
	Quality management processes on contracts including quality control by the consulting and contracting teams.
	Establish and implement cost management processes on contracts including the issuing, costing and implementation of site instructions and variations.
	Co-ordinate and monitor interface between all contractors.
	Co-ordinate and monitor implementation of health and safety plan.
	The ability to facilitate and co-ordinate the production of the health and safety file.
	The ability to manage, resolve and certify progress and contractual claims.
	The ability to co-ordinate and monitor completion and handover processes.

(SACPCMP, 2011:14-15)

The project management competencies that are given by the SACPCMP include tasks that require generic project management knowledge and other tasks that require industry specific project management knowledge.

Generic project management knowledge is essential but not sufficient as generic project management knowledge gives the toolbox filled with skills necessary for project management. This includes skills such as computer produced organisational charts, cash-flow statements, bar charts and work breakdown structures (Burke, 2006: 1). These are skills that can be used within any industry. Referring to Table 5.1, certain skills are generic. Some of the generic skills include the ability to build good relationships between client, consulting and construction teams, prepare letters of appointment for the procurement of the consulting team, and knowledge and understanding of the basic principles of law and contracts. However, in addition to these skills, the project manager in the construction industry needs construction industry specific skills. Industry specific tasks that are presented in Table 5.1 include: monitor and review construction progress and programme updates, prepare indicative construction programmes, clearly define the roles and responsibilities of the consulting team, the ability to take responsibility on construction contracts and to have knowledge and understanding of these contracts. These tasks demand certain knowledge of the construction industry. The level of knowledge a project manager requires, needs further debating.

The technical competencies, explained in Section 5.2.4 reviews knowledge of construction processes and building sequence as essential knowledge. This supports the research hypotheses that project management in the built environment demands industry specific knowledge. Therefore, even certain of the project management competencies demand a level of technical knowledge about the industry, the built environment.

There are project management courses - both industries specific project management and generic courses – that are graded between five and ten. SAQA describes the scope of knowledge that is required for the various NQF levels. Level five requires knowledge of the main areas of one or more fields, disciplines or practices, including an understanding of the key terms, concepts, facts, principles, rules and theories of that field. Level six requires detailed knowledge of the main areas of one or more fields, disciplines or practices, including an understanding of, and an ability to apply the key terms, concepts, facts, principles, rules and theories of that field, discipline or practice; Knowledge of an area or areas of specialisation and how that knowledge relates to other fields, disciplines or practices. Level seven requires integrated knowledge of the main areas of one or more fields, disciplines or practices, including an understanding of, and an ability to apply and evaluate the key terms, concepts, facts, principles, rules and theories of that field, discipline or practice. Furthermore, there is detailed knowledge of an area or areas of specialisation and how that knowledge relates to other fields, disciplines or practices. Level eight requires knowledge of and engagement in an area at the forefront of a field, discipline or practice. Furthermore, there is an understanding of the theories, research methodologies, methods and techniques relevant to the field, discipline or practice, and an understanding of how to apply this knowledge in a particular context. Level nine requires specialist knowledge to enable engagement with and critique of current research or practices. An advanced scholarship or research in a particular field, discipline or practice is present. Level ten requires expertise and critical knowledge in an area at the forefront of the field, discipline or practice, as well as the ability to conceptualise new research initiatives, and create new knowledge or practice.

There are various SAQA registered courses that are not generic, but examples of construction project management courses are the Certificate in Construction Project Management offered at the University of KwaZulu-Natal and the MSc in

Construction Project Management course offered at the University of Kwa-Zulu-Natal.

The MSc in Construction Project Management course has an NQF level of nine and specifies that the purpose of this qualification is to develop specialised/scientific knowledge of a selected aspect of construction project management through a course work of selected courses and a supervised research project. The importance of basic industry knowledge is reflected in the entry requirements. In order to get access to the degree, the entry requirement is a Bachelor of Science Honours degree in Property Development (Construction Management) or its equivalent (SAQA, 2011: Online).

The Certificate in Construction Project Management course also reflects the importance of industry specific knowledge. It states:

‘Admission to the certificate programme is open to matriculated persons who also have construction related working experience. Prospective candidates must be currently in employment and have access to experiential opportunity through their employment. Learners are required to provide documented evidence of prior experience in the construction industry, together with contact particulars of three referees who are able to attest to their academic potential’ (SAQA, 2011: Online).

The NQF level of construction project management knowledge that should be the minimum level required for a practicing construction project manager is reviewed later in this chapter.

### 5.2.2 Need for construction industry knowledge

A project manager needs to be able to think clearly. It is an essential aspect of management. The inability to think clearly often stems from an inadequate understanding of the objectives and priorities associated with the problem. It is thus vital that a project manager has an adequate understanding of the objectives and priorities associated with the problem. This leads once again back to the fact that project managers working in construction need to have knowledge of the construction industry (Ashworth & Hogg, 2007: 381-384). There is thus a need for industry specific knowledge.

In this thesis it is researched whether built environment industry knowledge is required for a project manager, in order to increase the effectiveness and possibility of project success. Project management is a combination of both technical and managerial knowledge and skills. Therefore, having technical knowledge is an important element.

Kerzner (2006: 146-149) states that one of the skills that both project and programme managers need is technical skills. Technical expertise is necessary to evaluate technical concepts and solutions, to communicate effectively in technical terms with the project team and to assess risks and make trade-offs between cost, schedule and technical issues. Kerzner (2006: 146-149) states that this is the reason why in complex problem-solving situations, many project managers need to have an engineering background.

Having a project manager with technical skills does not imply that the project manager needs to be a technical specialist. Having a technical specialist perform the role of project manager may cause numerous problems. It is, however, important that the project manager has some technical understanding. Technical expertise comprises an understanding of the technology involved, engineering tools and techniques employed, product application, specific markets, their

customers, and requirements, technological trends and evolutions, the relationship among supporting technologies and people who are part of the technical community.

The South African Council for the Project and Construction Management Professions (SACPCMP) states that a project manager in construction needs a specific set of technical competencies in order to effectively execute the work the construction project manager needs to do (SACPCMP, 2011: Online). The technical competencies are indicated in Table 5.2:

Table 5.2 Technical knowledge of a project manager

<b>Technical knowledge areas</b>	<b>Required knowledge</b>
Knowledge of construction science	Understanding structures.
	Understanding construction and building sciences.
	Understanding construction and building finishes.
	Knowledge of building materials.
Knowledge of construction processes	Site, plant and equipment.
	Formwork systems.
	Quality management.
	Health and safety management.
	Environmental management
	Organisational/ Management structures.
	General building sequences.
	General output and production factors.
Knowledge of the design processes	Sequence of design processes.
	Time required for design processes.
Knowledge of financial and cost factors	Financial processes.
	Cost of construction .

(SACPCMP, 2011: Online)

The primary research hypothesis states ‘Project management requires industry-specific knowledge, specifically when working in the built environment industries.’ The technical competencies that SACPCMP states a project manager needs to effectively execute a project, supports the debate.



The construction industry is unique and project management within this industry requires a specialised form of management. A construction project manager requires technical competencies in order to effectively execute the work the construction project manager needs to do (SACPCMP, 2011: Online).

Techniques that work for one industry do not necessarily work for the next. For instance, techniques derived from the manufacturing industry often will not work in construction. Therefore, Ashworth and Hogg (2007: 381) states:

'Ideally therefore, the project manager will already be a member of one of the construction professions. An understanding of the process and the product of construction, and a working knowledge of the structure of the industry, will clearly be advantageous if not essential. The importation of managers with no knowledge of the industry or its workings has drawbacks, and their appointment should be approached with caution.'

Professionals within the construction professions have to comply with certain requirements in order to register as practicing professionals. This includes a certain degree and set amount of years working experience.

As an example, in order to work as a quantity surveyor, the candidate needs to possess a BSc Honours degree in Quantity Surveying and gain experience in the field. The Bachelor of Science Honours degree in Quantity Surveying is graded on a NQF level seven. Consequently, a quantity surveyor's knowledge is minimally on an NQF level seven.

Investigating NQF level of qualifications and experiences that is essential may be a guide as to the construction project management NQF level that could be proposed. Architects register through the South African Council for the Architectural Profession (SACAP). Only persons that are registered with SACAP may render architectural services. To register as a professional architect, the

candidate needs a PrArch-degree(SACAP, 2012: Online), have at least twenty four months of experience as a candidate architect and pass the Professional Practice Examination (PPE). SAQA grades the PrArch-degree as a level seven. Thus a professional architect needs a minimum scope knowledge of an NQF level seven.

The above reflects the NQF level of knowledge of some of the construction professions. It is suggested that a CPM's NQF level of knowledge required for both project management and industry knowledge should be discussed and debated in future.

SACPCMP provides the technical knowledge areas they regard as essential for a construction project manager, as listed in table 5.2. It still leaves a void regarding which NQF level the knowledge needs to be. Literature supports the debate that technical knowledge is essential. Project managers need a solid basic experience in the relevant field (Patterson, 1991: 99). Cadle and Yeates (2001: 358) state that a project manager must have an accurate understanding of the technical requirements of the project so that business needs are addressed and satisfied. Webb (1994: 55) also supports the opinion that some technical knowledge is needed, not necessarily in-depth understanding, but rather a basic technical knowledge base. Cagle (2005: 111-116) states that in certain cases it needs to be expert knowledge, while for other projects basic knowledge is sufficient. The knowledge does not have to be in-depth, rather a basic understanding of the industry. Projects differ. Even the terminology and way of executing the project differs, for instance between a tilt-up concrete construction and a residential construction (PMI, 2008: 10). Projects also differ in complexity and in size and require different levels of proficiency. A small project requires a basic skill set, an intermediate project requires an advanced skill set and a large project requires an advanced skill set. A programme requires an expert skill set, a virtual project and an international programme require a specialty skill set and for a large-scale programme a principle skill set is required. These indicate that

the type of project and the skill set needed indicate that the level of knowledge or proficiency is not constant and similar for all projects.

SAQA NQF level five is described by SAQA as

‘knowledge of the main areas of one or more fields, disciplines or practices, including an understanding of the key terms, concepts, facts, principles, rules and theories of that field’ whereas level six requires more detail knowledge, SAQA describing it as ‘detailed knowledge of the main areas of one or more fields, disciplines or practices, including an understanding of and an ability to apply the key terms, concepts, facts, principles, rules and theories of that field, discipline or practice’. For projects, at least a level five is required, but may be higher should the project demand greater technical knowledge.

Project managers also need project management knowledge. This should be at a higher level as project managers need to be specialists in their primary field of work, namely project management. The level of project management knowledge needs to be detailed knowledge of that area of specialisation. SAQA describes the scope of knowledge for NQF level seven as ‘detailed knowledge of an area or areas of specialization and how that knowledge relates to other field, disciplines or practices.’ Reviewing professions within the construction industry such as architects, engineers and quantity surveyors, it is revealed that the required SAQA level of knowledge, as a specialist, is level seven. Therefore it can be suggested that the project manager’s knowledge, as an expert in project management, should be at an NQF level seven. This indicates that not only have they mastered lower level knowledge but also the top level.

### **5.3 KNOWLEDGE REQUIRED FOR COST AND QUALITY CONTROL**

A project needs to be delivered on time, to the estimated cost, according to the scope set out and according to the expected quality (Burke, 2006: 11; Kerzner, 2006: 597-603; Turner, cited in Burkes, 2006: 2).

A successful project needs a competent project manager. A competent person is someone that has the required knowledge, skills and abilities to perform their duties and responsibilities (Awasi, 1983: 103; Steyn *et al.*, 2010: 246).

As noted above, a project needs to be completed within time, to the scope and cost and according to the expected quality. Cost and quality are discussed to illustrate the importance of knowledge. The importance of knowledge in order to achieve the expected cost and quality and to gain project success is reviewed.

#### **5.3.1 Construction project manager and quality**

Quality may be defined as 'meeting the customer's expectations' or 'compliance with customer's specification' (Collins, cited in Jha & Iyer, 2006: 1155). In Zen and the art of motorcycle maintenance the narrator states that 'a person who cares about what he sees and does is a person who's bound to have some characteristics of quality' (Persig, 1974: 275). The International Organisation for Standardiation (ISO: 1991 efficiently ) sums up quality as the 'totality of characteristics of an entity that bears on its ability to satisfy stated or implied needs' (ISO, cited in Chung, 1999: 1). A project is expected to be according to the expected quality and meeting the requirements it has undertaken to produce (Heldman, 2007: 36).

Management plays a significant role in the construction industry, and is more important in affecting project quality than the workforce itself (Jha & Iyer, 2006: 1170). Jha and Iyer (2006: 1770) conducted research that revealed that middle

management (in the case of a project it will be the project manager), plays a more important role in most stages of the project.

It is important for any construction project to comply with quality specifications, as this is an important measurement of the project's performance (Jha & Iyer, 2006: 1169). Jha and Iyer (2006: 1156) state that many studies were conducted by numerous authors such as Chua (1999), Arditi and Gunaydin (1998), Pheng (2004), Abdel-Razek (1998), Ledbetter (1994) and Love and Smith (2003) in order to address quality related issues. Jha and Iyer (2006: 1156) then conducted research to identify the critical attributes that determine the quality level – be it a positive quality level or factors that adversely affect a project's quality. The aim should then be to maximise the factors that contribute to success, and minimise the factors that bring about failure to meet the desired quality.

The Construction Extension to the PMBOK guide states that in construction it is important that the project management system employs all processes needed to meet the project requirements. The primary goal of quality management is to ensure that the conditions of the contract are carried out and satisfied within the agreed-upon schedule and budget (PMI, 2008: 57).

The following factors have positive contributions to bring about quality: top management support and competence, interaction between project participants, owners' competence and monitoring and feedback by project participants. Factors that proved to have an adverse effect on the quality of a project are conflict among project participants, hostile socio-economic and climatic conditions, ignorance and lack of knowledge, certain project specific factors and aggressive competition at the tender stage (Jha & Iyer, 2006: 1169). The most significant factor that affects project quality was shown to be the competence of the project manager (Jha & Iyer, 2006: 1169). This has an impact on project

success. It is essential for a construction project manager to have the necessary knowledge base.

### **5.3.2 Construction project management and cost**

Cost is an integral part of project management and also construction project management. Cost is part of the critical elements as a successful project needs to be delivered on time, to the estimated cost, according to the scope set out and according to the expected quality (Burke, 2006: 11; Kerzner, 2006: 597-603; Turner, cited in Burkes, 2006: 2). Cost is an integral part of construction management; therefore the cost knowledge gained in the industry needs to be explored. This research reviews cost specifically and also the built environment professionals that work with cost, such as quantity surveyors.

#### **5.3.2.1 Cost**

A project takes place in a competitive market and should be completed within the approved budget and time (Heldman, 2007: 35 & Ashton and Hogg, 2002: 51)). The aim of cost estimation is to predict the cost of construction as accurately as possible (Smith, 1992: 1-3). Cost is therefore an important element in a project and in project management. In construction, the construction project manager has to have a strong cost management ability (PMI, 2008: Online).

The importance of cost is highlighted when looking at the PMBOK knowledge areas (Project Management Institute, 2003: 157). Cost management as one of the nine knowledge areas. It needs to be part of planning, budgeting and controlling. It distinguishes between three main processes in project cost management, namely cost estimating, cost budgeting and cost control. Cost estimating involves the approximation of the costs of the resources needed to complete project activities. Cost budgeting covers aggregating the estimated costs of individual activities or work packages to establish cost baseline. Cost

control involves influencing the factors that create cost variances and controlling these changes to the project budget (PMBOK, 2003: 157).

Estimating and pricing are part of cost management and are important elements of project (Kerzner, 2006: 541-542). It involves establishing estimates for resources and establishing budgets (Heldman, 2007: 35). Estimating is not blind luck but a disciplined, well thought out approach with methods such as analogous estimating, determining resource cost rates, bottom-up estimating and parametric estimating (Kerzner, 2006: 541-542; PMBOK:2003: 164-166). The aim of estimating is to determine the cost of a construction as accurately as possible (South African Property Education Fund, 1999: 101-122; Smith, 1992: 1-3). Successful estimating relies on sufficient knowledge of contracts, of the procedures used, how and when the work will be carried out, the level of pricing in the market and the commercial state of competitors (Willis & Ashworth, 1990: 135). Therefore, the knowledge base of a construction project manager is of great importance.

### **5.3.2.2 Cost in the built environment professions**

There are various professions in the built environment (Bennett, 2006: 42-43; Collier, 1995: 98-99). Certain professions focus on cost and have therefore broader knowledge on costs than others. Looking at all professional consultants in the built environment, the quantity surveyor is especially equipped to work with cost management and financial management (Zack, 2004: 17-21). A quantity surveyor has specialised knowledge regarding costing (Ashworth & Hogg, 2002: 5). Quantity surveyors are the cost and value experts of the construction industry and one of their tasks involves controlling of construction costs (Ashworth & Hogg, 2002: 5). Some of the titles that have been suggested are 'construction cost consultant and a 'construction accountant'.

Quantity surveyors are involved in costing and their competencies include cost planning (Seeley, 1997: 63), single rate approximate estimates (Ashworth & Hogg, 2002: 8), maintenance and operational costs (Seeley, 1997: 63), measurement and quantification (Ashworth & Hogg, 2002: 8), a bill of quantity that is compiled and supplied (Seeley, 1997: 63), cost control during construction, interim valuations and payments, financial statements, final account preparations and agreement and settlement of contractual claims (Ashworth & Hogg, 2002: 8). A quantity surveyor needs to assist all team members to deliver practical and effective designs, within budget and any variations the team members want to make to the project needs to be analysed (Seeley, 1997: 63).

Considering the importance of cost management in project management, and also the competencies of quantity surveyors relating to cost, it could be deduced that quantity surveyors may be equipped with a valuable skill if working as project managers. However, cost estimation and management should be shifted across various role players in the industry (Doloi, 2013: 267-279). Cost planning and control also need the input of the architect. In order to assist the quantity surveyor, the architect should provide the quantity surveyor with all the details required for the preparation of an elemental estimate. The required knowledge base empowers an architect to perform these tasks. Also, the architect should inform the quantity surveyor of all changes in design or specification and call for new estimates as the drawings progress (South African Property Education Fund, 1999: 121). Studying some professions within the built environment can thus add to a valuable knowledge base that can assist when working within project management. Formal studies in construction professions add to the knowledge base of industry related knowledge required for a construction project manager. Knowledge of land use and environmental impact, supervising work on site and checking progress, certifying payments of the contractor and ensuring health and safety are related to the construction industry and demand knowledge of the industry. Other professionals within the built environment also have sound knowledge of certain aspects of the industry, as a result of their formal studies.



As Clough (1979: 1) states, 'in order to effectively manage a construction project, considerable general knowledge background of the construction industry is required'.

#### **5.4 CONSTRUCTION PROJECT PHASES**

Chapter 2 described generic project management and illustrated the difference between generic and construction project phases. Construction project phases were touched on but are now discussed. Attention is paid to the industry specific tasks highlighting the importance of industry specific knowledge.

The South African Council for the Project and Construction Management Professions (SACPCMP) refers to the project phases as six stages, namely project initiation and briefing, concept and feasibility, design development, tender documentation and management, construction documentation and management and project close out (SACPCMP, 2011: Online).

#### **5.5 CONSTRUCTION PROJECT MANAGEMENT – IDENTIFICATION OF WORK**

The title of the research thesis, 'Project management in the built environment: the need for industry specific knowledge', indicates that construction project management is the focus. In order to understand what construction project management entails, knowledge of construction project managers' roles and responsibilities is essential. The research investigates project managers and the need for industry specific knowledge. Hence the importance of knowing what the roles and responsibilities of a project manager in the built environment are, in order to determine the knowledge base needed.

The SACPCMP provides an identification of work for construction project managers. The work is listed under the project phases. It is a reputable source to

use for this research study, as it covers the work and scope of services for construction project managers, as registered in terms of the Professions Act no. 48 of 2000 (SACPCMP, 2011: Online). All construction project managers should, according to legislation, be registered with SACPCMP.

The project stages as set out by RICS were discussed in general in a previous chapter. An in-depth look at the responsibilities of a construction project manager as set out by the SACPCMP, as a respected professional body, now follows.

Therefore the list provided below is applicable to all construction project managers (SACPCMP, 2011: Online). This information is very important in the study and forms part of a knowledge foundation for the empirical study and the development of a construction project management model, therefore sections from SACPCMP online has been directly quoted in 5.5.1 to 5.5.6.

### **5.5.1 Project initiation and briefing**

The project manager needs to ensure the following services during the project initiation and briefing phase:

- Facilitate the development of a clear project brief.
- Establish the client's procurement policy for the project.
- Assist the client in the procurement of the necessary and appropriate consultants including the clear definition of their roles, responsibilities and liabilities.
- Establish in conjunction with the client, consultants, and all relevant authorities the site characteristics necessary for the proper design and approval of the intended project.
- Manage the integration of the preliminary design to form the basis for the initial viability assessment of the project.
- Prepare, co-ordinate and monitor a project initiation programme.

- Facilitate the preparation of the preliminary viability assessment of the project.
- Facilitate client approval of all documentation for the project initiation and briefing phase.

Studying the duties above, certain duties reflect the necessity for the project manager to have industry specific knowledge. Such knowledge is essential in order to prepare, co-ordinate and monitor a project initiation programme and also to facilitate the development of a clear project brief. Project managers need industry specific knowledge in order to communicate with the technical staff on the project and also to understand what they are saying, understanding the terms used and the implications thereof (Webb, 1994: 55).

### **5.5.2 Concept and feasibility**

The project manager needs to ensure the following services during the concept and feasibility phase. Assist the client in the procurement of the necessary and appropriate consultants including the clear definition of their roles, responsibilities and liabilities. Advise the client on the requirement to appoint a health and safety consultant. Communicate the project brief to the consultants and monitor the development of the concept and feasibility within the agreed brief. Co-ordinate and integrate the income stream requirements of the client into the concept design and feasibility. Agree the format and procedures for cost control and reporting by the cost consultants on the project. Manage and monitor the preparation of the project costing by other consultants. Prepare and co-ordinate an indicative project documentation and construction program. Manage and integrate the concept and feasibility documentation for presentation to the client for approval. Facilitate client approval of all concept and feasibility documentation (SACPCMP, 2011: Online).

Studying the duties above, certain duties reflect the need for the project manager to have industry specific knowledge. Such knowledge is essential in order to prepare and co-ordinate indicative project documentation and construction programmes. Webb (1994: 55) states that some technical knowledge is needed as today's products are complex. Therefore it is not expected that project managers understand all aspects of the technology and they do not have to generate technical solutions, yet they do need technical knowledge. In order to compile a construction programme, knowledge of the construction industry is crucial. Project managers need the knowledge in order to know what questions to ask and make appropriate judgments (Turk, 2007: 25). Kerzner (2006: 477) states that with scheduling, large projects can be converted into PERT networks once the following questions are answered. The tasks that precede and follow a task need to be determined. Also, the tasks that run concurrently need to be determined. Hence, it is clear that a project manager needs industry specific knowledge in order to answer questions, or to make judgments and know whether the full story is being told or not.

### **5.5.3 Design development**

The project manager needs to ensure the following services during this phase. Assist the client in the procurement of the balance of the consultants including the clear definition of their roles, responsibilities and liabilities. Establish and co-ordinate the formal and informal communication structure, processes and procedures for the design development of the project. Prepare, co-ordinate and agree a detailed design and documentation program, based on an updated indicative construction program, with all consultants. Manage, co-ordinate and integrate the design by the consultants in a sequence to suit the project design, documentation program and quality requirements. Conduct and record the appropriate planning, co-ordination and management meetings. Facilitate any input from the design consultants required by construction manager on constructability. Facilitate any input from the design consultants required by

health and safety consultant. Manage and monitor the timeous submission by the design team of all plans and documentation to obtain the necessary statutory approvals. Establish responsibilities and monitor the information flow between the design team, including the cost consultants. Monitor the preparation by the cost consultants of cost estimates, budgets, and cost reports. Monitor the cost control by the cost consultants to verify progressive design compliance with approved budget, including necessary design reviews to achieve budget compliance. Facilitate and monitor the timeous technical co-ordination of the design by the design team. Facilitate the client approval of all the documentation of this phase. (SACPCMP, 2011: Online).

