Cape Peninsula University of Technology

Adoption of Cloud Computing to Enhance Project Management Processes and Outcomes in South Africa in the Private Sector.

By

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Declaration

I, Ayanda Pekane, declare that the content of this thesis represents my own unaided work, and that the dissertation/thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

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Signed **Date**

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Dedication

To my Lord and Saviour, Jesus Christ, if it were not for your love and guidance, I would not be where I am today.

Abstract

Project Management (PM) is defined as the application of tools and techniques to direct the use of diverse resources toward the accomplishment of a task within time, cost and quality constraints. In the information age, Information and Communication Technology (ICT) has emerged as an enabling tool, resource and a facilitator of the PM practice. With ICT as a major enabler of efficiencies in PM, the adoption of new ICT systems and tools have improved processes and outcomes in PM. The main argument is that cloud computing has a great potential to improve efficiencies in PM. The problem at the time of writing however, was that it was not clear whether this innovation was understood and maximally exploited by the PM community of practice in South Africa. Efficiency of PM is critical to competitiveness and growth in all sectors. Thus, the objective of this study was to explore the adoption of ICT systems and tools particularly cloud computing, to advance the practical objectives PM in the private sector.

Due to the socio-technical nature of the current study, the interpretivist approach together with a qualitative research method, as well as the purposive sampling technique were adopted for the study. In essence, 8 respondents consisting of 2 academic experts, 4 technology literate project managers and 2 client service providers of cloud computing were selected. Together with the Structuration Theory (ST) as an analytical framework and the content analysis technique was used to contextualise and to analyse data.

Findings show an acceptable level of awareness of cloud computing in the private sector. Nevertheless, negative perceptions that may threaten the adoption of cloud computing in PM in the private sector also emerged in the findings. Otherwise, PM has gained popularity in the sector. As the findings further reflect however, standards have tended to be compromised by cynics in the discipline. Positive developments are that the project failure rate is on the decline, which is further enhanced by the adoption of new innovative technological tools and systems. Rigid organisational norms also re-enforce resistance to change. It is, thus, recommended for project managers to review cloud-computing benefits in accordance with their requirements. In conclusion then, resources have not only proved to be a significant matter in PM, but also instrumental in advancing PM efficiencies, leading to improved PM successes. In the light of emergent shortfalls however, executive managers and project managers should keep themselves informed and be open to changes that can advance the organisational course.

Keywords: Business Processes, Cloud Computing, ERP systems, ICT, Project Management, Structuration Theory.

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List of Abbreviations

Abbreviation	Description
ICT	Information and Communication Technology
PM	Project Management
PMLC	Project Management Life Cycle
IT	Information Technology
SaaS	Software as a Service
PaaS	Platform as a Service
IaaS	Infrastructure as a Service
SANRAL	South African National Roads Agency
GFIP	Gauteng Freeway Improvements Projects
FIFA	Federation International Football Association
ERP	Enterprise Resource Planning
ISO	International Organisation for Standardization
PMI	Project Management Institute
RTOC	Regional Train Operating Company
GDSS	Group Decision Support System
PMBOK	Project Management Body of Knowledge
RAM	Random Access Memory

CHAPTER ONE

1. INTRODUCTION

1.1 Introduction

Project Management (PM) is a term and a field of practice that has attracted various definitions over time (Söderlund, 2004). Though there may be slight differences in how various commentators define PM, the meanings seem more supplementary than contradictory (ibid.). Anyway, sentiments are that none of the classical definitions are wrong, but each is just incomplete (Turner & Muller, 2003). One definition of PM is the application of tools and techniques to direct the use of diverse resources toward the accomplishment of a task within time, cost and quality constraints (Atkinson, 1999). Information and communication technology (ICT) has emerged as an enabling tool, resource and a facilitator of the PM practice in the information age (Ahuja et al., 2010; Nicoletti, 2012). With increased adoption of ICT, PM has become an essential endeavour in which human, material and financial resources are effectively organized in a novel way, to undertake a unique scope of work, of given specification, within constraints of cost and time, so as to achieve beneficial change defined by quantitative and qualitative objectives (Turner & Muller, 2003). A second definition by Burke (2007) adds the phenomenon of knowledge and skills to the tools and techniques.

What is common ground between PM definitions is a common focus different commentators place on the end goal (Larson & Gray, 2011). According to Atkinson (1999) for example, the application of tools is aimed at directing multiple resources towards accomplishing a common end of the project. In the same order, Burke (2007) sees the goal as the advancement of activities in order to meet stakeholder's needs and expectations. PM therefore, is not an end in itself, but a practical endeavour towards meeting stakeholder goals and interests (Burke, 2011). In addition to stakeholders, resources feature quite prominently in PM (Burke, 2007). In fact, the modern economic structure is about the balancing of the production, marketing, distribution and even the stewardship of resources in a private and/or public capacity (Wirick, 2009). Given the profit motive of the modern economic structure, efficiency in each of these functions and their coordination in respective projects is key to the productivity, competitiveness and profitability of the private sector (Voss et al., 2005). It is along this logic that innovations in PM practices continue to be prioritised in the private sector (Ward, 2006).

Adoption of PM and adherence to recognised standards, principles and best practices has enhanced productivity in the private sector (Larson & Gray, 2011). PM is utilised by organisations, both as a tool and a means to achieve strategic objectives (Desouza & Evaristo, 2006). PM has been used in various industries and it has proved more efficient than the conventional ways of management (Larson & Gray, 2011). Conventional ways of management refers to the management of recurring operations with the focus on planning, schedule, motivation and control (ibid.). However PM is focused on managing non-repetitive operations, there is a deliberation on prioriting what needs to be done and using a methodology to reach organisational objectives rather than simply managing a set of recurring processes (Burke, 2011). For example, PM has been a useful tool in ensuring change management in organisations for the past decade (Clarke, 1999). Other examples are the Research and Development (R & D) projects in engineering where PM principles are used to ensure that products get to the market at the desired time (Sharon et al., 2010). Generally, the private sector seems to lead in the adoption of PM principles and practices (Wirick, 2009). Take for instance the companies in the chemical process industry where billions of dollars are invested on capital projects, most of these projects become successful and achieve desired results (Harding, 2012). Another example is based on the construction industry, in this industry PM is a way of life, to an extent that most projects succeed in this sector due to the many years of practising PM (Zafar et al., 2012).

However, there are many organisations that still encounter limitations in their use of PM (Clarke,1999; Wu et al., 2012). In the chemical industry for example, not all is perfect. Some projects are partially successful, with an equally significant amount of failures (Harding, 2012). Likewise, the issue of cost overruns have been widely published in the construction environment (Doloi, 2012).

With ICT as a major enabler of efficiencies in PM, the adoption of new ICT systems and tools should help improve processes in many ways (Ahuja et al., 2010). With this insight, the objective of this study was to explore the adoption of ICT systems and tools such as cloud computing, to advance the practical objectives PM in the private sector. In this thesis therefore, emphasis was placed on professional organisations with a reputation of sound PM and a strong likelihood to use technology innovations in South Africa. In this quest, this chapter is divided into 8 sub-sections. After the opening introduction in section 1, the chapter continues with a background to the research problem in section 1.2, followed by the problem statement, the research objective and the research question in sections 1.3, 1.4 and section 1.5 respectively.

The terminology of the thesis is presented in section 1.6, followed by the structure of the thesis in section 1.7 and a conclusion of the chapter in section 1.8.

1.2 Background to the research problem

Project Management (essentially) evolved from management attempts to respond to the rising complexities of the business world, largely in the private sector (Hobday, 2000). The work of Fredrick Taylor and Henry Ford in the early years of the 20th century had a major influence on the development of PM in this respect (Butler, 1991). Fredrick Taylor's detailed studies on scientific reasoning about work in particular, deserve special mention (Giannantonio & Hurley-Hanson, 2011). Taylor's methods which found a way to scientifically define what a fair pay for the performance formula would be, through understanding the work process and the times required to complete tasks, shaped the earlier thinking about PM (Brogan, 2011). He provided workers with tools and skills, and taught them techniques to help speed up the work (Butler, 1991), the terms which remain predominant in definitions of PM to date.

The management approach known as a production line (mass production) through specialisation and the division of labour by Henry Ford also sought to improve the productivity of projects on the shop floor (Alizon et al., 2009). It ensured that workers are skilled and that the same techniques, methods and processes are used to improve speed, quality and quantity of production at reduced costs (Raff & Summers, 1987; Butler, 1991). On this basis, the principles of PM grew in popularity and were adopted beyond the industrial shop-floor by various organisations (Arnaboldi et al., 2004). This has led to the growth of PM adoptions in the private sector (Srivannaboon & Milosevic, 2006). It is also important to note that the private sector is known for its flexible adaptation to new innovations, in the interest of its visible contributions to the national systems of innovation and ultimately its role towards economic growth (Wirick, 2009). Adopting technological systems such as cloud computing within PM can be helpful in improving competitiveness in the global economy (ibid.). Thus as a focus of the study the private sector was considered to be a logical focus. As progressive as the private sector may be, it is also true that there have been operational limitations on how PM strategies and tools are applied in the sector (Dai & Wells, 2004).

Nevertheless, emphasis on value for stakeholders (customer appeal) and a focus on the end goal are evident in these early accounts of PM (Summers, 2009). As seen in definitions of PM therefore, such conventional wisdom is still evident in contemporary thinking about PM, albeit, with innovative adaptations. A multitude of techniques and tools have since evolved in the PM

practice over time (Johnson, 2013). The project management life cycle (PMLC) for example, is one of the basis upon which modern techniques and tools in this discipline can be built. In addition to the PMLC has been the adoption of Information Technology (IT) tools and systems such as cloud computing as enablers of efficiencies in PM in the information age (Dzameshie, 2012). It is shown later in this document (Section 1.2.1) how IT can improve efficiencies across various phases of the PMLC in PM (ibid.).

1.2.1 Information Technology in Project Management

Information Technology (IT) is a term that refers to a discipline and a field of practice in technical processes, or even in the development and use of tools and systems to effectively develop, manage, store, retrieve, analyse and exchange information for private, social and commercial purposes (Mlitwa, 2011; Cox, 2013). Within the field of practice – practitioners are able to use relevant IT tools as part of their trade, be it in software engineering, database or network development and Information Systems (IS), among others (Denning, 2001). In this instance, IT tools are skilfully applied to improve efficiencies in almost all vocational disciplines (Melville et al., 2007).

A database among other tools offers a basic example of how IT has become an integral part of all information-centric organisations in the knowledge-based economy of the information age (Castelles, 2002). A database can be defined as a collection of structured data (O'Donnell et al. 2001), that is arranged so that it can be searched (Ferrari & Selmi, 2011), organized and selected (Barker, 2001; Glick, 2012). It is the most common information management tool across almost all domains of the management practices, including PM (Harrison & Lock, 2004). It enables individuals and organisations to accurately manage large amounts of information, with minimal levels of sophistication (Sekino & Nakamura, 2006). At a smaller scale, a sole proprietor can manage employees, supplier or even customer related data, and access files that are small enough to be sent via email (ibid.). At a more complex level, larger organisations such as Metrorail in the public sector (Magetha, 2013) and Old Mutual in the private sector, use networked (website) driven tools such as Empac (Zungu, 2013), Oracle and other brands to manage data for and by thousands of users (Leavitt, 2010). Empac and Oracle are embedded with advanced administration tools that enable organisations to schedule tasks, receive alerts, optimize databases and configure security accounts for users at different levels in an organisation (Kent et al., 2004).

As an IT tool in PM then, a database can be used to develop and store key information such as project timelines, estimates, budgets and forecasts, equally as efficiently in the public sector, as it is in the private sector (Dousset & Hendery, 2010; Kiziltas et al., 2009). Other IT tools that are used by individuals and organisations are IS (Stair & Reynolds, 2011). They (IS) are defined as a set of interrelated components that collect, manipulate, store data and provide a feedback mechanism to meet an objective (ibid.). According to Ratzan (2004) IS are a consistent and coordinated set of components acting together towards the production, distribution or processing of information. An example of IS used by individuals for personal use includes emails, social networks like Facebook, Twitter and Instagram (Mangold & Faulds, 2009). Individual's use these IS tools through their information devices by collecting, manipulating, storing data or information and by communicating among each other (feedback mechanism) (ibid.). The usefulness of IS extends to organisations, where companies use IS to deal with the conceptualisation, development, maintenance and utilization of business processes (Wigand et al., 2003). This is focused on computer assisted information processing within enterprise networks (ibid.). There are a number of examples that can portray the use of IS in organisations however the most relevant system that has been adopted by organisations to improved efficiency in business processes are the enterprise resource planning (ERP) systems (County, 2011).

ERP systems are defined as application software that integrates business processes and administrative functions of an enterprise (Al-mashari, 2003). They are used in various industries attempting to automate and integrate operations in business processes such as supply chain, human resources, inventory control, customer relationship management, financial management and PM (County, 2011; Hitt et al., 2002). This integration enables companies to share information among all users of the system, facilitating near real time collaboration across all business processes (Wynche, 2010). The sharing of information in near real time enables managers to make informed decisions timeously; it allows accuracy within all business processes (ibid.). Most companies who are utilising this IS tool successfully have experienced improved levels of quality, cost effectiveness and time efficiency (Ratzan, 2004). Quality, cost effectiveness and time efficiency define project success, therefore companies who have integrated PM with other business processes, improve PM outcomes (County, 2011).

The imperative for project managers is a need for effective access, management and exchange of privileged information - securely, between authorised users across multiple points and times, without escalating costs (Ahuja et al., 2010). ERP systems such as SAP and Oracle have

helped in addressing the management and operational needs of business processes inclusive of PM (ibid.). However there are difficulties with some ERP systems that pose a threat to the very efficiencies they provide (Hitt et al., 2002). Firstly, they can take up to a number of months to implement and that implementation is very difficult when compared to other large scale system development projects (Jones, 2008). They require large amounts of storage and processing power (Wynche, 2010). They also require a functional and a reliable networked environment (ibid.). These requirements may not be practical enough in accommodating ERP processes (Saini et al., 2011). This is due to various organisation-specific limitations at different points in time (Jones, 2008). These limitations may force business processes, particularly PM, to yield inefficient results (ibid.). However, research suggests that the adoption of cloud computing in appropriate instances can help organisations minimize most of these limitations (Saini et al., 2011).

1.2.2 Cloud Computing

Cloud computing is a process and a platform where individuals and organisations can store and use data over networked hardware and software computing resources (Ebejer et al., 2013). Thus, cloud computing is described as a shared pool of computing resources over the internet within the boundaries of the organisation (Buyya et al., 2009). The term and practice have grown in popularity in the business sector in the first decade of the 21st century (Lori, 2009), for a number of reasons. Firstly, cloud computing facilitates flexible access to data resources that are located elsewhere other than in one's information device/s, thereby improving business efficiencies (Cohen, 2012; Ebejer et al., 2013). There can also be an added value for individuals in that they can access software applications they would otherwise not be able to afford without this facility (ibid.).

In effect, cloud computing comes in different service models. They range from cloud Software as a Service (SaaS), to cloud platform as a service (PaaS) as well as cloud Infrastructure as a Service (IaaS) (Nurmi et al., 2009). SaaS refers to a cloud computing service where the client uses the service provider's application on a cloud infrastructure (Leavitt, 2010). In this instance, hardware and the software applications are not owned by the user, but by the service provider (Kim et al., 2012). However, through the internet, the user can send input data to the cloud, this data is processed by the application provided by the service provider and the result is sent back to the customer (Wu, 2011). This implies that the user need not be concerned about the hardware, accessibility and the application software (ibid.). Full responsibility and operation is the responsibility of the service provider (Ramgovind et al., 2010). This can only work well when

the user has no expectations of controlling or changing features of the application they have accessed (Rochwerger & Breitgand, 2009). However, when the user requires specialized applications with modification flexibility according to their individual purposes, they would need to use a different model that allows them to provide their own software applications (Dillon et al., 2010). This is only possible in the PaaS model if the programs deployed are supported by the service provider (ibid.). For example, a user can develop their own applications and post them in a cloud without any changes to their programming language and they can run their applications however and whenever they require them (Taft, 2011).

Whilst developing and changing applications may be sufficient in this situation, an organisation may require a very large spectrum to support their IT operations (Kim et al., 2012). If this is the case, a cloud computing model that provides the outsourcing of servers, networking technology, storage and applications – the IaaS model, becomes appropriate (Olivier et al., 2010). For example, organisations would install resources such as servers and data centres in their sites but these resources can be fully outsourced as a pay as you use service (Kim et al., 2012). This way, project time and operational costs can be saved as data applications will be accessible anytime and anywhere where there is internet access (Misra & Mondal, 2011). A useful example would be decreased transport costs. Instead of frequent travelling between project sites and offices, or having to leave crucial meetings with stakeholders in order to fetch referral documents back in the office, the project manager can use the cloud to access information or data (Berl et al., 2009). In the management of mobile projects, cloud computing can help improve documentation, guidance and metrics on PM phases and practices (Nicoletti, 2012), without compromising industry standards and project quality control methodologies (Summers, 2009).

A notable advantage is that since cloud computing services are accessed via a service provider who is responsible for the maintenance of the network, IT costs can be minimized (Angeli & Masala, 2012; Misra & Mondal, 2011). Provided that a suitable service is selected (Qiu et al., 2010), organisations do not have to be concerned about infrastructure and maintenance costs, mostly because a responsibility for this lies with the service provider (Coles-Kemp et al., 2011). The agility and speed of implementation also makes cloud computing a value-added PM solution (Nicoletti, 2012).

The advantages that IT tools such as cloud computing offer to organisational efficiencies therefore, are clearly substantial (Nicoletti, 2012; Saini et al., 2011). It is unfortunate however, that such advantages are hardly exploited (Dillon et al., 2010; Deloitte, 2010).

1.3 Problem Statement

It is clearly argued in the preceding passages that cloud computing has a great potential to improve business processes and efficiencies in PM. The problem however, is that it is not clear whether this innovation is understood and maximally exploited by the PM community of practice in South Africa (Coles-Kemp et al., 2011). Efficiency of PM is critical to competitiveness and growth, both of the private and public economic sectors (Burke, 2011; Wirick, 2009; Larson & Gray, 2011).

Within the public sector in particular, there has been consistent public outcry over poor service delivery, marked by massive failure of key service delivery projects in South Africa (Sartorius et al., 2013). Though the magnitude may be less in the private sector, the quality of PM remains a major challenge in many projects in South Africa (Wu et al., 2012). As discussed in detail under the literature review, a major challenge is the limited (and even a lack of) research published on cloud computing and its adoption in PM in South Africa (SA National ETD portal, 2013). Projects in the private sector are not doing as well as expected. Whilst projects in the public sector seem to be worse off than those in the private sector, the failure rate of projects in the private sector is not at a minimum. Project failure can be caused by different factors e.g. stakeholder management, accountability, transparency, consistency in delivery, control, compliance, quality and ensuring value for money (Crawford & Helm, 2009). Cloud computing might help as it is said to improve efficiencies in a number of these areas.

1.3.1 Research Problem

The problem is that whilst the South African private sector is challenged in terms of operational efficiencies in the delivery of projects, cloud computing solutions which offer a substantial potential in this respect, are seldom explored. Unfortunately, this situation may continue due to a lack of scientific literature to inform causes and best practices in the field. This implies limitations in terms of the sources of insight towards finding solutions. The result is the problem of limited efficiencies in the private sector and, consequently, poor service delivery in South Africa may persist.

1.4 Research Objective

The objective of this study was to understand (and explain) the status of cloud computing adoption in PM in South Africa. Given the significance of productivity and competitiveness of the commercial (profit-making) sector to economic development and growth, emphasis was placed on understanding practices in the private sector.

The aim was to advance both scientific and practical insight, and ultimately, to contribute in informing solutions towards improving efficiencies in PM in South Africa.

1.5 Research Question

How is cloud computing adopted to enhance PM, in the context of the South African private sector?

1.5.1 Sub-Questions

How aware is the private sector of the cloud computing as a technological recource in PM?
How is cloud computing used in PM within the private sector?
How would cloud computing add value in PM in the private sector?
How can cloud computing be used to enhance PM efficiencies in the private sector in South Africa?

1.6 The significance of the study

This study can contribute to the exsting body of knowledge in the fiels of Information Technology and Socio-technical studies. The provision of a theory based conceptual framework for the adoption of cloud computing to improve project management in the private sector in South Africa using Structuration Theory enhances the level of understanding of the study. This study will also advance the practical insight inoder to inform solutions that may improve efficiencies in PM in South Africa.

1.7 The delineation of the study

This study only focuses on and also limited to the South African private sector. In order to achieve this, 2 academic institutions, 4 organisations and 2 service providers of cloud computing are used as a case study. The academic institutions were used on the basis of their direct expertise in the subject of cloud computing. The 4 organisations and the 2 service providers are national organisations in the private sector with a presence in the commercial

sector throughout South Africa. Though the study is in Information Technology in management, the focus however is on cloud computing technology and project management.

1.8 Conceptualisation

The following key terms are mentioned a number of times in the thesis, section provides the definitions the terms in the context of the thesis.

1.8.1 Project management

Project management (PM) is defined as the application of tools and techniques to direct the use of diverse resources toward the accomplishment of a task within time, cost and quality constraints (Atkinson, 1999). Burke (2011) concurs with this definition, but also adds the application of knowledge and skills (using tools and techniques) to project activities as another aspect of PM. There is agreement on the objective, being to meet stakeholder's needs and expectations from a project. It is within this context that the concept of PM is understood and used in this thesis.

1.8.2 Cloud computing

There are various definitions of cloud computing in the technology space. Fundamentally, however, cloud computing is a cluster of distributed computers that provide on-demand services over a network (normally internet) with the scale and reliability of a data centre (Grossman, 2009). As Buyya et al. (2009) adds however, cloud computing is not just about providing on-demand computing infrastructure but also flexibility, thereby allowing the use of a number of virtual machines to resolve computational problems.

This is the context in which cloud computing is understood and used in this thesis.

1.8.3 Information Technology (IT)

The ability that is offered by computers, software applications, telecommunications, technical analysis and design of work flows, processes in organisations and projects is known as information Technology (Davenport & Short, 1990). IT is also defined as a use of tools and systems to effectively develop, manage, store, retrieve, analyse and exchange information for private, social and commercial purposes (Mlitwa, 2011). It can also be referred to as a discipline or a field of study (ibid.)