Studying the duties above, certain duties reflect the need for the project manager to have industry specific knowledge. Industry specific knowledge is essential in order to do tasks such as to prepare, co-ordinate and agree on a detailed design and documentation programme, based on an updated indicative construction programme, with all consultants; to facilitate and monitor the timeous technical co-ordination of the design by the design team as well as to conduct and record the appropriate planning, co-ordination and management meetings; and to facilitate any input from the design consultants required by the construction manager on constructability. Turk (2007: 25) states that project managers need to know what questions to ask and thereby judge when they are not getting the full story. This is essential in meetings. If a construction project manager has no knowledge of the industry, it will be difficult to know what to ask and to apply the required judgment. Therefore technical knowledge is essential.

#### **5.5.4 Tender documentation and procurement**

The project manager needs to ensure the following services during the tender documentation and procurement phase. Select, recommend and agree the procurement strategy for contractors, subcontractors and suppliers with the client and consultants. Prepare and agree the project procurement program. Co-

ordinate and monitor the preparation of the tender documentation by the consultants in accordance with the project procurement program. Facilitate and monitor the preparation by the health and safety consultant of the health and safety specification for the project. Manage the tender process in accordance with agreed procedures, including calling for tenders, adjudication of tenders, and recommendation of appropriate contractors for approval by the client. Advise the client, in conjunction with other consultants on the appropriate insurances required for the implementation of the project. Monitor the reconciliation by the cost consultants of the tender prices with the project budget. Agree the format and procedures for monitoring and control by the cost consultants of the cost of the works. Facilitate client approval of the tender recommendation. (SACPCMP, 2011: Online).

Studying the duties above, certain duties reflect the need for the project manager to have industry specific knowledge. For instance industry specific knowledge is essential in order to prepare and agree on the project procurement programme. The construction extension to the PMBOK guide indicates the importance of industry specific knowledge as it refers to lessons learnt from construction projects specifically. It states that 'the procurement management plan of the buyer organisation is an important output of the acquisitions process, and is influenced by organisational policies, culture and procedures, and lessons learned from previous construction projects' (PMBOK, 2008: 104). Sears, Sears and Clough (2008: 15) state that a project manager needs basic construction fundamentals in order to fulfil the project management duties.

### **5.5.5 Construction documentation and management**

The project manager needs to ensure the following services during the construction and documentation and management phase. Appoint contractor(s) on behalf of the client including the finalization of all agreements. Instruct the contractor on behalf of the client to appoint subcontractors. Receive, co-ordinate,

review and obtain approval of all contract documentation provided by the contractor, subcontractors, and suppliers for compliance with all of the contract requirements. Monitor the on-going project insurance requirements. Facilitate the handover of the site to the contractor. Establish and co-ordinate the formal and informal communication structure and procedures for the construction process. Regularly conduct and record the necessary site meetings. Monitor, review and approve the preparation of the contract program by the contractor. Regularly monitor the performance of the contractor against the contract program. Review and adjudicate circumstances and entitlements that may arise from any changes required to the contract program. Monitor the preparation of the contractor's health and safety plan and approval thereof by the health and safety consultant. Monitor the auditing of the contractors health and safety plan by the health and safety consultant. Monitor the compliance by the contractors of the requirements of the health and safety consultant. Monitor the production of the health and safety file by the health and safety consultant and contractors. Monitor the preparation by the environmental consultants of the environmental management plan. Establish the construction information distribution procedures. Agree and monitor the construction documentation schedule for timely delivery of required information to the contractors. Expedite, review and monitor the timeous issue of construction information to the contractors. Manage the review and approval of all necessary shop details and product propriety information by the design consultants. Establish procedures for monitoring, controlling and agreeing all scope and cost variations. Agree the quality assurance procedures and monitor the implementation thereof by the consultants and contractors. Monitor, review, approve and certify monthly progress payments. Receive, review and adjudicate any contractual claims. Monitor the preparation of monthly cost reports by the cost consultants. Monitor long lead items and off-site production by the contractors and suppliers. Prepare monthly project report including submission to the client. Manage, co-ordinate and monitor all necessary testing and commissioning by consultants and contractors. Co-ordinate, monitor and issue the practical completion lists and the certificate of practical completion. Co-

ordinate and monitor the preparation and issue of the works completion list by the consultants to the contractors. Monitor the execution by the contractors of the defect items to achieve works completion. Facilitate and co-ordinate adequate access with the occupant for the rectification of defects by the contractors.

Studying the duties above, certain duties reflect the need for the project manager to have industry specific knowledge. Industry specific knowledge is essential in order to regularly conduct and record the necessary site meetings, monitor, review and approve the preparation of the contract programme by the contractor and regularly monitor the performance of the contractor against the contract programme. Webb (1994: 55) states that the project manager needs sufficient technical understanding in order to communicate with the project's technical staff on their terms and also grasp the implications of what is being said to him/her on technical terms. This is essential during site meetings and monitoring of progress.

#### **5.5.6 Project close out**

The project manager needs to ensure the following services during the project close out phase. Issuing the works completion certificate. Manage, co-ordinate and expedite the preparation by the design consultants of all as-built drawings and design documentation. Manage and expedite the procurement of all operating and maintenance manuals as well as all warranties and guarantees. Manage and expedite the procurement of all statutory compliance certificates and documentation. Manage the finalization of the health and safety file for submission to the client. Co-ordinate, monitor and manage the rectification of defects during the defects liability period. Manage, co-ordinate and expedite the preparation and agreement of the final account by the cost consultants with the relevant contractors. Co-ordinate, monitor and issue the final completion defects list and certificate of final completion. Prepare and present the project closeout report.



Studying the duties above, certain duties reflect the need for the project manager to have industry specific knowledge. Industry specific knowledge is essential in order to manage, co-ordinate and expedite the preparation by the design consultants of all as-built drawings and design documentation. The right questions need to be asked to consultants and in order to do that, industry specific knowledge is needed (Turk, 2005: 25).

## **5.6 PROFESSIONAL BODIES**

Gaining insight into the programmes that are offered by professional bodies serves as a bench mark with regards to project management knowledge that is essential. SACPCMP, CIOB and the PMI are such bodies. The SACPCMP offers a list of programmes that are accredited, some of which were discussed in previous chapters. The Chartered Institute of Building (CIOB) accredits programmes in disciplines such as quantity surveying, construction management and real estate. The universities and programmes that received accreditation through the CIOB are listed and can be accessed as a proof that the programmes adhere to a specific standard. The PMI is a well-recognized project management institution. It offers 9 knowledge areas with an extra four areas that relate to the construction industry specifically.

## **5.7 CONSTRUCTION SPECIFIC BODY OF KNOWLEDGE**

In Chapter 2 various organisations and project management organisations and institutes are reviewed, one of which is the Project Management Institute. The Project Management Institute published a book that is a global standard, known as the PMBOK guide, an abbreviation for the Project Management Body of Knowledge. It is the sum of knowledge within the profession of project management and provides a generic foundation for managing projects (PMI, 2004: 3-4).

The Project Management Institute published an extension to the PMBOK guide, called Construction Extension to the PMBOK guide (Zack, 2004: 4). This guide states that an extension to the PMBOK is needed when there are generally accepted knowledge and practices for a category of projects in one application area that are not generally accepted across the full range of project types in most application areas. The construction extension to the PMBOK guide states that as project management became more popular in various industries, a broadening of concepts and an inclusiveness developed that do not cover current project management in construction. It therefore reflects that generic project management is not sufficient. The Construction Extension to the PMBOK guide reflects the industry specific nature of project manager where it states that ‘...while the changes may not be substantial, they are different enough to warrant an extension’.

The purpose of the Construction Extension is to improve the efficiency and effectiveness of the management of construction projects and to include information that is currently not in the PMBOK guide. The guide focuses on project management practices that are specific to the construction industry. (PMI, 2008: 3-6). It is not as wide and generic as the PMBOK, but industry specific.

The construction industry was the foundation of the original PMBOK guide in 1987. Since then the project management profession has widened to include many other industries. This widening has caused project management to be broader and more universal in nature, thereby not covering present-day project management practices found in the global construction industry. Therefore the construction industry is different enough from other industries to justify an extension (PMI, 2008: 4). This is important to the research study as it is indicative of a distinction between project management in different industries. The research focuses on project management in the built environment.

### **5.7.1 Construction project management specific knowledge areas**

The nine knowledge areas - project integration management, project scope management, project time management, project cost management, project quality management, project human resource management, project communications management, project risk management and project procurement are discussed in Chapter 2. These areas are generic and applicable to all projects. Project management courses and construction project management courses registered with SAQA have an NQF level rating and vary between a level six for an advanced certificate to a level nine for an MSc-degree in project management. Looking at the lower end level, level six is described by SAQA as detailed knowledge of the main areas of one or more fields, and that it includes disciplines or practices and knowledge of an area or areas of specialisation and how that knowledge relates to other fields, disciplines or practices (SAQA, 2011: Online). Therefore, the construction project manager should have a detailed knowledge base of the project management areas, as well as the four construction specific areas that are discussed below. The construction unique project management knowledge areas are project safety management, project environmental management, project financial management and project claim management (Zack, 2004: 4-5). Considering that the Project Management Institute published a guide with four extra areas, especially for the construction industry, it clearly has importance for the industry. As this research is concerned with the built environment, taking a closer look at these four areas is essential.

#### **5.7.1.1 Project safety management**

Construction sites are considered to be one of the most dangerous working environments. Therefore, attention to safety and the management of safety is crucial (Fisk & Reynolds, 2010: 141-142).

In the PMBOK guide the knowledge area covering project safety management includes both safety management and health management (PMI, 2008: 119-137). Safety management's goal is to ensure that a project is executed safely, without accidents, injuries or damage (Zack, 2004: 6). It is important that all stakeholders that are involved are informed about the project's safety objectives and the implications of the execution thereof. Therefore, communication to the stakeholders is extremely important. In urban projects, a stakeholder that is involved, more so than on other projects, is the neighbouring community. Special attention must be paid to the community's needs and expectations, especially regarding safety. Safety management needs to be implemented throughout the policy, procedures, processes of safety planning, assurance and control and when undertaking continued improvement activities throughout the project (PMI, 2008: 119-137).

Smallwood and Haupt (2006: 133) state that health and safety deserves thorough attention as it can mitigate the exposure of a project to risk (Brown, 1996: 137-143). It is suggested that all decisions should consider potential health and safety implications before finalising and implementing the decision. Lester (2000: 114) suggests that health and safety should be added as one of the parameters of cost, time and quality – that is the severity of its impact on a project.

Safety management must primarily ensure that the conditions of the contract are carried out, including those contained in legislation and that any project technical safety specifications are carried out to assure the safety of both those working on site and in the vicinity of the project. Safety management needs to address both the management of the project and the product of the project.

The PMBOK guide provides guidelines for safety planning, performing safety assurance and performing safety control processes and activities that are applicable to most construction projects most of the time. SACPCMP lists one of

the essential knowledge areas a construction project manager needs, as safety (SACPCMP, 2011: Online).

### **5.7.1.2 Project environmental management**

Project environmental management is added as a knowledge area in the Construction Extension to the PMBOK guide. The purpose of project environmental management is to minimise the impact on the surrounding environment and natural resources (PMI, 2008: 139). Environmental issues are currently receiving a great deal of attention. A field of economics focuses specifically on the environment. This discipline is known as environmental economics and covers the efficient allocation of environmental resources. In environmental economics, attention is paid to sustainable development. This could be defined as development that meets the needs of the present without compromising the ability of future generations to meet their needs (Essential Environmental Literacy Agency, 2007: 15-17).

Construction projects cause environmental impact due to its nature. Therefore, project environmental management is essential, especially if trying to ensure that future generations are not worse off than the present generation, from a sustainable development point of view. It needs to ensure that a project operates within the limits stated in legal permits, and that various governmental permits, regulations and conditions are not violated (Zack, 2004: 17-21). If this is not ensured, it could cause serious problems for a project. Project environmental management includes identifying the environmental characteristics surrounding a construction site and the potential impact that the construction may have on the environment, planning how to prevent environmental impacts, achieving environmental conservation and improvement if possible, auditing the plan, controlling the results and inspecting environmental conditions (PMI, 2008: 139-158).

Environmental management requires that the project management system employs all processes needed to meet the project requirements and that these processes take the environment into consideration. Therefore it primarily consists of ensuring that the conditions of the contract are carried out whilst having a minimal effect on the environment. The environment referred to is not only the immediate environment but also the environment far from the construction site. The aim of a good environmental management plan is to keep the impact on the environment to an absolute minimum (PMI, 2008: 139-140). Depending upon the nature and location of the project, this may be a very technically complex part of project management (Zack, 2004: 17-21).

#### **5.6.1.3 Project claim management**

Claims are a significant part of the construction process; therefore it was added to the PMBOK guide as part of the Construction Extension. A claim is a demand for something that is due, or that is believed to be due. This is usually the result of an action, direction, or change order against the agreed terms and conditions of a construct, that cannot be resolved between parties (PMBOK, 2008: 167-178). The details of a claim should be investigated, the arguments summarised and the financial claims of each claim set out (Willis & Ashworth, 1990: 170). If a claim is resolved, it becomes a change, if not, it proceeds to negotiation, mediation, arbitration or litigation.

The best way to prevent claims is to eliminate claims. Therefore, attention is paid on how to prevent claims from occurring. A risk-allocated, well-scoped and well-executed contract should be the aim. A well-developed plan communicated with all stakeholders is critical. The early recognition of potential problems, and open communication between stakeholders create a collaborative environment in which claims are less likely to occur.

#### **5.6.1.4 Project financial management**

Project financial management is not the same as one of the other knowledge areas known as cost management (PMI, 2008: 159). Project financial management is more concerned with project revenue and monitoring net cash flows for the construction project (Zack, 2004: 17-21) than with managing the day-to-day cost, as in the case of cost management (PMI, 2008: 159).

Financial management includes financial control. Financial control involves asking funds from project partners when needed and performing insurance and bank withdrawals/deposits at the appropriate times. This process also ensures that bonds are reduced when necessary.

This ensures that an appropriate financial information storage/retrieval database is designed and maintained, which enables financial control to take place smoothly (PMI, 2008: 159-166). SACPCMP lists financial management as one of the essential knowledge areas a construction project manager needs (SACPCMP, 2011: Online).

The four areas discussed demonstrate the importance of industry specific knowledge. Also, concerning project management, the knowledge a project manager needs extends further than the generic knowledge base. In addition to the generic body of knowledge, a construction project manager also needs to have construction project management knowledge. This underlines the research topic of this thesis 'Project Management in the built environment: the need for industry-specific knowledge.'

### **5.8 CHAPTER SUMMARY**

Projects should be completed on time, according to the specifications, within expected performance and quality and within costs. This holds true for the

construction industry. Project management assists and increases the effectiveness of the project. The literature supports the research hypothesis that states that project management requires industry specific knowledge, specifically when working in the built environment industry.

The South African Council for the Project and Construction Management Professions lists the competencies that they regard as essential for a project manager in construction. Project managers require project management and management knowledge and also technical knowledge from within the built environment. This includes knowledge of construction science, construction processes, design processes and financial and cost factors. Project managers need construction industry knowledge that is defined as knowledge of the main areas of one or more fields, disciplines, understanding key terms and concepts and is rated by SAQA as a level five. The project management knowledge a project manager needs is on a SAQA level seven and is described as integrated knowledge of the main areas of one or more field and disciplines and the ability to apply this knowledge.

The PMBOK guide is a generic project management guide, however the Project Management Institute published the Construction Extension to the PMBOK as the construction industry demands certain additional knowledge areas. These areas in the Construction Extension to the PMBOK are project claim management, project safety management, project environmental management and project financial management. The publication of a project management guide, specifically for the construction industry, indicates that there are inherent differences between the generic PMBOK guide and a guide that is best suited for the built environment. In order to optimise the possible effectiveness of a project within the built environment, industry specific knowledge is essential.



## **CHAPTER 6 – RESEARCH DESIGN AND METHODOLOGY**

### **6.1 INTRODUCTION**

This chapter provides the detail of the research design and methodology used in the study. The rationale behind the research design and data analysis is provided. Attention is given to the theoretical underpinning of the research strategy, research design and research methodology. The research method defines and explains the research approach. The research strategy refers to whether the research is qualitative or quantitative. The research design is the map of how the research study will be conducted and questions who was involved, where the research will take place, in what environment, what the time dimension of the research will be and provides the analysis of the data. The methodology discusses the data collection using a control group. The literature review section and empirical section of the research is also addressed. The foundation of understanding the research that was undertaken takes place before presenting and expanding the research findings (Silverman, 2010: 333).

### **6.2 THE SCIENTIFIC METHOD AND PERSPECTIVES ON RESEARCH METHODOLOGY**

In order to support the research methodology followed, some terminology are discussed. Leedy and Ormrod (2010, 2) defines research as:

*‘A systematic process of collecting, analyzing, and interpreting information (data) in order to increase our understanding of a phenomenon about which we are interested or concerned.’*

Certain characteristics are usually part of research. Research originates with a question or problem. It requires clear articulation of a goal and a specific plan. It usually divides the primary problem into manageable sub-problems (Leedy & Ormrod, 2010: 2-3).

Research is also led by the specific problem, question or hypothesis and certain critical assumptions are accepted. The collection and interpretation of data is required in an attempt to resolve the problem that led to the research. Research is cyclical (Leedy & Ormrod, 2010: 2-3).

This research study is deductive. A deductive approach begins with an abstract, logical relationship among concepts and then takes on empirical research and evidence (Neuman, 1997: 46). The research started off with main questions and a logical relationship between the concepts of project management, the built environment and elements of knowledge. Research starts with questioning the knowledge base required by a project manager in the built environment. The question therefore is whether industry specific knowledge is a prerequisite for successful construction project management. This question led to the hypothesis. The research hypothesis is:

*‘Construction project management requires industry-specific knowledge, specifically when managing projects in the built environment industries’.*

Scientific inquiries are approached by a controlled process and are directed towards the attainment of desired objectives (Pretorius, 2002: 3-2). To achieve the objective of this study a scientific inquiry was conducted through such a process. The scientific method refers to gaining insight into the unknown by identifying the problem, positioning the hypothesis, gathering the data, and analysing and interpreting the data to determine whether the data supports the hypothesis. Application of the scientific method usually involves both inductive reasoning and deductive logic (Leedy & Ormrod, 2010: 34). A deductive approach was followed in the research to ensure that the results and answers procured are tested and that they adhere to required scrutiny.

The research needs to be valid and reliable. Validity refers to the degree to which the instrument or constructs succeeds in measuring what is intended and claims to measure (Buckingham & Saunders, 2007: 296). Validity can take on different forms. These forms are each important but for different situations. Face validity refers to the extent to which it looks like a certain characteristic is being measured on the surface. Content validity is the extent to which a measurement instrument is measuring a representative sample of the content area being measured. Criterion validity is the extent to which the results of an assessment instrument correlated with another measurement. Construct validity refers to a characteristic that cannot be directly observed, such as motivation. It is important to note that an instrument that is well suited for one situation may not be suited for another situation. The validity of an instrument is specific to the situation (Leedy & Ormrod, 2010: 92-93). Attention is paid to the research validity to ensure that the study is as valid as possible. The research provided findings to support the hypothesis, by measuring the construct that needed to be measured. The hypothesis refers to project management within the built environment. Therefore, respondents that work within the built environment and have experience within this industry were selected to participate in the research using a case study, interviews and questionnaires. The case study was used to notice and review actual events and problems that occur on site to ensure that practice as applied is considered for the study.

Reliability refers to consistency of a measuring instrument when the entity being measured has not changed (Leedy & Ormrod, 2010: 28-29). It means that it is likely that similar results will be produced each time a research instrument is used (Buckingham & Saunders, 2007: 295). Research can only be done accurately if it can consistently be measured the same. Reliability can be improved by administering the instrument in the same way, thus standardisation from one situation or person to the next. Furthermore, if subjective judgements are required, specific criteria should be established that would then dictate the judgements of the researcher. Lastly, it is important that any assistants that help

with the administering of instruments are well trained so that similar results can be gained (Leedy & Ormrod, 2010: 29). The method used to conduct this research ensured reliability. Three different methods of research, excluding the literature review, were used, namely questionnaires, interviews and a case study. The questionnaire was distributed to a pilot group before it was distributed to the possible respondents. Feedback from the pilot group included useful improvements were implemented before sending out the questionnaires to the respondents. The reliability of the interviews was established by using one researcher who was informed, to conduct the interviews.

A research methodology dimension consists of three levels, namely methodological paradigms, research methods and research techniques. Methodological paradigms are the distinction between qualitative and quantitative research, and both form part of this research. Research methods refer to the methods used in the research process for example, data collection, sampling and data analysis. Research technique refers to the techniques used in the research methods (Schoonraad, 2003: 129). This research followed specific research methods to collect and analyse the data. The collection methods included questionnaires, interviews and a case study. Using various methods resulted in confirming the same results.

### **6.3 RESEARCH STRATEGY**

The research strategy is derived from the methodological paradigm that refers to qualitative or quantitative research (Schoonraad, 2003: 129). Qualitative research refers to qualities, where the researcher investigates characteristics that may not be easily deducible to numerical values. Quantitative research refers to quantities, looking at amounts of one or more variables of interest. A researcher using quantitative research usually looks at ways to measure variables (Leedy & Ormrod, 2010: 94-95). It was decided to use both methods, thus presenting quantitative questions that are easily statistically quantifiable and offering

qualitative questions that offer respondents the opportunity to present open ended answers that might present information unknown to the researchers and thus would not have formed part of set options.

The research used both qualitative and quantitative methods to determine the need for industry specific knowledge for project managers in the built environment. The case study and interviews entailed qualitative research while quantitative research entailed using questionnaires. The qualitative research involved conducting interviews after which the gathered data was reviewed, scrutinized and assessed. The raw data was organised into conceptual categories and themes identified. Feedback from the qualitative research afforded an opportunity for respondents to elaborate on opinions, including experiences and case studies. Another qualitative research method used was a case study of a project in the built environment. Certain categories were identified and feedback was given based on experience from the case study. In the quantitative research, the raw data was coded before starting the analysis. The codes were then entered into a statistical computer program SPSS and usable statistics were compiled.

The purpose of qualitative research is to describe and explain, to explore and build a theory. In contrast, quantitative research aims to explain and predict, confirm and validate and test theory. The nature of the qualitative research process is holistic, there are unknown variables, the guidelines are flexible and a personal view is involved (Schoonraad, 2003: 129). In the research, the interviews are illustrative of this. They are not rigid in the answering options available for respondents. Although pre-set questions were used as guideline, the respondents elaborated and added information based on their knowledge and experience, as they deemed fit. The nature of the quantitative process is focussed, there are known variables, established guidelines and the view is detached (Schoonraad, 2003: 129). The questionnaire that was used in the research are indicative thereof. The Likert scale was used in most questions,

giving respondents a five choice option, ranging from 1 indicating not important to 5 that indicates critically important. The variables are known and were coded before interpretation and assessment took place.

Qualitative research data is usually textual and image-based; the sample is small and usually involves non-standardised observations and interviews. Quantitative research data is usually numerical; a large sample and standardised instruments are used (Leedy & Ormrod, 2010: 96). This is reflected in the research study that was conducted. The qualitative research involved a small sample, having conducted ten interviews and one case study. The quantitative research had a larger sample that consisted of a control group of ten and a research population of forty. To validate the statistical findings a larger sample had to be used than in the case of the qualitative research that is not based on a large enough sample to conduct valid statistical procedures. A standardised instrument, the Likert scale, was used.

Qualitative research is analysed in search of themes and categories. The analysis is subjective and inductive reasoning is used. Data of quantitative research is analysed through statistical analysis. The Likert scale is used to transform a qualitative attitude to a quantitative one. It is objective and deductive reasoning is used. Words, narratives and personal voice usually communicate qualitative findings. The research gives interview feedback by offering respondents' opinions and experiences and using their case examples and words. The quantitative findings are usually communicated through numbers, statistics and in a scientific style (Leedy & Ormrod, 2010: 96; Silverman, 2010: 8-9; 388). The quantitative research feedback lists many tables derived from the statistical analysis conducted.

## **6.4 RESEARCH DESIGN**

Research design investigates how data will be collected and analysed (Buckingham & Saunders, 2007: 294). It refers to how the research project was conducted, who will be involved and where it will take place (du Plooy, as cited in Schoonraad, 2003: 129-130). It also includes the control of variables, time dimension and participants' perceptions (Cooper & Schindler, as cited in Schoonraad, 2003: 139).

### **6.4.1 Time dimension**

The time dimension of research refers to the period over which research is conducted. Research can be done over a long time, repeating the research again after a certain period. Cross-sectional study is carried out only once (Cooper & Schindler, as cited in Schoonraad, 2003: 139). This research study was a cross-sectional study, as the research was completed within a certain period – the interviews were conducted in two weeks and questionnaires were sent out and received within a two-month period.

### **6.4.2 Research environment**

Research can be conducted in various settings, such as a laboratory, simulated conditions or in the actual environment (Cooper & Schindler, as cited in Schoonraad, 2003: 140). This research was undertaken in the actual environment and not in a laboratory or under simulated conditions. The project was done without any research interference. The interviews and questionnaires were based on reports of actual and real life experience and occurrences.

### **6.4.3 Sampling design**

The target population for the empirical study refers to interviews, questionnaires and a case study in the built environment. It is important to the study that the target population is from within the built environment, as the research sets out to

test the required knowledge for project managers in the built environment specifically.

The target population was further constricted by only interviewing people in influential positions, with many years of experience in project management. All the interviewees have more than ten years' experience and are either chief executive officers, or function in senior management levels in their organisations. They were thus selected as target population due to their experience and knowledge gained in the industry; this increased the reliability of feedback.

#### **6.4.4 Data analysis**

Research should involve logical reasoning. Quantitative research uses mainly deductive reasoning while qualitative research uses mainly inductive reasoning. However, quantitative research is not exclusively deductive and qualitative research is not exclusively inductive. Researchers usually use both styles of reasoning (Leedy & Ormrod, 2010: 96). For this study both qualitative and quantitative research and therefore both styles of reasoning were used.

Quantitative data is analysed by using numbers (Leedy, 2010: 253). The gathered data is coded and therefore in a form that is readable by a computer. All the codes are drawn up in a codebook. The codebook is then used to read the data after it has been analysed (Neuman, 1997: 295). The Likert scale that is used in the quantitative research in this study generates numerical data. Descriptive statistics is used to interpret numerical data and is therefore used in this study. Attention is paid to many aspects, such as the points of central tendency that constitutes the mode (single number of score that occurs most frequently), the median (numerical centre of a set of data) and the mean (the precise centre of a data set). The results of the statistical analyses are interpreted with respect to the research hypothesis and research questions (Leedy, 2010: 270-272). In the study all the questions in the questionnaire were



coded, the data was then statistically analysed after which deductions were made based on the results.

Qualitative data is analysed using a much looser set of rules. The method is inductive, therefore the data is sorted and categorised into a smaller set of themes. An applicable approach to follow in analysing qualitative data is by organising the data into smaller units. All the data is scrutinised a few times to get a clear sense of the whole and general categories, subcategories or themes are then identified. The data is then integrated and summarised (Leedy, 2010: 154-153). In this research study examples of themes that were derived from the data of the qualitative interview are the various types of knowledge, qualifications, experience of respondents in the built environment, position held and field of experience.

## **6.5 METHODOLOGY**

Methodology refers to the philosophy or logic that underlines a specific method (Buckingham & Saunders, 2007: 15).

### **6.5.1 Data collection**

Research needs to determine how data will be collected and interpreted. The data that is needed should be determined, as well as where the data is located, how the data will be obtained and how it will be interpreted (Leedy & Ormrod, 2010:105-106).

In the literature section information was obtained using books, internet websites, articles, research papers and scientific journals. The tools used to obtain these resources were the library, the library catalogue and databases like SABINET, also accessible through off campus computers and the internet. In total 288 literature resources were reviewed.

The empirical data required for this research study was obtained from individuals working in the built environment. Research methodology indicates that it is beneficial to the research if data were obtained through more than one method; therefore, data was gathered through interviews, questionnaires and a case study. It was also determined where the data is located and how it would be obtained. This was known through years of involvement within the built environment and contact made with professionals and organisations in the built environment. Organisations that have established a name in the industry as professional experts were earmarked as possible sources of information and opinions. The city and address of the organisations were determined. The interviews were planned, a date was set to meet and individual interviews were conducted. All discussions were recorded and used as the interview data. In order to distribute and collect data from the questionnaires, the email addresses were obtained from professionals in the built environment. There was a selection of professionals including quantity surveyors, engineers, project managers, town planners and contractors. They were invited to participate. The questionnaire together with a cover letter explaining the research request was sent to the prospective respondents. For the case study the contact person and contact detail were obtained. This person discussed the project. All the discussions and emails exchanged were noted. It was also determined how the data would be interpreted.

Knowledgeable respondents from various organisations that have been working in the industry for years and from various professional backgrounds within the industry participated in the research.

### **6.5.2 Control group**

A control group is often used in research. This is one way of increasing validity (Leedy & Ormrod, 2010: 226). It reveals whether the way a question is formatted, produces the same interpretation among research respondents (Silverman, 2010: 272). A control group was used in the study. There were ten

respondents that completed the first questionnaire. This was done before the questionnaire was adapted and circulated to the group of respondents. This pilot study was conducted to test the questions and obtain initial results. Through the control group, certain limited adjustments were made to the questionnaire. This was based on questions asked and suggestions made by the respondents. Wording was changed and some questions added. The adjusted and improved questionnaire was then used for the study.

### **6.5.3 Ethical issues**

Ethics has four main categories – protection from harm, informed consent, right to privacy and honesty with professional colleagues. Protection of harm declares that the study's respondents should not be subjected to unusual stress, embarrassment, or loss of self-esteem (Leedy & Ormrod, 2010: 103). This was applicable to the study. The research was conducted in an ethical fashion adhering to the various elements of ethics. No harm, embarrassment or loss of self-esteem was inflicted on respondents. Respondents were treated respectfully during all contact, be it emails, face-to-face contact sessions or telephonic discussions. All input received from respondents were valued and appreciation for participation and input was expressed to respondents. All participants had the choice of whether or not they wanted to participate in the study. They were not compelled to participate. The respondents' privacy was respected. Anonymity was ensured and maintained in the study. The research findings were not manipulated but are reported honestly. Where people were mentioned in respect of performances the names are not mentioned in the study and not given to anybody else.

### **6.5.4 Literature and empirical**

The research study consists of a literature section and an empirical section. The literature section includes four sections that present the investigated research topic, and the theory on the topic. Project management is reviewed first; secondly project management in organisational context; thirdly how the built

environment is structured and lastly project management in the built environment.

The empirical research consisted of the various instruments mentioned in previous paragraphs. All respondents indicated that they have an adequate number of years of work experience and are active in the built environment. This includes respondents working in positions as quantity surveyors, project managers, construction project managers, engineers and developers.

### **6.5.5 The questionnaire**

The questionnaire used in the research consisted of two sections. Section A covered general information and section B covered project management knowledge questions. The distinction was made between the two sections due to the question format that differed between them – section A used a checklist and section B the Likert scale. Section A consisted of eight questions and section B of eighty questions. The questionnaire contained checklists and rating scales. The checklists used in section A was to determine the respondents' profession, gender, highest qualification, field of qualification, years of working experience in the built environment, types of projects and the highest value of projects worked on. The Likert scale that was used in section B provided five categories. This falls within the range of categories suggested when using the Likert scale as Likert scales need a minimum of two categories and a maximum of eight or nine (Neuman, 1997: 159; Leedy, 2010: 189). The questionnaire was distributed electronically to all possible respondents. The option was offered to complete the questionnaire either electronically or in print. Most respondents chose to complete the questionnaire electronically and emailed it back to the researcher. All the questionnaires were accompanied by an official cover letter. This letter contained an official university letter head, and explained that the aim of the study was to extend the knowledge base within project management and the built environment. It stated who was conducting the research and that it formed part of a PhD study. It stated that completing the questionnaire would be highly

appreciated and would contribute to the success of the research project. The letter affirmed that the information received from respondents would be regarded as highly confidential and anonymity was ensured if preferred. The cover letter helped to validate the research study. The cover letter and the questionnaire were emailed to the respondents.

Leedy and Ornrod (2010: 194) propose a list of guidelines for compiling questionnaires. A questionnaire should be as short and concise as possible. It should only seek to gain truly essential information. The respondents' task should be as easy as possible. The questionnaire needs to be as easy as possible to read. The discussion questions should be limited as far as possible as it is time consuming, and the respondents' time needs to be respected. Clear instructions should be provided, for instance, not assuming that they are familiar with the Likert scale. Clear, simple and unambiguous language needs to be used with questions that do not probe certain desired responses. The questionnaire should be attractive and look professional. A control group should be used in a pilot study to ensure that the questions are as clear and effective as possible.

The questionnaire used in this research study followed the guidelines discussed above. The questionnaire was as short as possible while still comprehensive enough to retrieve the necessary information. All questions asked served a purpose and discussion questions were limited. Simple and clear language was used and instructions were given where necessary. The questions were worded as unambiguously as possible. For instance, question 5 states "Indicate your years of experience in implementing projects, after qualifications, in the built environment". An ambiguous way of stating the question would have been "Indicate your years of work experience" as it does not indicate whether it refers to work experience in any industry or only the built environment. Instructions given in the questionnaire were also clear, for instance both section A and section B starts off requesting respondents to:

*“Please indicate your choice by marking (X) in the block of your choice.”*

The Likert scale that was used in section B of the questionnaire used clear language and instructions to explain and avoid any possible misunderstanding.

The beginning of section B states that the scale indicates the following:

- 1 – Not important
- 2 – Fairly important
- 3 – Important
- 4 – Very important
- 5 – Critically important

Attention was given to the appearance and professional appeal of the questionnaire. For instance, all Likert scale tables were neatly aligned below each other. There was consistency in the font that was used, the bolding of questions and spacing. This added to the professional appearance of the questionnaire. A control group first tested the questionnaire to ensure that the questionnaire was designed as clearly and effectively as possible. A few adjustments followed the control group’s feedback.

The target population was professionals working within the built environment. The respondents included people with various degrees related to the built environment. This includes engineering, quantity surveying, town planning, project management and construction management degrees or diplomas.

Questionnaires generally have a low return rate. Mail surveys often have a 10-50% return rate (Neuman, 1997: 246). Most researchers view a response below 50% as poor. Fortunately, this research study received an acceptable return rate of 57.14%. The questionnaire was sent to seventy people and forty questionnaires were received back. Questionnaires have other possible drawbacks, one being that they reflect the respondents’ reading and interpretation skills. Thus, there is the possibility of misinterpretations (Dowson & McInerney, as cited in Leedy, 2010: 189). Different research instruments were

used in respect of this study. The advantage is that the weakness of one instrument is complemented by the strength in one of the other instruments. As an example, where questionnaires are open to misinterpretation, interviews offer the interviewer the chance to clarify questions and decrease the possibility of misinterpretation (Leedy & Ormrod, 2010: 188). This approach was followed with regard to the questionnaire, interviews and the case study.

### **6.5.6 Interviews**

It was decided to conduct 10 interviews as it was regarded as sufficient control on the other results due to the profile of the interviewees and the depth of the interviews. Ten interviews were conducted with high positioned professionals, such as chief executive officers or senior management staff, that have years of experience within the built environment. The same person conducted all interviews in this research study. Using only one interviewer increases the reliability of the research (Leedy & Ormrod, 2010: 191-193). Buckingham and Saunders (2007: 290) state that interviews can be conducted face-to-face or by using a medium such as the telephone. In this research, the interviews were conducted face-to-face. There are certain guidelines as set out by Leedy and Ormrod (2010:191-193) that were followed. Leedy and Ormrod state that the questions need to be identified in advance. The respondents' cultural backgrounds are considered before starting the interview as their possible responses are anticipated. Cultural beliefs may influence the interview and the answers given. The respondents and a suitable venue for the interviews were selected. For this study, all respondents are in senior positions and have many years of experience. Chapter 7 presents a table indicating the positions of the interview respondents. Verbal interviews were conducted with the respondents. Attention was paid by the interviewer to remain as neutral as possible, not placing words in the respondents' mouth and not revealing personal reactions to answers. Both quantitative and qualitative information was obtained by the questions asked. The interviewer was alert and probed for further information when necessary.

### **6.5.7 Case study**

One case study was used as part of the research. A case study is defined as research based on the study of a naturally occurring setting (Silverman, 2010: 432). The data collected for the case study has to be analysed. The data, in other words the facts of the project, need to be organised in a logical order. Categories are identified to cluster the facts together. Specific incidences that may be relevant to the research are identified. The data is then carefully scrutinised to determine whether certain patterns and themes can be identified. An overall portrait of the case is constructed and conclusions are drawn (Leedy & Ormrod, 2010: 138). This offers answers and presents understanding to the research questions. It also presents further validity and reliability towards the other research methods used, with supporting and coinciding findings.

The research case study was discussed using the categories time, cost, scope, communication, health and safety, and conflict. The data of the case study used as part of the research was analysed. The research method was qualitative. It was then presented in a logical order. Specific categories created to discuss the case study were presented under certain headings. These headings were general background of the case study, industry factors and project management. Specific incidences where the project manager's lack of industry specific knowledge affected the project were identified and reviewed in the case study. This bares meaning for research from evidence presented through the case study. An overall portrait of the case was given and conclusions were drawn.

The case study used in this research is a building project to the value of R35 million. The project manager that worked on the project had limited previous knowledge of the built environment industry. This was used to increase understanding of the impact that industry specific knowledge, or the lack thereof, may have on a project.



## 6.6 CONCLUSION

This study was undertaken using a scientific method and systematic process of collecting and interpreting data in order to make deductions and increase the understanding of project management in the built environment and the need for industry specific knowledge. All research needs to be reliable and valid; therefore, close attention was given to maintain a reliable and valid research process and feedback. The research strategy was both quantitative and qualitative. Quantitative research uses instruments such as questionnaires to gain data. The data is based on statistics and is numerical. The study made use of questionnaires distributed to a control group that gave feedback. The feedback was used to adjust and improve the questionnaire before circulating it to the research respondents. In research, after receiving data results, interpretations are made with respect to research hypothesis and research question. Qualitative research makes use of instruments such as interviews and case studies to gain data. It is a more informal approach than quantitative research, and makes use of reasoning. The study interviewed 10 professionals working in the built environment. The data gathered was then perused, categories were identified and data placed within these categories. Conclusions were then drawn. A case study was also part of the study. It involved a project that took place within the built environment. It was decided to use various research methods, a case study, questionnaire and interviews to increase the validity and reliability of the study. It also ensures the research does not rely on a single set data procurement method and allows for comparison between the three sets of data. The research findings from the questionnaires, interviews and the case study are presented and discussed in Chapter 7.

## **CHAPTER 7 – RESEARCH FINDINGS**

### **7.1 INTRODUCTION**

The research project that forms part of the study includes interviews, questionnaires and a case study. Interviews were held with ten individuals in senior positions and with extensive experience within the built environment. The contents of the interviews, in respect of questions asked, were the same to ensure consistency. The case study is an analysis of a project within the built environment where the project manager seems not to have had the required industry specific knowledge. The implications of this on the project were investigated. The questionnaire was completed by experienced and knowledgeable professionals working in the built environment. Ten questionnaires were sent to a control group. The completed questionnaires were analysed through the pilot study in order to test the questions, adjust and make improvements to the questionnaires before sending it to forty respondents for completion. Their feedback forms part of the findings. The forty questionnaires are regarded as sufficient since the empirical study is not based solely on questionnaire feedback but also on interviews and the case study. These three research tools were used to test the reliability of each and of the study itself. It forms a solid research basis that is sufficient, impartial and comprehensive.

### **7.2 INTERVIEWS**

The aim of the interviews was to generate feedback to determine opinions of professionals in the built environment who are active in project management related fields, to obtain their views on the importance of industry specific knowledge of a construction project manager and to review the form of knowledge seen as essential, critically.

### 7.2.1 Interviewee profile

The interviews were conducted with senior professionals that work or previously worked as project managers on large projects within the built environment. These professionals were selected based on their experience within the built environment. Table 7.1 reflects the ten interviewees' background and answers the question whether they have formal qualifications within the industry as well as the number of years of experience in the built environment. It was decided that interviews were to be conducted with individuals with adequate number of years working experience in the built environment. The benchmark was 10 years, to ensure interviews with persons with ample experience are done so that a reliable data set is procured. All interviewees have more than 10 years of experience in the industry and occupy senior positions. Nine of the ten interviewees have formal qualifications within the built environment and ten interviewees have qualifications on an NQF level 6, having at least one degree. The interviewee without a formal built environment qualification uses project managers with a qualification in the built environment in order to assist in managing the developments. Even though the interviewee does not have a formal qualification in the built environment, he acknowledges the relevance and importance of using qualified project managers and he actually employs them.

During the interviews all respondents confirmed their position and job title. These include senior project managers, a programme manager, development managers, quantity surveyors, a chief executive officer (CEO) of a large engineering firm and a CEO of a property development company that has successfully completed various commercial property developments. It is valid to compare them due to their built environment knowledge, involvement and prior project management experience. It was also done in order to have persons that are comparable based on their seniority position. Even though all the interviewees were not currently working as project managers, their experience and proficiency in the built environment qualifies them to voice an opinion about

industry specific knowledge. The respective companies the respondents work for include engineering, commercial construction, quantity surveying and property development.

Table 7.1 lists the ten respondents and their respective positions and the field of the organisation they work for. Of the ten respondents, one is a programme manager, three are project managers, two are development managers, two are quantity surveyors and two are chief executive officers. All ten respondents have been involved in project management. Five respondents work for organisations that specialise in commercial construction, two for organisations that specialise in property development and three for organisations specialising in civil engineering.

Table 7.1: Built environment position and fields of experience

<b>INTERVIEWEE</b>	<b>POSITION</b>	<b>ORGANISATIONS' FIELD</b>
1	Programme manager	Civil engineering
2	Project manager	Civil engineering
3	Development manager	Commercial construction
4	Development manager	Commercial construction
5	Project manager	Commercial construction
6	Quantity surveyor	Commercial construction
7	CEO	Civil engineering
8	Project manager	Property development
9	Quantity surveyor	Commercial construction
10	CEO	Property development

Table 7.1 gives an indication of the reasons why the interviewees' opinions may be regarded as reliable. All interviewees occupy professional positions and work in professional fields within the built environment. They all have prior experience

working as a project manager, making them valid candidates to interview in the study. The project managers are registered in the project management field.

All interviewees have done projects of more than R100 million related to construction and construction project management. They have adequate experience as project managers in the built environment and have completed large projects successfully. All the interviewees and the organisations they work for are well respected within the built environment and have significant track records and extensive experience of project management functions. The interviewees are regarded as reliable and trustworthy.

## **7.2.2 Empirical findings**

### **7.2.2.1 Important knowledge**

The interview findings conclude that knowledge of project management, the built environment and knowledge gained through experience are essential. Three common areas of knowledge were identified: generic project management knowledge, built environment knowledge and knowledge through experience. All ten interviewees indicated that it is essential for a project manager to not only have knowledge in both project management and the built environment, but also experience in the industry.

The research hypothesis states that project management requires industry specific knowledge, specifically when managing projects in the built environment industries. The results from the interviews support the hypothesis and illustrates that knowledge of the built environment is important for project management in the built environment. One interviewee stated that the company he works for only appoints project managers if they have worked in the built environment in one of the professional fields, such as for instance engineering. Knowledge gained through working in the built environment industry is seen as essential.

### **7.2.2.2 Industry related knowledge required**

All interviewees indicated that industry specific knowledge is essential. Five of the interviewees expanded their answers and further discussed their thoughts on this topic. Those not mentioned hold similar views. A few of the interviewees' thoughts are discussed next.

Interviewee 7 stated that a project manager in the built environment should know the essentials of the industry. In-depth knowledge is not necessary – a project manager needs to 'see the trees and not count the leaves'. He stated that a project manager needs a qualification in the built environment, such as a degree in engineering, quantity surveying or architecture. The engineering projects company he is employed by prefer project managers who have a qualification in engineering as many of their projects are engineering based.

Interviewee 1 used a reservoir project their company was involved with as an example to indicate the need for industry specific knowledge. Project managers do not need to be reservoir experts but they need to have a thorough knowledge about the specific environment and how different elements of the reservoir project fit together. Interviewee 1 works as a programme manager in engineering and therefore has been involved in many engineering projects. From his experience and industry specific knowledge gained from working on projects for many years, he states that the project manager has to know and understand the process and systems of mining engineering when working on mining engineering projects. They would not be able to work effectively as project managers in mining engineering without industry specific knowledge. People should have various levels of knowledge. The interviewee stated that knowledge of mining engineering is essential for project management in mining engineering; nevertheless, in-depth knowledge is not required.

Interviewee 1 also stated that all project managers in the company have to be familiar with the steps and processes in engineering in order to manage the projects. He stated that an IT project manager would not be successful in their

environment. The interviewee mentioned a water project the company worked on as an example. The project manager needs to have technical knowledge of water affairs. Industry knowledge is most important, as well as project management certification based on proven knowledge such as a project management professional certification (PMP). A generic project management qualification without industry specific knowledge will not suffice in the engineering environment.

Interviewee 2 stated that generic project management without industry specific knowledge has no meaning when observing successful and effective project management. Project managers need project management knowledge plus industry specific knowledge. He stated that a project manager needs above average knowledge about the industry and an understanding of how various elements fit together. He stated that a project manager has to understand the processes involved in the industry. For instance, in a project that involves a town establishment, the project manager needs to understand the process involved in town establishment and how it is done. Without technical knowledge the project manager will struggle to make an intelligent deduction when needed.

Interviewee 2 stated that having an industry specific qualification such as engineering or quantity surveying is advantageous for a project manager working in the built environment. It serves to offer a holistic picture. Another example that he presented is a mining town establishment worth R1.5 billion. The development involves 5 000 stands. The project requires the project manager to have knowledge of commercial developments, stands, water and sewerage, electrical services, roads, how municipalities operate and mining requirements. The interviewee concluded that a project manager needs to have knowledge of the industry as well as project management knowledge in order to be as effective as possible.

Interviewee 7 also believed that industry specific knowledge is very important in project management in the built environment. He uses an analogy of an automobile accident as an illustration. He stated that if someone is injured, the person who assesses the situation and decides who is needed to help the patient has to have medical knowledge. Without medical knowledge and knowledge of the role of different doctors such as an orthopaedic surgeon, radiologist, or neurosurgeon, the person assessing the injured person will not know who is needed. Medical knowledge is needed as well as knowledge of the job description of the role players. Similarly, the project manager in the built environment needs to have knowledge of the built environment and the roles and responsibilities of the parties involved in a building project.

Interviewee 3 indicated that processes are very important. A project manager in the built environment needs to understand the processes relevant in the industry to understand what is going to be developed and built. He further stated that a project manager needs to have knowledge and experience within the built environment. A project manager should have experience in the field before advancing to managing a project.

Interviewee 5 illustrated the need for industry specific knowledge with an example of the construction boom of the early 2000s. During this time, various houses built by opportunists without industry specific knowledge ended up having problems with dampness. Many project managers ventured into the industry due to the property boom and the prospect of making money, even though their knowledge of the industry was not sufficient. Often building problems relating to quality resulted from an insufficient knowledge base required by the project. The quality was below expectation. Interviewee 5 also stated that a project manager on a housing project needs a different level of required knowledge compared to a project manager for a multi-billion rand stadium. The latter project is of greater complexity and therefore demands a greater level of knowledge from the project manager. The research reflects that project managers do need specific



knowledge although the level of industry specific knowledge may vary depending on the complexity of the project. Theory underlines the fact that projects differ in size and complexity and require different levels of proficiency (Cagle, 2005: 111-116 & Kerzner, 2006: 3).