1.8.4 Adoption

The conception of technology adoption according to Davenport & Short (1990) includes the acceptance and use of a technology. Mitropoulo and Tatum (2000) uses different words to make the same point, describing adoption as a process where an individual or organisation recognizes and implements a new technology, which includes acceptance and use, though implementation may be done on behalf of others who could be the actual users. In this thesis thus, adoption refers to the act or process of giving official acceptance or approval (Mirriam Webster dictionary, 2014), and taking up an option or cause of action (Oxford English dictionary, 2003).

1.8.5 Efficiency

Efficiency is basically an action applied to work productively with minimum wasted effort (Oxford English dictionary, 2014). It is also defined as the accomplishment of a task with the minimum expenditure of time, cost and effort (management dictionary, 2002). PM is the application of tools and techniques applied to accomplish a task within time, cost and quality constraints (Atkinson, 1999). This definition shows the fundamental significance of time and cost in PM (Burke, 2007). In the context of this thesis the accomplishment of a task with the minimum expenditure of time, cost and effort is regarded as efficiency (or project efficiencies).

1.8.6 Enterprise Resource Planning (ERP)

ERP systems are an enterprise package that enables organisations to integrate all necessary business processes into a single system with a shared database (Sadrzadehrafiei et al., 2013). The integration ensures the sharing of information among all users, which yields business benefits such as real time data availability, improved visibility and increased automation task (Aslan et al., 2012). ERP systems are the latest technology that has been undertaken by a vast number of organisations (Rashid et al., 2002). ERP systems were characterized as the most significant developments in the corporate use of technology from the 1990's onwards (Sadrzadehrafiei et al., 2013). Major ERP system providers such as SAP and Oracle take a large market share in corporate companies to this day (Rashid et al., 2002).

1.9 Thesis structure

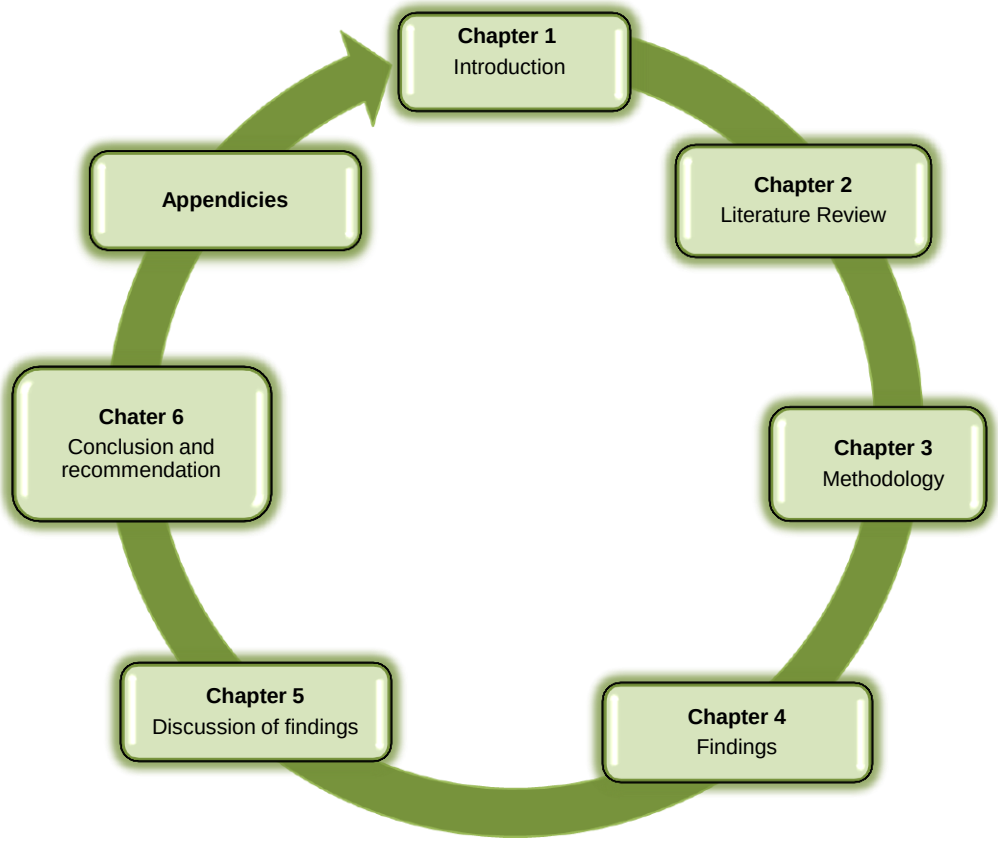

Figure 1: Structure of the Thesis

The structure in Figure 1 outlines the chapters presented in this thesis.

1.10 Conclusion of chapter 1

Chapter 1 provides an overview of the research project. It introduces the topic by giving a background to the study. The research problem, the research question/s, and the research objective which follow the background, clarifies the context of, and the motive for, the study.
This background in-turn, introduces the research problem and the main question/s of the study. A definition of key terms is also offered in this chapter, so as to guide the meaning of concepts that are used throughout the thesis.

In line with the structure of the thesis as outlined in Figure 1, the literature review is presented in the following chapter, chapter 2.

CHAPTER TWO

2. LITERTURE REVIEW

2.1 Introduction

The argument under the introductory background as well as in the problem statement is that the subject of cloud computing adoption in PM is under-researched. To substantiate this claim, the status of research in the field of cloud computing and PM is presented in Figure 2, and discussed in detail in sections that follow.

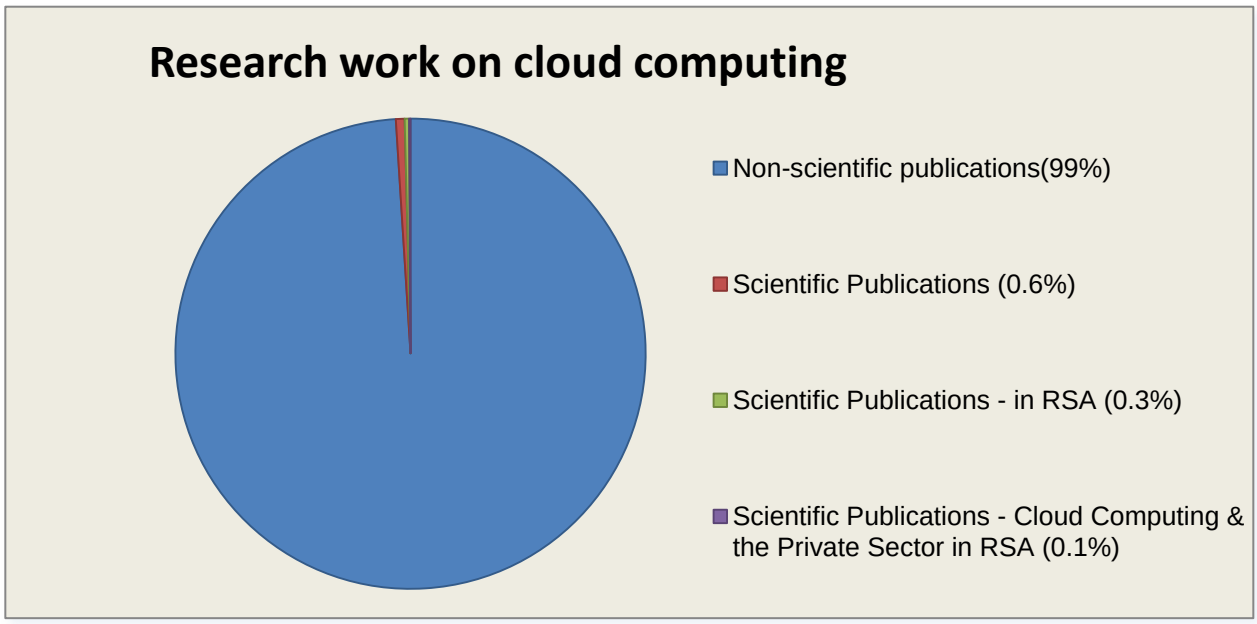

Figure 2: The Status of Research in the Field

The above conclusion was reached through a selected method that would reveal the above ratios or percentages. The keyword that was used for the search in both scientific and non-scientific searches is *Cloud Computing,* generally. This very same keyword was then used to search for scientific publications in South Africa. Ultimately, the search was further narrowed down to the South African private sector with additional keywords such as *Private Sector, Corporate, Companies* and *Organisations*. Google and Yahoo were used as a reference for non-scientific publications, Proquest (a database that is focused on ICT publications) and Google Scholar was used as a reference for scientific publication.

Then the results that were found in scientific publications were narrowed down to South Africa. The National ETD portal, South African theses and dissertations database managed by the National Research Foundation and Sabinet e-Publications consisting of South African published articles was used as a reference for scientific publications in South Africa. When keywords are used for searches, a number of articles appear in the page or monitor with the number of pages available under in the relevant publication. Thus the average number of articles per page was taken and multiplied with the number of pages resulting from the search. This gives an average of the total publications in each publication. The total number of both scientific and non-scientific publications was combined, thus the ratios of all the relevant publications depicted in Fig 2 were calculated based on the results in each publication.

Whilst a synopsis of articles in leading academic databases such as Proquest and Google Scholar suggest, at first glance, that there is substantial work published in the area of cloud computing generally, both in scientific journals and in non-scientific publications. On closer examination however, the picture is not as rosy as it seemed at first glance. Figure 2 shows that out of a total of 121 027 articles published in leading scientific publications, only 0.6% are in scientific journals (Proquest, 2014). The remaining 99% represents work in non-scientific publications (such as trade magazines and newsletters) or as non-academic material on websites such as Google and Yahoo, in April 2014 (Google, 2014 & Yahoo, 2014).

As it is observed in Figure 2, there is a clear lack of scientific literature on the subject of cloud computing in the South African context. For example, the SA Thesis' database on the new SA National ETD portal (South African theses and dissertations database managed by the National Research Foundation) lists only 6 theses (SA National ETD, 2014), with Sabinet and e-Publications only showing 10 journal articles on the subject up to April 2014 (Sabinet, 2014). As if this was not limited enough, the situation was worse when it comes to research done and published on cloud computing and its adoption in the private sector. In effect, Figure 2 shows that only 4 articles (0.001%) had been published on cloud computing and the private sector in South Africa at the time of writing this work. On this basis it was clear therefore, that there is inadequate scientific literature to inform insight on cloud computing and the private sector in South Africa.

Nevertheless, insight on how cloud computing can improve project management (PM) processes calls for a clear elaboration of the concept of PM. In fact, the issue of operations, tools, techniques, time, costs and quality constraints, and the need for efficient enablers of

these factors stand out in accounts of PM (Atkinson, 1999). In another account for example, Larson and Gray (2011) even sees the building of collaborative relationships among project stakeholders as something that deserves priority in PM (Burke, 2011), and cloud computing can be a useful enabler in this respect.

The project management life cycle (PMLC) has emerged as the most useful approach for understanding and analysing the techniques of PM in contemporary literature (Burke, 2007).

2.2 The Project Management Life-Cycle (PMLC)

A PMLC is a collection of sequential phases whose purpose is to equip the project manager who needs to effectively control and manage the project (Kloppenborg, 2009). It is also an approach to subdivide every aspect of the project into sequential project phases (Burke, 2003). The PMLC has four main phases, namely: the initiation phase, the planning phase, the execution phase and the close-out phase (Lee et al., 2006). The PMLC technique thoroughly defines and outlines project requirements for every segment to ensure project success (Kloppenborg, 2009). Within the private sector as a focus of this study then, a project in a financial organisation or even in an engineering company would commence with the initiation phase and end with the close-out phase.

2.2.1 The Initiation Phase

The initiation phase is where the feasibility, profitability and strategic impact of the project are conceptualised and analysed (Ahlemann, 2009). The feasibility which is unbiased research about the viability of a proposed project is aimed at assessing the project's potential for success (Larson & Gray, 2011). To be useful, a feasibility study should assess aspects such as the cultural, environmental, financial, legal and technical matters, as well as operational items such as market assessment, resource identification and management, project tenure and schedule (Payne et al., 2011; Munns & Bjeirmi, 1996). The feasibility study therefore, equips the project owner with relevant information on whether or not to proceed with the proposed project (ibid.). Otherwise, without the feasibility study, there is a high risk of proceeding based on misinformation, with a strong likelihood of implementation disruptions and failure. Examples of market related projects that failed due to discrepancies in the market feasibility assessment can be drawn from one of the MTN and Vodacom initiatives. For instance, NokNok and Meep social network systems which resembled Mix it were developed by MTN and Vodacom, respectively (Intrinsicmedia, 2011), The NokNok system would have allowed users to send and receive

messages and share information (ibid.). Both projects failed to take-off after launch due to inadequacies in the feasibility study processes (mybroadband, 2011). Users could just not respond positively to these alternative networks, leading to their imminent closure (Intrinsicmedia, 2011; mybroadband, 2011). Analysts have since questioned credibility of these feasibility studies, asking why were market indicators not discovered in time to avoid failures in both companies (Ahlemann, 2009).

2.2.1.1 Stakeholder management and application of tools in PM

A number of activities significant to the tenure of the project are undertaken during the initiation phase. Therefore, a consideration of resources and tools (i.e. ERP systems, and lately, IT innovations such as cloud computing, among others) needed to facilitate the project becomes relevant at this stage. During this initiation phase the stakeholder analysis is carried out where all stakeholders' needs and expectations are clarified (Varvasovszky, 2000). Whilst PM definitions only emphasize the significance of a stakeholder, Lim et al. (2010) goes on to define a stakeholder as any person who is actively involved or affected by the project, and has influence on, and may be affected by the project. On this basis, understanding and analysing stakeholder interests becomes important in a number of ways. Firstly, a common ground and agreement on the objective and expected outcomes needs to be reached between all the parties, be it the project owners, the client and the project manager (Burke, 2011) to help minimize the risk of project failure (Chandra et al., 2012). There are many examples where large projects have failed due to a lack of transparency and sound stakeholder management. An engineering project which was managed by the South African National Roads Agency SOC Limited (SANRAL), is the Gauteng traffic e-Tolling system in South Africa is a case in point (Sanral, 2013).

The project consisted of the upgrading of 185 Km of the most congested freeways in Gauteng which was to be financed by the government (Sanral, 2013). When the project was approaching the implementation phase, users refused to adhere to the e-tolling system (OUTA, 2012). Stakeholders took the matter to court, picketing on the streets in protest against the e-tolling system (Saville, 2012). SANRAL was accused of not being transparent, citing a lack of consultation between SANRAL and the public, hence the discontentment (OUTA, 2012).

In the private sector, the financial services projects have similar requirements in the initiation phase. The core businesses in the financial sector include providing financial services such as

Insurance, Investment management and auditing (Harel Insurance, 2013). Companies in this sector are susceptible to strict regulations which frequently change and the sector is at a stage where it is highly dependent on technology (Fitzpatrick & Neill, 2003; Amel et al., 2004).

Of interest to this thesis however, is the extent to which cloud computing can be adopted, integrated and used to supplement PM processes in the private sector. As stated in Figure 2, there is a shortage of literature sources to offer insight on the application of this innovation in the initiation phase of PM. Therefore, additional insight on the application of this tool in PM is explored in more practical detail with research subjects under the findings section in chapter 5. Nevertheless, the initiation phase is necessary for the success of projects in both the private and public sector. A successful initiation phase will, subsequently, lead to the planning phase, which cannot start until the previous phase is complete, because the output of the initiation phase is used to produce the project plan (Resch, 2011).

2.2.2 The Planning Phase

Following the initiation phase in the PLMC, is the planning phase (Larson & Gray, 2011). According to Thompson and Maginn (2012), planning is the actual process of making decisions that will guide future processes. In this statement, the shaping of future plans seems significant. A plan according to the Webster Dictionary is defined as “a detailed formulation of a program of action”, which implies the articulation of goal-intentioned processes. The Oxford Dictionary further defines the plan as “a detailed proposal for doing or achieving something”. A clear articulation of what is to be done and how – before the physical execution of activities are carried out, therefore, is evident. The assumption in the definition of planning, then, is that significant activities may not just mushroom, but should follow a concise and deliberate map that defines outcomes, processes and the means of achieving a specified end. It is in this context therefore, that planning has been understood and used in conventional and contemporary management theory (Wilson & Gilligan, 2005) and practice (Thompson & Maginn, 2012).

2.2.2.1 Planning as a Key Factor of the Management Practice

The thinking in management practice is that planning is about having a manager who knows which goals to establish and how to acquire the desired results and the resources needed (Kreitner, 1995). Such a manager is reasonably certain to gain greater accomplishment compared to the manager who guesses (Wilson & Gilligan, 2005). In other words, understanding of, adherence to, and the use of effective planning techniques is a basis for

successful management processes. On this point, Thompson and Maginn (2012) argues that effectiveness in planning lies in the articulation of the steps that are essential to turn intentions into actions. In support of this argument, Haugan (2002) argues that plans are not just guidelines but have timelines which include the resource schedule, detailed schedules and the budget. Project management has inherited these concepts of planning from the management field, hence the importance of the planning phase within the PMLC (Lester 2014).

2.2.2.2 Significance of Planning in PM

A clear programme of action in PM therefore, is outlined in the planning phase (Söderlund, 2004). This includes detailed schedules, an action plan, a detailed budget and the necessary resources to produce the end-product or service (ibid.). It is also in this phase that the guidelines set by the feasibility study (to achieve the end goal) are operationalized (Ren et al., 2006). In effect, this is when a process of doing the actual project is decided on and documented in detail (Burke, 2007). This further allows for the articulation of the start and end dates of the project's activities which in turn, guides the project budget and the cash flow (ibid.). A project such as the 2010 International Federation of Association Football (FIFA) world cup in South Africa is a case in point. The magnitude of the project was massive in the sense that it was a multi-stakeholder initiative, it required advanced infrastructure which had to be built from the start, with quality specifications, a limited budget and within a limited timeframe.

A clear programme of action is outlined in the planning phase (Söderlund, 2004). This includes detailed schedules, an action plan, a detailed budget and the necessary resources to produce the end-product or service (ibid.). It is also in this phase that the guidelines set by the feasibility study (to achieve the end goal) are operationalized (Ren et al., 2006). This is when a process of doing the actual project is decided upon and documented in detail (Burke, 2011). This further allows for the articulation of the start and end dates of the project's activities which in turn, guides the project budget and the cash flow (ibid.). Errors or omissions in the planning process therefore, would inhibit the implementation and the success of the project. For example, budget short-sightedness or misunderstanding between the project coordinators, service providers and material suppliers could lead to disagreements and unhealthy disruptions of the execution phases. The 2010 International Federation of Association Football (FIFA) world cup project in South Africa is a case in point (SAFIFA, 2010).

The magnitude of the project was massive in the sense that it was a multi-stakeholder initiative, it required advanced infrastructure which had to be built from the start, with quality

specifications, a limited budget and within a limited timeframe (ibid.). In addition to building quality soccer arenas, the project organisers needed to plan and coordinate a host of logistics associated with the successful running of 64 World Cup matches between 32 national soccer teams over a four week period from 11 June to 11 July 2010 (DoS, 2010). Chief among these arrangements was to complete stadiums within time, budget and quality specifications (Embajadasudafrica, 2010).

Unfortunately, lapses in the planning processes led to disruptions later in the implementation phase. The construction work in a number of sites halted soon after it began, due to the workers and project organisers holding different remuneration expectations. Clearly, a consensus in some critical aspects between the affected parties may have been neglected in the planning phase, resulting in undue delays in the project schedule. Discrepancies were, eventually redressed, which, ultimately, led to the success of the first FIFA World Cup on the African Soil (SAFIFA, 2010).

The ideal planning phase in PM generally thus, should consists of a detailed schedule, covering labour, production materials, costs and an estimation of project duration based on the amount of work that has to be completed (Kwak & Ibbs, 2000; Larson & Gray, 2011). Within the planning phase, budgeting also includes labour and resources needed for the project where expenses are concerned (Haugan, 2002).

A detailed map of the entire project however, cannot be viewed in isolation, but be dependent on other aspects of an organisation that is managing the project (County, 2011). For this reason, the planning process must allow a seamless alignment of a project with relevant operations in other departments, and integration with other business processes (Stoddard & Jarvenpaa, 1995). PM for example, would need to be integrated with relevant processes in the financial, human resources, procurement, compliance, risk, marketing, claims, customer service, sales, and IT department if the optimum results are to be realized (Learned, 2007; Burke, 2011).

IT plays a key role in integrating the different aspects of business processes. Therefore, organisations have employed various technologies for accomplishing this task (ibid.). One of the technology systems used for this task is called Enterprise Resource Planning (ERP) system (Hitt et al., 2002). The ERP system can be defined as a customisable, standard application software solution that seeks to integrate the complete range of business processes and

functions in order to present a holistic view of a business (Al-mashari, 2003). The purpose of ERP systems is to unify all functions and departments, and provide an enterprise database where all business transactions are entered, recorded, processed, monitored and reported (Umble et al., 2003). There are tangible and intangible benefits of using ERP systems in organisations (Al-mashari, 2003). The tangible benefits may include a reduction of personnel, increased productivity, improved management, improved cash flow management, increase of revenue and profits, reduced transportation costs and logistics costs, reduced maintenance for the system and improved time delivery performance (Sadrzadehrafiei et al., 2013).

The intangible benefits on the other hand, would include the optimum visibility of corporate data, improved business processes, improved responsiveness to stakeholders, standardization of computing platforms, increased flexibility, improved business platforms, improved visibility into supply chain management, global sharing of information and flexibility in compliance (Al-mashari, 2003). Compliance is an important aspect in financial projects, where there are constantly changing rules of governance, with ERP systems playing a significant integrative role (Franks et al., 1998; County, 2011).

Nevertheless, besides planning for the actual project in this phase, it is also important to plan against the risk factors, hence a reference to what is known as “contingency planning” (Resch, 2011). Inclusion of a contingency plan is to prepare an alternative programme of action in case of the occurrence of identified and un-identified risks which might threaten the success of the project (ibid.). Vigilance in the planning phase will ultimately determine the success or failure of processes in the implementation or execution phase (Haugan, 2002). It is not clear in the literature how specifically, can cloud computing be used to supplement the planning phase. Whilst this aspect is explored in detail under the findings section later in the thesis, the least a project manager may do is to explore the potential use of this tool during the planning phase, to see whether it would add value in the implementation of the project.