The feedback indicated that experience is one of the essential knowledge components in the built environment. Experience is gained over time. Interviewee 1 indicated that project managers should start on a smaller scale and on smaller projects to gain experience in the field. The project manager needs to start with smaller, less complex projects and over time, gain experience to work on larger and more complex projects. This is an effective way of gaining industry specific knowledge through experience. Interviewee 5 stated that building a few residential houses differs substantially from doing a project involving building a stadium. The size and the complexity of the projects differ. Interviewee 2 mentioned that the size and complexity of projects are not necessarily tied together. It is possible that a project may be small but very complex, or large, with a low level of technical complexity. According to interviewee 1, it is advisable for a project manager in the built environment to start on projects that are both smaller and less complex.

All interviewees gave feedback and participated in discussions during the interviews. However, all interviewees did not engage in extensive discussions with added examples as did interviewees 1, 2, 3, 5 and 7. Therefore, the feedback on the discussions does not include all ten interviewees.

### **7.2.2.3 Required qualification**

The large engineering company where one of the interviewees is employed requires all their project managers to have a qualification in the built environment as well as a project management qualification. The built environment qualification could be in one of the various fields in the built environment for

instance engineering or quantity surveying. The project management qualification refers to both a project management course that the project managers need to have attended, even if it is merely a basic project management course. All project managers are encouraged to obtain project management certification. This company aims for certification for project managers by the Project Management Institute which is a well-known project management professional (PMP) certification. The project managers in this engineering company also need to have at least ten years' experience in the built environment industry, before they are entrusted to start working as project managers in the company.

Figure 7.1 illustrates the prerequisites for a project manager working in the engineering company as discussed above. It reflects the combination of skills the project manager needs. This includes a built environment qualification, a project management qualification and at least 10 years working experience in the built environment. It was set as a benchmark. Less than 10 years was regarded as possibly too little. Should a candidate only have 2 years for instance, it would not suffice. The inner circle of Figure 7.1 shows project management prerequisites with the other project prerequisites presented in the outer circle. There are three small circles in the outer circle each representing one of the prerequisites, namely a built environment qualification, project management qualification and a at least ten years work experience in the built environment.

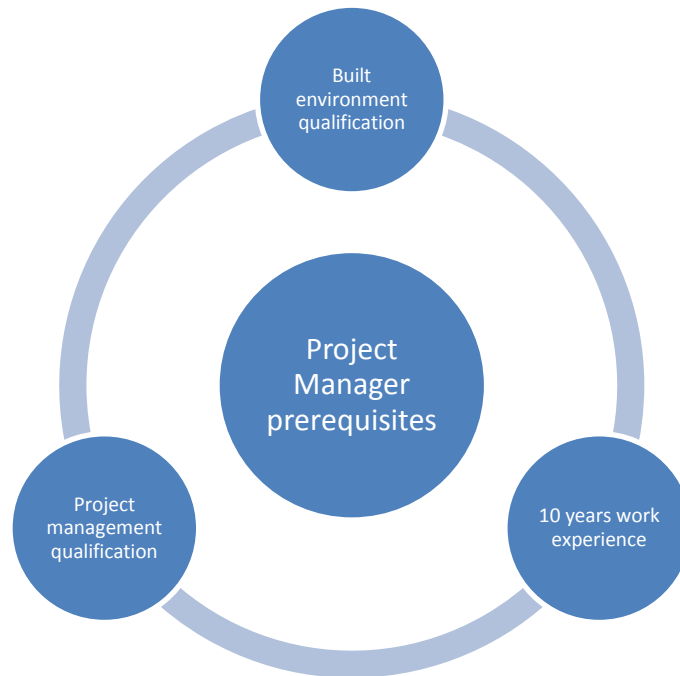


Figure 7.1 Project Management prerequisites

Figure 7.1 shows the project management requirements for a project manager set in place by a company that one of the interviewees works for. This illustrates the value placed on, and the various fields of knowledge that the company regards as essential for a project manager. This includes a project management qualification, a built environment qualification and experience in the field. It supports the research hypothesis stating that project management in the industry requires industry specific knowledge.

#### **7.2.2.4 Implications of knowledge**

Knowledge has an influence on the organisational elements of trust, leadership and communication as well as the specific terms used in a building industry project. This is supported by previous research by Berry, Verster and Zulch (2009:12-15), Butler and Cantrell (as cited in Robbins, 1996:357) and Culp and Smith (1992: 68-69). The study presented evidence that revealed a strong correlation between knowledge and trust, knowledge and leadership and

knowledge and communication. The ten interviewees all indicated that they believe a project manager needs to be a leader and that leaders require proficient knowledge. All interviewees indicated that leaders need competency in order to be trusted and respected. This adds to the validation of the study. As indicated by previous research by Chiocchio (2007: 97) and Culp and Smith (1992: 68-69) trust, leadership and communication are all elements needed for project success. These elements are affected by a project manager's knowledge or lack thereof. The knowledge required includes industry specific knowledge, project management knowledge and knowledge gained through experience in the industry. All interviewees stated that project managers need to be leaders and leaders need knowledge of the projects they are managing.

All the interviewees stated that a leader needs to be competent to gain and retain the respect and trust of followers. A project manager without the required knowledge needed for the specific project is not competent and loses the respect and trust of the project team. This affects time, cost and the quality of a project, thereby impacting on project success.

All interviewees indicated that industry specific knowledge is important in order for a project manager to communicate. The research feedback revealed that a project manager needs specific knowledge in order to be able to ask the right questions from the project team. The project manager has to understand the feedback provided by the project team and be able to communicate the feedback and status to the client. The project manager also has to anticipate potential problems, make the necessary decisions and take action in order to prevent the problems. This supports the research done by Turk (2007: 25) and Cadle and Yeates (2001: 358). Interviewee 7 stated that project managers have to anticipate potential problems. This is only possible if the project manager has industry specific knowledge and experience working in the built environment. Interviewee 5 stated that without the required knowledge, a project manager cannot communicate effectively with the team. He further mentioned that

problems with communication impact on the time, cost and quality of a project. Project meetings need to be proactive and goal orientated. To meet these requirements, a project manager needs the required knowledge.

Interviewee 2 stated that knowledge influences the quality of the message communicated by the project manager. The interviewee said that the project manager has to lead and know what questions to ask. If the project manager's knowledge about the industry is insufficient, he will not be able to understand the feedback and will not be able to make intelligent deductions from the feedback received.

Figure 7.2 illustrates the elements of the knowledge a project manager needs in order to be able to communicate effectively. As previously stated by Chiocchio (2007: 97) communication is very important to ensure effective project management.

Figure 7.2 shows five elements in a circle that are dependent on a project manager's knowledge and subsequently his communication ability. These are asking the right questions, understanding team feedback, communicating feedback to clients, anticipating potential problems and planning and taking action to prevent problems. If a project manager is not knowledgeable and a competent communicator, these essential elements will not be realised.

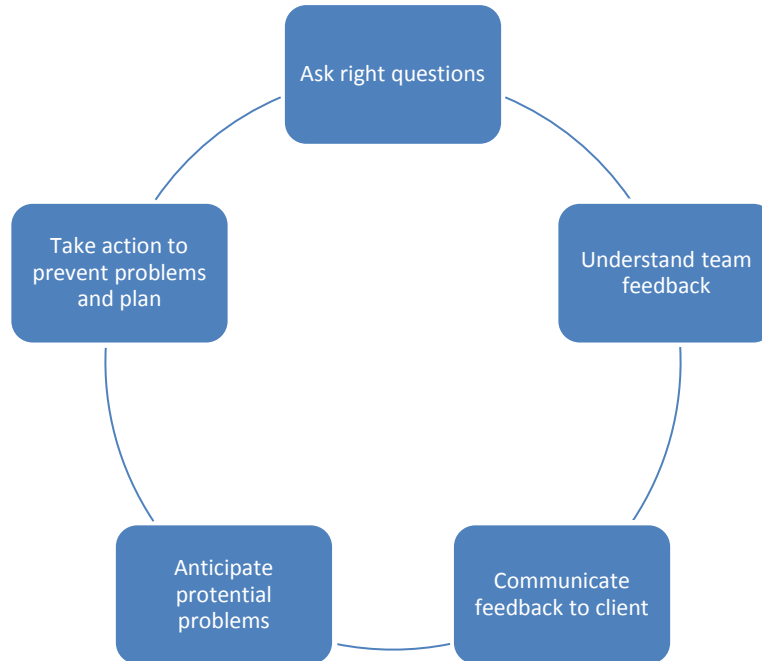


Figure 7.2 Project manager needs competency to communicate effectively

Figure 7.2 indicates a link to the research hypothesis that regards industry specific knowledge as essential for a project manager. As previously indicated, a project manager needs knowledge to ask the right questions. Figure 7.2 illustrates that a project manager needs to be competent to communicate effectively – to ask the right questions, understand team feedback, communicate feedback to clients, anticipate potential problems and plan and take action to prevent problems. The interviews supported this, since the interviewees' feedback supported the need for competency to ask the right questions, understand the feedback that is given, communicate the feedback to the client, anticipate potential problems and take action to plan and prevent problems.

All the interviewees indicated that industry specific knowledge is essential in order for a project manager to do project planning. Quoting interviewee 7: "how is it possible to plan if there is no knowledge of the industry and the project manager doesn't know how everything fits together?"

In summary, all respondents agree that a project manager needs the required knowledge and experience in order to increase effectiveness of project management and to increase the probability of project success.

## **7.3 CASE STUDY**

### **7.3.1 General background**

This case study was chosen because the professional team that presented feedback are known and reliable people. The information was true, reliable and valid and the impact of the lack of knowledge was clear and could be documented. The project used as case study was a building and improvement project. It was a FIFA world cup 2010 project to the value of R35 million. It involved improving Hoffman Square in Bloemfontein. Part of the scope included taking out a basement, laying new paving, planting a number of trees, building new ablution facilities and paving the roads adjacent to the square. FIFA compiled a document containing the project scope. The consultants had to plan the project, and offer design and budget documentation. The construction phase did not take place as FIFA lost faith in the project. The factors contributing to the failure of the project are discussed in this study. It is important to this research study as it reveals that the lack of industry specific knowledge may have had a detrimental effect on the project. It underlines the importance of industry specific knowledge for a project manager working in the built environment.

This project was chosen as case study because it investigates the research hypothesis “Construction project management requires industry specific knowledge, specifically when managing projects in the built environment industries”. The research focuses on the built environment specifically and the project manager working within that industry. The case study took place within the built environment being steered by a project manager that lacked industry specific knowledge. It assists in the investigation to determine whether a project

manager within the built environment needs industry specific knowledge to be effective and to assist in successful project completion.

The project manager appointed on the project was registered as project manager and worked as a consultant for an engineering firm. He has a BCom qualification without any qualifications in the built environment. He has a few years' work experience.

The civil engineering firm received the tender and had to appoint a team. The consultants that worked on the project were selected and appointed by the engineering firm.

### **7.3.2 Industry factors**

As stated and presented in the section on theory, SACPCMP (2011: Online) lists four technical knowledge areas that they regard as essential for a project manager in the built environment. These areas are knowledge of construction science, knowledge of construction processes, knowledge of the design processes and knowledge of financial and cost factors.

Various interviews were conducted with the quantity surveyor. The quantity surveyor was questioned due to his assessment of problems that were faced on the project. The professional team experienced the issues caused by the project manager's incompetence. They voiced and laid complaints to the quantity surveyor that was noted and reported on. The quantity surveyor reported on the case study. His input and opinion is regarded as reliable and valid as he is a professional that has completed many construction projects and has more than ten years working experience in the built environment. He reported that the consultants, who include the architect, engineers and quantity surveyor that worked on the project, stated that the project manager lacked knowledge of construction science and construction processes. Construction science includes understanding structures, construction and building sciences, building finishes



and knowledge of building materials. Knowledge of construction processes includes site, plant and equipment, formwork systems, quality management, health and safety management, environmental management, organisational/management structures, general building sequences, general output and production factors and basic knowledge of building trades. According to the consultants the project manager lacked knowledge in the fields of construction science and construction processes.

The project manager did not have knowledge of basic construction terms. An example of the project manager's lack of understanding basic construction terminology was when the quantity surveyor needed the bending schedules for concrete slabs. The quantity surveyor requested the bending schedules from the project manager. The project manager did not know what bending schedules were. His lack of industry specific knowledge caused frustration among project team members and negatively affected the project.

### **7.3.3 Project management**

Oberlender (cited in Archer, 2011: 29) states that a project manager should have integrated knowledge of the industry. A project manager needs to have knowledge of the work of all the role players in the built environment. This will include some knowledge of the work of an architect, quantity surveyor, engineer, town planner and land surveyor. Technical knowledge about the built environment is essential for effective project management (Turk, 2007: 25). With regard to the project discussed as case study, the project manager lacked integrated knowledge. The quantity surveyor confirmed this during various extensive interviews with the researcher while discussing the case study and the project manager's inefficient management of the project. The quantity surveyor's opinion is regarded as he has in-depth understanding of the built environment and more than ten years working experience within the industry. The quantity surveyor confirmed that the project manager's lack of knowledge negatively

affected various project team members, and they therefore lost trust in the project manager and his leadership abilities.

#### **7.3.4 Leadership**

Theory indicates that a leader has to communicate effectively (Goetsch, 2004: 66) and has to be trustworthy (Bennis, cited in Bjerke, 1999:61-62).

The project manager in this case study was not regarded as a leader as he did not instil trust among project team members. Additionally, his communication was ineffective due to a lack of technical knowledge about the built environment. The lack of trust among team members was due to his insufficient knowledge base, because even though he communicated, his communication was ineffective. He did not understand what the team members were saying and the implications of what they were saying. He also did not know what questions to ask and therefore asked the wrong questions. They did not trust his expertise as project manager and hence his leadership. The quantity surveyor stated that this was the opinion of various team members, which includes the architect, the engineer and himself. These team members are professionally registered persons. Their opinions are regarded as reasonable and reliable.

#### **7.3.5 Communication**

The project manager was the link between the project team and FIFA. He communicated project information to them. The project team confirmed that his lack of industry specific knowledge led to miscommunication during the project. FIFA asked questions that he was unable to answer. Miscommunication was one of the factors that contributed to FIFA losing faith in the project resulting in the project being cancelled.

During this research study, interviews with the quantity surveyor provided various examples of communication problems with the project manager.

The project manager had limited knowledge of many of the construction process and terminology, as he did not have insight into all the elements of the construction processes contributing to the costs. This is evident in project correspondence and project meeting minutes. Certain construction processes had to be followed that led to increased costs. He could not communicate and justify the cost and the reason for the cost to FIFA, because he did not understand the processes and why it had to be implemented. An example is the three hundred trees that were to be planted on site according to the FIFA scope. The amount quoted by the quantity surveyor was substantially higher than expected. The project manager could not comprehend why the rate per tree was so high. Due to his lack of industry specific knowledge, he did not know that the costs involved more than merely the purchase price per tree. He did not understand the implications of the process that had to be followed and the costing involved, therefore he could not comprehend why the calculation was structured that way. Provision for a sprinkler system, grid around each tree, foundation and pipe for the sprinkler and the way the trees were to be planted, as they were large trees, escalated the cost. Due to the project manager's lack of knowledge, he could not answer the questions from the client. It wasted a lot of project time. He had to ask consultants questions that are regarded as general knowledge in the built environment. This contributed to ineffective communication.

### **7.3.6 Trust**

The project manager's lack of knowledge and inability to answer the client's questions led to mistrust in the project manager. This was stated and confirmed by the project team members and conveyed to the researcher during the interviews conducted with the quantity surveyor. The teams' mistrust led to

ineffective project management that resulted in the client lacking trust in the project and the role players. It also created a lack of trust in the project manager among the consultants. This led to low morale during the project and the consultants believing that the project was going to possibly fail, thus wanting to limit their time and effort spent on the project.

### **7.3.7 Time**

The quantity surveyor stated that the project managers' lack of industry specific knowledge had an effect on project time, as there were time delays due to miscommunication. The major reason for the time delays is that the project manager had to communicate back and forth between project role players to try to obtain information and knowledge that should have been part of the project manager's industry specific knowledge. However, due to his inadequate knowledge, he had to enquire about a lot of information that should have been part of his knowledge base. This resulted in wasting project team members' time. The project architect and engineers were frustrated about their time being wasted. They conveyed their dissatisfaction to the quantity surveyor who in turn mentioned it during the research interviews. There were time delays due to the project manager's lack of knowledge, as he could not answer questions asked by the client. He had to confer with consultants to ask questions regarded as general knowledge in the built environment after which he then had to get back to the client. One such instance was when the project manager had to convey information to FIFA, but due to lack of knowledge could not answer the questions. An example of not being able to explain the information to the client was with regard to the project scope and costing that stated three hundred trees had to be planted on site. Provision for a sprinkler system, a grid around each tree, and the way the trees were to be planted, was included in the cost of the trees. Such lack of general built environment knowledge by the project manager resulted in him not being able to explain logical information regarding the process and costing. This wasted a lot of project time. The project needed extra time.

The engineering consultants at one stage stated that they could not approve extra time in addition to time initially allocated to the project.

### **7.3.8 Cost**

The quantity surveyor stated that the project manager did not understand the industry standard quantity surveying costing, or the construction processes that had to take place due to specific circumstances, as the project manager did not have knowledge about costing and construction processes.

The quantity surveyor stated that the project manager's lack of knowledge was evident in the questions he asked the team about costing and his inability to understand the information they gave. He did not have essential basic industry knowledge to understand costing. The quantity surveyor's opinion regarding the project manager's knowledge of cost is reliable as he is a professional quantity surveyor who is experienced in cost and costing and can assess the knowledge standard of the project manager. The quantity surveyor has worked on many projects before and has experience within the built environment and about project managers working on projects within the built environment.

One such example is the city's main waterline that ran through the project site. The waterline had to be moved, as it was necessary to drop the site by 1.2 meters. Huge cost implications were involved. The quantity surveyor calculated that the cost to move the line would amount to R500 000. The project manager did not understand the implications and actions involved in moving the line. He suggested that the contractor deal with it once on site. Due to the complexity of moving the waterline, and it being the main waterline in the city, the consultants realised that the action proposed by the project manager is impractical and will likely result in cost and time overrun. The quantity surveyor had to spend time to attempt to explain the costing and processes to the project manager. The lack of industry specific knowledge added to the project manager not realising the complexity, objective and priority of the problem. The lack of industry specific

knowledge was evident during the project meetings and observed by all professionals involved in the project, including the engineers and the architect.

This incident illustrates how insufficient industry specific knowledge affects the cost of a project. If the advice of the project manager were followed, it would have led to the project exceeding the budget.

Exceeding the allocated time on the project has a cost implication for consultants. The more time the project takes, the less time the consultants have to spend on other projects. Hence the consultants will be able to bill less. Therefore, if time is wasted, it affects the consultants' income.

### **7.3.9 Scope**

The project team confirmed that the project manager could not check the project work of the consultants, as the project manager did not have the knowledge of the work required to do construction related tasks, and he could therefore not determine whether it was complete or not. The project manager did not know this due to the fact that he did not have knowledge of construction processes and construction science.

### **7.3.10 Conflict**

The project team stated that the project manager's lack of industry specific knowledge led to conflict on the project. There was conflict between the project manager and the quantity surveyor, electrical engineer and architect. The conflict was a build-up of various factors discussed before such as the effect of the lack of knowledge on project communication, leadership, time management and trust.

The project was not successful and effective as it was cancelled by FIFA before it rolled out to the construction phase. Some of the factors that led to the cancellation were insufficient communication, cost and time management, and the project clients' decreasing trust in the project management. This is the opinion of the professional consultants that worked on the project – the architect, engineers and quantity surveyor. Their opinion was verbalised and discussed among each other.

The quantity surveyor that worked on the project is convinced that a large contributing factor in the eventual termination of the project was the project manager's lack of industry specific knowledge. The input from the quantity surveyor is highly valued and seen as reliable and valid as he is a professional that has participated in many projects and has more than ten years working experience in the built environment. The project manager would most likely have been reluctant to reveal mistakes. Interviewing a professional that was directly involved gives a reflection of what took place on the project and the project manager's actual actions. The evidence conducted during the interviews confirmed that problems related to a lack of knowledge actually existed.

#### **7.4 QUESTIONNAIRES**

The aim with the questionnaires was to generate feedback to determine the opinions of professionals active within the built environment. The aim was to determine whether they think it is important for a project manager to have industry specific knowledge and to discover what form of knowledge they regard as essential. The questionnaire was sent to seventy-eight respondents that were directly contacted by either telephone or email and were asked whether they would be willing to complete the questionnaire. These individuals were selected because they work in the built environment and the researcher knows them or contacted them through other built environment professionals known to the researcher. They in turn also suggested colleagues in the industry that they

regarded as professional. Forty respondents completed and returned the questionnaires.

#### **7.4.1 Respondents' background**

The target population was professionals working within the built environment with experience within the industry. Table 7.2 indicates the professions of the respondents. The questionnaire gave four options for respondents to choose from – project manager, project administrator, programme manager or other. The other option offered the respondents the opportunity to indicate what their current profession is, if it falls beyond the provided options. The other professions the respondents indicated were structural engineer, site engineer, academic, developer, development manager, quantity surveyor, architect, valuer and construction manager. Nineteen of the forty respondents indicated their profession as either project manager, project administrator or programme manager. Twenty-four respondents gave other professions. This adds up to forty-three as three of the nineteen respondents indicated they are project managers and also another profession. Two indicated that they are both a project manager and a programme manager. One respondent indicated that he is a development manager and a programme manager. The table reflects data on the types of professions of the respondents, the number of respondents that fall within that category in the frequency column, the percentage and valid percentage of each professional category.



Table 7.2 Respondents professions

<b>Profession</b>	<b>Frequency</b>	<b>Valid percentage</b>	<b>Cumulative percentage</b>
Project manager	16	37.21	37.21
Project administrator	0	0.00	37.21
Programme manager	3	6.98	44.19
Structural engineer	8	18.60	62.79
Site engineer	2	4.65	67.44
Built environment academic	1	2.33	69.77
Developer	2	4.65	74.42
Development manager	2	4.65	79.07
Quantity surveyor	5	11.63	90.70
Architect	1	2.33	93.02
Valuer	1	2.33	95.35
Construction manager	2	4.65	100.00
Total	43	100.00	

Table 7.2 indicates the professions of the respondents. All the respondents work in professions within the built environment. In total 37.21% of the respondents work as project managers, 18.6% as structural engineers, and 11.63% as quantity surveyors. The remaining 32.56% of the respondents are represented in the nine other categories of professions. They therefore have exposure in the built environment. Thus, without knowing about their exact knowledge base, it can be deduced that they have experience within the industry on which the research is focussed. Thirty per cent of respondents have up to ten years' experience in the built environment, 35% have between ten and twenty years and 35% have more than 20 years working experience within the industry.

Table 7.3 lists the type of projects the respondents have worked on during their career, with the various types of projects in the first column, followed by the frequency indicating the number of respondents that fall within that category and then indicating the percentage and cumulative percentage. The types of projects are residential projects, offices, shopping centres, industrial buildings, engineering projects, stadiums, hotels and casinos, hospitals, repair and maintenance and asset management. A total of 18.5% of the respondents have worked on residential projects, 18.5% on offices, 16.8% on shopping centres, 16% on industrial buildings and 22.7% on engineering projects. A lower percentage of respondents have worked on the remaining types of projects namely 0.8% on stadiums, 2.5% on hotels and casinos, 2.5% on hospitals, 0.8% on repair and maintenance and 0.8% on asset management. Professionals from various professions were interviewed because of their specific experience related to the built environment and of the development systems used to procure construction projects. Their contact with project manager's that work on building projects is also substantial, providing a strong opinion based on construction project management and the construction project manager.

Table 7.3 Various types of projects respondents have worked on

Types of projects	Frequency	Percentage	Cumulative
			percentage
Residential projects	22	18.5	18.5
Offices	22	18.5	37
Shopping centres	20	16.8	53.8
Industrial buildings	19	16	69.8
Engineering projects	27	22.7	92.5
Stadiums	1	0.8	93.3
Hotels and casinos	3	2.5	95.8
Hospitals	3	2.5	98.3
Repair and maintenance	1	0.8	99.1
Asset management	1	0.8	
Total	119	100	100

The table above reveals that the respondents have experience in various types of projects and that these projects are within the built environment. Of the forty respondents, 22 have worked on residential projects, 22 on offices, 20 on shopping centres, 19 on industrial buildings and 27 on engineering projects. The respondents are reliable sources to use for the research as they have industry specific experience and can contribute to the study regarding industry specific knowledge.

The highest values of the projects the respondents have worked on are also substantial. Almost all, namely 92.5% of respondents, have worked on projects above R100 million, while 50% of all respondents have worked on projects above R500 million. The technical requirements of a project of that magnitude are higher than a project of a substantially lower amount. Kerzner (2003: 155-158) states that the technical expertise required differs depending on the project.

Certain projects demand a high command of technical understanding by the project manager while other projects require less. The level of technical competencies depends on factors such as the positional authority of the project manager and the size and nature of a project (Hamilton, 1997:213 & Kerzner, 2003: 155-158).

Respondents with experience in the built environment as well as built environment qualifications were carefully selected. The level of qualification varies from matric to PhD level. Most respondents have a degree or higher qualification. Of the respondents 17.5% have a diploma, 42.5% have a degree, 12.5% have a post graduate degree, 20% have a degree on master's level and 5% have a PhD-degree. A total of 97.5% of the respondents have a diploma or higher qualification. Over 80% have degrees.

Looking at the professional qualifications of the respondents, 50% have engineering qualifications, 20% quantity surveying qualifications and 12.5% construction management qualifications. Cadle and Yeates, (2001: 358) and Turk (2007: 25) indicate that it is important for project managers to have knowledge of the built environment in order to understand questions and make informed decisions. The respondents that completed questionnaires were therefore carefully selected based on their extensive experience in the industry, or qualifications in the field or both qualifications and years of experience.

## **7.4.2 Findings**

### **7.4.2.1 Project management**

To increase the effectiveness and possibility of project success, project management and the project manager are important factors (Chordas 2008: 66-69, Kerzner, 2006: 2-10 & Trebilcock, 2007: 40). The answers to the

questionnaire also indicate that project management is an important factor to increase the possibility of success.

The questionnaire was compiled after thorough theoretical research based on the research topic. The questionnaire was divided into a general section conveying general information relating to the respondents and a project management section with questions covering project management related areas. The general section was important in order to acquire information about the respondents' professional background, experience in the field, qualifications, projects worked on and the magnitude of the projects that they worked on. This was regarded as important as the aim was to have respondents that have worked in the profession and have gained experience in the field. The questions in the project management section were based on the theory in the PMBOK and South African Council for the Project and Construction Management Professions (SACPCMP). Some questions were based on the PMBOK knowledge areas and other questions on the technical knowledge areas for project managers in the built environment suggested by the SACPCMP. It was important to test the knowledge base as this is centre to the research topic.

Figure 7.3 represents data from the questionnaire that has been analysed and presented in a pie chart, illustrating the importance of the project manager in increasing project success. All respondents stated that a project manager is to some degree important for project success. Only 3% stated that it is fairly important, 10% that it is important, 54% that it is very important and 33% that it is critically important.

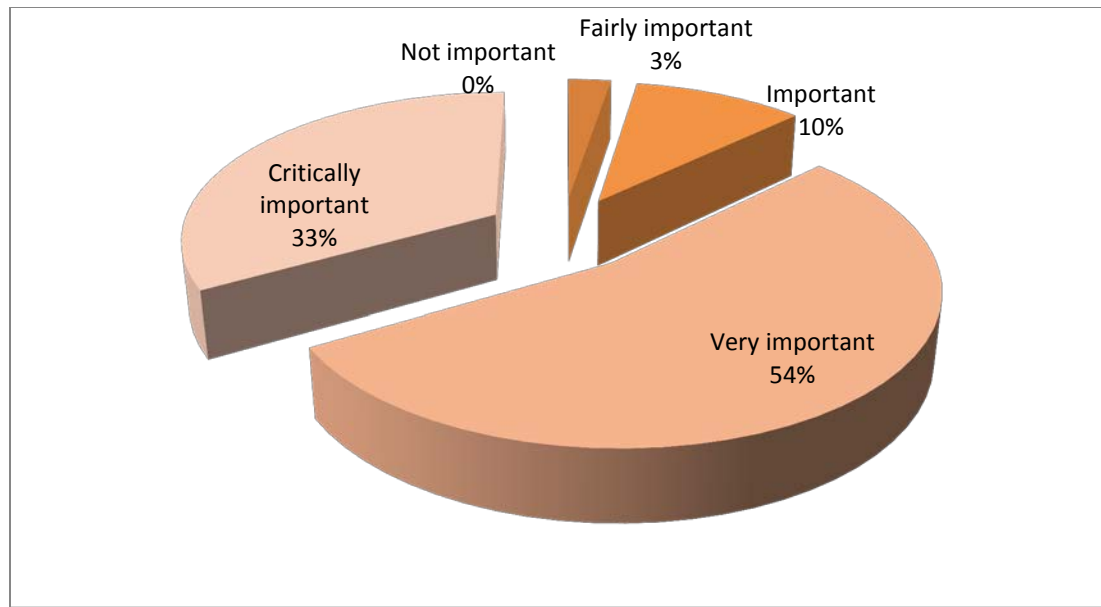


Figure 7.3 Importance of the project manager to increase project success

Previous reference to Sears, Sears and Clough (2008: 15) indicated that persons with expertise and experience in the application of specialised management techniques are needed to do the planning, scheduling and control of construction operations. Figure 7.3 shows that it is important for the project manager to have adequate knowledge and experience to be able to do the planning, scheduling and control and consequently add to the probability of project success.

The questionnaire feedback confirms this, namely that project planning, scheduling and control are important to ensure project success. Tables 7.4 to 7.6 show the importance of a project manager's planning, scheduling and control abilities. Tables 7.7 to 7.9 illustrate the importance of a project manager's technical knowledge in order to plan, schedule and control. The importance of planning and the importance of technical knowledge are related, because should the research reveal that technical knowledge is important to planning, scheduling and control, and should the research also reveal that planning, scheduling and control are important, then it underlines the importance for a project manager to have technical knowledge. This is an important finding as it links to the research hypothesis investigating the industry specific knowledge in project management.

Table 7.4 shows the opinion of respondents in respect of the importance of the planning ability of the project manager to increase the possibility of project success. The table has seven columns. The first column lists the response categories, of which the first row contains responses. The second row contains the number of respondents referring to the number of respondents that answered the question in the questionnaire. This is followed by the percentage of the total that refers to the percentage of respondents that answered the question that chose the specific Likert scale indicator one to five. The last row contains the average rating that indicates the weighted average allocated to the question. The data for each of these categories is displayed in columns two to seven. The Likert scale 1 – 5 is represented in columns 2 – 6. Column 2 presents value one of the Likert scale, column 3 value two, column 4 value three, column 5 value four, column 6 value five and column 7 the combined values of columns 2 – 6. The Likert scale value is from one to five; one indicates not important, two fairly important, three important, four very important and five critically important. All tables in this study are based on this format.

Table 7.4 illustrates that all respondents rated the importance between 3 (important) to 5 (critical important); 12.8% stated a project manager's planning ability is important, 48.7% stated it is very important and 38.5% that it is critically important. It received a high weighted average of 4.26

Table 7.4 Importance of the project manager's planning ability

Responses	1 = Not important important					5 = Critically	Total
	1	2	3	4	5		
Number of respondents	0	0	5	19	15	39	
Percentage of total	0	0	12.8	48.7	38.5	100	
Average rating	4.26						

As previously stated by PMI (2004: 39-70) and Kerzner (2003:3), planning is very important in project management. The research findings shown in Table 7.4 also indicate, with a weighted average of 4.26, that it is very important for a project manager to have a strong planning ability in order to increase the possibility of project success. Table 7.10 presents the need for planning in project management. The discussion indicates the importance of technical knowledge in order to plan. As the research problem investigates the need for industry specific knowledge in the built environment, Tables 7.4 and 7.7 are important to this study.

The following table, Table 7.5 indicates the respondents' opinions regarding the importance of the project manager's scheduling ability to increase the possibility of project success. Scheduling is the process of taking the time frame that was generated through planning and assigning starting and finishing dates to the activities and allocating resources (Burke, 2006: 154). The table shows that all respondents regard scheduling as important, as none of the respondents indicated that it is not important or fairly important. It was awarded a high weighted average of 4.0.

Table 7.5 The importance of the project manager's scheduling ability

Responses	1 = Not important important					5 = Critically	Total
	1	2	3	4	5		
Number of respondents	0	0	9	20	9	38	
Percentage of total	0	0	23.7	52.6	23.7	100	
Average rating	4.0						

Table 7.5 shows that all respondents rated the importance of a project manager's scheduling ability between 3, indicating important, to 5 indicating critically important. The weighted average of 4.0 indicates that it is very important for project managers to have good scheduling ability in order to increase the



possibility of project success. Kerzner (2006: 437) supports this finding stating that scheduling is very important in order to complete the project in the least time, at the lowest cost and with the least possible risk.

The need for scheduling in project management is important to this research study and is presented in Table 7.8, and discussed by looking at the importance of technical knowledge in order to schedule. As the research problem investigates the need for industry specific knowledge in the built environment, Tables 7.5 and 7.8 are important to this study.

Table 7.6 indicates the importance of the controlling and monitoring ability of the project manager to increase the possibility of project success. The table indicates that all respondents rated the importance of a project manager's control and monitoring ability between 3, indicating important, to 5 indicating critically important. It received a high weighted average of 4.24

Table 7.6 The importance of the project managers control and monitoring ability

Responses	1 = Not important important					5 = Critically	Total
	1	2	3	4	5		
Number of respondents	0	0	5	19	14	38	
Percentage of total	0	0	13.2	50	36.8	100	
Average rating	4.24						

A high weighted average of 4.24 indicates that it is very important for project managers to have good control and monitoring abilities in order to increase the possibility of project success. Previous theory presented by Shaughnessy (1994: 155) also supports the importance of monitoring a project's performance throughout the project life cycle as important to ensure project success. The need for monitoring and control in project management holds meaning to research presented in Table 7.9, and discussed by investigating the importance

of technical knowledge in order to monitor and control. As the research problem investigates the need for industry specific knowledge in the built environment, Tables 7.6 and 7.9 are important to this study.

Figure 7.4 is an illustration of the data in Table 7.4, Table 7.5 and Table 7.6. The Likert scale is used and placed in the figure displaying not important (1), fairly important (2), important (3), very important (4) and lastly critically important (5). Each one of these has three percentage values displayed on top of a bar. These bars indicate the percentage firstly for planning, then scheduling and lastly control.

The figure has three bars with percentages for each of the five Likert scale indicators of 1 to 5. The first Likert scale indicator has a bar indicating planning, the second scheduling and the third control. Viewing the figure, it shows that planning, scheduling and control all received 0%, therefore none of the respondents indicated that planning, scheduling and control are of no importance. This is followed by the second Likert scale indicator representing that it is fairly important. All three bars have 0% showing that none of the respondents indicated that planning, scheduling and control are fairly important. The next indicator, namely 3 on the Likert scale, indicates importance. The three bars reveal that it was chosen and regarded as important by some respondents. The first bar, reflecting planning, received 12.8%, the second bar that reflects scheduling 23.7% and the third bar that reflects control 13.2%. The next indicator on the Likert scale, namely 4, represents very important. A total of 48.7% of the respondents indicated that planning is very important, 52.6% indicated that scheduling is very important and 50% that control is very important. The last indicator on the Likert scale, value 5, shows how many respondents regard planning, scheduling and control as critically important.

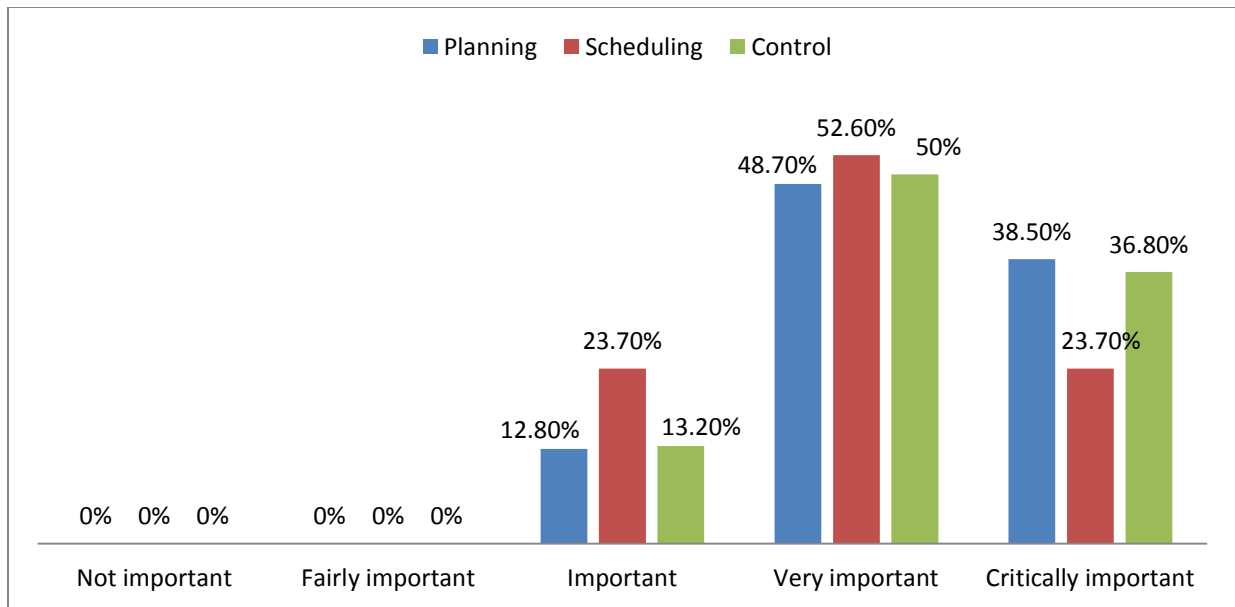


Figure 7.4 Importance of planning, scheduling and control to increase project success

All respondents stated that planning, scheduling and control is important to critically important, with the majority indicating that it is very important or critically important. The weighted average for the factors planning, scheduling and control is 4.17 indicating that it is very important for a project manager to have planning, scheduling and controlling, and monitoring abilities in order to increase the possibility of project success.

The importance of a project manager's technical knowledge about the built environment in order to be able to plan, schedule and control a project is shown in respectively Tables 7.7, 7.8 and 7.9. A high importance rating in these tables will indicate the need for industry specific knowledge in project management, as Tables 7.4, 7.5 and 7.6 have just indicated the importance of planning, scheduling and control to increase project success.

Table 7.7 indicates the respondents' views regarding the importance of a project manager's technical knowledge in order to plan a project effectively. All respondents indicated between 3 (important) to 5 (critically important).

Table 7.7 Importance of a project managers' technical knowledge in order to plan

Responses	1 = Not important important					5 = Critically	Total
	1	2	3	4	5		
Number of respondents	0	0	9	26	5	40	
Percentage of total	0	0	22.5	65	12.5	100	
Average rating	3.9						

Table 7.7 reveals that all respondents indicated that a project manager's technical knowledge is important in order to plan effectively, the ratings varying between 3 (important) and 5 (critically important). The weighted average is 3.9 and indicates that technical knowledge is important, leaning strongly towards very important. As Table 7.4 indicates that it is important for a project manager to plan, and Table 7.7 indicates that it is important for a project manager to have technical knowledge in order to plan, it can therefore be stated that a project manager needs technical knowledge. This relates to the research study investigating project management in the built environment and the need for industry specific knowledge, supporting the necessity of technical knowledge.

Table 7.8 shows the importance of a project managers' technical knowledge in order to schedule a project effectively. All respondents indicated between 3 and 5 (important to critically important) on the Likert scale with the weighted average as 3.93. Of the respondents 27.5% stated that technical knowledge is important for a project manager in order to schedule a project, 52.5% stated it is very important and 20% indicated that it is critically important.

Table 7.8 Importance of a project managers' technical knowledge in order to schedule a project

Responses	1 = Not important important					5 = Critically	Total
	1	2	3	4	5		
Number of respondents	0	0	11	21	8	40	
Percentage of total	0	0	27.5	52.5	20	100	
Average rating	3.93						

Table 7.8 indicates that it is important, almost very important with a weighted average of 3.93, for project managers to have technical knowledge in order to have an effective scheduling ability. As Table 7.5 indicates, it is important for a project manager to schedule, and Table 7.8 indicates it is important for a project manager to have technical knowledge in order to schedule, it can therefore be stated that a project manager needs technical knowledge. These are important findings and add to the research study investigating project management in the built environment and the need for industry specific knowledge, supporting the necessity of technical knowledge.

Table 7.9 shows the importance of a project managers' technical knowledge in order to control and monitor a project effectively. The table indicates that all interviewees indicated that a project manager's technical knowledge is important in order to control and manage a project effectively, varying between 3 (important) to 5 (critically important) on the Likert scale. The weighted average is 4.05.

Table 7.9 Importance of a project managers' technical knowledge in order to control and monitor

Responses	1 = Not important important					5 = Critically	Total
	1	2	3	4	5		
Number of respondents	0	0	11	16	13		40
Percentage of total	0	0	27.5	40	32.5		100
Average rating	4.05						

Table 7.9 has a weighted average of 4.05 indicating that technical knowledge is very important in order to control and monitor a project. As indicated in Table 7.6, it is important for a project manager to monitor and control a project, and as indicated in Table 7.9 that it is important for a project manager to have technical knowledge in order to monitor and control, it can therefore be stated that a

project manager needs technical knowledge. This relates to the research study investigating project management in the built environment and the need for industry specific knowledge, supporting the necessity of technical knowledge. The data in Table 7.7 Table 7.8 and Table 7.9 are illustrated in Figure 7.5.

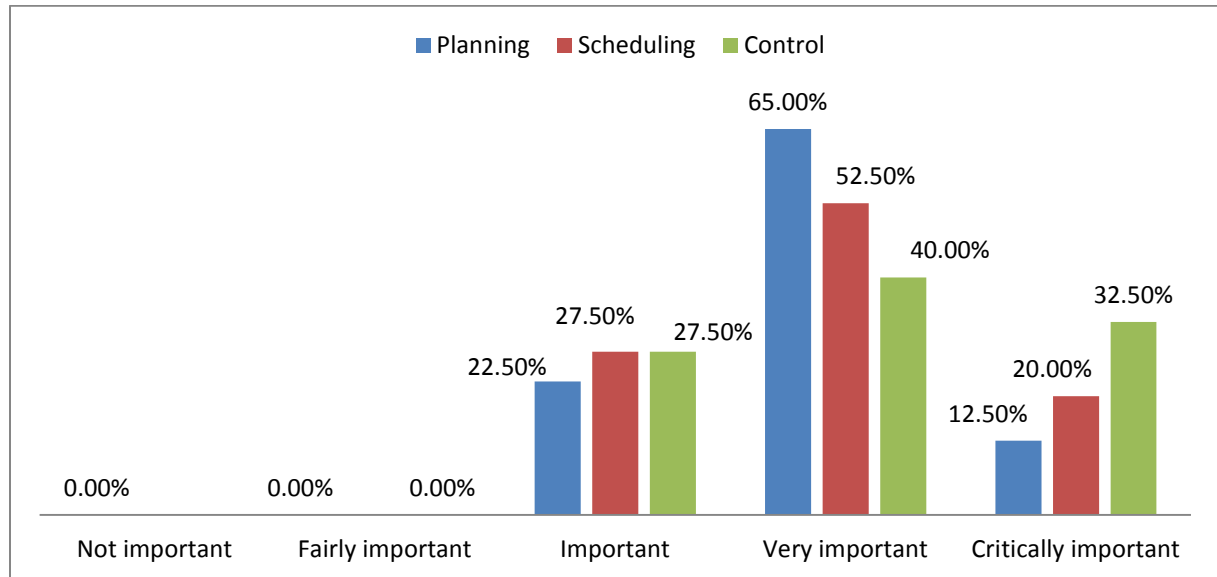


Figure 7.5 Importance of a project manager's technical knowledge in order to plan, schedule and control

The Likert scale is used and placed in the figure displaying not important (1), fairly important (2), important (3), very important (4) and lastly critically important (5). Each one of these five indicates three percentage values displayed on top of a bar. These bars indicate the percentages, firstly for planning, then scheduling and lastly control. Viewing the first two Likert indicators (1 and 2) on the figure it shows that all three bars for both indicators, which are planning, scheduling and control, received 0%. This indicates that no respondents rated technical knowledge as unimportant or only fairly important for planning, scheduling and control. The next indicator, 3 on the Likert scale, indicates importance. The three bars reveal that some respondents regarded it as important. The first bar, reflecting planning, was regarded as important by 22.5% of the respondents, the second bar, reflecting scheduling, by 27.5% and the third bar by 27.5%. The next indicator on the Likert scale, value 4, indicates very important and 65% regarded planning as very important, 52.5% regarded scheduling as very important and 40% regarded control as very important. The last indicator on the

Likert scale, value 5, shows the number of respondents regarding planning, scheduling and control as critically important, respectively as 12.5%, 20% and 32.5%.

From Tables 7.4, 7.5 and 7.6 it is clear that project managers need to have the ability to plan, control and monitor, and schedule projects. Tables 7.7, 7.8 and 7.9 indicate that in order to plan, control and monitor, and schedule a project, a project manager needs to have technical knowledge about the industry. This supports the research hypothesis that the construction project manager requires industry specific knowledge, specifically when managing projects in the built environment industries.

#### 7.4.2.2 Leadership

Theory supports the importance of leadership in project management in order to increase project success. The leadership role of a project manager is a critical factor in determining project success (Snow, Davison, Snell & Hambrick, 1997: 99; Snell, Davison, Hambrick & Snow, cited in Iles & Hayers, 1997: 99). Table 7.10 displays the data indicating the importance of leadership to increase the possibility of project success. All respondents indicated either 4 or 5 on the Likert scale with a very high weighted average of 4.56. This means that leadership is very important to critically important. Nearly half of the respondents, namely 43.6%, indicated that leadership is very important and 56.4% indicated that it is critically important for project success.

Table 7.10 The importance of leadership to increase project success

Responses	1 = Not important important					5 = Critically	Total
	1	2	3	4	5		
Number of respondents	0	0	0	17	22	39	
Percentage of total	0	0	0	43.6	56.4	100	
Average rating	4.56						

The weighted average displayed in Table 7.10 is almost critically high at 4.56. The research findings indicate that leadership increases project success. Previous reference to Culp and Smith (1992, 68-69) indicated that leaders need technical knowledge. Research findings on the importance of technical knowledge are discussed in section 7.4.2.5.3. Should technical knowledge prove to be important in project management, it could then be deduced that as leadership is very important, technical knowledge is of great importance to ensure project success.

The theory supports the view that the ability to communicate well is the foundation of effective leadership and leadership is part of what a project manager needs (Burke, 2006: 10 & 270). The importance of communication is discussed next.

#### **7.4.2.3 Communication**

The importance of a project manager's technical knowledge about the built environment was investigated in order to facilitate project communication management. Table 7.11 shows the research results. Various aspects of communication were tested, namely the need for technical knowledge to collect and distribute information, to do performance reporting and to manage stakeholders. All forty respondents answered the questions regarding these three aspects of communication. The ratings varied from 1 on the Likert scale to 5, although very few respondents selected the low ratings of 1 and 2 on the Likert scale. For all 3 aspects of communication one respondent rated technical knowledge for communication as not important.

Table 7.11 shows that it is important to very important for a project manager to have technical knowledge to facilitate the collection and distribution of information effectively with a weighted average of 3.83, doing performance reporting with a weighted average of 3.7 and to manage stakeholders with a



weighted average of 3.85. The overall weighted average for the three categories discussed is 3.79.

Table 7.11 Need for technical knowledge to facilitate project communication

Responses	1 = Not important                      5 = Critically important					Total
	1	2	3	4	5	
<b>Information is collected and distributed</b>	3.83					
Number of respondents	1	2	12	13	12	40
Percentage of total	2.5	5	30	32.5	30	100
<b>Performance reporting is done</b>	3.7					
Number of respondents	1	3	12	15	9	40
Percentage of total	2.5	7.5	30	37.5	22.5	100
<b>Stakeholders are managed</b>	3.85					
Number of respondents	1	1	11	17	10	40
Percentage of total	2.5	2.5	27.5	42.5	25	100
<b>Average rating</b>	3.79					

Previous reference to Chiocchio (2007:97) stated that communication is a very important part of project management and necessary to effectively manage projects. The research findings displayed in Table 7.14 states that a project manager requires technical knowledge in order to facilitate project communication. Thus, due to communication being important to project management, and technical knowledge a requirement for project management facilitation as reflected in Table 7.11, it can be stated that it is very important for a project manager to have technical knowledge to support effective project management.