2.2.3 The Implementation Phase

The implementation phase (the 3rd phase of the cycle) represents the actual process where the plans are realised (Resch, 2011). In effect, implementation is the process where the planned activities are physically executed. The execution of activities therefore, is a key aspect of this phase (ibid.). Equally significant is ensuring that the execution of the activities follows the plan to produce the desired project outcomes (Shenhar & Dov, 1996). This requires the project manager to regulate effectively the schedule, cost and quality in all activities (Kwak & Anbari,

2009). Regulation in this instance implies coordinating, controlling and monitoring of the schedule, cost and quality (quality assurance) (Summers, 2009).

2.2.3.1 Regulation of Schedule

The project plan outlines the sequence of activities, where every activity has a start and finish timeline (Meredith & Mantel, 2005). Proper coordination ensures that each activity starts and ends at the desired time (Burke, 2011). In practice however, there can be deviations and variations due to unforeseen circumstances (ibid.). Coordination then is improved by controlling activities as they unfold, which includes reporting (Chen et al., 2013) Reporting is time sensitive, and once the project has started there is a strong likelihood for deviations that, should they occur, must be accounted for without delay (Burke, 2007). So, if reporting is delayed and the stakeholders are not informed in time, conflict may be caused, which may affect the schedule of the project (Kwak & Anbari, 2009). Manufacturing, finance, human resources and materials division and the purchase department of a manufacturing company for example, would have to be carefully coordinated (Muscatello et al., 2003). Whilst ERP systems would provide the needed capabilities of coordinating business processes, cloud computing may support the storing and exchange of information between project stakeholders in distant locations (Fitzpatrick & Neill, 2003).

For the manufacturing process to begin, a number of other business processes must have already taken place (Aslan et al., 2012). In this industry a customer may require a quotation, and the manufacturing company will have to respond with the retrieval of product data, assessment of available resources including human resources, estimation of cost and lead times (Maropoulos et al., 2002).

Therefore, a project manager needs to be closely observant of all process details in order to note and report in time (Burke, 2007). A lack of, or delays in, reporting however, is reported in poorly managed projects, often due to inefficient monitoring of activities or timely access and exchange of key documents and information (Larson & Gray, 2011). In such cases it takes longer to detect deficiencies, delaying decisions on alternative measures leading to unnecessary timeline extensions and ultimately, increased operational costs (ibid.). If the challenge is purely “storage and exchange” related, exploring the potential of cloud computing for this purpose may be worthwhile.

2.2.3.2 Regulation of Cost

While emphasis on meeting the scheduled time frames is critical, vigilance in cost regulation is equally important to the success of a project (Larson & Gray, 2011). For example, without efficient monitoring and coordination of activities it becomes difficult to keep operational costs within budget (Aliverdi et al., 2013). The budget is informed by the activity plan (ibid.). That is, every activity will have its own budget allocation which largely depends on both the variable and fixed costs of that particular activity (Cristóba, 2014). Take for instance an ERP system in manufacturing, the manufacturing budget is linked to the financial department (Mabert et al., 2003). All accounting, payment, invoicing activities during the manufacturing process are processed in the financial department (Frimpong et al., 2003). This provides transparency throughout all the processes and the automatic transactions take place in real time (Wynche, 2010). This provides the manufacturing manager with the advantage of monitoring costs in real time and therefore the ability to control or manage any cost variations (Umble et al., 2003). With effective coordination and regulation of operational costs, activities in the execution phase and, ultimately, the outcomes of the project are enhanced (Álvarez et al., 2008; Cristóba, 2014).

2.2.3.3 Labour Costs

Cost coordination includes measures such as the reduction of labour costs and efficient sourcing of materials (Jun & El-Rayes, 2010). Whilst employing unskilled labour can escalate labour costs for example (Mishan, 2006), employing skilled labour can improve productivity and reduce cost (Roberts & Skoufias, 1997). That is, skilled labour can complete a task in less time than unskilled labour, and without quality compromises (Burke, 2011). The opposite is regrettably true with unskilled labour; the project manager might have to implement corrective actions to rectify the poor quality work that had been produced (Summers, 2009). On this basis, the project manager must consider the pros and cons of training unskilled labour, employing skilled labour or of outsourcing specialised services (Nevo & Kotlarsky, 2014; Arashpour et al., 2015). Therefore, securing appropriate skills for the execution of the project activities remains a significant part of PM (Larson & Gray, 2011).

As stipulated priority that the convenience of the ERP system provides to the manufacturing manager are the specifications of the types of skills that are available for the manufacturing projects (Maropoulos et al., 2002). The human resource integration becomes an important aspect in accessing the labour and whether there could be further training requirements, as this may affect the budget (Umble et al., 2003). It may be a requirement that employees be

knowledgeable of IT systems and tools which may be utilised in business processes (Yang et al., 2012). It is recommended that individuals working on the implementation of project in the manufacturing process have knowledge of ERP systems (ibid). Unfortunately, It may not be easy to access individuals with such skill due to human resource regulation, labour law and unions (Burke, 2011). In this case the integration of the manufacturing department and the Human resource department provides information that enable manufacturing managers or project managers to make informed decisions (County, 2011). The cost of skilled labour relative to the budget, project time line and quality considerations – may determine whether to employ or to outsource services (Larson & Gray, 2011).

2.2.3.4 Sourcing and Outsourcing of Services and Machinery

Considerations on material sourcing as well as the outsourcing of services and machinery, including plant-hire also affect costs (Nevo & Kotlarsky, 2014). For example, when foreign material sources of a required quality or foreign service providers are more efficient and affordable than local suppliers, it may be cost effective to source from abroad (Kobelsky & Robinson, 2010). The converse is also true in terms of local supplies. In either case nevertheless, selecting a reliable supplier for procurement is vital (Larson & Gray, 2011). For this reason, the project manager should thoroughly understand both the global and local sourcing and outsourcing principles and regulations (Adeleye et al., 2004; Handley & Benton, 2013). If the sourcing and outsourcing principles and regulations are not understood there is an increased risk of non-compliance (Adeleye et al., 2004). Rules and regulations of outsourcing are meant to guide the process and help to eliminate undue threats to the success of the projects. Following the principles and guidelines against dealing with unqualified vendors and service providers for example, would help the project owner avoid entering into sugar-coated deals that may later turn out to be “White Elephants” (Larson & Gray, 2011).

Though most public goods and services are of utmost significance, it is regrettable that most cases of failed projects are cited within the public sector project managed by the private sector. A case of the Smart ID project of the Department of Home Affairs (DHA) in South Africa is a useful example in this respect (ITweb, 2013). In 1995 the DHA decided to embark on a project called the Home Affairs National Identification System (Defenseweb, 2011). The objective of the project was to roll out ID cards to all South Africans instead of the green ID books and to upgrade the Department of Home Affair's IT infrastructure (ibid.). The smart ID cards would have an embedded chip on them with relevant information about the card holder (Thenewage,

2013). Vulnerable people in our society such as pensioners were among the first who were going to be issued with these cards (ITweb, 2008). This card was to be used for a number of purposes such as payment of pensions and social grants (ibid.).

After a feasibility study and a project plan the cabinet approved the project, at the end of 1996 the first tender was published (Brainstorm, 2009). In 1999 the first contract worth R800 billion was signed with a consortium from the private sector consisting of Unisys, NEC which was headed by MarPless Communication Technologies and another subcontractor called Gijima (ibid.). Gijima's responsibility was to produce the smart Cards (Bennett & Lyon, 2008). The DHA indicated that the roll out of the smart IDs would be implemented in the year 2013 (Thenewage, 2013). A decade has passed, milestones were moved forward, and the due date for the project was postponed (Defenseweb, 2011). Gijima did not meet the DHA deadlines or requirements; they did not deliver, instead their costs escalated (ibid.). At the end there was a dispute and a court case between the department and Gijima (ITweb, 2008). The court case proved that there were irregularities in the way the contract was awarded. Irregularities in this sense imply divergence from accepted regulations, principles, and procedures. As a result case was withdrawn (Defenseweb, 2011). The matter was settled out of court, the DHA opted to cancel the contract with Gijima as the cost would have exceeded the return on investment (ROI) – by far (ITweb, 2008). This means that the contractor did not deliver the product as specified, which implies a complete failure of the project (Burke, 2011).

Though it is not clear as to what type of ICT tools were used to manage this project, it is clear that this was a mega project with a number of stakeholders and data to manage (Defenseweb, 2011). The fullness of ERP systems and cloud computing might have been advantageous (Finger, 2009). The ERP system might have ensured that all the parties had adequate skills, systems, accountable financially and legally. The ERP system could have alerted stakeholders of the mismanagement that resulted in project failure (Varvasovszky, 2000; County, 2011). Another tool would have been to outsource cloud computing services as there are several stakeholders involved (ibid.). Such a project also involves a number of IT operations like networking, storing and processing all the associated data (Defenseweb, 2011). Cloud computing enables the avoidance of such deficiencies that may have been encountered in such projects (Olivier et al., 2010). The adoption of cloud computing will be clarified in the findings section of the thesis.

In principle, selecting the right supplier is the key to a successful and, possibly cost-effective, procurement (Kobelsky & Robinson, 2010). Otherwise, relying on a supplier who cannot provide adequate documentation and proof of reliability is risky (Silvera & Jain, 1994). Should the supplier fail to adhere to the schedules agreed on, the project timelines and therefore costs might be affected negatively (ibid.). Quality considerations are also central to both the material procurement and service-outsourcing processes (Adams et al., 2014). Products or services of poor quality will compromise project deliverables (Zeydan et al., 2011), with negative costs implications addition to selecting reliable and non-exorbitant supplies, adherence to sound cost-control mechanisms is necessary.

As a basis for controlling costs, the budget estimate is the measure against which to control the expenditure on the project (Turner, 2005). Major steps are to continuously estimate future performance, monitoring the actual performance, always calculating and, ultimately, redressing the cost variance (ibid.). In the field of PM a mechanism called the earned value has been used to successfully achieve the above (Aliverdi et al., 2013). The main objective of this mechanism is to enable meaningful comparisons to be made between actual costs and planned costs (Kwak & Anbari, 2009). It uses data from the project plan to accurately compare the time-phased costs with scheduled activities, so as to effectively determine how much work was accomplished for the money spent (ibid.). The use of this mechanism can help project managers improve the regulation of costs in the execution phase of PM (Resch, 2011). Handling accounts to ensure that expenses and profits are managed appropriately is vital, hence the significance of the enabling IT tools and systems (Ahuja et al., 2010).

ERP systems serve as a great tool in project control. Especially the aspect of monitoring cost and time (County, 2011). In the implementation phase, the integration of PM with other business processes provides the project manager with the advantage of accessing information and making crucial decisions on project deliverables (Jones, 2008). This will allow the project manager to react to changes that may threaten or give opportunity to project deliverables as the project progresses (ibid.). Taking an example with a typical finance project, a basic ERP system will have a central database where all functions or business processes in an organisation are centralised (Wynche, 2010). In other words, the PM plan (an output from the planning phase) will be integrated with functions such as human resource management, business analytics, supply chain management, manufacturing, financial management, sales and distribution, risk management, resource management, materials management and quality management (Jones, 2008). This enhances transparency across all departments that may affect PM (Wynche, 2010).

The PM plan also enhances proper allocation and delegation of resources required for the project, in order to comply with time and budget constraints (ibid.). However, the centralisation aspect of data as well as the dependence of each business process on other processes highlights the significance of related infrastructure and a 'networked environment' (Nah et al., 2007). Infrastructure adequacy forms an important aspect of ensuring an operational ERP system (ibid.). In particular the capacities of the servers need to be adequate in storing and processing the amount of centralised data (Wynche, 2010). Second to that, the networked environment must be functional and capable of ensuring accessibility and exchange of information at any point within business processes (Cardoso et al., 2004).

When the ERP system is implemented it requires enough processing power for the operationalization of the system without which, network functionality and ultimately, the process efficiencies may be hindered (Wynche, 2010). In enterprises where the ERP system application is used, it becomes an important operational aspect of the implementation phase. This is significant, because it enables the project manager to prioritise resources for the project in response to prioritisation (integrated resource management) (Umble et al., 2003). Scenarios can be created and developed to allow flexibility, to develop contingency plans to avoid compromise on the budget and timelines (Integrated financial management) (County, 2011). For example, weather can be a costly risk in construction projects because when it rains the execution of the project is put on hold (Assaf & Al-Hejji, 2006). When it stops raining the project will proceed; this impacts the time and budget constraints of the project (Frimpong et al., 2003). The different scenarios can be known and understood by the project manager, and other managers like the financial, human resource and risk manager (County, 2011). This ensures flexibility in cost and labour, in other words the project manager is always equipped and ready to deal with such scenarios (ibid.).Quantitate and qualitative risks may be identified (integrated risk management) (ibid.).

Quantitate risks include budgetary, schedule and quality matters during the project implementation. Qualitative risks include roles and responsibility of personnel in the company involved or affected by the project responsibilities and possible stakeholder's risk tolerances (County, 2011). If there are various vendors and service providers, this can be overwhelming for the project manager when making the decision for selecting the best product (Frame, 2002). ERP provides the assessment and identification of vendors/service providers which simplifies decision making in this regard (Arm Research, 2007). The assessments of quality control matters and assistance in developing a quality control plan is made available (Integrated quality

management) (ibid.). ERP technology has introduced an aspect of efficiency in PM that may be difficult to achieve without it. As advantageous as ERP may be, it also has aspects that can pose a challenge to organisations that either utilise the technology or are in the process of adopting it.

There are several challenges: ERP systems are expensive, time consuming and requires substantial internal resources for implementation (Hitt et al., 2002). For this reason, it can be a requirement that project members have some knowledge of utilising ERP for effective collaboration if the project is to be effectively implemented as per the project plan (Sumner, 2000). ERP implementation is also known to be very difficult even when compared to other large scale system development projects (Hitt et al., 2002). When it is implemented it requires enough processing power for the operationalization of the system without which, network functionality and ultimately, the process efficiencies may be hindered (Wynche, 2010).

However, there are other technological innovations that can bring solutions to such challenges. For example, cloud computing can provide freedom for scalability as companies grow and therefore constraints that are imposed by hardware specifications will be reduced (Saini et al., 2011). When a company adopts cloud computing, hardware costs are also reduced (ibid.). There is also flexibility rather than unending deployment changes that may be costly to the organisation (Olivier et al., 2010). Cloud computing offers easy accessibility through the internet, especially for virtual projects run by project members in dispersed locations (Misra & Mondal, 2011). Due to limited literature and research publications on the adoptions on this innovations in PM however, it remains unclear how cloud computing has been used to supplement operations for this purpose in PM. Nevertheless, because of the centrality of the cloud computing innovation to the topic of this thesis, its potential adoption to the PM practice is discussed more widely in the section of findings.

2.2.3.5 Regulation of Quality (Quality Assurance)

The main objective of PM is to ensure, not only that the product is cost effective and is timely delivered (Burke 2011). It is also important that the final product does, most significantly, meets client specifications (ibid.). In support of this statement, Summers (2009) argues that quality is that virtue of the product that is specified and expected by the client. By implication, quality is just as significant (and should be given the same attention) as the schedule and cost controls in the project execution phase (Larson & Gray, 2011).

Quality control is the process of monitoring and recording results of executing quality activities, as well as to measure performance and make necessary changes if required (Yaseen & El-Marashly, 1989). The main goal of quality control is to guarantee and improve quality, the outcomes are acceptance decisions, rework and process adjustments (Bernroider & Ivanov, 2011). Similarly, quality assurance is defined as a set of planned and methodical activities created to ensure that a product or service is according to the given specification (Yaseen & El-Marashly, 1989). Whilst quality control places emphasis on defect identification, quality assurance focuses on defect prevention (Summers, 2009). When quality assurance and quality control have been included in the execution phase and the project manager is satisfied with the results of the product and procedures, stakeholders are contacted to verify the readiness of deliverables (Burke, 2011). After the client has been informed, and the handover has taken place, the project closure (closing phase) is, ultimately, effected (Westland, 2006).

2.2.4 The Closing Phase

While the close out phase may seem the easiest, it has processes that are designed to ensure a smooth handover and closure of the projects (Larson & Gray, 2011). Interaction between stakeholders and the exchange of key (and perhaps, privileged) information, which is a case for cloud computing, is also important in this phase.

This phase encompasses a declaration of the final product (or service results), an administrative closing and a contract closure procedure (Schwalbe, 2009). Administrative procedures include the closing of accounts, reassigning of resources and staff, closing facilities and the compiling of a final report on the outcomes of the project (Wood et al., 2008). A clear advantage of cloud computing solutions in once-off projects in particular, lies in the fact that rented storage infrastructure can be released at the close of the project. With cloud computing for example, unnecessary hefty investments on fixed capital that could be used only for a fixed tenure of the project is avoided. Contract closures should also ensure that all parties have adhered to the contract, that deliverables are in accordance with pre-defined specifications and that payments have been made accordingly (Schwalbe, 2009). In practise, a project is said to be successful when it has been completed within schedule, budget and in line with quality specifications (ibid.). In a quest for efficiency, business organisation have explored a number of efforts, such as IT tools and systems to improve project processes and outomes. In this respect, the author explores the utilisation of cloud computing – as an alterantive towards improving the success of projects in business organisations.

2.3 The utilisation of cloud computing in organisations

Cloud computing can be deployed in three models, private cloud, public cloud and hybrid cloud (Pallis, 2010). There are advantages and disadvantages to consider when making a choice of deployment (Lango, 2014). For example, some organisations may deploy their business operations in the cloud to lower operational costs and minimize the time it takes to complete operations (Armbrust et al., 2010). Some organisations (particularly in the financial sector), may place their focus on accessing high reliability and security services (Zhang et al., 2010). On the other hand, other organisations may require security, reliability and optimisation of operations (Sosa-sosa & Hernandez-ramirez, 2012). A private cloud is designed for exclusive use by a single company which is mostly developed and maintained by the organisation (ibid). However there is an option to outsource the external service provider (Zhang et al., 2010). The advantage of the private cloud is that it offers high levels of control, reliability and security (ibid.). The public cloud is designed for the general public where the service provider offers their resources and services to the public (Armbrust et al., 2010).

The public cloud often offers greater scalability, versatility, simplicity and it is generally cheaper than the private cloud (Zhang et al., 2010; Quarati et al., 2015). This is because it is designed for the general public; hence the capacity for storage and options must be adequate (Qiu et al., 2010). In addition the liability of maintaining the infrastructure lies with the service provider (Lango, 2014). However the disadvantage with the public cloud is that it lacks fine grained control over data, network and security settings which may not be sufficient for business organisations (Sosa-sosa & Hernandez-ramirez, 2012). The few examples of service providers of the public cloud are Amazon, Microsoft and Google (Qiu et al., 2010). Lastly, a hybrid cloud is a combination of private and public cloud models (ibid). In hybrid clouds, some of the service infrastructure runs on a private cloud while the rest runs on a public cloud (Quarati et al., 2015). This offers more flexibility than either the public or the private clouds (Armbrust et al., 2010). The hybrid clouds provide tighter control and security over application data compared to the public cloud, while still facilitating on-demand service expansion and construction (Zhang et al., 2010). However the hybrid cloud requires careful determination of the optimum division between the public and private cloud segments (Armbrust et al., 2010).

2.4 Conclusion of chapter 2

The aim of this study was to understand how the adoption of cloud computing can enhance PM efficiencies and outcomes in the South African private sector. The aim of this chapter was to provide a comprehensive review of literature on PM processes, so as to highlight a potential that cloud computing can offer in supplementing the PM practice.

The most significant observation in the opening passages of the study however, is the extreme shortage of scientific publications on the adoption and use of cloud computing in the discipline generally, and most particularly, in the context of the South African private sector. The background insight is mostly reported in non-scientific publications, most probably because cloud computing is one of the most recent innovations in IT. Explanations are that there has not been enough time to generate a decent number of scientific publications by comparison to non-integrated software applications. At this stage ERP systems have been generally used in PM, as companies have thought this to be adequate. ERP systems integrate the business processes of an organisation in order to share information in real time, therefore improving operations in business processes.

The chapter places the PM business process in a clear operational context. It discusses the application of new technologies such as ERP systems, with a view to acknowledge their significance, and to highlight a gap for cloud computing in related business processes. The use of technology solutions in the four phases of PM, the initiation phase, planning phase, implementation and the close out phase, are discussed in greater detail in this chapter. Highlighting the various processes and complexities of each phase helped to link the literature on the phases with the literature on the relevant aspects of ERP systems which are used in organisations to achieve efficiency. The chapter further outlines the benefits of ERP systems, giving examples that are based on scientific publications that focus on such systems. The literature showed that ERPs indeed improved time management, cost management and quality management. Time, cost and quality are characteristics that are often used to measure PM success. This has shown the justification of the adoption of ERPs as a technology in organisations. However the literature also showed limitations such as the inadequacies of servers in organisations, the limited network technologies and the challenges that are faced with the implementation of ERP systems. In this regard the literature showed that cloud computing can help to address some of the challenges storage required to supplement ERP systems.

To this effect, companies in various industries (particularly in IS) have acknowledged the benefits that cloud computing can offer to organisations. As a result, non-scientific publications emphasize the need for more awareness of this technological innovation. As argued in this chapter, there is a clear need to generate informed literature on the subject of cloud computing in contemporary academic research.

The next chapter will outline the analysis and explain the theories used in this study.

CHAPTER THREE

3. THEORETICAL FRAMEWORK

3.1 Introduction

A theory is defined as “a set of interrelated constructs, definitions and propositions that present a systematic view of phenomena by specifying relations between variables, with the purpose of explaining and predicting the phenomena” (Kerlinger, 1973:9). The clarificatory function seems to be a central feature of the theory in this definition. For example, whilst it is clear that a theory consists of multiple constructs, their systematic interrelatedness, which is linked to the articulation of relations between variables, is presented as a means to contextualising various aspects of investigations. In line with this view, Babbie and Mouton (2004) present a theory as a systematic description of, and explanation for an observation that relates to a particular aspect of life.

A theory is also described as a set of statements about concepts that have a relationship (Holloway & Wheeler, 2010). Two key points stand out in this account. Firstly, systematic explanation implies the existence of an orderly arranged sum of interrelated parts, which points to correlations between multiple constructs. Secondly, that a theory seeks to ‘enable an observation’ supports (Kerlinger's) 1973 claim in the definition – that the theory seeks to “present a systematic view of phenomena”. In a different account, Schneider (2006) concur that a theory incorporates various concepts through statements of relationships and aims to explain a phenomenon. In short, a theory does not merely specify a relationship between concepts but also gives an explanation to the reasons for these existing relationships in an observed phenomenon (Mouton, 1996).