In the research study the researcher investigated whether a project manager should have a qualification based on technical knowledge within the built

environment in order to communicate with the project team, understand the implications of what is being communicated and know what questions to ask. Table 7.12 depicts the importance of a qualification based on technical knowledge within the built environment in order to communicate with the team. Communicate with project team has a weighted average of 4.08, understanding implications of what is being communicated has a weighted average of 4.23 and know what questions to ask has a weighted average of 4.3.

Table 7.12 Need for a qualification for effective communication

Responses	1 = Not important                      5 = Critically important					Total
	1	2	3	4	5	
<b>Communicate with project team</b>	4.08					
Number of respondents	2	1	3	20	14	40
Percentage of total	5	2.5	7.5	50	35	100
<b>Understand implications of what is being communicated</b>	4.23					
Number of respondents	0	1	2	24	13	40
Percentage of total	0	2.5	5	60	32.5	100
<b>Know what questions to ask</b>	4.30					
Number of respondents	0	0	2	24	14	40
Percentage of total	0	0	5	60	35	100
<b>Average rating</b>	4.20					

From Table 7.12 it can be deduced that it is very important to have a qualification based on technical knowledge. All subcategories – communicate with team, understand implications of what is being communicated and know what questions to ask – show that it is very important to have a qualification based on technical knowledge in the built environment. The level of qualification recommended for project management in the built environment is discussed later in this chapter.

Theory correlates with the research stating that technical knowledge is necessary to evaluate technical concepts and solutions and to communicate effectively in technical terms with the project team (Kerzner, 2006: 146-149). The theory states that communication is a key factor in team performance, successful project completion and effective project management (Chiocchio, 2007: 97) therefore it is essential for a project manager to have a qualification based on built environment knowledge.

#### 7.4.2.4 Trust

Previous theory presented by Romahn & Hartman (1999: 1) supports the importance of trust – that a project manager needs to be trusted by the team. Trust is essential for effective communication (Romahn & Hartman, 1999: 1) and communication is important for project management success (Chiocchio, 2007:97).

The need for project managers to have a qualification based on technical knowledge within the built environment in order to be trusted by team members was tested. Table 7.13 reveals the importance for a project manager to have a qualification in order to increase the teams' trust in the project manager. Two respondents did not regard it as important but 95% rated a qualification as important to critically important to being trusted. The weighted average is 3.93.

Table 7.13 Impact of a qualification on team trust

Responses	1 = Not important important					5 = Critically
	1	2	3	4	5	Total
Number of respondents	2	0	9	17	12	40
Percentage of total	5	0	22.5	42.5	30	100
Average rating	3.93					

Table 7.13 shows that it is very important for a project manager to have a qualification in the built environment, the weighted average being 3.93. The recommended level of qualification forms part of a later discussion.

The importance of trust to increase the possibility of project success was also tested in the research. The results are presented in Table 7.14. All respondents indicated trust as between important to critically important to ensure project success. The weighted average is 4.29.

Table 7.14 Importance of trust to ensure project success

Responses	1 = Not important important					5 = Critically	Total
	1	2	3	4	5		
Number of respondents	0	0	5	17	16	38	
Percentage of total	0	0	13.2	44.7	42.1	100	
Average rating	4.29						

Table 7.14 indicates that it is very important to have trust in order to increase the possibility of project success. The weighted average is 4.29 indicating very important to critically important.

From Table 7.13 and Table 7.14 it can be concluded that trust is essential to increase the possibility for project success and that it is very important for project managers to have a qualification in the built environment to increase trust among team members in the project manager. Therefore, it is advisable for a project manager to have a qualification in the built environment, to contribute to project success.

By implication, a qualification refers to knowledge. Earning a qualification indicates that some knowledge of the built environment was obtained by the person who received the qualification. This relates to the research study as the

study investigates the importance of industry specific knowledge in project management. A discussion on built environment knowledge follows next.

#### 7.4.2.5 Knowledge required

##### 7.4.2.5.1 Experience in the built environment

The respondents rated the importance of experience in the field of the built environment according to the Likert scale. This is presented in Table 7.15 in weighted averages format. The weighted average is 4.35. Thirty-eight of the forty respondents rated the importance of experience as either 4 or 5, with 52.5% regarding it as very important and 42.5% as critically important.

Table 7.15 Importance of experience in the built environment

Responses	1 = Not important important					5 = Critically	Total
	1	2	3	4	5		
Number of respondents	0	1	1	21	17	40	
Percentage of total	0	2.5	2.5	52.5	42.5	100	
Average rating	4.35						

Table 7.15 presents critical findings as the research investigates knowledge and one of the elements investigated is the importance of experience in the built environment. The questionnaire findings in the table above support the importance of knowledge through experience in the built environment.

The data in Table 7.15 is displayed in graphical format. Figure 7.6 illustrates how important the respondents view experience in the built environment as a crucial knowledge element for a project manager.

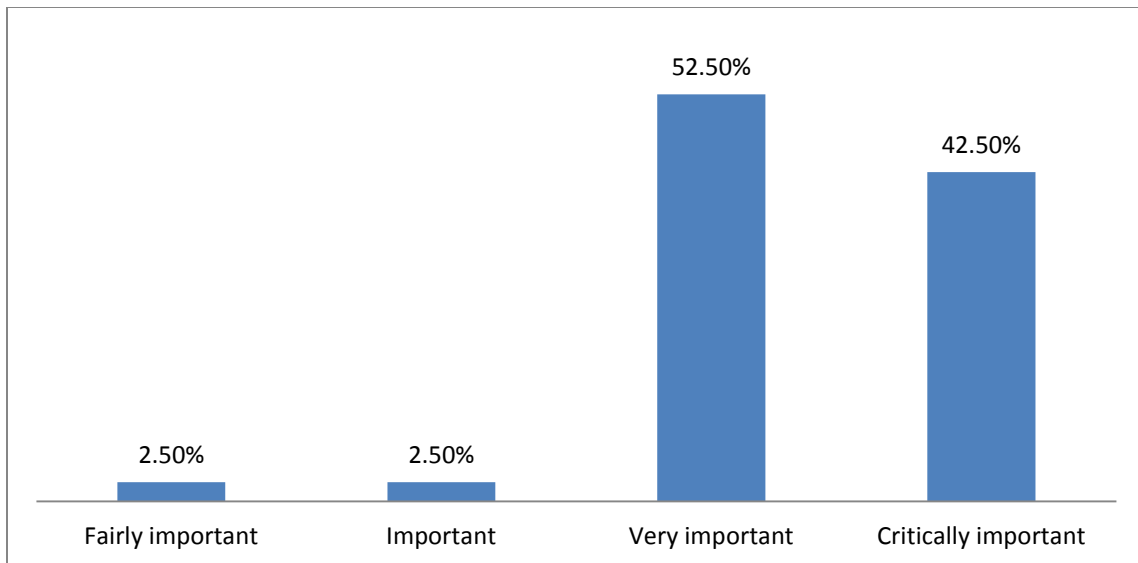


Figure 7.6 The importance of experience in the built environment.

Experience in the built environment is regarded as a very important, knowledge-based form of expertise for a project manager to have with a high weighted average of 4.35. Only 2.5% of respondents stated that experience is fairly important, 2.5% that it is important, 52.5% that it is very important and 42.5% that it is critically important. A total of 95% indicated experience as being either very important or critically important.

#### 7.4.2.5.2 Project management knowledge

Previous theory revealed that project management knowledge is essential knowledge for effective project management (Declerk, Eymery & Crener, cited in Pettersen, 1991: 100; Pacelli, 2004: 54). The theory was researched and the questionnaire findings are presented in Table 7.16. The weighted average measured in the research is 3.43.

Table 7.16 Importance of project management knowledge in the built environment

Responses	1 = Not important important					5 = Critically	Total
	1	2	3	4	5		
Number of respondents	1	5	15	14	5	40	
Percentage of total	2.5	12.5	37.5	35	12.5	100	
Average rating	3.43						

The research results indicated that project managers should have theoretical project management knowledge. The weighted average of 3.43 indicates that project managers need project management knowledge. The findings add to the research investigating the knowledge base that a project manager in the built environment should have, indicating the necessity of project management knowledge.

The Project Management Institute divides the knowledge areas for construction professionals into thirteen areas (PMBOK: 2004, 9-11; Zack, 2004: 4-5). The respondents rated the thirteen knowledge areas according to the Likert scale, indicating the importance of a project manager's technical knowledge about the built environment in order to facilitate the important elements in the knowledge areas. The findings are presented in Table 7.17 in weighted averages format. This is used so that the various knowledge areas are comparable and clear findings can be drawn about the importance and ranking of the construction knowledge area.

Table 7.17 Importance of technical knowledge for facilitation of PMBOK areas

PMBOK knowledge areas	Weighted averages
Project integration management	3.82
Project scope management	4.00
Project time management	4.10
Project cost management	4.04
Project quality management	3.83
Project human resources management	3.86
Project communication management	3.79
Project risk management	4.01
Project procurement management	3.56
Occupational health and safety	3.70
Environmental management	3.39
Financial management	3.92
Claims management	4.03
<b>Average rating</b>	<b>3.85</b>

Table 7.17 indicates that it is important for a project manager to have technical knowledge of the built environment in order to facilitate the PMBOK knowledge areas. Areas such as project scope management (4.00), project time management (4.10), project cost management (4.04), project risk management (4.01) and claims management (4.03) indicated that it is very important for a project manager to have technical knowledge.

#### 7.4.2.5.3 Technical knowledge

Respondents indicated the importance of a project manager's technical knowledge about the built environment in order to ensure successful and effective projects. Technical expertise is necessary to evaluate technical



concepts and solutions, to communicate effectively in technical terms with the project team and to assess risks and make trade-offs between cost, schedule, and technical issues (Kerzner, 2006: 146-149). The South African Council for the Project and Construction Management Professions (SACPCMP) states that a project manager in construction needs a specific set of technical competencies in order to effectively execute the work the construction project manager needs to do (SACPCMP, 2011: Online). There are four main areas of technical knowledge in the built environment, each with subdivisions presented as the work and scope of services a construction project manager needs to know (SACPCMP, 2011: Online). The areas listed by SACPCMP were tested in the research. The four areas are knowledge of construction science, knowledge of construction processes, knowledge of design processes and knowledge of financial cost factors.

The findings for the first knowledge area, construction processes, are presented in Table 7.18 in percentages with weighted averages. This is used so that the various knowledge elements are comparable and clear findings can be drawn about the importance and ranking of the construction knowledge area.

Table 7.18 lists areas within construction science namely understanding structures, understanding building sciences, understanding building finishes and knowledge of building materials. According to SACPCM, these are the areas within construction science that are very important for a construction project manager to understand. It indicates the importance for a project manager to have knowledge of construction science in order to ensure successful and effective projects.

The weighted averages for the construction science areas range between 3.55 to 3.83. Knowledge of building materials received the lowest average of 3.45 and is the only construction science area that one respondent rated as not important. All the other areas received ratings between fairly important and critically important.

Regarding the importance to understand structures, 12.5% of the respondents stated fairly important, 27.5 stated important, 37.5% stated very important and 22.5% stated critically important. Regarding the importance of understanding building structures, 5% of the respondents stated fairly important, 30% stated important, 42.5% stated very important and 22.5% critically important. For the importance of understanding building finishes, 5% of the respondents stated fairly important, 30% stated important, 47.5% stated very important and 17.5% stated critically important. For the importance of knowledge of building materials, 2.5% of the respondents stated not important, 15% stated fairly important, 25% stated important, 40% stated very important and 17.5% stated critically important. The majority of the respondents rated knowledge of construction science between important and critically important with 87.5% for understanding structures, 95% for understanding building science, 95% for understanding finishes and 82.5% for knowledge of building materials.

Table 7.18 Knowledge of construction science

Responses	1 = Not important                      5 = Critically important					Total
	1	2	3	4	5	
<b>Understanding structures</b>	3.7					
Number of respondents	0	5	11	15	9	40
Percentage of total	0	12.5	27.5	37.5	22.5	100
<b>Understanding building sciences</b>	3.83					
Number of respondents	0	2	12	17	9	40
Percentage of total	0	5	30	42.5	22.5	100
<b>Understanding building finishes</b>	3.78					
Number of respondents	0	2	12	19	7	40
Percentage of total	0	5	30	47.5	17.5	100
<b>Knowledge of building materials</b>	3.55					
Number of respondents	1	6	10	16	7	40
Percentage of total	2.5	15	25	40	17.5	100
<b>Total average rating</b>	3.72					

From Table 7.18 it is clear that all four subdivisions of construction science have a weighted average that indicates that it is important to have an understanding and knowledge of it in order to ensure effective and successful projects. The average for understanding structures is 3.7, understanding building sciences 3.83, understanding building finishes 3.78, knowledge of building materials 3.55. The total average of all four subdivisions is 3.72. It is important to very important for a project manager in the built environment to have knowledge about construction science. These findings contribute to the research investigating the importance of technical built environment knowledge.

Research findings on the second SACPCMP knowledge area, namely construction processes, are presented in Table 7.19. It reveals the importance for a project manager to have knowledge of construction processes in order to ensure successful and effective projects. This includes knowledge of site plant and equipment, formwork, general building sequences, general output and production factors and basic knowledge of building trades – the areas within construction processes listed by the SACPCMP.

The weighted averages for the five areas within construction processes range between 3.45 and 4.1. Formwork received the lowest average of 3.45 and is the only construction process one respondent rated as not important. All forty respondents rated the other areas between fairly and critically important knowledge to possess.

The respondents rated site plant and equipment as follows: 7.5% fairly important, 35% important, 45% very important and 12.5% critically important. For formwork, 2.5% of the respondents regarded it as not important, 15% as fairly important, 32.5% as important, 35% as very important and 15% as critically important. For general building sequences, 2.5% of the respondents regarded it as fairly important, 17.5% as important, 47.5% as very important and 32.5% as critically important. The respondents rated general output and production factors

as follows: 2.5% regarded it as fairly important, 20% as important, 47.5% as very important and 30% as critically important. The fifth SACPCMP area listed in Table 7.19, basic knowledge of building trades, was rated by the respondents as follows: 7.5% stated that it is fairly important, 32.5% that it is important, 35% very important and 25% critically important.

Table 7.19 Knowledge of construction processes

Responses	1 = Not important                      5 = Critically important					Total
	1	2	3	4	5	
<b>Site plant and equipment</b>	3.63					
Number of respondents	0	3	14	18	5	40
Percentage of total	0	7.5	35	45	12.5	80
<b>Formwork</b>	3.45					
Number of respondents	1	6	13	14	6	40
Percentage of total	2.5	15	32.5	35	15	100
<b>General building sequences</b>	4.1					
Number of respondents	0	1	7	19	13	40
Percentage of total	0	2.5	17.5	47.5	32.5	100
<b>General output and production factors</b>	4.05					
Number of respondents	0	1	8	19	12	40
Percentage of total	0	2.5	20	47.5	30	100
<b>Basic knowledge of building trades</b>	3.78					
Number of respondents	0	3	13	14	10	40
Percentage of total	0	7.5	32.5	35	25	100
Average rating	3.8					

The importance of the knowledge of construction processes is summarised in Table 7.19. All the processes received high weighted averages, although formwork was the lowest and also the only process one respondent rated as not

important. The average rating of 3.8 indicates that it is important to very important for a project manager in the built environment to have knowledge of these processes in order to ensure project success. Individual weighted averages for the subdivisions are 3.63 for site plant and equipment, 3.45 for formwork, 4.10 for general building sequences, 4.05 for general output and production factors and 3.78 for basic knowledge of building trades. It is important to very important for a project manager in the built environment to have knowledge about construction processes. These findings contribute to the research investigating the importance of technical built environment knowledge.

Table 7.20 indicates the importance for a project manager to have knowledge of design processes in order to ensure successful and effective projects. This includes knowledge of the sequence of design processes that received a weighted average of 3.98 and time required for design processes that received a rated weighted average of 3.9.

Table 7.20 Knowledge of design processes

Responses	1 = Not important                      5 = Critically important					Total
	1	2	3	4	5	
<b>Sequence of design processes</b>	3.98					
Number of respondents	0	0	12	17	11	40
Percentage of total	0	0	30	42.5	27.5	100
<b>Time required for design processes</b>	3.9					
Number of respondents	1	2	8	17	11	39
Percentage of total	2.6	5.1	20.5	43.6	28.2	100
Total average rating	3.94					

Table 7.20 indicates that knowledge of design processes is very important. The sequence of design processes received a weighted average of 3.98 and the importance of knowledge of time required for design processes received a

weighted average of 3.9 with one respondent rating time required for design processes as not important.

Previous reference by Kerzner (2006: 3-5) and Burke (2006: 11) indicate that a project needs to be completed within cost, therefore cost management is important. Table 7.21 shows the research findings indicating the importance for a project manager to have knowledge of financial and cost factors in order to ensure successful and effective projects and investigates knowledge of the cost of construction. The weighted average is 4.33 with 90% of respondents stating it is very to critically important.

Table 7.21 Knowledge of financial and cost factors

Responses	1 = Not important                      5 = Critically important					Total
	1	2	3	4	5	
<b>Cost of construction</b>	4.33					
Number of respondents	0	0	4	19	17	40
Percentage of total	0	0	10	47.5	42.5	100
Average rating	4.33					

The weighted average of 4.33 in Table 7.21 shows that it is very important to critically important for a project manager in the built environment to have knowledge of cost factors and specifically cost of construction, to achieve project success.

Tables 7.18 – 7.21 list the four areas with their sub divisions of recommended skills and knowledge for a project manager as indicated by SACPCMP. The research findings indicate that all the areas and subdivisions are important to ensure project success, with the design processes almost on the very important rating and financial and cost factors very important to critically important. A project manager needs to have adequate technical knowledge in order to ensure

project success. Kerzner (2006: 146-149) states that one of the skills that both project and programme managers need is technical skills. Technical expertise is necessary to evaluate technical concepts and solutions, to communicate effectively in technical terms with the project team and to assess risks and make trade-offs between cost, schedule and technical issues. Kerzner (2006: 146-149) states that this is the reason why, in complex problem-solving situations, many project managers need to have an engineering background. Project managers working in construction need to have knowledge of the construction industry (Ashworth & Hogg, 2007: 381-384). The sum of the weighted averages for industry knowledge as shown in Tables 7.18 – 7.21 is 3.95. The research indicated that it is very important to have a knowledge based form of expertise in order to be a successful project manager.

#### **7.4.2.6 Qualifications**

From the above it is clear that it is important for a project manager in the built environment to have experience in the field, project management knowledge and also technical knowledge about the built environment.

Table 7.22 presents a summary of the data received from the respondents. The questionnaire asked the respondents to indicate, by means of 1 – 5 on the Likert scale, the NQF level of knowledge they deemed important for a project manager in the built environment. The question was repeated for NQF level 5 & 6 (national certificates), NQF level 7 (higher diplomas and national first degrees), NQF level 8 (honours degrees), and NQF level 9 (master's degrees). The results show that certain NQF levels had more respondents that rate it as not important than other NQF levels, while 5.6% stated an NQF level 7 as not important, 15.6% said an NQF level 5 & 6 is not important, 20% said an NQF level 8 is not important and 38.9% stated an NQF level 9 is not important. According to the feedback, NQF level 7 is the most important level of knowledge a project manager in the built environment should have. Only 11.2% stated that it is not

important (5.6%) or only fairly important (5.6%) compared to 77.7% that stated that an NQF level 7 is very important (44.4%) and critically important (33.3%) with a weighted average of 3.94. An NQF level 9 is least important 72.2% stated that it is not important (38.9%) or only fairly important (33.3%) with a weighted average of 2.08 that is only fairly important. Only 13.9% said that an NQF level 9 is very important (8.3%) or critically important (5.6%).

Table 7.22 NQF knowledge level required for a built environment project manager

Responses	1 = Not important                      5 = Critically important					Total
	1	2	3	4	5	
<b>NQF level 5 &amp; 6</b>	3.25					
Number of respondents	5	4	10	4	9	32
Percentage of total	15.6	12.5	31.3	12.5	28.1	100
<b>NQF level 7</b>	3.94					
Number of respondents	2	2	4	16	12	36
Percentage of total	5.6	5.6	11.1	44.4	33.3	100
<b>NQF level 8</b>	2.83					
Number of respondents	7	3	16	7	2	35
Percentage of total	20	8.6	45.7	20	5.7	100
<b>NQF level 9</b>	2.08					
Number of respondents	14	12	5	3	2	36
Percentage of total	38.9	33.3	13.9	8.3	5.6	100
Average rating	3.02					

The research indicates that respondents view a higher diploma and a national first degree (NQF level 7) as the most important level of qualification a project manager in the built environment should have and that a master's degree (NQF level 9) is least important. The NQF level 7 weighted average of 3.94 indicates that it is recommended that a project manager obtains a qualification on NQF level 7. Whether there is a link between the respondents' personal qualifications



and their opinion concerning the necessity for NQF level qualifications could be considered for future research.

Figure 7.7 displays the respondents' feedback visually, from left on the x axis NQF 5 & 6, NQF 7, NQF 8 and NQF 9 with the five bars of each representing the Likert scale 1 to 5.

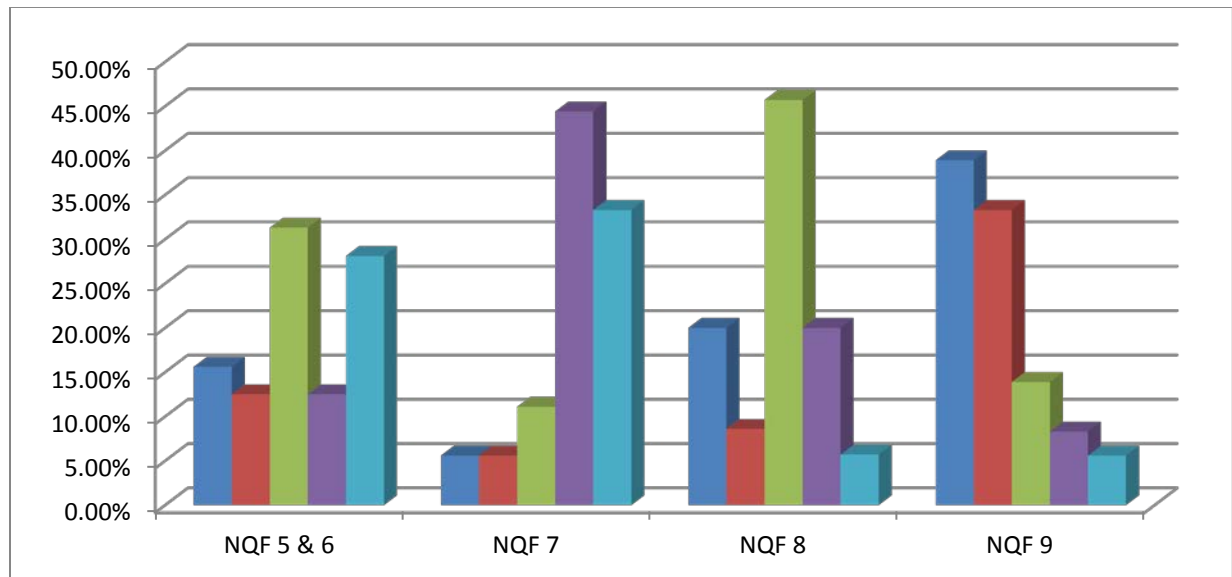


Figure 7.7 NQF level knowledge required for a built environment project manager

The graph indicates NQF levels 5 & 6, 7, 8 and 9 each with five bars indicating the Likert scale from left - not important, fairly important, important, very important and critically important. NQF level 5 & 6 represents a national certificate, NQF level 7 a higher diploma and national first degree, NQF level 8 an honours degree and NQF level 9 a master's degree.

It is clear from the graph that NQF level 7 has a much higher bar four and bar five in comparison with NQF levels 5 & 6, 7 or 8's bars four and five. Bars four and five indicate that the respondents regard the NQF level as very important or critically important for a project manager in the built environment.

The research indicates that three areas of knowledge – experience in the industry, project management and technical knowledge – are important for a

project manager in the built environment. This is supported by data in Tables 7.15-7.21. The weighted average for knowledge gained through experience in the industry is 4.35, project management knowledge 3.43 and for technical knowledge 3.72, 3.8, 3.94 and 4.33 with a technical knowledge average of 3.95. All three areas are important; experience in the industry ranking the highest followed by technical knowledge and project management knowledge.

## **7.5 GENERAL**

Different research instruments were used for this study. There is triangulation that adds to the reliability of the research.

The findings of all research methods used – the interviews, the case study and the questionnaires – overlapped in numerous areas. The questionnaires indicated that leadership is very important to almost critically important to ensure project success, with a weighted average of 4.56. The interviews also stated that leadership is very important, with all interviewees indicating that project managers have to be leaders.

The importance of trust is highlighted in the questionnaires presenting a weighted average of 4.29, stating that trust is very important in order to project success. The case study indicated that trust is crucial. The project manager on the case study project was not trusted due to his lack of knowledge that affected his project management abilities. This had a negative impact on the project.

Communication is essential on a project. The questionnaires reflected a weighted average of 3.79 indicating that it is important to have effective knowledge to ensure effective communication. The questionnaire findings also indicated that the need for a qualification is very important for effective communication, with a weighted average of 4.2. The findings indicate that it is very important for the project manager to have a qualification in the built

environment in order to understand the implications of what is communicated. The weighted average for this is 4.23. The case study also supported these findings. The project manager's lack of technical knowledge led to miscommunication. He did not understand the implications of what was being said. He could not make effective interpretations and this led to communication problems, causing problems between the client and the project teams. Through the interviews it became clear that a project manager needs to be competent to communicate effectively. This entails asking the right questions, understanding teams' feedback and communicating feedback to clients.

All three research methods used – interviews, case study and questionnaires – reflected the importance of an essential knowledge base for project managers in the built environment. The types of knowledge regarded as essential is knowledge through experience, project management knowledge and technical knowledge based on the built environment. Experience in the built environment is very, almost critically, important. The weighted averages from the questionnaires indicated an importance of 4.35. All ten interviewees indicated that knowledge gained through experience by working in the built environment is essential. A project manager in the built environment needs to have project management knowledge. The weighted averages from the research questionnaires reflected a weighted average of 3.43. All ten interviewees also indicated that project management knowledge is essential. Built environment knowledge is essential for a project manager in the built environment. The case study supported this indicating that the project manager on the case study project lacked industry specific knowledge, which caused the project to suffer. The weighted averages for all the construction knowledge areas tested supported these findings. Knowledge of construction science is weighted at 3.7, construction processes at 3.8, design process 3.94 and knowledge of construction financial and cost factors at 4.33.

All research reflected the importance of built environment qualifications. The case study underlined the importance thereof. The project manager who worked on the case study project did not have a qualification and lacked technical knowledge. All the interviewees stated that technical knowledge is important. The engineering firm that two of the interviewees work for has a policy that an individual may only be appointed as project manager should the individual have a qualification within the built environment. The questionnaire findings reflected a weighted average of 3.94 that indicated it is important to very important for a project manager in the built environment to have a higher diploma or first degree in the industry.

## **7.6 CONCLUSION**

The research was conducted using three research methods – the case study, questionnaires and interviews. The case study that was chosen offers reliable, valid and true information. The questionnaires were compiled, distributed and analysed using a scientific method and the interviews were conducted with 10 persons with ample experience contributing to a reliable data set. This procurement research method, making use of a case study, questionnaires and interviews, contributed to a reliable data set. There is not only one data set used but three, which leads to a comparison between the data findings received from the various methods used.

To effectively manage a project in the built environment a project manager needs to have the required knowledge. This includes industry specific knowledge, project management knowledge and knowledge gained through experience working in the built environment. Technical knowledge is essential to increase the probability of project success, as it affects leadership, trust and communication. These aspects are essential requirements in project management. It is advisable for a project manager to have technical knowledge of construction science, construction processes, design processes and financial

and cost factors. Research states that it is very important for a project manager within the built environment to have qualifications based on built environment knowledge. The level of qualification recommended is an NQF level 7, a higher diploma or national first degree. The weighted average for this was higher than the weighted average of lower or higher qualifications namely NQF level 5 & 6 that is national certificates or NQF 8 that is an honours degree or NQF level 9 that is a master's degree. It is advisable for all project managers working in the built environment to have an industry specific qualification together with experience in the field of project management and project management knowledge to assist in successful project management.

## CHAPTER 8

### CONCLUSION AND SUGGESTIONS

#### 8.1 INTRODUCTION

The research study consists of a literature review and empirical research. This chapter presents the summary and conclusion of the study. The thesis examined project management in the built environment and the need and importance of industry specific knowledge. The thesis consists of five sections namely the research proposal (Chapter 1), the theoretical framework and study (Chapters 2 – 5), the methodology (Chapter 6), the empirical research findings (Chapter 7) and the study overview, summary and conclusions in this chapter.

The premise upon which this research study is based is that a project manager needs sufficient knowledge to manage a project as effectively as possible. The primary objective of this study was:

- To establish whether a construction project management requires industry specific knowledge, specifically when managing projects in the built environment industries. This primary hypothesis was proven by both the literature study and the empirical review.

The secondary objectives of this study were:

- To establish the importance of knowledge for a project manager working on built environment projects. This secondary hypothesis was proven by both the literature study and the empirical review.
- To establish and propose NQF levels for the required knowledge. This secondary hypothesis was proven by both the literature study and the empirical review.

- Develop a construction project management model. This secondary hypothesis was proven by both the literature study and the empirical review.
- To increase the effectiveness of the project and probability of project success. This secondary hypothesis was proven by both the literature study and the empirical review.

The summary of the study that follows, addresses these objectives.

## **8.2 Study overview**

Chapter 1 presents the research proposal and purpose of the research. It states that the use of project management has expanded and many industries have implemented a project based approach.

An overview of project management is needed in order to gain insight into the knowledge a project manager in the built environment requires to effectively manage projects in the industry and to add to the essential knowledge base needed for project management in the built environment. This is presented in Chapter 2 where attention is paid to project management, standardisation and certifications in project management, the project management body of knowledge, and essential knowledge required in project management. Project management is defined by the Project Management Institute (PMI) guide in the Project Management Body of Knowledge (PMBOK, 2004: 8) as follows:

*“Project Management is the application of knowledge, skills, tools and techniques to project activities to meet project requirements.”*

Project management aims to complete a project within time and cost, to the desired quality and according to the project scope. The required knowledge base is essential in order to meet project requirements.

A project manager needs a combination of project management knowledge (Declerk, Eymery & Crener, as cited in Pettersen, 1991: 100; Pacelli, 2004: 54) technical knowledge and experience (Kerzner, 2003: 9-1; Lee & Sweeney, 2001: 16; Petterson, 1991: 99).

Project management has been standardised, with certifications through associations and institutions, and courses and qualifications available. In South Africa qualifications are registered through the South African Qualifications Authority (SAQA) and given a certain National Qualifications Framework (NQF) level. Various project management courses have been registered receiving a certain NQF level.

The literature review in Chapter 3 investigates the organisational factors and their influence on project management. Organisational factors such as organisational structure, organisational culture, leadership, communication and trust all affect project management and influence on a project.

Projects are unique and are influenced by many factors. One such factor is the organisational structure, be it a functional, matrix or projectised organisational structure, The organisational structure has an impact on a project and allows a certain level of project management authority.

Another factor that influences project management is leadership. The purpose of a project is to attain the project objectives. The leadership role of a project manager is a critical factor in project success. Project managers need to have leadership qualities.

Leaders need to be competent. Project managers as leaders need project management skills and technical knowledge. The most effective leaders have a



desire to grow and learn constantly, increasing their competence. Project managers need to be leaders and leaders need the required knowledge.

A leader needs to communicate effectively. Effective communication takes place when information is understood. This is a key factor for team performance, successful project completion and effective project management. In the built environment certain communication instruments such as feasibility studies, estimates, final accounts, cost reports, cost planning and payment advices are industry specific. A project manager needs knowledge of these instruments and thus needs industry specific knowledge to effectively coordinate and manage a project.

Another organisational element that influences a project is trust. Trust influences effective communication and teamwork and is very important for a successful project. The concept of trust is based on five dimensions – integrity, consistency, loyalty, openness which means willingness to share thoughts and ideas openly, and competence. The two dimensions that ranked the highest are integrity and competence. Competence is one of the most important elements in trust, and underlines the importance of knowledge.

In Chapter 4 an overview of the built environment is given as the research hypothesis focuses on this industry. Project management in the built environment is also examined. Therefore, a review of the built environment is essential.

The following definition provides some clarity on the built environment (Hauptfleisch & Sigle: 2009:1):

*'The building industry is that operational sector which constructs buildings to the requirements of an employer (client) by making use of the built environment professions, main contractors, subcontractors and a variety of allied resources.'*

*'The construction industry is the collective name for the building and civil engineering construction industries'* (Hauptfleisch & Sigle: 2009:1).

A project manager in the built environment is usually involved throughout the development process, moving through inception, feasibility, outline proposals, scheme design, detail design, production information, bills of quantities, procurement for building projects, project planning, operations on site, to completion and feedback. The stakeholders involved during the development process include the employer, developer, planning authorities, financiers, building contractors and professional advisors. The professional advisors include architects, engineers, quantity surveyors, land surveyors, estate managers, town planners, tax advisors and accountants.

A project manager in the built environment needs an appropriate knowledge base. There are various courses offered on project management; some are generic project management courses and others built environment specific project management courses. These courses may range from short courses to master's degree courses. An industry specific qualification such as BSc architecture, BSc Construction Management, BSc Quantity Surveying, and BSc Real Estate offer an industry specific knowledge base useful for a project manager in the industry.

Project management within the built environment is reviewed in Chapter 5. This is essential for the research that focuses on project management within a specific industry – in this case the built environment. The industry is clearly portrayed in the research title:

*'Project Management in the built environment: the need for industry-specific knowledge.'*

The Project Management Body of Knowledge highlights the importance of knowledge for construction project management:

*'An effective construction project manager needs technical knowledge, project management knowledge and general management knowledge. It adds to the efficiency and effectiveness of the management of construction projects (PMI, 2008:4-10).'*

Project managers in the built environment also need to have technical expertise in order to communicate effectively with the project team using technical terms, evaluate technical concepts and solutions, assess risks and make trade-offs between cost, schedule and technical issues. In very complex problem-solving situations project managers often need an engineering background. Ideally, a project manager in the built environment should already be a member of one of the construction professions as this will give them an understanding of the process and product of construction and also the structure of the industry. Most construction professionals hold degrees graded on a NQF level 8.

SAQA offers descriptions for the NQF levels, stating that an NQF level 5 requires 'knowledge of the main areas of one or more fields, disciplines or practices, including an understanding of the key terms, concepts, facts, principles, rules and theories of that field'; level 6 requires more detailed knowledge described as 'detailed knowledge of the main areas of one or more fields, disciplines or practices, including an understanding of, and an ability to apply the key terms, concepts, facts, principles, rules and theories of that field, discipline or practice'. Thus, regarding built environment knowledge for project managers, at least an NQF level 5 is required, but an NQF level 6 may be required, should the project demand greater technical knowledge.

NQF level 7 is described as ‘detailed knowledge of an area or areas of specialisation and how that knowledge relates to other fields, disciplines or practices.’ Therefore, it may be suggested that project management knowledge, for an expert in project management, should be equivalent to an NQF level 7 qualification.

The South African Council for the Project and Construction Management Professions (SACPCMP) lists a specific technical skill set that a project manager needs in order to manage a project effectively. The technical knowledge areas are construction science, construction processes, design processes, and financial and cost factors. Industry specific knowledge is essential. The publication of a project management guide, specifically for the construction industry, indicates that there are inherent differences between the generic PMBOK guide and a guide that is best suited for the built environment.

In Chapter 6 the research methodology is addressed. The scientific method, the research methodology and the design that were used are explained. Research has to be valid and reliable. Both quantitative and qualitative research was used. Qualitative research involved using ten interviews and a case study as instruments to gain information. Quantitative research was conducted by distributing forty questionnaires to gain data. The data is based on statistics and is numerical. The study used questionnaires distributed to a control group that gave feedback.

The feedback and findings are presented in Chapter 7. The findings show that the knowledge base of a project manager working in the built environment is critical to ensure effective project management. The required knowledge includes project management knowledge, industry specific knowledge and experience working in the built environment.

Organisational factors - leadership, trust and communication - are important in project management. However, a project manager needs technical knowledge in order to be an effective leader, to be trusted by the team and to ensure effective communication. It is proposed that a project manager in the built environment should have a built environment qualification of at least an NQF level 6, a project management qualification of at least an NQF level 7 and experience gained through working in the built environment.

The technical knowledge areas for a project manager in construction, as listed by SACPCMP were tested and should form part of the knowledge base of a project manager working in the built environment. This includes knowledge of construction science, construction processes, design processes and financial and cost factors. The research indicates that trust, leadership and communication are all important elements to increase project success.

The research findings resulted in developing the 'Construction Project Management Knowledge Model'.

### **8.3 Construction Project Management Knowledge Model**

#### **8.3.1 Introduction**

The important determinants that comprise the Construction Project Management Knowledge Model were researched. Presenting the knowledge areas and recommended NQF levels of knowledge would be advantageous to the built environment.

### **8.3.2 Determinants of the Construction Project Management Knowledge Model**

The most important elements that influence the Construction Project Management Knowledge Model have been discussed in the research findings in Chapter 7. They are:

#### **8.3.2.1 Technical knowledge**

The technical knowledge areas are those listed by the SACPCMP, namely knowledge of construction science, knowledge of construction processes, knowledge of design processes and knowledge of financial cost factors.

#### **8.3.2.2 Project management knowledge**

The project management knowledge areas are the areas listed in the Construction PMBOK. These areas are project integration management, project scope management, project time management, project cost management, project quality management, project human resources management, project communication management, project risk management, project procurement management, safety management, occupational health and safety, environmental management, financial management and claims management.

#### **8.3.2.3 Knowledge through experience**

This knowledge is gained through working within the built environment. Where areas of experience are integrated.

### **8.3.3 Importance of the determinant**

The importance of the knowledge areas as elements of the proposed Construction Project Management Knowledge Model was regarded very positively and received the following weighted averages:

- Technical knowledge (3.95)

- Project management knowledge (3.43)
- Knowledge through experience (4.35)

The evaluation by respondents of the knowledge areas work experience, project management knowledge and technical knowledge are illustrated on a radar graph in Figure 8.1. The weighted average of work experience is 4.35, technical knowledge is 3.95 and project management knowledge is 3.43.

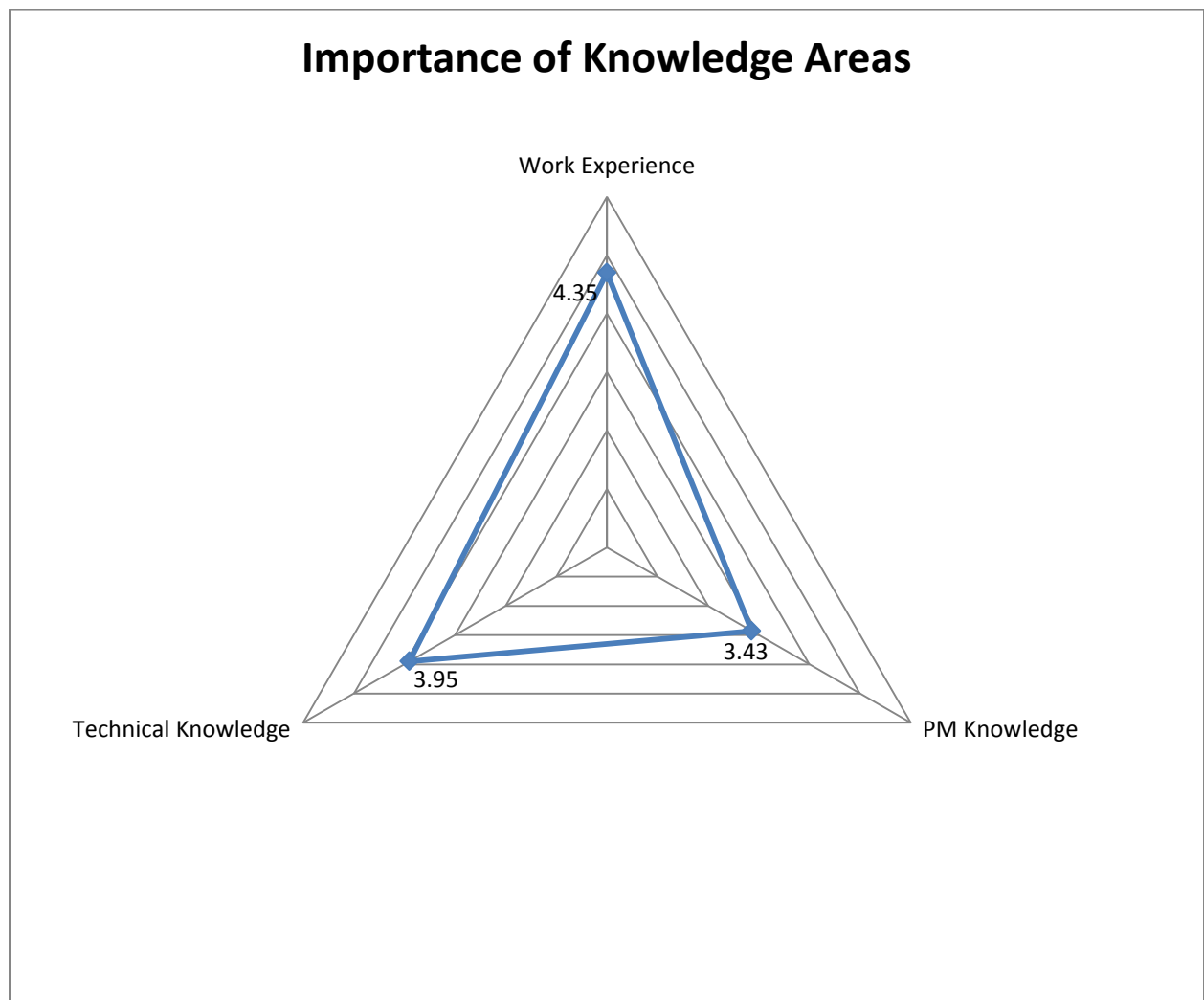


Figure 8.1 Important knowledge areas

Figure 8.1 indicates the three knowledge areas. They all received a high weighted average from respondents that indicates that technical knowledge,

project management knowledge and experience are all important in order to attain project management success.

Built environment technical knowledge areas and the averages received from respondents are shown in Figure 8.2. This indicates the importance of the four SACPCMP areas, which are knowledge of construction science, knowledge of construction processes, knowledge of design processes and knowledge of finance and cost. The weighted averages for these areas are 3.72 for construction science, 3.8 for construction processes, 3.94 for design processes and 4.33 for finance and costs.

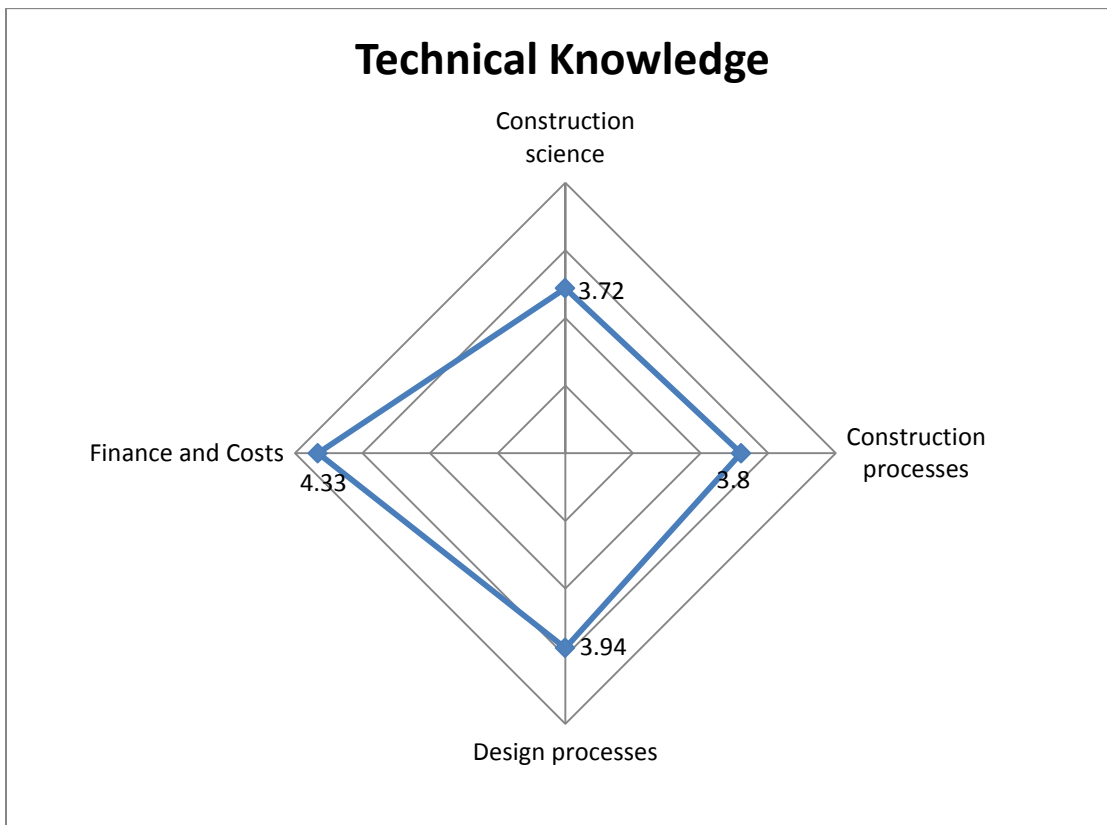


Figure 8.2 Technical knowledge areas

Figure 8.2 shows that all four technical knowledge areas, as listed by The South African Council for Project and Construction Management Professions (SACPCMP), are important for a project manager in the built environment; all



four knowledge areas have weighted averages that indicate that it is important. It is therefore important for a project manager in the built environment to have technical knowledge as part of their knowledge base.

Figure 8.3 illustrates the importance of technical knowledge in order to be able to effectively apply the thirteen project management knowledge areas, in accordance with responses, as per the construction extension to the PMBOK. The weighted averages for the thirteen areas are project integration knowledge 3.82, project scope management 4.00, project time management 4.10, project cost management 4.04, project quality management 3.83, project human resource management 3.86, project communication management 3.79, project risk management 4.01, project procurement management 3.56, project occupation health and safety 3.70, project environmental management 3.39, project financial management 3.92 and project claims management 4.03. Procurement and claims are integral to construction Law principles and processes and as such an important knowledge area for project management. It should be noted that construction law is also important and regulates areas such as scope, time, cost, quality, communication, risk management, resourcing that are all integrated into the construction project management knowledge areas. The weighted averages indicate that technical knowledge is needed in order to effectively apply these areas.