3.2 The Purpose of a Theory in Research

Theories explain certain aspects of a phenomenon, and facilitate the relevant answering of questions asked (Pettigrew & McKechnie, 2001). Through theories, constructs are identified, with relationships between them stipulated and tested (Gregor, 2002). Constructs are basically a mental notion or an abstract idea that can be measured or observed (Schneider, 2006). A major function of a theory according to Hennink et al. (2011) is to provide a model or a map of why a phenomenon is the way it is, thereby helping to advance science and knowledge development (Pandit, 1983). The advantage in research then, is that theories are used for

analysing, categorizing, describing, explaining and simplifying phenomena; they can also be used for predicting the future (Mlitwa, 2011). Theories have two categories namely, the deductive and the inductive functional categories (Babbie, 2010).

3.2.1 The Deductive Use of Theory in Research

Theories in the deductive category set up laws which ensure alignment with the positivist epistemology (Mlitwa, 2011). In the deductive sense theories are used to predict as well as to formulate and test hypothesis (ibid.). The logic behind this category or the reasoning process starts with a general theory or a notion that the researcher might have about a phenomenon (Dantzker & Hunter, 2012). Then a hypothesis is formulated based on the key assumptions of the theory about that particular phenomenon (Bara et al., 2001). The next step would be to apply the assumptions of the formulated hypothesis in order to make a prediction (Babbie, 2010). Based on the theoretical basis of the hypothesis, a research project would be designed to observe the similarities or non-similarities (based on the general theory) of an observation, to the claims and assumptions of the hypothesis (Bara et al., 2001). Depending on the outcome, the hypothesis is confirmed or disproved, leading to a specific conclusion/s and generalisation/s about the observed phenomena (Dantzker & Hunter, 2012). Thereafter, the theory is either confirmed or disproved. If the theory is disproved it will be subjected to amendment according to the new findings (Babbie, 2010).

This category is normally used in natural sciences where the positivist epistemology is prioritised (Mlitwa, 2011). Researchers in natural sciences work with physical objects (Mouton, 1996). Within this positivist tradition, assumptions are that the only way of getting to know about scientific truths is through objective empirical processes (Babbie & Mouton, 2001). The ontological assumption of an objective reality in natural sciences thus, further implies the use of precise measurements supported by quantifiable evidence obtained through rigorous empirical observations (Balnaves & Caputi, 2001).

However, the phenomenon under investigation in this thesis, is different from the physical objects whose properties can be predicted or tested through inductive means. The aim of the current study is to understand the potential that cloud computing has in improving PM efficiencies in the private sector in South Africa. By implication, this requires descriptions, explanations and interpretation of textual data that require in-depth and inter-subjective interpretation/investigation. But there will be hardly any predictable engagement with data, the

context or the environment of the observed phenomenon. Therefore the current study will follow the methods associated with inductive logic.

3.2.2 The Inductive Use of Theory in Research

Theories in the inductive category provide assumptions associated with interpretative epistemology (Mlitwa, 2011). The logic behind the inductive reasoning process starts with observations from the data at hand or data that has been collected (De Vaus, 1985). The next step is to identify the patterns in the observations. This in turn, will result in a hypothesis based on the observation (Babbie, 2010). This leads to a general theory about the phenomena (Welman et al., 2005). In the inductive sense then, theories are mostly used as models, guidelines, analytical lenses and frameworks to study a phenomenon (Holloway & Wheeler, 2010). This category is normally used in the social sciences where the interpretive epistemology is adopted (Babbie & Mouton, 2004), in order to analyse, explain and simplify contextual relationships between phenomena (Mlitwa, 2011). This tradition is used for the interpretation of context-specific factors like feelings, beliefs and motivations (ibid.). The theories in this category allow the researcher to work with inter subjective data that requires translation (Dantzker & Hunter, 2012). It is also used to analyse, explain and simplify contextual relationships between phenomena in social sciences (Mlitwa, 2011). The inductive use of a theory can take one of at least three forms e.g. taxonomies, models and frameworks (Mouton, 1996).

3.2.2.1 Taxonomies

Also known as a science of classifications, taxonomy is a study of principles and practice of classifications (Verma, 2011). At the very basic level, theoretical assumptions are drawn to construct and then to classify systems mostly leading to the placing of concepts into specific group/s (Dunn & Everitt, 1982). In social research taxonomies are used in conceptual frameworks (where concepts are explained within a framework) where they serve as a frame of references (Mouton, 1996).

3.2.2.2 Models

Theories are also used as a basis for models upon which both deductive and inductive inferences can be made (Hugh, 1997). For example, a model is used as an analogy, where it shapes functions of a particular project or study (Kaplan, 1994). In research, a model allows the researcher to duplicate their study in accordance to an already established model (Mouton, 1996). In other words similar models can be used in studies that are structured in a similar way

(Hugh, 1997). Models are basically a part of a bigger picture or a fraction of the actual phenomenon (Kaplan, 1994). Models can be used as mathematical representations, in the inductive sense however, models are confined to abstract descriptions (Mouton, 1996). The objective of the current study is to analyse and explain the phenomenon under investigation. Models can be used as an analogy but they cannot be used to explain a phenomenon. The use of a theory as a framework therefore, was more appropriate for this study.

3.2.2.3 Theoretical frameworks

A theoretical framework explains relationships between the concepts in relation to their dependant and independent variables (Blaikie, 2010). It offers more analytical options that models cannot (Sekaran & Bougie, 2010), and provides a conceptual guide for selecting concepts to be investigated, for suggesting research questions and for framing research findings (Corbin & Strauss, 2008). Theoretical frameworks come from a named theory rather than broader views of a particular theme (Pearce, 2012). A framework represent one's beliefs on how certain phenomena or concepts are related to each other and an explanation of why one believes that these variables are associated with each other (Anfara & Mertz, 2015). A framework is therefore appropriate for this study.

To inform the analytical context of this study therefore, the theoretical perspectives of PM those of information systems are explored in this chapter. Since this study is concerned with the adoption of cloud computing to improve efficiencies in PM, a clearer articulation of the key PM functions becomes necessary. To this effect, the theories of execution and control as well as a theory of constraints and the theory of complexity were applied to a synopsis of PM practices (Curlee & Gordon, 2010; Choo & Bontis, 2002), to explore a possible fit of cloud computing in this management field.

3.3 Theories in Project Management

As a management discipline, PM involves planning, the execution and control functions, with the execution and control by default, being the most dominant in the actual management of already planned projects (Summers, 2009). In effect, PM is often narrowed down to strict issues of control, predominantly, with a focus on time, cost and quality (Burke, 2011). Research under this field is largely quantitative, under strictly empirical positivist approaches (Curlee & Gordon, 2010). In spite of the precise measurements and rigorous observations in the quantitative approach used by early researchers (Balnaves & Caputi, 2001). A high failure rate was

experienced in PM (Cicmil et al., 2006). This led to the addition of social theories towards the understanding and analysis of PM phenomena (Söderlund, 2004). The theories in question include the complexity theory, the control management theory, the execution theory, and the structuration theory.

3.3.1 The Complexity theory

PM is a discipline that incorporates a variety of activities, standards, objectives, processes, stakeholders and a complexity of interplay between these various aspects (Burke, 2007). Because of this situation, researchers and practitioners have called on various methods and theories to understand, and to navigate within, this complexity, in the pursuit of PM objectives (Koskela & Howell, 2002a). The complexity theory is one of the common theories that have been used to make sense of the complexity of the PM practise (Hass, 2009).

The complexity theory is a theory that acknowledges the complexity of non-linear systems and environments, with a view that complex systems can be analysed in whole, rather than breaking them down into fundamental parts (Curlee & Gordon, 2010). Drawn on the chaos theory which is concerned with the none-linear nature of multifaceted dynamic systems (Swedin, 2005). Complexity theory simply states that interacting components self-organise to form potentially evolving structures exhibiting a hierarchy of emergent system properties (Lucas, 2006). In PM, the assumption is that the complexity in the interplay between different phases of the PMLC (and aspects between each phase) is not un-natural (Cicmil et al., 2006). Instead of viewing the interaction between the project objective, the uncertainty during the planning phase and inconsistencies in the execution, as a chaos, Pollack & Remongton (2011) suggest that the components will self-organise towards a desired end. As a result, it is not desirable to break down the structure into independent parts in order to analyse it and understand it (Morrison, 2002). Instead of restraining the chaos in a complex structure, the assumption is that independent parts will evolve into an appropriate hierarchy of system properties (ibid.).

The assumptions of the complexity theory however, are not without contestations. Taken at face value for example, agility rather than adherence strict structural standards and procedures, is implied (Thomas & Mengel, 2008). The problem with this assumption is that it contradicts research findings indicating that non-adherence to sound PM standards is a major cause of failures in a multitude of projects (Doloi, 2012; Yang et al., 2012). In effect, a structural approach to PM – with a clear articulation and adherence to the initiation, the planning, execution, control and the project close-out phases is appraised (Larson & Gray, 2011). Obviously, this involves

paying careful attention to each aspect (and phase) in the entire structure of the project (Hass, 2009). Moreover, without an attempt to separate different parts of the complex structure, it would be difficult to explore the role and fit of cloud computing into each aspect of PM – which is the main objective of this study. For the same reason, scholars and researchers have opted for the pro-structure theories such as control theory and execution theory to view PM as a sum consisting of different, but interrelated parts (Koskela & Howell, 2002a).

3.3.2 Theory of Control in Management

Similar to the complexity theory, the theory of control acknowledges complexity and chaos in none-linear structures, but also recognises various components of the structure with a strong focus towards control (Larson & Gray, 2011). Control is described as a process that monitors progress and includes receiving feedback to ensure a successful completion of a project (Burke, 2011). In the controlling process, progress (cost, time and quality) is measured regularly to identify any variances from the project plan so that corrective actions are taken to ensure that the project objectives are achieved (Summers, 2009). This process corresponds to the thermostat model, which is quite dominant as an analogy in the controlling phase in PM (Koskela & Howell, 2002b). This model stems from three assumptions, that there is a set standard of performance, which is measured at the input or output and that the possible variance between the standard and the measured value is used for correcting the process so that the standard can be reached (Hofstede, 1981).

The theory of control and its model is used to measure the output in comparison to a given standard (Koskela & Greg Howell 2002b). The measured results will be the variance, which is directly proportional to the corrective process towards the attainment of the project objectives (Summers, 2009). Through this measure, success is normally experienced in areas of cost, time and quality, which is central in PM (Kwak & Anbari, 2009). However, this theory is limiting in that it only focuses on the control aspect of PM. For example, the theory is not applicable to the initiation aspect, the planning, the communication and the execution aspects of a project (Burke, 2007). Since this study incorporates every aspect of PM, other theories are also overviewed. To this effect, the theory of execution is explored as another theory that can be used in PM.

3.3.3 The Theory of Execution

In the implementation phase of PM, the execution theory is used to guide the coordination of procedures and activities (Koskela & Howell, 2002a) towards a successful execution of a project

plan (Burke, 2007). In this theory, coordination refers to the synchronization and integration of activities, responsibilities, commands and control structures to ensure that resources of an organisation or projects are used most efficiently in pursuit of specific objectives (Business Dictionary, 2014; Andersen et al., 2007). In the management sector coordination is regarded as the planning and management of multiple tasks simultaneously to achieve a given goal (Resch, 2011; Larson & Gray, 2011). Coordination helps improve efficiency in operations by avoiding overlapping efforts and duplication of work (Burke, 2011). In other words the input to a task and the resources needed to execute it are readily available in time for the task to begin (Koskela & Howell, 2002a). In this context, the execution theory assumes that at the beginning of the task, the work flow will be seamless due to the fact that the task is understood, and that everything will work according to the plan (Koskela & Howell, 2002b). Through coordination, all tasks are connected to ensure unity and stability of a project; even when disruptive events occur (ibid.).

The coordination function of the theory is a key aspect of the execution process. It minimizes the time taken to complete a task, reduces costs associated with the poor management of tasks, and ensures that processes comply with the quality expectations (Burke, 2011). The advantage of the execution theory in this study therefore, was to facilitate a synopsis of whether and how cloud computing can advance the execution processes in PM. Whilst the theory was useful for this purpose, the objective of this study is much broader than the mere execution phase of PM. The aim is to understand how cloud computing also enhances the planning, the initiation, the close out phase and other aspects of PM – this aim calls for a broader, integrative and systems based lenses to not only one, but to all key aspects of this investigation.

From the discussion in section 3.3.4, the Structuration Theory as was considered to be more comprehensive, offering richer analytical lenses to the analysis and an understanding of the possible interactions between cloud computing and various aspects of PM.

3.3.4 The Structuration Theory (ST)

Social theory has an important part to play in the development of the discipline of IS, by helping to understand the interaction of IS with the societal, organisational, and personal contexts without which the technology is meaningless (Rose & Scheepers, 2001). The ST was developed by Giddens in the early 1980's. Prior to the development of this theory, there were two social strands of thinking, the structuralist and the heumunitic traditions (Giddens, 1984). Whilst the structuralist tradition emphasizes the structure as mainly a constraint to human action, the heumunitic tradition emphasizes the human actor in structures (Gediehn, 2008). Gidden's ST

basically recasts both ideas as a mutually dependant duality (Buhr, 2002). As depicted in Table 1, structuration theory has fundamental concepts namely: structure, system and structuration, as well as related sub-concepts, agent, agency, social systems, rules, resources, space, time, and the underlying assumptions connecting these concepts (Pozzebon & Pinsonneault, 2001).

Table 1: Structuration Theory Concepts & Assumptions

Concept	*Definition & Related Assumption/s*
Structure	Referred to as the medium or outcome of action (Carmack, 2008), structure refers to rules and resources used by agents to interact. Therefore agency is the ability for human actors (agents) to exercise power by recreating or transforming the existing structure (Gediehn, 2008). Rules and resources are implicated in the reproduction of systems (Giddens, 1984). Structures include aspects of transformation and mediation relations, which influence social and system integration (Buhr, 2002). A structure is not necessarily a mechanical construct but it also exists in the agent's memories that are within the structure (Giddens, 1984).
Structuration	Conditions governing the continuity or transformation of structures, and the reproduction of systems (Giddens, 1979). It involves the construction of social relations over time and space, through the duality of structure (Giddens, 1984). The duality of structure is the dependency of structure and agency on each other (Englund & Gerdin, 2014). Structure is drawn upon by agents in their day-to-day actions, then produced & reproduced by this action (Rose & Shceepers, 2001). At the same time action is both constrained & enabled by structure (Buhr, 2002). Agents, as they are acting, also constantly produce and reproduce the structure (Rose & Hackney, 2003). In the same manner structure enables agents in their action and it also constrains them as they act.
System	Reproduced relations between actors or their collectivities, organized as regular practices, over time & space (Giddens, 1984). These are visible patterns where there are activities or agency between interdependent networks where change in one area results in change in other areas (Pozzebon, 2001). Systems make up society's institutions; they account for social relations & activities but have no existence beyond the social practices that constitute them (Gediehn, 2008).

As outlined in Table 1, structuration theory can best be understood with reference to its major key terms, viz., structure, system/s and structuration.

3.3.4.1 Structure

The structure, according to Giddens (1984) consists of rules and resources. Rules are stocks of knowledge utilized as formulas for action in social systems. They also refer to general procedures and methodologies that agents possess in their memory (Buhr, 2002). Therefore, rules exist as memory traces that agents use (ibid.). For example, in a factory environment rules (procedures and manuals) form a significant part of doing the work, enforcing and repeating specific practices (Adler et al., 1999; Aik, 2007). In the beginning, rules have to be studied, understood and internalized by employees when executing defined tasks (Becker & Scholl,

2006). As time progresses, individuals get familiar with the rules which in turn become embedded in their memories, becoming memory traces, translating into a skill or dexterity (Aik, 2007; Buhr, 2002).

Normally adherence to these rules is encouraged and/or rewarded (Dekker, 2003). For example, a person who is excelling in the application of these rules is encouraged to continue doing so and in some instances they are promoted because this is interpreted as excellence, performance appraisals are normally used as a measure of the person's excellence (Murphy & Margulies, 2004). This is termed legitimation, which often yields to the recurrence of the practice, hence the agency that reproduces the structure (Golsorkhi et al., 2010). On the other hand, when a person diverges from the rules, it is interpreted as a lack of excellence and such behaviour is normally discouraged (sanctioned) (Macintosh & Scapens, 1990; Dekker, 2003). However, rules alone do not complete tasks, but the application of rules on resources (tools and facilities) does (Ross, 1994). Resources refer to material equipment and organisational capacities for agents to accomplish tasks (Rose & Hackney, 2003). For instance, in the assembly line in a factory, there are procedures that must be followed to complete a product (Álvarez et al., 2008). Employees working on the assembly line need the actual facilities, equipment, tools and technologies to (and on) which these rules can be applied to accomplish tasks and objectives (Dekker, 2003). The manners in which these rules and resources (structure) are reflected and applied in the context of this study are discussed in more detail under section 3.3.5. In essence rules without resources are not adequate and vice versa, hence, a need for a balance between rules and resources (ibid.). At this point, it is important to highlight the significance of agency (Gediehn, 2008).

Agency is the ability of employees to coordinate their actions with others actions with the intention of those actions resulting in the desired outcomes (Rose & Scheepers, 2001). As employees work on the assembly line, they are continuously coordinating their actions in order to reach the end goal (Becker & Scholl, 2006). However, agency does not only end with the coordination of actions (Carmack, 2008). When it is observed, it is noted that individuals have a choice or free will to make decisions that affect the structure through their actions (ibid). A Giddens (1984) point out that agency is the ability to make a difference. This speaks to power, as the lack of making a difference is associated with powerlessness (Rose & Scheepers, 2001). Making a difference also comes from a sense of conviction held by the agent or actor to make a difference, in other words actors are purposive beings (Broger, 2011).

This is where the knowledgeability of the individual is portrayed. In this regard, the application and use of knowledge is used to transform the existing social structure (Gediehn, 2008). For example, an employee on the assembly line may propose an efficient procedure for completing the work. In doing so, the employee would have added value to the structure by bringing a change that would have transformed the structure. Another example is that of promotion (often to management level) of an employee within the structure, this allows the employee to have an added advantage in influencing or transforming the structure (Power) (Luthans et al., 1993). This is because promotion will often come with added resources/facilities to the individual (ibid.). Added resources are an advantage which gives some form of authority to an individual and (Domination). The use of structuration theory including the concept of agency, and its complete application in this study is presented in more detail under the 'Application of Structuration Theory in this Study' in section 3.3.5.

Generally, according to (Golsorkhi et al., 2010), the domination aspect of agency is seen as power relationships among individuals. However it can also be power over materialistic objects (Gediehn, 2008). This is also where the capacity of an individual to exercise free will and choice expands and is mostly observed (business planning, equipment acquisition, hiring and firing (Luthans et al., 1993). For further illustration on this matter, take the management positions or rather agency in management. Managers have the power to bring about change in the workplace (Ross, 1994). According to McGregor (1957) the managers task is to organize the elements of a productive enterprise, technology, equipment and people in the interest of economic ends. Generally then, managers should be aware of the changing world due to technology and should have the ability to direct the operations of an organisation in order to have a competitive edge in the industry. Managers who fail to anticipate change or effect change in organisations run the risk of being irrelevant in the future. This is where the transformation of the structure is observed (Luthans et al., 1993). Where the apparent need for change is unreasonably avoided, failure to transform may threaten the very structure of an organisation. In agreement with others, Rose & Scheepers (2001), specifically say that agency can also be described as the ability of agents to make a difference. In what is referred to as structuration in this context then, agents make a difference by reproducing or transforming the structure, as the structure is reproduced agency is enabled (Ng'ambi & Rambe, 2008).

3.3.4.2 Structuration

Understanding the relationships and influences that work in structuration is paramount (Giddens, 1984). Structuration refers to the gradual development and recursive reproduction of structure over time and space (Rose & Scheepers, 2001). Basically, structure and agency are dependent on each other; the one cannot exist without the other (Rose & Hackney, 2003). In other words, structure and human agency are the duality of structure (ibid). Looking at the factory assembly line example where rules and resources represent structure (the factory), agency is represented by the actions of the employees and managers (Carmack, 2008). As employees are working on the assembly line, applying procedures on equipment and material using technology they ensure that the factory (made out of rules and resources) is operational (Johnston, 1994). The factory enables both the managers' and employees' actions, however it also constrains the agency as work is carried out and decisions are made. When good decisions and actions are implemented in the structure through improvement of rules and resources, the structure becomes a great enabler for agency. Further, poor procedures and inadequate resources such as technology may impact negatively on the agency, reducing productivity and, ultimately, revenues. This is how agency and structure are interlocked. However, structure (rules and resources) does not only affect agency. Structure also has a telling impact on social systems (Ng'ambi & Rambe, 2008).

How the structuration and the system/s concepts are translated and applied in the context of this study, are elaborated in section 3.3.5 later in this chapter.

3.3.4.3 Systems

Systems are reproduced relations between actors organized as social practise/s (Ng'ambi & Rambe, 2008). Social systems comprise of activities between human agents, which take place over a specific time and space (Englund & Gerdin, 2014). Drawing from the assembly line example, systems are represented by the relationships between the employees who are actively interacting with, and relating to one another to accomplish the assembly line output (the same goal) (McGregor, 1957). These relations are reproduced between floor workers, foremen, inspectors, line managers and executive managers; they represent a social practice within the assembly line (Ross, 1994). A social practise is represented by the way in which the above employees relate to each other (Ng'ambi & Rambe, 2008).

The roles on the shop-floor greatly influence the interaction between employees; this is due to the clear-cut superordinate and subordinate relationships (Ross, 1994). The executive managers and general managers are situated at the top of the status hierarchy. At this level these individuals have a greater ability than others lower in the hierarchy, to transform or make a difference in the work environment; this is power (Rose & Scheepers, 2001). These individuals have the power to make decisions, to change processes, to add or remove resources; they are the individuals who possess the most authority/dominion (Luthans et al., 1993). Normally, the personnel occupying such positions have offices that are separate from labour personnel therefore there is hardly any communication or interaction between the two (Thompson, 1983). If communication occurs it is a one way communication from the managers. Whenever managers require information on the labour floor the foreman is the employee who is given duties to report back to management (Roethlisberger, 1945). His duties also included that of assisting on the shop-floor whenever required, assigning jobs to the floor workers and supervising activities (Thurman, 1978).

Activities are carried out according to specific rules and methods therefore the foreman supervises the floor workers ensuring that they carry out the work according to the rules (Thompson, 1983). When a worker shows consistency and excellence in the carrying out of rules then the work is rewarded which can be seen as legitimation (Murphy & Margulies, 2004). A floor worker can only become a foreman once he has shown ability in following rules in various functions on the shop floor (Thompson, 1983). When an employee fails to show consistency in following through with rules then he may be called to disciplinary bodies, this procedure illustrates being sanctioned (Macintosh & Scapens, 1990; Dekker, 2003). The foreman's role is neither that of management nor of the floor worker, he is always in-between. The foreman keeps the floor workers accountable ensuring that they work as expected (Roethlisberger, 1945). The foreman is seen as a manager by the floor workers, however he is not part of management because the managers do not see him as part of their camp (Thompson, 1983). As a result, he is always in the middle lacking a sense of belonging. In the context of structuration the foreman serves as a vehicle to re-enforce rules and ultimately the reproduction of structure. The attitude toward the foreman from the shop floor is that of dislike and mistrust because he is seen as a tool used by management to make their work difficult (ibid.).

Notably, in production, efficiency and the quality of the output product should be prioritised at all times (Shaaban & Hudson, 2009). Therefore workers are expected to work as quickly as

possible; this negates the possibility of social interaction. However the nature of the assembly line requires team work as everything must link up to make up a completed product which brings unity on the shop-floor (Becker & Scholl, 2006). So the social practice in those relationships is that of anonymity yet there is a sense of unity among floor workers (Thompson, 1983). These relationships are continuously reproduced. Further, social systems have structural properties in the sense that relationships are stabilised across time and space (Giddens, 1984). In basic terms, systems refer to the relationship between rules and resources among other things (Ng'ambi & Rambe, 2008). For example, the relationships or the links between workers enable the implementation of rules on resources.

The ability of workers to coordinate tasks using rules that are embedded in their memories with machinery (resources) to build up separate components achieving a complete product is the heart of observing a system in such an environment (Buhr, 2002). Therefore, structure is implicated in reproduced social relationships, and the application of rules on using resources is embedded in reproduced relationships between individuals (Rose & Hackney, 2003). Therefore systems and structures are recursively interrelated through the duality of structure (Thurman, 1978). For example, the link between procedures and resources on the assembly line is represented by the relationships among employees and managers. Procedures and resources are utilised through the interaction and the relationships between employees and managers which in turn, reproduces the social system (Ross, 1994).

3.3.5 Relevance of Structuration Theory

Structuration Theory has been used by social theorists to analyse and understand their environments (Rose & Scheepers, 2001). The theory can be used in most environments where the concepts and relationships between these concepts or assumptions of the theory are applicable (Orlikowski & Robey, 1991). In the next section examples of the application of ST are given, and the application of structuration theory in this study is discussed.

3.3.5.1 The use of Structuration Theory in similar studies

IS researchers have long been interested in using ST to strengthen the level of understanding in this field (Rose & Scheepers, 2001). An example of the use of structuration theory in IS is that of (Orlikowski & Robey, 1991), who draw the ST to understand the relationship between organisations and information technology. Where information technology represents structure, an organisation represents structural and social context (time and space) whilst the interaction

of humans and information technology is represented by agency. Thus, information technology is a social product of subjective human actions within a specific structural and cultural context. Simultaneously, IT is a set of rules and resources involved in facilitating and constraining human action. In other words information technology is a product of human action (structure). It is an occurrence of the human action as design, development, appropriation and modification (agency). Structural properties (organisation) influence humans in their interaction with IT, such as standards and resources. Therefore as the humans interact with IT, institutional properties of the organisation are influenced. This reinforces or transforms the organisation.

Another example of the application of the structuration theory is drawn from Rose and Hackney, (2003) They conducted a case study analysis of a project aimed at the privatisation of the British railway industry in 1992. Prior to this time the railway industry had been operated by the government. After a few years the industry was franchised to the private sector. Regional Train Operating Company (RTOC), a private company became the passenger rail operator. When the railway industry was operated by the government, the information systems technologies that were used were GEMINI, which was the hub of managing operations and RAVERS, which was a system designed for recording maintenance data. Although the systems were designed to be interfaced and to update each other they operated independently. When privatisation took place, TRUST which is a system that produces standardised reports and data, linking delays and other computer system, was introduced. This complicated business processes. It became apparent that the system needed to be interfaced; therefore a company was outsourced for the purpose of interfacing and maintaining the system. This was a complex task because of the conflicting programming languages between the systems. This resulted in poor business processes which caused train delays, reducing passenger rail services from excellent to poor.

The structuration theory concept that Rose and Hackney (2003) used was that of systems. They focused on social practices and the role of IT in social practices. Systems are defined as the reproduced relationships between actors organized as social practice/s (Ng'ambi & Rambe, 2008). Structure is also implicated in reproduced social relationships, and the application of rules on using resources is embedded in reproduced relationships between individuals (Rose & Hackney, 2003). Therefore systems and structures are recursively interrelated through the duality of structure (Englund & Gerdin, 2014). Initial findings revealed that the employees in IT and operations, who were employed in the government, were already lacking adequate skills to utilise the technology. The technology appeared to be well embedded in people's memory. However, the designers intended practices were only partially understood and the

developments in business practices had led to a mismatch between practices in humans and computer systems. Because the technologies imposed a particular set of interactions, actors resorted to desperate remedies by using paper at times to store information. This shows structuration theory in that the social practices that had existed ended up being the norm. The inadequate relationships between the actors organised as social practice/s were recursively reproduced.

In another study, DeSanctis and Poole (1994) also used ST as a framework for studying social influences that occur as information technologies are used. There is a duality of structure whereby there is interplay between the structures that are inherent in information technologies and the structures that emerge in human action as people interact with the technology. A small group using a Group Decision Support System (GDSS) was considered. A GSDD is a type of advanced technology that combines communication, computing and decision support capabilities to aid group idea generation, planning, problem solving, and choice making. In a typical configuration, a GDSS provides a computer terminal and a keyboard to each participant in a meeting so that information (facts, ideas, comments, votes) can be readily entered and retrieved. Specialised software provides decision structures for grouping, sorting, and otherwise managing the meeting information. In this case study the emergent structure of the technology and the emergent structure of social action are studied. The structure of the technology is divided into rules and resources; these are basically the capabilities of the technology and the intent of the technology. In GDSS, on the one hand, capabilities are the recording of ideas, periodic pooling of comments, and voting algorithms for making group choices. This means that the information that can be gathered, manipulated and managed by users is governed by the GDSS. This illustrates domination, which is power to control user interaction. On the other hand, the intent of the technology includes the provision of support to manage information in meetings (planning, voting, and grouping of comments) and co-ordination among people which provides interpersonal exchange. This provides legitimation to the technology by supplying a normative frame with regards to behaviours that are appropriate in GDSS. Similarly social structure consists of rules and resources which are provided by information technology and institutions. Thus, IT structures influence the social aspect of work through domination yet the human interaction or action continues to legitimise the technology.

3.3.6 Conceptual Framework - Application of Structuration Theory in this Study

This section builds on the theoretical background in section 3.3.4 to outline how the structuration theory (ST) was applied in the study presented in this thesis. Here, ST, as applied in this investigation of the adoption of cloud computing in the private sector (with emphasis on the engineering and the financial sectors) is summarised in Table 2 and immediately elaborated in sections that follow.

Table 2: Application of Structuration Theory

Concept	*Concepts applied to the study*
Structure - the medium or outcome of action (Carmack, 2008) represented by **rules** and **resources** used by **agents** to interact, with **agency** as the ability for **human actors** (agents) to exercise **power** by recreating or **transforming** the existing structure (Gediehn, 2008).	**Rules:** project management procedures, methodologies, guidelines, ISO standards, policies, and legislation, standards cloud computing guidelines. **Resources:** Technological tools (ERP systems, cloud computing, software programs, ERP systems, emails, phones), human resources (skilled & unskilled individuals), finances & suppliers. **Agents:** stakeholders (project team, managers, members, project owner/clients & etc. **Agency:** stakeholder management, feasibility study, project leadership, project communication, Risk management, quality management, Project control, Resource planning, Procurement control, outsourcing, in-sourcing, contracting, and adoption of a technology.
Structuration - Conditions governing the continuity or transformation of structures, & the reproduction of systems (Giddens, 1979).	**Structuration:** this is where project management is being drawn upon by day-to-day project activities (agency). These activities are both constrained and enabled by project management (structure). Then, project management procedures (rules) & various enablers, tools (resources), operational practices, including the adoption & use of technological tools (agency), are mutually reinforcing and interdependent.
System - Reproduced relations between actors or their collectivities, organized as regular practices, over time & space (Giddens, 1984).	**Systems:** Relationships among stakeholders (internal & external). Internal stakeholders (project team, project managers & the client. External stakeholders (environmental groups that may affect the project, suppliers, contractors, service providers, etc.)

The aim of the study was to explore and explain the status of the adoption of cloud computing in PM in South Africa, using the ST as an analytical framework and a lens through which this phenomenon could be observed. As summarised in Table 2, the key ST concepts of the structure, system and structuration – as well as the underlying assumptions, were applied to interpret and analyse the potential of cloud computing in project management in the private sector, with a focus on the engineering and the financial sectors.

3.3.6.1 Structure of Project Management in the Private Sector

The structure, according to the ST, is the medium or outcome of action, it is also referred to as rules and resources used by agents to interact (Giddens, 1984). Since the objective of this study was to understand and explain the status of cloud computing adoption in PM in the South African private sector, PM in the private sector represents structure. This study focuses on organisations that use PM as a means of fulfilling the organisation's strategic objectives. Organisations use technologies to enhance PM outcomes; the currently adopted technology is ERP systems.

An example in the context of this study is investment/insurance companies in the financial sector. Companies in the financial sector have projects that serve to support the company's objectives. An example of a typical insurance company project is a quick quote system for, say, motor vehicle insurance. The organisation develops software that will make it easy for their employees to provide quick insurance quotes to clients. Such software must take into consideration that insurance quotes are customised to specific conditions or clients. In this case, a specific project (and its management) could be set up for software development, involving project methodologies, a lifecycle project plan, a risk plan and a resource plan. Financial organisations utilize technologies to achieve their project objective; hence it is common to find PM processes integrated with other business processes using ERP systems.

Another example in the context of this study is those organisations that provide outsourced services for the purpose of managing projects. This includes engineering companies that provide technical services and PM services within the engineering industry. Typical projects in this area would be the building of bridges, houses, upgrades of electrical power stations and the development of ports. These companies tend to be a great pool of resources for governments. Governments outsource them to manage complex engineering infrastructure programs consisting of multi-disciplined projects. The skills offered include, engineering, supply chain, resource, procurement and construction management. These companies utilise leading project controls and information management systems like ERPs developed specifically for flexibility in PM. As stipulated earlier, PM represents structure; structure consists of rules and resources. Ideally rules are represented by PM procedures, methodologies, guidelines, International Organisation Standardisation (ISO), the Project management body of knowledge (PMBOK) (PMI, 2013), company policies and legislation. Ideally these methodologies, processes, guidelines etc. must be studied and internalised by individuals directly involved in the project.

In the engineering industry in particular, an ideal situation is that employees will have qualifications which serve as a measure of their knowledge if the field and of the industry. Employees will also be required to register with institutions such as the Project management institution (PMI), which measures their abilities, training, practice and knowledge in PM, by analysing their experience and qualifications. Registration is important for employing organisations, as affiliation with such institutions serves to legitimise compliance and adherence to operational standards (rules), to re-enforce skills sets, and ultimately, to reproduce structure. Recognised qualifications are needed for the software development project in the financial sector as well, since development employees are expected to understand project methodologies that enhance software development with the intention of achieving software requirements. Normally, individuals begin by being members of a project team. As they show excellence in the application of PM they are often promoted and given their own projects to manage becoming project managers. This is the aspect of legitimation. However the failure to show excellence in applying the embedded knowledge can lead to being demoted or overlooked, which is the aspect of being sanctioned.

Rules are not enough on their own, project members require facilities, equipment, tools and technologies to (and on) which these rules can be applied to accomplish project objectives. Resources include: finances, human resources (skilled & unskilled individuals), machinery (in the case of the engineering sector), technical tools for engineering purposes, technological tools (ERP systems, cloud computing, software programs, emails, phones), suppliers and service providers. When adequate resources are absent from a project, it becomes a challenge to accomplish project objectives efficiently.

ERP system is one of the current technologies (resource) utilised in PM to accomplish the desired project outcomes. However it has storage limitations, is prone to ineffective use during networking faults and is very difficult to implement in an organisation. To address this situation, there is a need to enrich or heighten the recent working technologies to enhance efficiency in PM processes in organisations. Therefore project managers and stakeholders need to ensure that there are adequate skilled project members and resources. As has been detailed in the previous sections, cloud computing (resource) has characteristics that can assist in overcoming the challenges faced by PM. This calls on agency which is the ability for human actors to exercise power by recreating or transforming the existing structure (PM) (Gediehn, 2008). Agency is also the ability of employees to coordinate their actions with those of others, with the intention of those actions resulting in the desired outcomes (Rose & Scheepers, 2001). In the

engineering sector, agents (stakeholders) such as the project owner/client, executive managers, programme managers, project managers, project team members, contractors and sub-contractors, engineers, quality assurers, safety inspectors, environmentalists, etc. demonstrate agency by taking charge through working together towards the accomplishment of project objectives. In the financial sector agents include users/customer, project managers, financial managers/accountants, developers/ programmers, testers and business analysts. The collaboration in working as a team among all agents increases the probability that the project achieves success by producing a quality product within the specified schedule and cost.

Agency does not end at collaboration. It also focuses on the ability of the stakeholders to exercise power through making decisions and adopting whichever elements that may be required to reinforce or transform structure. Stakeholders have different roles to play, hence the different activities. For example, in the engineering sector a project team member may be in charge of a section of the project, perhaps, ensuring that contractors comply with the safety aspect of the project or to lay foundations of the bridge being constructed, or to perform quality checks after every activity. At the same time, a project manager will oversee the whole project ensuring that there is adequate coordination among team members.

The ideal agency in this study is the adoption of technologies that enhance PM outcomes, in this case, cloud computing. Drawing from the engineering industry projects, these companies are often involved in mega projects, where activities may take place on site in various locations, where the PM processes are integrated with other business processes, where large amounts of data need to be stored, shared and processed. In this case there is a need for access to adequate servers, documentation, reliable networks and PM software programs.

In order to simplify situations like the one described above, the adoption of cloud computing offers the company the opportunity to outsource servers, networking technology, storage and applications. This, in turn, minimizes operational costs and project timelines, as data applications are accessible anytime and anywhere where there is Internet access (Misra & Mondal, 2011). The adoption of this technology requires project managers, strategic managers and executive managers to exercise the power they have. Cloud computing has the potential of transforming PM (structure).

Agency is the same in the financial sector with differences in the nature of the work that is involved. Agency in this sector may be observed through developers, who are involved in

coding and developing the actual software in the execution phase. For example, a tester may be testing whether the software meets the requirements of the user/client. However the ideal agency in this study is the adoption of cloud computing. Software development projects require a lot of hard drive space and processors that have the capacity to handle programming processes. The ERP systems used for integration also require adequate space and an adequate networked environment. The adoption of cloud computing provides enough storage and processors required for such activities. This may minimize the costs of maintaining hardware equipment, it may also minimize project timelines because cloud computing service providers are solely focused on maintaining working equipment and systems. Cloud computing also provides easy accessibility for the programmers or software developers anywhere where there is Internet access. The adoption of this technology requires the project managers, strategic managers and executive managers to exercise the power they have (Domination), this has the potential of transforming PM (structure).

3.3.6.2 Structuration in Project Management in the Private Sector

Structuration is represented by conditions governing the continuity or transformation of structures, & the reproduction of systems (Giddens, 1984). These conditions are represented by day to day PM activities. In this case, the adoption of cloud computing. Cloud computing is a tool that allows PM activities to be enhanced to accomplish efficiency. As stakeholders adopt cloud computing to enhance PM efficiencies, PM will be transformed rather than re-enforced. This is due to the benefits that cloud computing offers to PM that were not offered prior to its adoption. Simultaneously, the use of cloud computing is either enabled or constrained by PM. In this context cloud computing can only be given significance by effective PM. Therefore PM and the adoption of cloud computing are mutually re-enforced and interdependent.

3.3.6.3 Systems of Project Management in the Private Sector

Systems are reproduced relationships between actors organised as social practice/s (Ng'ambi & Rambe, 2008). Social systems are comprised of activities between human agents, which happen over a specific time and space. In this case social systems are represented by the reproduced relationships between leadership, the management of the project personnel and the interested stakeholders. Social practices are observed in the type of interaction the leadership, management and project personnel have among each other. The interaction between leadership and the project personnel is influenced by their different roles. In a way similar to the

assembly line example, leaders such as the executive managers and programme managers are at the top of the status hierarchy.

The executive manager's responsibilities are to ensure that the corporate vision is pursued within the business through the development of corporate strategies and the associated change management processes. The responsibility of a program manager is to manage and coordinate the multiple projects of a company. These leaders have a greater influence than their project managers and members on transforming the structure through their agency, which is seen as power. These individuals also have the power to make decisions, to change processes, to add or remove resources; they are the individuals who possess the most authority/dominion. These leaders usually occupy offices, where access to have contact with them, is through a personal assistant. This creates a boundary between these leaders and project staff members. If communication occurs it is a one way communication from the managers. It is the project manager who is responsible for project deliverables; this is done through the management of the various activities in each phase and the management of contractors or service providers. The project manager is accountable to the portfolio manager while the project members are accountable to the project manager.

The relationship between the project manager and portfolio manager are normally focused on deliverables. The focus is on work more than on being sociable, because the project manager often has a greater responsibility for ensuring project success than the portfolio manager. The project manager works closely with project members and normally understands the importance of team work. Even though the relationships between the project manager and project members are very much focused on adhering to rules and ensuring that milestones are achieved. The relationships turn out to be those of collaborating and working as a team. These relationships are continuously reproduced. It is important to note that social systems have structural properties (Giddens, 1984). The relationships or the links between leadership, management and project staff members enable the implementation of rules on resources. The ability of workers to co-ordinate tasks using rules that are in their embedded memories with a technological resource, like cloud computing (resources), to accomplish project objectives efficiently, shows the importance of systems. Thus PM procedures, methodologies, guidelines and technological tools (ERP systems, cloud computing, software programs, emails, phones), human resources (skilled & unskilled individuals), finances & suppliers etc. can be utilised through the interaction of the leadership, managers and stakeholders in the cloud (using cloud computing as a resource). Cloud computing brings a new aspect of interaction. Therefore the relationships

between employees and managers are reproduced and transform the social systems(Ross,1994).

3.4 Conclusion to chapter 3

This chapter provides a comprehensive definition of a theory and the purpose of theories in research. The two categories of a theory (deductive and inductive) were outlined with the focus on differentiating the theories that are derived from a positivist approach and the theories that are derived from an interpretivist approach. This was useful in that it justified the selection of a theory that is formed through the inductive approach. Theories used in PM were then named and explained to illustrate the use of theories in PM. However, only one theory was selected for the purpose of analyses in the current study. The rest of the theories were eliminated due to the limitations they would put on the analysis in the current study. Thus, ST was selected based on the fact that it is more comprehensive than the other theories, offering rich analytical lenses to analyse and understand the possible interactions between cloud computing and varying aspects of PM. This choice was considered to be appropriate because structuration theory has been used by other researchers in the field of IT and management in organisations.

The main concepts of structuration theory were discussed and outlined in detail. This was mainly for the purpose of simplifying the theory for an effective application to the current study. An example of an assembly line in a factory environment was given to further illustrate the use of structuration theory in socio-technical environments. Following that, the successful use of ST in similar studies was described. These examples showed the relevance of ST. Finally, the structure and the information in this chapter enabled the researcher to apply structuration theory to the current study by aligning the concepts of the theory with the study and showing the links between the concepts

CHAPTER FOUR

4. METHODOLOGY

4.1 Introduction

This section provides a logical sequence of activities that illustrates the approach adopted to address the research questions, that explains the choice of the research methodology, and describes how to collect and (how to) analyse the data (Kuada, 2012). The fundamental concepts regarding the chosen research methodology are discussed and the guidelines used by the researcher to decide on the appropriate research approach are given (Flick, 2011). The following sections explain in detail the design approaches, theories and methodologies that could be used.

The chapter is structured into 5 sections, it starts with an outline of the research design in 4.2, 4.3 focuses on research methodology, followed by the sampling and data collection in 4.4, data analysis in 4.5 and the chapter concludes in section 4.6.

4.2 Research Design

A research design is defined as a blueprint of how a researcher plans to conduct a study (Babbie & Mouton, 2004). It can also be defined as a set of guidelines that can be followed in addressing a research problem (Creswell, 2014). The purpose of a research design is to enable the researcher to foresee what the appropriate research questions are that should be asked to maximise the validity of the study or results (Welman et al., 2005). When a decision has been made, a research process or methodology has to be identified (Flick, 2011). To facilitate the process, the underlying philosophical, methodical and operational assumptions also need to be clearly articulated (ibid.). Firstly the ontological foundations of the phenomenon and enquiry, which is a basis upon which methodological assumption could be based, should be clarified (Mouton, 1996).

4.2.1 Ontology

Ontology is a study about the nature of being or of existence with numerous ontological perspectives held in the world of science (Tolk, 2013). They can be categorized into varying dimensions within nominalism, idealism, realism, and relativism among others (ibid.). Realism is based on the assumption that reality is strictly in the form of a physical, tangible, and in many

cases, even of a quantifiable nature (Mouton, 1996). This perspective is largely associated with, and is often evident in natural science presuppositions where most research is conducted on physical matter (Neuman, 2006). Whilst this belief about the nature of reality is logical when understanding natural science objects, it fails to account for the non-tangible form of reality that is associated with human behaviour such as attitudes, feelings and beliefs (Mlitwa, 2011). The current study investigates the potential of cloud computing in improving PM efficiencies. The subject of efficiencies and use are social phenomena that cannot be adequately explained from a realist perspective. A different ontological perspective that acknowledges non-tangible, relative and socially constructed forms of reality therefore are the ideal basis upon which, contextual and interpretive forms of reality can be understood.