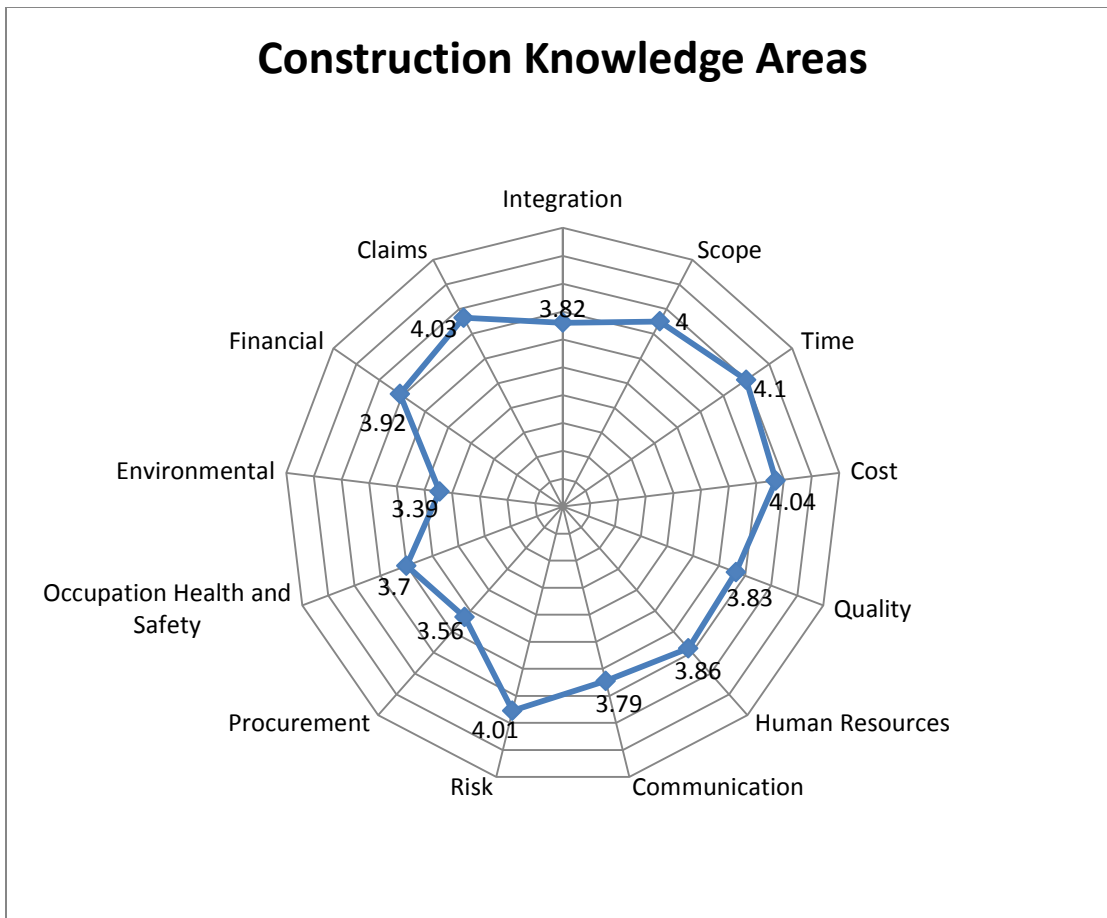


Figure 8.3 Construction project management knowledge areas: Importance

Figure 8.3 shows that technical knowledge is important in order for a project manager to effectively apply the project management knowledge areas. All thirteen project management knowledge areas received a high weighted average.

Figure 8.1 indicates the three knowledge areas that are important in project management in the built environment, and Figures 8.2 and 8.3 indicate the technical knowledge areas and the construction project management knowledge areas that are important. This information forms part of a model called the Construction Project Management Knowledge Model constructed to illustrate the knowledge required by a construction project manager.

### **8.3.4 Presentation of the Construction Project Management Model**

The Construction Project Management Knowledge Model is proposed to indicate the areas of knowledge that a construction project manager needs and the levels of each in order to obtain effective or mature construction project management.

The model was developed from the empirical study and reflects the core of the study results. The study investigated the need for industry specific knowledge for project managers in the built environment. The three research methods used produced the same results, showing that a project manager in the built environment requires various areas of knowledge – technical knowledge, knowledge through experience and project management knowledge.

The centre of the model illustrates the knowledge required for effective construction project management. Therefore, effective construction project management is placed at the core of the model. The circle around the core represents industry specific knowledge, followed by the circle depicting experience and the last circle that reflects the project management knowledge areas. The research findings indicate the necessity of these knowledge areas, supported by weighted averages emphasising the importance thereof.

The NQF levels were studied and the research indicated the importance for a project manager in the built environment to have an NQF level 6 qualification by a weighted average of 3.25. The importance for a project manager in the built environment to have an NQF level 7 qualification received a weighted average of 3.94 – both NQF level 6 and 7 were rated as important. The NQF levels were allocated to the knowledge areas and are reflected in the model.

A project manager in the built environment needs to have technical knowledge. The areas within technical knowledge – construction science, finance and cost, construction process and design process – were derived from the SACPMP,

tested and proven important by the research. The questionnaire's weighted averages for all the construction knowledge areas tested support these findings. Knowledge of construction science is weighted at 3.7, construction processes at 3.8, design process 3.94 and knowledge of construction financial and cost factors at 4.33. The weighted averages from the questionnaires reflected a weighted average of 3.43. All ten interviewees also indicated that project management knowledge is essential. It is essential for a project manager in the built environment to have built environment knowledge. The case study supports this indicating that a project manager on that project lacked industry specific knowledge, which caused the project to suffer. An NQF level 6 is described by SAQA as 'detailed knowledge of the main areas of one or more fields, disciplines or practices, including an understanding of and an ability to apply the key terms, concepts, facts, principles, rules and theories of that field, discipline or practice'. This research study suggests that a project manager in the built environment should have industry specific knowledge equivalent to an NQF level 6. The NQF level 6 and the technical knowledge subareas are reflected in the industry specific knowledge circle in the model.

Project managers need project management knowledge. This should be on a higher level as technical knowledge because project managers need to be specialists in their primary field of work, which is project management. The level of project management knowledge needs to be detailed knowledge of that area of specialisation. SAQA describes the scope of knowledge for an NQF level 7 qualification as 'detailed knowledge of an area or areas of specialization and how that knowledge relates to other field, disciplines or practices.' The required project management level of knowledge is therefore an NQF level 7.

Experience in the built environment is very, almost critically, important. The weighted averages from the questionnaires indicated an average of 4.35. All ten interviewees indicated that knowledge gained through experience working in the built environment is essential.

Figure 8.4 shows the Construction Project Management Knowledge Model indicating each necessary knowledge area by means of a different colour. The colours are as follows:

- Yellow inner circle: effective construction project management
- Pink second circle: technical knowledge
- White third circle: knowledge through experience
- Green forth circle: project management knowledge

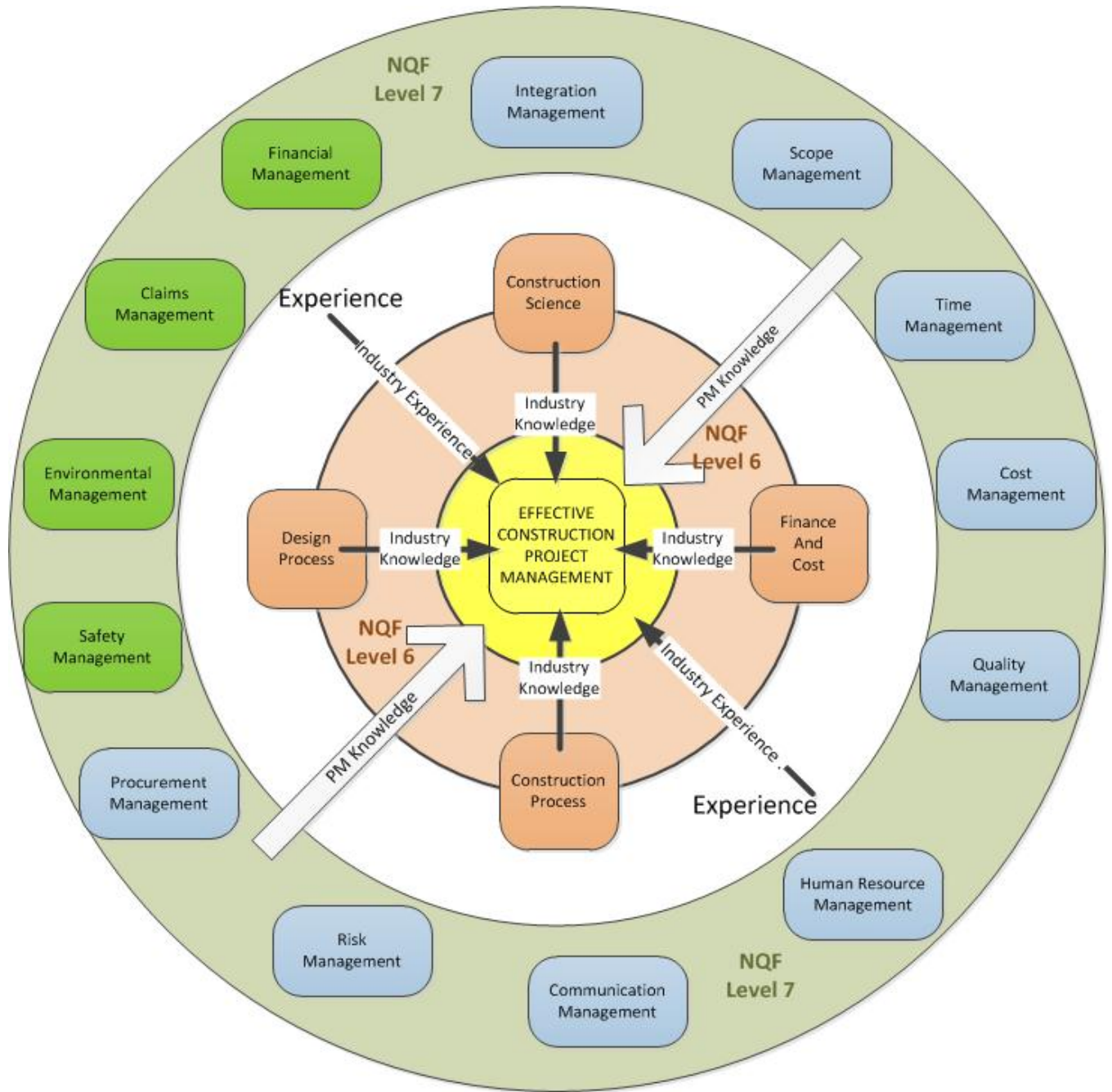


Figure 8.4 The Construction Project Management Knowledge Model

The core of the model in Figure 8.4 is the yellow inner section, indicating effective construction project management. The model illustrates the essential inputs required for effective construction project management.

The pink, white and green circles illustrate the three knowledge areas that are essential to ensure effective construction project management, the yellow core in the model. Each of these circles has arrows flowing towards the core.

The four technical knowledge areas that are needed are indicated in the pink circle and are construction science, finance and cost, construction process and design process. The technical knowledge area should be on at least an NQF level 6 – this is indicated within the circle. There are arrows flowing from the pink circle to the yellow core stating 'industry knowledge' on the arrow. This indicates that the knowledge areas on the pink circle are the technical knowledge areas and that they are essential in ensuring the yellow core that is effective construction project management.

The third circle is the white circle, indicating work experience within the industry. The arrows flowing from the circle to the yellow core, illustrate the importance of experience to ensure effective construction project management.

The thirteen project management knowledge areas are shown in the green circle. The nine generic project management areas are indicated in blue and the four construction specific project management areas are indicated in green within the circle. The blue generic project management knowledge areas are integration management, scope management, time management, cost management, quality management, human resource management, communication management, risk management and procurement management. The four construction specific project management areas that are indicated in green are safety management, environmental management, claims management and financial management. The project management knowledge areas should be on at least an NQF level 7 – this is indicated within the circle. The arrows stating PM knowledge illustrate that project management knowledge is required to ensure effective construction project management.

The need for knowledge is illustrated by the arrows that flow from each knowledge circle to the yellow core of the model that is effective construction project management, indicating that the knowledge area is required for effective construction project management. The technical knowledge should be at an NQF level 6 and the project management knowledge areas should be at an NQF level 7. Effective construction project management requires technical knowledge, project management knowledge and work experience within the industry. The aim of the model is to reflect and summarise the research findings, showing the required knowledge and level of knowledge that a project manager in the built environment needs. It aims to contribute to improving the project management environment, aiding in awareness of the various knowledge areas and subareas that are important and the NQF level that is suggested. This could also contribute to sufficient education by creating awareness of the level of education a project manager in the built environment requires.

Organisations could use the model as reference to determine which areas their project managers could improve on in order to develop and increase project management maturity in the organisation. The project management construction model also offers tertiary institutions a framework for syllabus planning of constructions project management courses.

#### **8.4 Recommendation and further study to follow**

This research study investigated and explained the areas of knowledge needed by a project manager in the built environment and the necessary NQF knowledge level required.

The research aims to add value to various professions within the built environment, through the research findings. It aims to improve the project management profession within the built environment, affecting professionalism, the people involved and preventing potential problems. The findings bare



relevance to project management and disciplines within the built environment, i.e. Quantity Surveying, Construction Management, Town Planning, Engineering and Architecture.

Further studies that focus in depth on the recommended basic knowledge base for a project manager in the built environment may be necessary. Quantity surveying and cost engineering knowledge, as contributors to successful project management in the built environment, may also be explored. This may also be true for other professions.

It is evident from the study that industry specific knowledge is seen as a very important contributor to the success of building and construction projects. Clients should be made aware of the levels of skills, specific knowledge and experience a project manager should possess to ensure the most appropriate selection of a project manager. Construction project managers require knowledge from various areas in order to effectively manage a project. This includes generic project management knowledge, industry specific knowledge and experience in the built environment

A further area of research opened by this study might be to improve the model, or using the model as foundation to develop a measuring instrument to determine the knowledge of a construction project manager. Such an instrument could also indicate knowledge areas of the project manager that might require development and attention. Such an instrument may contribute to improving project management in an organisation.

## **8.5 CONCLUSION**

Project management has gained support in organisations and across industries. Planning, monitoring and controlling a project successfully and completing a project as effectively as possible is of great importance. In this chapter the findings are linked to the proposed model. The model answers the question of

how the knowledge areas are integrated, through development, education, training and experience, to effective construction project management. A project manager needs industry-specific knowledge on at least an NQF level 6 and generic project management knowledge on at least an NQF level 7, as well as knowledge gained through experience obtained by working within the built environment. Projects in the built environment need to be managed by a project manager with a sound level of industry specific knowledge. However, certain projects demand greater technical and industry specific knowledge. A project manager who is not knowledgeable diminishes the trust relationship and effective communication between the project team and the project manager; this may cause ineffective project management and limit the probability of success. A strong knowledge base of the built environment will enhance the effectiveness and performance of project management, consequently benefiting clients and enhancing project success.

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## **Appendix A**

### **Questionnaire**

## SECTION A: GENERAL INFORMATION

Please indicate your choice or status by marking (X) in the block of your choice.

### 1 Your profession

<input type="checkbox"/>	Project manager	
<input type="checkbox"/>	Project administrator	
<input type="checkbox"/>	Program manager	
<input type="checkbox"/>	If other, please name _____	

### 2 Gender

<input type="checkbox"/>	Female
<input type="checkbox"/>	Male

### 3 Your highest level of qualification

<input type="checkbox"/>	Matric
<input type="checkbox"/>	Certificate
<input type="checkbox"/>	Diploma
<input type="checkbox"/>	Degree
<input type="checkbox"/>	Post graduate degree (Honours level)
<input type="checkbox"/>	Masters level
<input type="checkbox"/>	Ph.D

### 4 Please indicate in which of the following fields you hold a qualification and specify the level; for example, a certificate, diploma, B degree or Honours degree

<input type="checkbox"/>	Engineering, please specify your qualification _____
<input type="checkbox"/>	Quantity surveying, please specify your qualification _____
<input type="checkbox"/>	Construction management, please specify your qualification _____
<input type="checkbox"/>	Town planning, please specify your qualification _____
<input type="checkbox"/>	Architecture, please specify your qualification _____
<input type="checkbox"/>	Project management, please specify your qualification _____
<input type="checkbox"/>	Other qualifications, please specify _____

### 5 Indicate your years of experience in implementing projects, after qualification, in the built environment

<input type="checkbox"/>	0-5 years
<input type="checkbox"/>	5-10 years
<input type="checkbox"/>	11-15 years
<input type="checkbox"/>	16-20 years
<input type="checkbox"/>	20+ years

**6 Type of projects you have worked on:**

- Residential projects
- Offices
- Shopping centres
- Industrial buildings such as factories
- Engineering projects
- Others: Please name: \_\_\_\_\_

**7 Highest value of a single project worked on**

- less than R1 000 000
- R 1 000 000 - R5 000 000
- R 5 000 000 - R 10 000 000
- R 10 000 000 - R 20 000 000
- R 20 000 000 - R 50 000 000
- R 50 000 000 - R100 000 000
- R 100 000 000- R200 000 000
- R 200 000 000 - R 500 000 000
- Above R 500 000 000 please specify \_\_\_\_\_

**8 Job title/ description on the projects** \_\_\_\_\_

**SECTION B: PROJECT MANAGEMENT AND THE BUILT ENVIRONMENT**

Please indicate your choice by marking (X ) in the block of your choice.  
The scale indicates the following:

- 1 - Not important
- 2 - Fairly important
- 3 - Important
- 4 - Very important
- 5 - Critically important

**9 Indicate the level of maturity of project management in the organization you work for**

- Organization has no structured approach to project management
- Organization is aware of project management benefits, but doesn't implement it
- Project Management processes are formalized but there is room for improvement
- Best practice approach, PMI (This refers to the optimum way to reach the project goals)

**How important is it for a project manager to have a qualification based on technical knowledge within the built environment in order to**

- 10 Manage a construction project
- 11 Communicate with the project team
- 12 Understand the implications of what is being communicated
- 13 Know what questions to ask

Importance				
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5



- 14 Make informed judgements
- 15 Be trusted by the team members
- 16 Make certain plans are acceptable
- 17 Ensure that designs, contract documents, specification and Bills of Quantities are done to standard
- 18 See that site meetings are effectively managed

1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5

**What level of knowledge is important for a project manager in the built environment to have**

- 19 NQF level 2-5 - National certificates
- 20 NQF level 6 - Higher diplomas and national first degrees
- 21 NQF level 7 - Honours degrees
- 22 NQF level 8 - Masters degrees and Doctorates

Importance

1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5

**In your opinion, how important is it to have knowledge-based forms of expertise in order to be a successful project manager**

- 23 Experience in the field of the built environment
- 24 Theoretical project management knowledge related to specific projects
- 25 Project management experience
- 26 Technical industry knowledge

Importance

1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5

**PROJECT SUCCESS FACTORS**

**To increase the possibility of project success, how important are the following factors?**

- 27 The project manager as a person
- 28 Leadership
- 29 Trust
- 30 Problem solving ability of the "team"
- 31 Project managers technical knowledge about the built environment
- 32 Planning ability of the project manager
- 33 Scheduling ability of the project manager
- 34 Control and monitoring ability of the project manager

Importance

1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5

**In your opinion, please indicate the importance of a project managers' technical knowledge about the built environment in order to ensure successful and effective projects**

**Knowledge of construction science**

- 35 Understanding structures
- 36 Understanding construction and building sciences
- 37 Understanding construction and building finishes
- 38 Knowledge of building materials

Importance

1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5

**Knowledge of construction processes**

- 39 Site, plant and equipment
- 40 Formwork systems
- 41 General building sequences
- 42 General output and production factors
- 43 Basic knowledge of building trades

Importance

1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5

**Knowledge of design processes**

- 44 Sequence of design processes
- 45 Time required for design processes

Importance

1	2	3	4	5
1	2	3	4	5

**Knowledge of financial and cost factors**

- 46 Cost of construction

Importance

1	2	3	4	5
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**PROJECT MANAGERS' KNOWLEDGE AREAS**

**In your opinion, please indicate how important a project managers' technical knowledge about the built environment is in order to**

- 47 Plan all the knowledge areas
- 48 Execute all the project processes
- 49 Control the project

Importance

1	2	3	4	5
1	2	3	4	5
1	2	3	4	5

**PROJECT INTEGRATION MANAGEMENT**

**In your opinion, please indicate how important a project managers' technical knowledge about the built environment is in order to facilitate**

- 50 Developing documentation such as the project charter and the project management plan

Importance

1	2	3	4	5
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**PROJECT SCOPE MANAGEMENT**

**In your opinion, please indicate how important a project managers' technical knowledge about the built environment is in order to facilitate**

- 51 That the project scope includes all work necessary
- 52 Creating the WBS (Work breakdown structure)
- 53 Scope control throughout the project

Importance

1	2	3	4	5
1	2	3	4	5
1	2	3	4	5

**PROJECT TIME MANAGEMENT**

**In your opinion, please indicate how important a project managers' technical knowledge about the built environment is in order to facilitate**

- 54 Identifying and planning the duration of the activities
- 55 Developing the schedule

Importance

1	2	3	4	5
1	2	3	4	5

**What impact does a project managers knowledge have on**

- 56 Completing a project within the specified time

Importance

1	2	3	4	5
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**PROJECT COST MANAGEMENT**

**In your opinion, please indicate the importance of a project managers' technical knowledge about the built environment in order to facilitate**

- 57 Estimating the cost of the project
- 58 That the project is delivered within approved budget

Importance

1	2	3	4	5
1	2	3	4	5

**PROJECT QUALITY MANAGEMENT**

**In your opinion, please indicate the importance of a project managers' technical knowledge about the built environment in order to ensure**

- 59 Quality planning
- 60 The project is delivered according to the expected quality expectations

Importance

1	2	3	4	5
1	2	3	4	5

**PROJECT HUMAN RESOURCE MANAGEMENT**

**In your opinion, please indicate the importance of a project managers' technical knowledge about the built environment in order to facilitate that**

- 61 A project team is procured
- 62 The people involved on the project are utilized as best possible

Importance

1	2	3	4	5
1	2	3	4	5

**PROJECT COMMUNICATION MANAGEMENT**

**In your opinion, please indicate the importance of a project managers' technical knowledge about the built environment in order to facilitate that**

- 63 Information is collected and distributed
- 64 Performance reporting is done
- 65 Stakeholders are managed

Importance

1	2	3	4	5
1	2	3	4	5
1	2	3	4	5

**PROJECT RISK MANAGEMENT**

**In your opinion, please indicate the importance of a project managers' technical knowledge about the built environment in order to facilitate**

- 66 Risk identification
- 67 Risk analysis
- 68 Compiling a risk management plan

Importance

1	2	3	4	5
1	2	3	4	5
1	2	3	4	5

**PROJECT PROCUREMENT MANAGEMENT**

**In your opinion, please indicate the importance of a project managers' technical knowledge about the built environment in order**

- 69 To identify procurement system
- 70 To plan contracting arrangements
- 71 For the implementation of the procurement method system

Importance

1	2	3	4	5
1	2	3	4	5
1	2	3	4	5

**SAFETY MANAGEMENT**

**In your opinion, please indicate the importance of a project managers' technical knowledge about the built environment in order to facilitate**

- 72 The prevention of accidents and personal injury and avoid property damage
- 73 Safety assessment
- 74 Drafting and adherence to safety specifications
- 75 Safety plan

Importance

1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5

**OCCUPATIONAL HEALTH AND SAFETY**

**In your opinion, please indicate the importance of a project managers' technical knowledge and experience in the built environment in order to facilitate**

76 That the project follows all laws and regulations pertaining to the occupational health and safety affecting the project

Importance

1	2	3	4	5
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**ENVIRONMENTAL MANAGEMENT**

**In your opinion, please indicate the importance of a project managers' technical knowledge and experience in the built environment in order to facilitate**

77 That the project follows all laws and regulations pertaining to the environment affecting the project

78 The assessment of materials and identification of environmentally friendly building materials

79 The assessment and management of, for example carbon emissions

Importance

1	2	3	4	5
1	2	3	4	5
1	2	3	4	5

**FINANCIAL MANAGEMENT**

**In your experience, please indicate the importance of a project managers' technical knowledge about financial arrangement in the built environment in order to facilitate**

80 The feasibility and viability assessment of a project

81 The profitability assessment of a project

82 The necessary steps to be taken to acquire and manage the financial resources for the project

Importance

1	2	3	4	5
1	2	3	4	5
1	2	3	4	5

**CLAIMS MANAGEMENT**

**How important is a project managers' technical knowledge about the built environment and contractual arrangement in order to**

83 Assist in the processes required to prevent or eliminate construction claims from arising

84 Assist in the implementation of a claims model

85 Assist in dispute resolution proceedings

Importance

1	2	3	4	5
1	2	3	4	5
1	2	3	4	5

86 Please comment on the factors that you regard as detrimental and that could prevent successful completion of a project

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87 Any comments on project management in the built environment or the knowledge of project managers in the built environment

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88 Any general comments

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***Thank you for your help!***