On the other hand, relativism acknowledges the relative and contextual forms of reality. Within this perspective also stands beliefs that reality cannot be limited to physical matter, but it can also be socially constructed (Babbie & Mouton, 2004). For example, an individual's opinions, feelings and thoughts are as much real as the tangible matter such as rocks in Geology or minute bacteria in chemistry, but would require a form of recognition and proof different from that that would be applicable in tangible objects (Neuman, 2006). Given the phenomenon of investigation in the current study, which is to understand social phenomena in the form of 'the adoption of cloud computing to improve efficiencies' in the public sector, the social constructivists approach is more appropriate, and is adopted as an ontological stance. An epistemological position that is commensurate with the social constructist stance is explored and motivated for, in section 3.1.2 below.

4.2.2 Epistemology

Epistemology is defined as a study about the way of knowing and of getting to know (Tolk, 2013). Epistemological approaches vary accordingly between different research traditions, with a clear link between held assumptions and different ontological stances (ibid.). The dominant epistemological positions include positivism, interpretivism and the critical research paradigm. In line with realist ontological presuppositions, positivism is a way of knowing about physical reality using rules of formal logic and rules of deductive logic (Babbie & Mouton, 2004; Mlitwa, 2011). Based on the realist assumptions about existence that limits reality to physical objects, positivism assumes that the only way of getting to know about scientific truths is through objective empirical processes (Creswell, 2014). Oftentimes natural sciences turn to follow

research methods aligned to this epistemology, with a strong emphasis on deductive reasoning, and with a separation of the object from the subject and context of research (ibid.).

However, the current study investigates the potential of cloud computing in improving PM, which can be categorized as the behavioural science phenomena that cannot be adequately understood through empiricist approaches associated with positivism. Instead, the interpretive approach is more appropriate.

Interpretivism is a way of knowing about social constructs using methods that aim at interpreting or understanding human behaviour (Kasi, 2009). As an epistemology based on the non-realist assumptions about reality, interpretivism acknowledges the significance of the context in understanding a social phenomenon, and the interpretation of the environment made by researchers is also accommodated (ibid.). This philosophical approach is more appropriate when conducting research on behavioural, managerial and socio-technical phenomena – where the context and observer interpretation is necessary.

4.3 Research Methodology

Research involves the application of a variety of standardised methods and techniques in the pursuit of valid knowledge (Welman et al., 2005). In this process, scientists always aim at generating truthful knowledge (ibid.). This is achieved through the use of objective methods and procedures that increase the likelihood of attaining validity (Kasi, 2009). In this respect, research methodology which is a broad term for the methods and techniques of conducting research, guides the process (ibid.). Research methods therefore, tend to address the 'how' aspect of doing research in that they encapsulate different steps, principles, procedures and techniques of sampling, collecting and analysing as well as interpreting of data (Babbie & Mouton, 2004). Research methods thus, can be divided into two common categories, viz., quantitative and qualitative research methods (Creswell, 2003).

4.3.1 Quantitative research method

Quantitative research methods refer to methods of study that investigate numeric or quantitative data (Welman et al., 2005). There are numerous formats of quantitative methods, which include experimental and survey methods (Neuman, 2006). The common factor across all quantitative methods is that they set out to facilitate investigations into problems and questions whose solutions can be expressed in quantifiable formats (Mlitwa, 2011). In this process the elements of a research population are easily quantified, with quantitative implications on the selection of a

research sample. Probability sampling thus, is based on the principle of randomly selecting participants from a numerically finite research population and is often used in quantitative research (Babbie & Mouton, 2004). Quantitative methods therefore, incorporate the techniques of working with data that can be analysed and interpreted numerically (Mlitwa, 2011). Whilst these techniques are appropriate to the numerically quantifiable formats of data, they become inappropriate for handling textual descriptions and explanatory formats of data (Neuman, 2006). Instead, qualitative research methods become applicable (ibid.).

The aim of the current study is to understand the potential of cloud computing in improving PM efficiencies in the public sector in South Africa. By implication, this requires descriptions, explanations and interpretation of textual data that cannot be investigated using quantitative techniques. Therefore qualitative research methods need to be examined at this point.

4.3.2 Qualitative research method

Qualitative research methods refer to methods of study that investigate textual data consisting of impressions, words, sentences and photos (Babbie & Mouton, 2004). Qualitative research has three main methods; these are ethnographic studies, life histories and case studies (ibid.). Ethnographic studies are studies of cultural anthropology that are obtained from observing behaviour of a specific society (Welman et al., 2005). In this type of study interviewing techniques and participant observation are often used as methods of data collecting (Kasi, 2009; Neuman, 2006). The second method, life histories, is a book that entails a full account of a person's life in his/her own words with the guidance of a social scientist (Babbie & Mouton, 2004). This form of study is ideal when a researcher's objectives are to capture an individual's reality taking account of daily events, various experiences and capturing an individual's perspective in totality (Mlitwa, 2011). The last method is the case study method; this is a thorough investigation of a single component (Neuman, 2006). This allows the researcher to understand the uniqueness of a particular case in all its complexity (Welman et al., 2005). This component can be a community, an individual, an organisation or institution, events or nations/countries (Babbie & Mouton, 2004). In case studies, data is collected using mainly the techniques of interviewing and participant observation (Welman et al., 2005).

Whilst all these methods are used in qualitative research, a method must be selected which should be aligned with the purpose of the selected study. Neither the ethnographic method nor the life history can be used because this study is not based on cultural anthropology nor is it based on an individual's life history. The aim of this study is to understand the potential of cloud

computing in improving PM efficiencies in the private sector in South Africa. Due to the fact that the subject of investigation is in the private sector, and the aim is to understand a particular uniqueness, the case study method is chosen.

4.4 Sampling and Data Collection

In scientific investigations, every researcher comes to a point where they must conduct a study on one form of a research population or another (Welman et al., 2005). In this respect, the most ideal form of conducting an investigation would be to investigate every single unit, element or case of any particular research population (ibid.). However, a research population can often be so large that it is sometimes difficult for a researcher to reach every unit or case (Mouton, 1996). In these situations, researchers select representative units or cases from a larger research population which allow them to make generalisations about that particular research population (Melville & Goddard, 1996). The process of selecting a workable representative sum of the units of a larger research population is called sampling (Neuman, 2006). Sampling is categorized into two types, probability and non-probability sampling (Welma et al., 2005).

4.4.1 Probability Sampling

Probability sampling is the technique where each unit of a research population is given an equal chance of being selected, through a random selection process, into a research population sample (Ranjan, 1996). Examples of probability sampling techniques include simple random, stratified and cluster sampling.

The underlying assumption in this technique is that the location and number of all the elements of a research population are known to the researcher, such that s/he can count and physically apply the random selection process on all units (Render et al., 2014). In this instance, if needing a sample of 5 participants among a research population of 50 cashiers in a supermarket of a busy suburb, by knowing the location and the number of the units the researcher can easily apply any one of the random selection processes to select 5 participants from the population of 50 cashiers. For example, a researcher can list the names, divide the numbers into 10 groups of 5 units, and select every fifth unit to get into a sample of 5 participants. In cases where the location and the actual number of all the units of a research population are not fully known and easily reachable to the researcher however, it becomes difficult if not impossible to randomly select participants from the research population. In these circumstances, a non-probability rather than the probability sampling technique is applied (Babbie, 2011).

The aim of this study is to understand the potential of cloud computing in improving PM efficiencies in the public sector in South Africa. Here the research population consist of public organisations whose locations are dispersed around the whole of South Africa. In other words, the locations of all the individual units of the research population are too dispersed, with numbers too vast to be identified with a practical level of certainty. Using probability sampling, the random technique of sample selection, therefore, would not be realistic. Instead, a non-probability sampling method, which is a non-random technique of selecting a sample from the elements of a research population, needs to be applied (Babbie, 2011).

4.4.2 Non-Probability Sampling

In cases where the total number of the units of a research population is uncertain, and their location is too dispersed to enable a random selection of its units into a research sample, the non-probability sampling technique is applied (Ranjan, 1996). In non-probability sampling, cases are selected gradually using a specific content of a case and the sample size is not determined before sampling is done (ibid.). In this type of sampling the researcher cannot choose randomly (Mouton, 1996).

Non-probability sampling consists of a number of techniques that vary according to the type, location and availability of the units of a research population, and the purpose of research, with models ranging from accidental sampling, quota sampling, self-selection sampling, convenient sampling, snowball sampling, to purposive sampling (Welma et al., 2005). Snowball sampling for example, is used when cases or individuals of a research population are difficult to locate (Babbie, 2011). Snowball sampling is done by collecting data from a few cases or individuals with the objective of getting referrals until the researcher has reached a satisfactory sample size (Rubin & Babbie, 2010). For example when a researcher needs to conduct a study on prostitutes, this population might not be easily located and available so referrals might be the best way to locate the population (Neuman,2006). However, the units of a research population in this study are not of an inaccessible nature that warrants a referral technique. So, the snowballing technique would not be appropriate. Instead, since the units of this research population are numerous and diverse a deliberate effort to select a sample in a manner that is commensurate with achieving the purpose of the investigation, is necessary. Thus the purposive sampling technique must be considered.

4.4.3 Purposive sampling

Purposive sampling is a technique of selecting a workable sample from the research population, according to the purpose of the study and according to the discretion of a researcher (Babbie & Mouton, 2004). The process is to identify and use all the possible cases that fit specific criteria using different methods. In other words the researcher must compile the criteria that will be used to select the cases that are of interest to the study (ibid.). This will assist the researcher to identify and select the appropriate sampling units (Neuman, 2006). To this effect, purposive sampling will be used in this study. The use of a purposive sampling technique in this study is outlined in Table 3 and elaborated further in sections that follow.

Table 3: Sample Selection

Main Question: What is the extent of the adoption of cloud computing in the South African private sector?					
Issue of Investigation	**Data Source**	**Tool/s**	**Unit of Analysis**	**Unit of Observation**	**No. of Participants**
Background, Literature review and Methodology	• Literature (print & electronic sources)	• Read, write	• Academic & non-academic content from Books, journals, magazines	• Project management & cloud computing books and journals	2 Lecturers/ researchers in IT & cloud computing 2 client service officers (service providers) 4 Technology literate Project managers
Benefits of cloud computing in PM, generally.	• Literature (print & electronic sources) • Experts in theory & application of technology (including cloud computing) in management	• Read, write • Interview	• Academic & non-academic content from Books, journals, magazines • Established researchers in IT, IS & cloud computing • Cloud computing service providers • Technology literate project managers in the technology, engineering & finance sectors	• Project management & cloud computing books & journals (electronic & print). • One IT lecturer (CPUT) & One IS lecturer (UCT) • Client service officer @Damension data & @ Business connexion cloud computing service providers. • Project manager @ Santam, @ Old Mutual, @ Metropolitan, @Aerocon	
Effective uses (best practices) of cloud computing in PM, generally.	• Literature (print & electronic sources) • Organisations that mostly use technology tools in management	• Read, write • Interview • Observe	• Academic & non-academic content • Technology literate project managers in the technology, engineering & finance sectors	• Project management & cloud computing books and journals • Project manager @Santam, @ Old Mutual,@ Metropolitan and Aerocon • Client service officer @Damension data & @ Business connexion cloud computing service providers.	
Awareness & Perceptions on cloud computing in the Private sector	• Organisations that mostly use technology tools in management	• Interview • Observe	• Technology literate project managers in the technology, engineering & financial sectors	• Project manager @Santam, @ Old Mutual,@ Metropolitan and Aerocon	
Status of PM efficiencies in the private sector	• Literature (print & electronic sources) • Organisations that mostly use technology tools in management	• Read, write • Interview • Observe	• Academic & non-academic content • Technology literate project managers in the technology, engineering & financial sectors	• Project management & cloud computing books and journals • Project manager @Santam, @ Old Mutual, @ Metropolitan and@ Aerocon	
				Total Participants:	**8**

The aim of this study was to understand the potential of cloud computing in improving PM efficiencies in the private sector, with emphasis on the financial and technology related fields in South Africa. A question concerning the extent to which cloud computing is adopted in the private sector was, thus, posed to experts and practitioners in these fields, to guide the investigation.

A representative sample of 8 participants (*n*) was then selected from the population of academic institutions and from private corporations in the Western Cape. As presented in Table 3, the sample (*n*) consisted of 2 academic experts in the fields of IT (including cloud computing) and PM, 4 managers (1 from an engineering company and 1 from each of the 3 selected financial service providers), and 2 clients' service officers from the 2 cloud computing service providers.

Using the purposive sampling technique, each of the 2 academics was selected on the basis of their direct expertise in the subject of cloud computing. For this reason, one of the experts was an established researcher in the Department of Computer Science at the University of Cape Town (UCT), with the second being a software engineer in the Department of Information Technology at the Cape Peninsula University of Technology (CPUT). In terms of the practitioners, companies were selected based on their reputation in the adoption and use of modern technology in the core functions of their business operations. Thus, Aerocon was selected not only because of its successful integration of IT with its business processes in the field of engineering, but also because it provided the researcher with easy accessibility to data due to the researcher's close proximity and knowledge of the environment. Similarly, the 3 insurance companies – Santam (Pty) Ltd, Old Mutual (Pty) Ltd and Metrolpolitan (Pty) Ltd Life were selected based on their status as national operators, and their patterns of constant growth aligned with innovative integration of IT in their business processes (Ray & Barney, 2005). Therefore, one project manager from each of the 4 companies, were selected.

Finally, the 2 service providers, Business Connexion Solutions and Dimension Data were also selected on the basis of their expertise in a variety of IT related communication solutions both for individual and corporate clients. The 2 service providers were also chosen on the basis of their presence at national level. Therefore, one client service officer was selected from each of these service provider companies. Obviously, the client service providers were selected on the basis of their knowledge and their direct interaction with cloud computing users.

In line with the research objective, the research question was then broken down into 4 areas of investigation, as outlined in Table 3. The areas of investigation are (a) the benefits of cloud

computing in PM, (b) effective uses of cloud computing in project management, (c) awareness and perceptions on cloud computing in the private sector, and (d) the status of PM efficiencies in the private sector. In Table 3, each area of investigation is presented to reflect the Sources of data needed to answer questions on that issue, the tools needed to acquire data from the source, the Unit/s of Analysis and the Unit/s of Observation.

4.4.3.1 The benefits of cloud computing in project management

The first issue of investigation is *the benefits of cloud computing in PM.* Items of literature from both print and electronic sources were identified as the necessary sources of secondary data. In this respect, reference was made to both academic and non-academic content, as the units of analysis, and to scientific books, journals and online publications in both PM and cloud computing, as the specific units of observation (Table 3). Obviously, data from these sources was interrogated through reading, analysis and writing.

Experts in the theory and application of technological tools (including cloud computing) in management were identified as sources of primary data. In this case, established researchers in IT, IS & cloud computing; cloud computing service providers; and technology literate project managers are the units of analysis. Under the established researchers, two experts one an IT lecturer from CPUT and the other an IS lecturer from UCT were the units of observation. Similarly under cloud computing service providers, two client service officers from two of the leading specialist organisations in South Africa, Business Connexion Solutions and Damension Data were selected as the units of observation. Finally, four technology literate project managers were selected from the four companies (Santam, Old Mutual, Metropolitan Life and Aerocon), based on the reputation of these companies in successful PM practices. Interviews were identified as the ideal tool or technique for data collection in this process.

4.4.3.2 The effective uses of cloud computing in project management

The second issue of investigation is, *the effective uses of cloud computing in PM.* The literature was also identified as providing the necessary sources of secondary data. As mentioned above data from these sources was interrogated through reading, analysis and writing. The community of practise was identified as the source of primary data. Just as for the first issue of investigation, two client service officers and four technology literate project managers were selected as the units of analysis. Therefore two client service officers from two of the leading specialist organisations in South Africa, Business Connexion and Damension Data were

selected. And four project managers each from Santam, Old Mutual, Metropolitan Life and Aerocon companies were selected as units of observation, which is based on the reputation of these companies in successful PM practices. Interviews were identified as the ideal tool or technique for data collection in this process.

4.4.3.3 Awareness on cloud computing in the private sector

In the context of this thesis, awareness refers to the understanding, and perceptions that actors hold on the concept of cloud computing in organisations under investigation. For the third issue of investigation, a*wareness on cloud computing in the private sector,* the same four organisations that are noted for their use of technology tools in management (Santam, Old Mutual, Metropolitan and Aerocon) were identified as sources of primary data. Four project managers, one from each of the four companies, were selected as the units of observation. These units of observation were selected on the basis of their direct involvement with projects that are core to the survival and competitiveness of their respective organisations. Interviews were identified as the ideal tool or technique for data collection in this process.

4.4.3.4 The status of project management efficiencies in the private sector

On the fourth issue of investigation, *the status of PM efficiencies in the private sector,* the literature was also identified as the necessary source of secondary data. Data from these sources was interrogated through reading, analysis and writing. As in the case of the previous issue, the same organisations were selected, and the same units of observations (project managers) were interviewed. In this instance project managers were selected on the basis of their first-hand experience of projects that may involve IT solutions. So, they were selected in the anticipation that they would have the most relevant and rich insights on the status of PM processes and efficiency levels in their respective work environments.

Project managers are expected to be familiar with the many projects taking place in their respective IT-centric organisations. The expectation therefore, was that if cloud computing is used to improve operations and projects in these progressive organisations, then project managers would be the most appropriately positioned sources of such information.

4.5 Data Analysis

The method of collecting data having been selected, the method of analysing data also has to be selected in line with the nature of the study (Babbie & Mouton, 2004). In the current study

interviews were used for data collection therefore Content Analysis was the most appropriate technique to be used for data analysis. Content analysis is defined as a methodological measurement applied to text or symbolic materials for social science purposes (Klenke, 2008). It is basically an instrument that is utilised in research to determine the presence of certain concepts within text (ibid.). It is used to study words or phrases from different sources such as literature, interviews and questionnaires (Welman et al., 2005). This method enables the interpretation of content, from a wide range of sources of data, to be interpreted and to become significant information (Klenke, 2008). Content analysis consists of a process, whereby the text is coded or broken down into manageable categories of a word, phrase or theme and then interpreted as closely as possible to the collected data (Aubel, 1984). This is a multistep procedure that is led by the purpose of the investigation, the questions to be answered and the hypothesis to be tested. In this context, interviews were used as a data collection method therefore the first step is to transcribe the recorded interviews (Aubel, 1984). This will result to transcripts that are ready for analysis. The second step would be to understand what is being investigated, thereby identifying variables to measure the issues being investigated (Wilkinson & Birmingham, 2003). This is done by developing categories, words or themes. At this stage colour coding is carried out by highlighting themes using a different colour for the them (Rubin & Babbie, 2010). This enables the researcher to know the number of times a specific theme was identified, thereby revealing the importance or lack of it in each theme (ibid.). This enables the researcher to analyse all the themes and the draw a conclusion at the end of the process (Wilkinson & Birmingham, 2003).

4.6 Conclusion of chapter 4

The aim of this study was to understand how the adoption of cloud computing is able to enhance PM efficiencies and outcomes in the South African private sector. The objective then, is to articulate clearly the research philosophy, which is part of the research design, and the research methodology used to achieve the purpose of the study. The research design outlines the ontological foundations of the phenomenon and enquiry, which is a basis upon which methodological assumptions are made by the researcher. To this effect the interpretivist approach is acknowledged to be appropriate, due the socio-technical nature of the current study. This forms a foundation to enable the researcher to select an appropriate research method that is aligned with interpretivism. Therefore a qualitative research method is selected to further the objectives of the study. In qualitative approaches a variety of sampling methods can

be used. Purposive sampling proved to be the most appropriate for this study. Content analysis was found appropriate for data analysis.

The next chapter outlines the data analysis process and gives a descriptive presentation of the findings.

CHAPTER FIVE

5. FINDINGS

5.1 Introduction

The aim of this study was to understand the adoption of cloud computing to enhance project management efficiencies and outcomes in the South African private sector. Operationally, the researcher sought to ascertain the extent to which cloud computing was (or was not) being adopted in PM in the South African private sector. Therefore, the aim of this chapter is to present the findings that emanated out of the research process followed in this study.

In presenting the findings, the chapter is structured into 5 sections, starting with an outline of the data analysis process in sub-section 5.2. This section is followed by a descriptive presentation of the factual information, based on the key themes, in section 5.3, a discussion of findings in section 5.4 and finally a summary and conclusion of the chapter in section 5.5.

5.2 The Data Analysis Process

The findings presented in this chapter are a function of a complex data analytical process emanating from the use of a structuration theoretical (ST) framework, within the content analysis technique – to contextualize, analyse and interpret data according to various emergent research themes. For example, the theory helped in breaking down the PM and cloud computing phenomena into various components – for a broader and more holistic analysis and understanding. ST also informed the shaping of research questions and the research themes that emerged as clusters under which various chunks of data could be understood, categorized and interpreted in the findings. Multiple stages of analysis were followed in preparation for the categorization and interpretation of data, with the main segments categorized (grouped) into the contextual building segment, and the interpretation process.

5.2.1 The Context Building Process

At the initial level of analysis, key concepts (and their underlying assumptions) – Structure System, Structuration, Agency, Reinforcement (reproduction) and Change (transformation), were drawn from the ST theory and used to categorize data in Table 11(Appendix 1) for interpretation and critique in this chapter. The first column in Table 11 (Appendix 1), consist of the key thematic concepts, with the second representing analytical translations as drawn from

interview transcripts. In the true content analysis fashion, each of the six concepts/themes is further divided into multiple sub-themes to simplify the analysis. The analytical approach then, was to use color-coding to identify data that corresponds to each of the themes. The corresponding data and the number of times a theme emerges in data transcripts is listed in Table 11 (Appendix 1). It is further described, interpreted and critiqued under the findings section, section 5.3 in this chapter (Chapter 5).

The main focus of the initial analytical phase was placed on the convergence of these ST concepts with data in the transcripts. Since structure according to Giddens' (1984) is represented by rules and resources, the concept of structure was divided into rules and resources, which, in the context of this study, consists of PM policies, regulations, methodologies and guidelines. The goal of this categorization was to ascertain the significance that the PM discipline places on the underlying determinants and enablers of practices, a continuation of these and a potential for innovative changes. In this respect, emphasis is placed on the type of rules (policies, guidelines, methodologies) cited by respondents, and the number of times such terms emerge in the transcripts. This is further linked to how the rules are related to emergent enablers in the form of resources. An account of this concept and of the pattern of its emergent themes is outlined in more detail under the findings in section 5.3.
The concept of resources is a significant part of Giddens' (1984) description of structure. In the PM context, resources are divided into human and non-human in this study. The aim of the analysis of this theme, as in the analysis of the rules theme, was to understand the type of human and non-human resources prioritized in PM, and the convergence between each emergent resource theme, the rules and related practices. As outlined in Table 11 (Appendix 1), the focus of this level of analysis was to identify different types of resources (and tools) and how rules are applied to channel these resources and tools towards continued or changing PM practices. The conditions that influence the continuity or the change of PM practices is elaborated in the next section on structuration process in Table 11 (Appendix 1).

Structuration according to Giddens (1984) refers to conditions that govern the continuity on the one hand, or a transformation on the other hand, of structure - as well as the reproduction of systems (ibid.). As shown in Table 11 (Appendix 1), the conditions that govern the continuity of structure in PM are identified as preferences of known practices and trust issues when it comes to the use of cloud computing. On the other hand, the conditions that govern the transformation of structure were identified as the efficiency and improvement of services in business, the demand for processing power and the benefit of low cost that comes with the use of cloud

computing. In this analytical process, the goal of identifying structuration in the PM discipline was to ascertain the conditions that cause the continuity of PM rules and practices or that bring about change in these practices. As shown in Table 11(Appendix 1), continuity and transformation are not just applicable to rules and resources but to systems. Emergent themes on this concept are described in more detail under the findings in section 5.3.

A system is defined by Gidden's (1984) as reproduced relations between actors or their collectivities, organized as regular practices, over time & space. The reproduced relations between actors are displayed as constant communication, the sharing of information, constant feedback and accountability among the actors (Table 11). In this analytical process, the objective of identifying systems in the context of the PM discipline was to ascertain the relational practices that take place among the stakeholders representing different business processes within the context of PM.

5.2.2 The Interpretation Process

The Structuration Theory (ST) concepts mentioned above were then linked to the research objective and the research question in the second level of analysis. In this process, the ST concepts were associated with a research objective and a research question – which were then broken down into four issues of investigation: Benefits of cloud computing in PM; Uses of cloud computing in PM; the awareness and perceptions of cloud computing in the private sector and finally, the status of PM in the private sector. The initial inferential data in Table 11 (Appendix 1) was associated with the four issues of investigation, which were then used as the major themes into which interview data could be categorized and translated. The color-coding format of content analysis was used to identify themes for further interpretation and critique.

In line with the research objective, analysed data was then interpreted according to the research questions associates with the four issues of investigation. In this respect, data is presented in a descriptive format, with a detailed discussion and critique preceding the conclusion to the chapter. It is on the basis of this analysis process that the findings are presented in section 5.3, and critically discussed in the section that follows.

5.3 Descriptive Presentation of Findings

This section presents the findings in a descriptive format, drawn from direct in-depth interviews held with respondents as outlined in Table 11(Appendix 1). In this table for example, structure

with its thematic elements of rules and resources, represents the first major theme in the ST framework.

5.3.1 The Rules Aspect of Structure in Project Management (PM)

In line with Giddens (1984) emphasis on the significance of structure, it is clear in the findings that the rules component (and its underlying themes) of structure plays a dominant role in project management practices. Whilst rules in this study are represented by policies, all respondents in the interview transcripts frequently cited regulations, PM procedures, guidelines and methodologies, these themes. In fact, themes that indicate rules were cited 21 times in the 7 interview transcripts (Table 11). This implies that PM is, predominantly, rules-based field of practice. However, varying levels of significance are attached to different categories of rules in the findings. For example, adherence to specific methodologies appeared more prominent than other categories of rules, with a methodology theme appearing 9 times out of 21 citations of rules across all transcripts. Policies and regulations emerged as the second most prominent category of rules, with the theme appearing 7 times followed by PM procedures and guidelines with 3 appearances in all transcripts.

5.3.1.1 Methodology/ies as Rules

The centrality of methodologies in PM was evident in various responses, including assertions that "…*applications that are out there which are web based come with the entire PM methodology*…" (DB_BCS – R35). This is presented as an accepted standard practice and a necessity upon which, regular implementations can be based. In essence, it is a standard practice and an expectation that for almost every task in PM, there needs to be one form of a technique (methodology) or another (PMI, 2013). In the words of one project manager on this point for example, "…*PM…comes as part of the PM tools and techniques*…" (TP_STM – R25) and "…*from every activity, from every phase, from planning, from executing and also to get to the point where you close out the report*…" (MR_ARCN – R15), a specific technique must be followed and applied.

Interviewee's responses revealed that even the choice of operational tools and applications should be methodology dependent, with adoption decisions determined by whether a technology application can "…*suit the PM methodology*…" (DB_BCS – R35) and not the other way round. It is clear therefore, that methodologies are treated as 'sacred holy cows' in PM. If there is a conflict between PM, the application tool and a methodology for example, only the

application will be tweaked "…*to fit different methodologies*…" (DB_BCS – R35), and a methodology is accepted as a norm that must be left intact. Policies and regulations were the second most significant theme after methodology, with the second highest number of citations across all transcripts.

5.3.1.2 Policies and Regulations as Rules

Sentiments from respondents place policies high both at the level of significance and complexity in their application to PM. Whilst significance is embedded in the cross-sectoral versatility of this business process, adapting the PM practice to policies across respective areas of project operations is seen as complex. Complexity implies a need for adaption to different policies – without compromising the fundamentals of the PM practice. On this point, one of the academic experts in the use of technology in businesses stated, "…*there are vertical markets where things are a little bit more regulated like in the financial services*…" (ER_UCT – R15). In vertical markets vendors provide customized services and products to a particular sector, in this case, the financial sector. The financial sector has policies that are non-negotiable with various regulations focusing on matters such as security, privacy, accuracy and consistency. As a result "…*you'll find that there will be some enterprises where they want control inside the organisation*…"(ER_UCT – R15) to ensure that these policies are not violated. There is a lot of pressure to comply with regulations hence the current practices are kept intact. In terms of technological innovations to improve PM however, "…*there has been …incredible advances and that's why this industry [finance] has had to change, the service models have had to change*…"(TP_STM – R26). In other words, policies in environments such as the financial sector determine the extent to which certain innovative solutions can or cannot be adopted. In this instance, the respondent (TP_STM_26) suggests that technological solutions have forced certain amendments to policies, on the one hand, and amendments to the way an innovative solution itself – can be applied in serving the sector.

Within the ICT solutions sector, the emergent 'Go Green' drive and its embedded policies offer yet another example of complexity. The challenge for a project manager is that "…*all businesses and most organisations now get scored on how green they are*…"(JM_DD – R9), meaning that beyond a need to observe sector-based policies on the one hand, and guidelines determining the adoption of a new technology solution, one must also embrace "…*those statutory obligations placed on businesses*…" (JM_DD – R9) to 'Go Green'. The least cited representatives of rules are PM procedures and guidelines.

5.3.1.3 PM Procedures and Guidelines as Rules

Despite the minimal recognition of procedures and rules in the findings, the Project Management Body of Knowledge (PMBOK), nevertheless, places great significance on procedures and guidelines in PM. In fact, project managers "…*look at ways of holding a piece of work [project] within the guidelines, [especially] within budgetary guidelines*…" (TP_STM – R13). There are guidelines in almost all aspects of PM, with Scope Management, Time Management, Cost Management, Quality Management, Communications Management, Human Resources Management, Risk Management, Procurement Management and Integration Management (Burke, 2011) – considered as the "…*9 pillars of PM discipline*…" (DB_BCS – R35). Because of the centrality of these components in PM practice, the accepted norm is to ensure that they are catered for in any enabling tool or application that is adopted and implemented to aid PM processes (DB_BCS – R35). For this reason, the understanding of procedures and guidelines is emphasized, with training and certification programs ensured to sustain the skill and enforce a continuous reproduction of the PM practice (TP_STM – R25). Therefore, procedures and guidelines as a component of rules are central to PM, they direct the process of the conversion of resources – into desired coherent project outcomes.

As a rules-based discipline and practice, loyalty to held PM standards of practice; rules and guidelines can override the potential uptake of technology solutions that are deemed non-compliant. Considerations for the adoption of cloud computing therefore are most likely to depend on the extent to which this innovative solution adds value without diverting from the core values of the PM business process. Findings on this aspect are presented in more detail in section 5.4. In conclusion to this section, it must be borne in mind that PM as structure is not just presented by rules but also resources (Gediehn, 2008).

5.3.2 Resources in Project Management (PM)

Rules and resources are used by agents to interact through exercising power by recreating and transforming the structure. Therefore resources were frequently cited, mostly because they allow the physical implementation of projects, thus they have clearly emerged as the most important aspect of PM in the findings (Table 11). For example, references to various forms of resources appear 348 times in the 7 interview transcripts, with the citations shared between the human and non-human resources categories. Within these categories, human resources appear 64 times compared to the 284 citations of non- human resources.

Whilst resources are important in PM, different levels of significance are attached to various themes within different resource categories. In as much as non-human are the cores of PM; human resources are even more significant in that they mobilize all resources to bring life to a project. The results support these assertions, human resources were cited 64 times in interview transcripts, with professionals mentioned 47 times, followed by expertise (skills) with 11 citations, and finally, project managers appearing 6 times in all transcripts.

5.3.2.1 Human Resources

In human resources, stakeholders/professionals proved to be the most significant in terms of the number of citations and the statements that transpired from the interviews. It was apparent that the ability of stakeholders to coordinate resources and apply rules was seen as important. PM has always been a discipline that utilizes individuals and teams of people to carry out activities in a project. With regard to teams in particular, one respondent re-iterated that as a project manager "...*you work with a team*…" (MR_ARCN – R20). In the context of this study therefore, the adoption of cloud computing is represented by agency. Where, agency is for the enhancement of PM outcomes. Thus teams do not only play a vital role in effectively coordinating both human and non-human resources, they also coordinate the activities related to each. In addition they play a role in the decision making related to the adoption of cloud computing in PM. One respondent indicated "…*it takes teams of people, to debate, what's the right way of doing it [adopting cloud computing]*…" (TP_STM – R14).

In this context therefore, respondents said it was significant that stakeholders interact, apply their minds, then exercise their power to decide whether or not to adopt cloud computing in PM practices. Thus "…*organisations have to carefully take that decision to go to the cloud*…"(JM_DD – R16), they must "…*make solid decisions about whether [they] want to use the cloud technology or not*…" (NM_OM – R5). To this effect, one needs "…*to create a strategy, you need to dedicate some people to get that sorted*…" (TP_STM – R20). This statement shows a clear link between human agents (human resources) in terms of how they apply rules (strategy or policy) as a power of agency to guide the implementation of resources into project activities. In this circumstance then, specialized professional skills were highly valued. Participants tend to identify human resources of the discipline, either as individuals or groups, as those possessing specialized skills, or simply as "professionals". A sentiment by one project manager that "…*from a quality point of view*…" a group of professionals (TP_STM – R23) are

able to focus on activities to ensure that the project follows the projected plans – illustrates this point.

The type of expertise and skills therefore, defines the type, role and function of an appropriate human resource for a particular project. In effect, sentiments show that without the adequate skills professionals would not succeed in ensuring project success. For example, skills that are required in PM include communication and negotiating skills, multi-tasking skills, administrative skills, problem solving skills and most importantly technical skills (Larson & Gray, 2011). In the context of using technology innovations such as cloud computing to advance PM processes however, technical skills were rated higher than other skills sets in the interviews. Additionally, the acquiring of technical skills were viewed as a challenge. This is due to the constantly changing technical skills requirement in technology innovations. To this effect a participant emphasized that It is important to "…*reskill them [project team] or look at other ways of dealing with that complexity*…" of changing requirements of skills (TP_STM – R19). Because of this belief, participants seem receptive to the prescriptive power (agency) that directs the way they should do things, to the extent of asking to be adequately skilled in order to be fully compliant.

In the agent-power-agency context, the most cited people in human resources are project managers. Given their agency responsibilities, they are described as individuals who need to be very knowledgeable in order to enforce rules that guide the exploitation of non-human resources into tangible project processes. To this effect, the ability of project managers to exercise power in recreating or transforming the structure comes through these debates and through the decision making process of whether or not to adopt cloud computing. The extent to which the human resource agents exercise power to reproduce continuous practices or to transform the practices towards the adoption of new innovations such as cloud computing in PM – is presented in detail in section 5.4. As important as human resources are however, it is only when they are viewed together with non-human resources that their meaning will make sense in the context of PM.

5.3.2.2 Non-human Resources

Together with human resource, non-human resources are an important aspect of structure in Structuration Theory. In this study, non-human resources were divided into 6 themes. In the interview transcripts IT Infrastructure has 60 citations, Software Programs and Applications have 40 citations and, Internet and Connectivity has 37 citations. However, references to Internet-based innovations such as Cloud Computing and its related solutions are generously

distributed among these emergent themes, across all the interview transcripts. Clearly IT Infrastructure, with the highest number of citations in the interview transcripts (Table 11) is seen as the most valued resource in PM. For this reason "…*many organisations have built and invested in their own IT infrastructure*…" (JM_DD – R6). Implications are that IT infrastructure is more than an option, but a necessity upon which the organisation's operations are based, more particularly when it comes to the potential use of cloud computing in PM.

Even though the cost of the IT infrastructure may be escalating, it remains an un-avoidable "overhead" due to its significance in modern business operations. In the words of one respondent for example, "…*there's a continuing cost of having to invest or re-invest in maintaining the IT capacity*…" making it "…*a very, very expensive overhead for many organisations which are not IT organisations*…" (JM_DD – R6), yet doing without this resource is not an option. Organisations "…*would rather outsource all of that to a service provider who is going to be able to do that for them, and being able to deliver that for them*…" (JM_DD – R6). However, "cloud computing" has emerged as the most useful alternative to organisational storage infrastructural needs. In order to provide cloud services however, cloud computing still needs a fair level of infrastructure backbone. Thus, it cannot be a complete replacement – it must be regarded as a supplement to the general IT resources of the entity (TP_STM – R3). For example, it can help "…*multiple stakeholders from the same infrastructure, some are far*..." (ER_UCT – R4) to share the infrastructure at the same point. With this technology however, projects can enjoy the benefits of "…*lower cost to infrastructure, lower setup, it's a more tax efficient way of doing it*…" (TP_STM – R5). In the PM context thus, the IT infrastructure is seldom viewed in isolation, but cited within the context of other enabling technologies such as software programs and applications. The findings on the extent to which the significance of the IT Infrastructure resource integrates with certain rules and policies to inform the potential of cloud computing in PM is presented under section 5.4 later in this chapter.

Software programs and applications are the next most cited resource with a notable level of significance in the transcripts. In fact, most respondents portrayed PM software programs as a necessity in managing projects. In support of this claim, respondents said that project managers need some sort of application like a "…*PM application*…" (DB_BCS – R31), "…*let's say*… *Microsoft Project*…" (ER_UCT – R18), "…*Dot Project*…" (BK _CPUT – R15) or "…*SAP as an application*…" (JM_DD – R11) in order to effectively carry out project activities. PM software programs offer project managers innovative ways to effectively develop, manage and implement project plans, often through systemic processes such a work breakdown structure, Gantt charts,

procurement schedules, resource planning, project accounts, project control through tracking progress and analyzing workloads. Take for instance "…*dot project is an open source Internet program that you can set up and manage projects*…" (BK _CPUT – R15) in or you "…*can create something on it [PM software] like, project program*…" (MR_ARCN – R27). In the networked society of the modern inter-connected world (Castelles, 2002), digital software programs all information resource are stored on IT infrastructure, therefore easy to store, access, manage and exchange over the "cloud" innovation. In the financial sector such as banking and insurance, where the majority of resources are electronic in nature – built on software programs, cloud computing is clearly relevant. With this background, findings on the practical links between Software Programs and Applications, the rules of operation, and the continuation and changes in PM practices, are presented in more detail under section 5.4 later in this chapter.

The Internet was also highly rated in the interviews, with most respondents describing it as a link, connectivity or even an enabler of core interactions and information access. For example, if you "…*lose Internet access you don't have access to your staff*…" (ER_UCT – R16), with the interruption of project operations as a major risk. In other words, "…*if you are in a business and you got only one Internet link outside from your building to your service provider, if someone cuts that line, you are effectively off line*…" (ER_UCT – R16). The Internet also serves as a connectivity platform for networked solutions such as cloud computing. Without the Internet therefore, the connectivity needed to facilitate rules, resources and processes towards a successful project activity, would be limited. In a discourse about the potential of cloud computing in PM however, the Internet is not viewed in isolation, but often cited together with hardware tools, and Internet-based innovations such as Cloud Computing.

Internet-based innovations like Cloud Computing and its related solutions emerged many times in all transcripts. The cloud computing related solutions were broken down into 9 sub-themes. They consist of the Random Access Memory (RAM), with 39 citations, servers with 33 citations, storage with 28 citations, scalability with 17 citations, processor with 16 citations, resource pooling with 5 citations, web server with 4 citations, computing power with 4 citations and drop box/Google drive/Hotmail with 2 citations. Since the aim of this research was to understand the dynamics of the adoption of cloud computing in PM, this background is central to the findings. As the major theme of investigation in this thesis then, findings on the extent to which the significance of cloud computing related solutions enhance PM outcomes, is presented under section 5.4, later in this chapter.

In the context of cloud computing adoption in PM, RAM appeared the most significant in the interviews. For example, most respondents labeled cloud computing as a platform that gives you access to more RAM than an average organisation can have. Sentiments were that with cloud computing you have "…*the RAM of this machine and the RAM of that machine and so it becomes infinite*…" and available to you (BK_CPUT – R1). In business processes inclusive of PM processes, the significance lies with the ability of the RAM to ensure enough space/storage to store and process data. Through this tool, organisations can "…*distribute…work to all these machines*…" (BK_CPUT – R1). It is clear in appraisals of RAM, that Storage and the CPU technology applications are important in PM, albeit, not as independent but as inter-linked and coherent packages. For example, the Internet needs the RAM, and RAM cannot function outside a system to which it is designed to enable access, hence, concurrent references to the importance of the server in most accounts of RAM and storage functions.

The server in particular, adds to the computing and server capacity that is required for storing, processing and managing business processes. Respondents not only referred to the very large servers which cloud computing provides, but also the accessibility to those servers from any geographical location. In reference to the significance of a server in enabling cloud computing, a client service officer said "…*customers want to do away with their own ability and their own requirement to be able to provide that compute and server capacity*…" (JM_DD – R13). Thus, "…*a massive server sitting somewhere in a location and everybody makes use [of it], for instance in that server or that computer to run off his project*…" (DB_BCS – R31). Effectively, the size of a server and the accessibility of it were seen to be beneficial in the adoption of cloud computing in PM and other business processes.

In terms of the storage capacity, most respondents valued cloud computing in terms of the accessibility of storage through any information device regardless of your location. With cloud computing any organisation could "…*access complete compute resource storage*…" (ER_UCT – R6), and can "…*connect a computing device and it can give you computing power and storage. And you can make it available as you wish*…" (DB_BCS – R1). To this effect respondents found that the benefit of accessible storage can be useful and necessary for teams working remotely or on virtual projects. However the offering and availability of storage in cloud computing is enhanced compared to the normal storage concept; hence scalability became the valued capability.

As a cloud computing related resource, scalability also appeared to be significant in the transcripts. Most respondents appreciated the ability of cloud computing to shrink or increase storage capacity according to the amount of data in use. For example, organisations could "…*access complete computer resource storage*…" (ER_UCT – R6) and service providers can "…*decide to slice and dice it up and slot it up for their end users*…" (ibid.). As a result, one respondent recommended cloud computing to organisations that have "…*a system that has to save a lot of people or a system that's using too much computing power*…" (BK_CPUT – R6). Another recommendation was made to "…*financial institutions where they need high demand at short periods*…" (DB_BCS – R27) on a monthly cycle. To this effect, users are only liable for the amount of storage that they use. This is significant in PM as projects have a beginning and an end. When a project starts there is normally a large amount of data or documentation, however at the close out phase, data and documentation decrease and therefore the storage used decreases. In addition to the scalability of the storage, is the importance of the ability of cloud computing to process business processes efficiently.

The next significant cloud computing related resource is the processor, the Central Processing Unit (CPU). It's citing was significant in the transcripts respondents referred to its ability to increase the processing power/speed in processing business processes. To this effect, cloud computing is also recognized as the "…*availability of processing power*…" (DB_BCS – R1). Especially "…*when you are doing a lot of computational mathematical staff*..." (BK_CPUT – R1). In essence, cloud computing pools a number of resources and makes them available to users.

The next significant cloud computing related service was Resource Pooling. Sentiments from respondents showed that the ability to afford and access a number of resources on a single platform is beneficial. For example it has becomes possible to "…*have access to a larger pool of resources than they [organisations] would necessarily be able to afford*…" (ER_UCT – R11). Therefore "…*the ability to pull all these resources to one pool then share the access*…" (ER_UCT – R4) is quite significant and advantageous.

Findings on the significance of, and the extent to which, cloud computing related resources integrate with PM practices is presented under section 5.4 later in this chapter. Whilst non-human resources were of significance, human resources were equally important. Closely related to the phenomenon of rules and resources however, is the concept of power as embedded in agency. One of the objectives of this study was to understand this phenomenon. Especially the dynamics of a continued re-enforcement of rules in PM, and developments that

affects divergence (transformation) from rules, giving rise to new innovations for improved social practices. This phenomenon (to re-enforce or transform/change structure) is referred to as structuration (Giddens, 1984).

5.3.3 Structuration in Project Management (PM)

In the current study, the structuration concept was divided into 2 categories. The first category represents conditions to transform structure (rules, resources, and the combining factors thereof). These were further divided into 12 themes (1) Limited Storage (with 11 citations); (2) the Evolving Technology (with 3 citations); (3) Cost of Employee Training; (4) Infrastructure Costs and Maintenance as well as (5) the Estimated Future Trends appeared (with 3 citations for each of the three themes), and, (6) Improvement to Service Levels (with 2 citations) – across all interview transcripts. The rest of the themes: (7) Resource Distribution Intelligence; (8) Demand of Processing Power; (9) Opportunity to Solve Industry Problems; (10) Efficiency; (11) Time to Market, and finally, (12) the Growth of the Organisation, were also mentioned once by at least one of the participants in the interview process (details are outlined in Table 10). The order of citations clearly ranges from a high total of 11 citations, which signifies popularity and perhaps, higher preference - to the less popular themes with the least number of appearances in the transcripts. In this case, findings show that the challenge of limited storage (which appeared 11 times) is a key driver for change towards the adoption of cloud computing when starting new projects in financial organisations. The acceptance of the advantages embedded in new evolving technology, the escalating cost of training employees, the cost of infrastructure maintenance, and the strategic positioning of the organisation to easily adapt to future trends – also emerged as the main drivers of change – towards the adoption of cloud computing technologies for PM in the financial sector. On this theme, more detailed sentiments from participants are presented in section 5.3.3.1 below.

5.3.3.1 The Conditions to Change/Transform Structure

The conditions to change the structure that proved to be the most significant in this category are detailed in this section. In terms of the storage challenge for example, arguments were that there is a "…*need for storage facilities*…" (NM_OM – R14), with others clearly stating that "…*about the space*…", *that's the [organisation's] problem*…" (BK_CPUT – R18). To emphasize the issue of space, another respondent even said, "…*At this stage, the demand is for storage and cheap storage*…" (DB_BCS – R20), meaning that whilst more storage is needed, only cost-effective alternatives are required. On this point, cloud computing is generally accepted, not only

as a viable effective storage solution, but also a cost effective alternative to both the storage and managing of information. Reasons, according to one respondent are that "…*the cloud is always cheap*…" (BF_CPUT – R17), meaning, "…*it definitely makes financial sense to move across*…" (TP_STM – R2). Take for instance, the "…*licensing model per user is quite cheaper*…" (DB_BCS – R32). This will eventually become the cost effective way of reducing licensing costs. Hence, organisations are looking into the use of cloud computing for storage purposes (JM_DD – R16), a move which may change the traditional way of storing information in organisations.

Advantages associated with the evolving new technologies also emerged as drivers of cloud computing acceptance among participants. First and foremost, respondents acknowledged, "…*Technologies evolve*…" (JM_DD – R14) and that there is "…*constant upgrade of versions of all of the IT components*…" (TP_STM – R19). A common belief was that "…*in years to come certain things [software programs] are going to become by default available from the cloud*…" (JM_DD – R17). In other words some of the software programs and applications will only be accessible in the cloud, hence a need for the uptake of cloud computing in modern business processes. Further, since "…*technology is certainly a massive disruptive factor*…" (TP_STM – R26), it will be a challenge for organisations to stay with the same components of technology. Organisations therefore, may adopt new technological innovations at least, if not for any other reason, to stay in line with emerging technological trends. That future trends in technology are almost inevitable emerged quite strongly in interviews, with most participants predicting definite changes in most aspects of business processes in the near future. As such, perceptions were that since organisations will eventually be forced to use the cloud, it is a matter of strategic prudence to start adopting it as soon as possible.

Concerns about the expenses associated with training employees to maintain the status also emerged as a driver for the uptake of cloud computing. One of the reasons on this point is that the "…*skill that people need to have*…" (JM_DD – R14) keeps evolving, meaning that the "…*skills set required keeps changing*…" (TP_STM – R19), needing constant updating and change. The assumption in this respect is that the cloud computing innovation reduces this human resources challenge and related costs burdens, at least on the storage and related information management functionalities. The same arguments were made about infrastructure and its related maintenance cost. For example, there is always a need to "…*refresh your IT components*…"(TP_STM – R19) and in general, it is "…*costing you to maintain it*…" (TP_STM – R17). If the organisation can find an alternative to keeping and maintaining some of their own

infrastructure, therefore, cloud computing can easily be considered a viable option for adoption. Cloud computing is viewed in the positive light in this respect. For example, respondents describe "… *its lower cost to infrastructure, lower setup*…" as motivating factors, with a respondent going as far as to label it as "…*a more tax efficient way of doing*..." things (TP_STM – R5).

General sentiments to the fact that cloud computing also serves as a vehicle for "...*intelligence*…*to distribute resources*…" (BK_CPUT – R12) for improved use to supplement its operational value as a tool, and to address the high demand for processing power. Events like the Two Oceans marathon that takes place once a year require co-ordination and adequate IT systems. Organisations that run events or project of such a nature always need "…*high demand at short periods*…" (DB_BCS – R27). Further, whilst participants believe that cloud computing provides adequate storage and ample processing power dependent on the user, other participants described it as an efficiency enabler, which suggests that "…*efficiency for some organisations could be the main driver*…"(JM_DD – R16) to move to the cloud.

Findings on the significance of and the extent to which the conditions that govern the transformation of PM practices through the use of cloud computing are viewed and presented under section 5.4 later in this chapter.

5.3.3.2 The Conditions to Re-enforce Structure

The second category of the structuration concept encompassed conditions that tend to reinforce the structure. These conditions were further divided into 4 themes (1) a Lack of Trust in the Security of Unfamiliar Innovations (with 4 citations); (2) Belief in the Potency of Existing Employee Training Practices (with 2 citations); (3) Preference for In-house Infrastructure, and finally (4) Contentment with Old Technology (with 1 citation each) – from the interview transcripts.

A lack of trust in the security of new innovations, according to the findings, seems to be a main reason for organisations to resist the adoption of cloud computing. This is especially true for the financial sector because there is "…*huge sensitivity…in wealth management*…" (NM_OM – R4) when it comes to "…*confidentiality of the information*…" (NM_OM – R13). However, confidence does develop over time, with trust in a technical solution often improving as "…*comfortability with security*…" grows (NM_OM – R10). That is, it is when "…*people get comfortable with it that's when they'll start engaging with it…"* (TP_STM – R11). Seemingly, organisations need to

cautiously accept and use cloud computing for a period, long enough to dispel security fears, before they can fully adopt it in their day-to-day operations. Similarly, the belief in the Potency of Existing Employee Training Practices tends to encourage resistance to change. With changing technology for example, some organisations often continue with the practice of training employees to operate in old ways rather than training them to adopt cloud computing. That way, the current PM practices and the current state of organisations are re-enforced; thereby ensuring that change does not take place.

Preference for in-house infrastructure also stands to discourage acceptance of emerging technology solutions, such as cloud computing, particularly where individuals are comfortable with tangible items like hardware. Some organisations and employees for example, "…*still prefer to send the infrastructure dude to the server*…" (NM_OM – R2), as opposed to trying external solutions. Often the trend is that individuals who work with old technologies find it difficult to change to new technologies, because it seems "…*difficult for them [some organisations] to adopt change [current technology]*…" (TP_STM – R26). A general explanation was that once employees become accustomed to a type of technology for prolonged periods, they tend to have difficulty in taking up new technologies.

Nevertheless, expanded findings on the extent to which the significance of the conditions that govern the continuity of PM practices and the resistance to the adoption of cloud computing, prevail, is, presented under section 5.4 later in this chapter.

5.3.4 Systems in Project Management (PM)

The Systems concept is represented by reproduced relations between actors organized as regular practices (Giddens, 1984). In the current study, systems are therefore represented by 5 themes. They consist of, (1) Constant communication (with 6 appearances), (2) Accountability/follow up (with 2 citations), (3) Meetings, (4) Reporting/feedback and (5) the Sharing of information (with one appearance for each).

The significance of constant communication is not only embedded in the statements of respondents but also in PM practice. Basically, for a project to succeed there have to be continuous communications. Communication is for the purpose of issuing instructions, solving problems, making decisions and ensuring everyone is updated on project matters. PM therefore, is considered to be "…*quite communication intensive*…" (NM_OM – R14) in that team members need to share information, exchange ideas on a regular basis and influence attitudes.

And, the "…*breakdown of communication impacts everything*…" (NM_OM – R11). As a result it is important to continue using platforms like "…*phones, video conference, to talk through it [all]…"* (NM_OM – R15). However, since face-to-face communication remain the most potent form of interaction, ideal technology should offer as close to a "…*face to face*…" format of communication solutions as is technically possible (MR_ARCN – R26).

In this respect, synchronous interactive on line solutions are preferred (TP_STM – R26). Ideally, constant communication is considered vital in producing and maintaining potent relations between the project managers and stakeholders. In other words communication is a critical link between actors, ideas, and information that is necessary for project success. As it emerged in the findings however, cloud computing was considered the most viable (if not an ideal) alternative, in this respect. Illustrating the potency of cloud computing in facilitating real information exchanges, for example, one PM reflected on personal experience, saying that "*during execution* [when] *the teams are in different places, we don't* [even] *have to get on the phone or be in the same place to know how C and D are progressing within the project…*" (NM_OM – R14). To make this point even clearer, this respondent used a practical example where one project team member was on a contract site in another country whilst the rest of the teams were in South Africa. In his illustration, he said "…*like I explained before, where I draw up a business case but my reviewer is in Timbuktu, I put it on the cloud. He accesses it from Timbuktu. He reviews it. We get on the phone, we video conference, we talk through it, he does his…review… he puts it back on the cloud, I access it from here, and so forth*…" (NM_OM – R14). It is clear in this example how cloud computing helps simplify interactive information exchanges between project partners in different locations.

5.3.5 Summary to the Description of Findings

The findings in the previous section can be summarized in 7 important points. Starting with the concept of structure, (1) rules were presented as an important part of PM, although the various aspects of rules vary in their levels of significance. In this study for example, most PM processes are based on specific methodologies – more than being dependent on policies and regulations. They help enforce established procedures that lead to project outcomes. Equally significant were (2) human and non-human resources, largely because they are physically exploited through rules, into tangible project outcomes. Whilst project managers are the core of human resources, information technology infrastructure, systems and tools clearly emerged to be the leading forms of non-human resources in the study.

Under the structuration concept, (3) conditions that determine either the uptake or rejection of cloud computing in PM were afforded high significance in the interviews. However, participants seemed to lean more towards openness to new innovative PM practices than to the rigid dominant practices in the findings. In other words, conditions that favor the adoption of cloud computing in PM out-numbered those that may result in its rejection, according to the interview transcripts. It is therefore apparent that power and domination are not an issue because they are not coming out strongly in the study. This shows flexibility and room for new innovations. The adoption of new innovations introduces a new practice, which is first accepted as useful in principle. The message of this observation is that there are a number of opportunities for the adoption of cloud computing which may result in the transformation of structure and system/s in PM.

Finally, a system as the third major concept in structuration theory, (4) reflects the contrast between rigid adherence to accepted normative ways of relating and doing things on the one hand, or flexibility and openness to embrace new innovations and related new practices in PM, on the other. On the point of reproduced relations and practices, findings suggest interactions and relations that are open to the uptake of emerging technology such as cloud computing in PM. A belief is that cloud computing introduces new ways of doing the usual things in PM, much more efficiently. It makes it easy for stakeholders to communicate, access information remotely and to hold continuous meetings for feedback or reporting. It also provides a common platform for remotely located stakeholders to hold joint meetings in real time, which is vital in PM practices. However, despite the positive sentiments about cloud computing, an element of cynicism about the relevance of cloud computing also emerged in the findings.

Whilst some statements praised cloud computing, other statements were critical of the new technology. One criticism that a respondent mentioned is the accountability gap that cloud computing creates between the project manager and his team. The challenge is that as technology advances, and cloud computing is adopted; it liberates individuals to exercise agency by focusing on the technical aspect of PM. The concern was that in this way the conventional PM practices and their related levels of accountability will be eroded. The feeling was that there has to be a way to "…*Hold them [people] accountable*…" (MR_ARCN – R13) and "…*bits of follow ups are needed*…"(MR_ARCN – R25) when the technology has been adopted.

Another criticism was that "…*cloud things are often very difficult to customize. For example, …if a provider has a software running on a cloud, and we have seen that personally ourselves, it's*

very cookie cut, in terms of their workflows…but it always comes down to cost. It always comes as a customized feature or an extra thing that you need so you got to be able to say if I take that then I live with the fact that I can't much change it, I must live with their view of the world. Often their view of the world is not to take into account your business flows, your business processes, they would have a standard approach saying, we doing this on PMBok or whatever. And they could be very rigid." (ER_UCT – R25).

Whilst it is clear that not everyone is prepared to blindly 'sing the praises' of cloud computing, a message of acceptance is nevertheless present in the critique. For example, a statement that "*It always comes as a customized feature or an extra thing that you need"* clearly reflects admission of the 'need' – or something they cannot do without. In acknowledging this reality, the participant concluded that *"…so you got to be able to say if I take that then I live with the fact that I can't much change it, I must live with their view of the world"*, meaning that as much as it is not perfect, one has to be prepared to live with it.

The objective of this research was to understand the extent to which the cloud computing innovation is acknowledged, adopted, and is integrated into business processes, such as PM, in the private sector in South Africa. To address this objective, so as to address a research question of this study, a discussion and critique of the findings is presented in section 5.4.

5.4 Discussion of Findings

The previous section drew from the structuration theory to analyse interview transcripts data on the potential of cloud computing, and the factors influencing its adoption (or non-adoption) in PM. This current section builds on the data analysis of section 5.3, to present a comprehensive discussion and critique of the findings. To frame the discussion, the researcher draws on a research question to reflect on the extent to which the research objectives have (or have not) been achieved. In this process, each research question is broken down into 4 issues (variables) of investigation - the Benefits, the Uses, Awareness and Perceptions of cloud computing in PM and finally, the Status of PM efficiencies in the private sector. These themes were embedded in the research interview topical themes (or sub-questions) with respondents, as outlined in Table 4.

Table 4: Number of Respondents

Organisation	Title/Role	No of Participants	
		Selected	Responded
UCT*	IS Lecturer	1	1
CPUT**	IT Lecturer	1	1
Damension Data	Client service officer	1	1
Business Connection	Client service officer	1	1
Santram	Project Manager	1	1
Old Mutual	Project Manager	1	1
Aurecon	Project Manager	1	1
Metropolitan	Project Manager	1	0
	Total no of Responds	8	7

* University of Cape Town (UCT)
** Cape Peninsula University of Technology (CPUT)

Table 4 outlines the names of organisations (units of analysis) and the number of respondents (units of observation) that actually participated in the interview process – relative to the original selected sample in Table 3 (in Chapter 4). As depicted in Table 4, only 7 respondents (out of the sample of 8) actually participated in the interview process. The project manager of Metropolitan Life had initially agreed to participate in the study, but for unknown reasons, was not able to participate in the interview.

Following this account concerning the respondent participation rate, is the presentation of the findings across the 4 areas (themes) of investigation. Findings on the first theme of investigation, the benefits of cloud computing in PM – is presented in section 5.4.1.

5.4.1 Benefits of Cloud Computing in Project Management

Under this theme, the researcher wanted to know what the level of knowledge on the benefits of cloud computing in PM is, particularly in the private sector. For this purpose, interviews were held with participants from 7 organisations that had been identified as the relevant units of analysis. Questions and descriptive first level responses are shown in Table 5 and each of these responses are dealt with in detail in the sections that follow.

Table 5: Benefits of Cloud Computing in Project Management

Questions	# of TR*	Responses										
		Accessibility of Resources	Operational Flexibility	Sharing of Information	Convenience	Cost Efficiency	Time Efficiency	Enhanced Quality	Scalability	No Benefits	DK/ NR**	
1. What are the benefits of cloud computing?	8	7	7	4	3	7	3	1	6	0	1	Number of respondents per response item
2. What are the benefits of cloud computing in PM***?		4	6	2	2	5	3	1	3	1	1	

* Total Respondents
** Don't Know/No Response
***Project management

The first question presented to all respondents was, "what are the benefits of cloud computing?" The general benefits of cloud computing, according to the majority of respondents in Table 5, are the improvement of accessibility to resources, operational flexibility, sharing of information, convenience, cost efficiency, time efficiency and also scalability.

5.4.1.1 Accessibility of resources

A response to the question whether respondents find cloud computing to be beneficial, is captured in their collective sentiments on technology tools and systems generally. The findings in section 5.3 indicate that IT tools and systems are the most prevalent of non-human resources in PM. One of the reasons is that ICT facilitates the accessibility of information resources, and this aspect of cloud computing is highly rated (Buyya et al., 2009). To illustrate this point, one respondent said "…*I can access applications as a service, sales forces as application, Facebook as an application, SAP as an application, which I can now access from the cloud*…"(JM_DD – R11). The most obvious advantage arising from this account is that the cited functions seem to be purpose-focused, which translates into an advantage for productivity. Of added significance is that it is not just the applications that are accessible but the actual infrastructure that is built into the cloud (Kim et al., 2012). This is especially beneficial for small organisations that might not have infrastructure "…*of their own where they can actually go and share infrastructure via the cloud*…" (TP_STM – R1). In the same light, client service officers felt that since "…*you can make it available as you wish, on demand*" (DB _BCS – R1), that access is unlimited, which adds an element of convenience. Further, "…*a lot of people with low skills*"

(BF_CPUT – R23) can now be empowered with “access to computing power” (ibid.) and to information (MR_ARCN – R12). Whilst the advantage of the accessibility function is evident, one can only ask whether it is adequate to drive the adoption of cloud computing. Answers may depend on the context, the objectives as well as the technology needs of the business. For a business with accessibility limitations, this aspect alone would justify the adoption of cloud computing. In general then, it becomes both logical and necessary to make considerations on added benefits relative to the costs involved.

It is clear in the findings however, that cloud computing offers more than just accessibility benefits to an organisation, and ultimately, to the management of various projects (Nicoletti, 2012). In relation to this point, one academic expert felt that cloud computing is more valuable, generally, as a pool of resources. In linking this to PM he said, “…*resource pooling is an important one, so the ability to pull all these resources to one pool [whilst sharing] the access*” (ER_UCT – R4) is the most significant advantage of cloud computing in collaborative projects.

Drawing on the structure, system and structuration concepts in section 5.3, a possibility in the case of this study would have been for practitioners either to be constrained by loyalty to familiar practices and rules (resist change in favor of reproducing structure), or to be open to the adoption of new innovations and change. Whilst PM is clearly a rules based field (Burke, 2011), openness to new technological innovations and change is evident in the findings. In this respect, sentiments about the origins of these tools reveal positive perceptions accorded to the inventors, with most respondents describing them as creative innovators who introduced new helpful solutions. In this context, one project manager described the originator/s of cloud computing as “…*some innovative person [who] decided that there’s a different way to do things and for it to be accessible wherever you are in the world*…” (NM_OM– R1), which is a praiseworthy statement. From a structuration theory perspective however, a deduction is that instead of inflexible loyalty to rules and ultimately, a resultant reproduction of structure, the trend seems to lean more towards transformation and change – in favor of “new helpful” innovations and adaptations to related emergent social practices in PM.

For PM in particular, what respondents appreciated most was the ability to access these resources anytime, and from anywhere (MR_ARCN – R12). In PM, it is not rare to find the project team dispersed all around the world, and under such circumstances “…*the key thing is you want availability, that [the] system should be available to the users when they want it* …” (BF_CPUT – R15). For PM success, tools are a pre-requisite therefore all project

managers/teams require access to tools (Larson & Gray, 2011). The great advantage in this respect then, is that cloud computing seamlessly makes available resources "…*for logistically displaced teams where we [members] are not in the same place*…" (NM_OM – R14). For example, "…*your Gantt chart and all will be more accessible from anywhere*…" (DB_BCS – R36).

It is clear therefore, that cloud computing is a value adding innovation that makes functions and processes accessible beyond and across borders, easily, conveniently and flexibly (Nicoletti, 2012).

5.4.1.2 Operational Flexibility

An additional advantage of cloud computing, and a motivation for its adoption in the private sector according the participants is that it facilitates operational flexibility. Participants tend to use three service models of cloud computing to illustrate this point, referring to Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) (Numri, 2009). With SaaS users/organisations "…*can access applications as a service, sales forces as an application, Facebook as an application, SAP as an application* …"(JM_DD – R11) from the cloud. Therefore, there are options available depending on the objectives behind the deployment of the operations on the cloud platform. These options assist organisations to increase efficiency, which addresses operational flexibility.

Applications that enable operational flexibility were frequently afforded positive appraisals, with some respondents saying that "…*what cloud does is that it brings an intelligence application…that distributes resources where they are efficiently needed*…" (BF_CPUT – R12). The feeling is that such applications provide operational flexibility with various options for an organisation or a project, as well as other benefits. For instance, cloud computing "…*can provide additional computing processing power as well as memory and storage. So it [cloud computing] is very flexible in that regard*…" (DB_BCS – R1). It can also provide automation where organisations can access specialized applications with modification flexibility that is required by their operations (Dillon & Chang, 2010). This refers to PaaS (Taft, 2011), where "…*the user does not necessarily have a little bit of a dashboard where he says I want so many of this and so many of that, then it's just self-provision automatically*" (ER_UCT – R2). PaaS seems to provide a little bit more flexibility to an organisation, though IaaS can provide an even broader flexibility. An organisation may require the outsourcing of servers, networking technology, storage and applications. Then the IaaS model becomes appropriate where the

companies have teams where they have some "…*understanding of servers, databases, network, integration*..." (TP_STM – R22). In this case IaaS will allow for a provision of an even larger spectrum of functions to support IT operations (Kim *et al*, 2012).

However, a lack of trust of new technologies was raised as a significant impediment to the adoption of cloud computing in section 5.3 of the findings. That is, whilst participants expressed high levels of excitement about the flexibility benefits, skeptics were concerned about the security risks brought about through the flexibility element. In mission critical organisations and projects for example, questions are raised on the diligence of entrusting one's security assets to a third party (cloud service provider). This concern however, is shortsighted in failing to recognize that contracting parties can simply be diligent in observing international, national and commercial law provisions and remedial aspects in client and service provider contracts. As if this was not shortsighted enough, concerns about vulnerabilities to unscrupulous practice and risks associated with cyber-crime as reasons why cloud computing should not be accepted are also raised. There are concerns that come with "…*exposure, the risk could be, are you okay with storing … personal information…*" (ER_UCT – R16). For example, there could be a situation where information on the cloud could be accessed and fall into the wrong hands, or a project stakeholder, operating under a poorly secured network environment, could gain unauthorized access to organisational information assets. Once again, as is the case with any other technology, the issue of training and adherence to diligent behavior becomes a pre-requisite to a successful adoption and use of the cloud facility. In response to certain special circumstances a private cloud is available to secure confidential data for organisations yet allowing the sharing of information within the organisational boundaries (Zhang et al., 2010).

Considering the aspect of operational flexibility, the question of the benefit of cloud computing in PM came up very strongly. One of the project managers said that there has to be flexibility in the IT infrastructure, failure to manage this aspect may cause major constraints in enhancing project outcomes in a business (TP_SANTAM – R2). In addition to such matters, deploying PM operations onto the cloud may enhance project outcomes especially when the organisation is expanding. Therefore there may be a requirement "…*to expand resources…to continue keeping the same level of service so the cloud will intelligently expand and give that, so if you are a company and you have that aspect then, yes you should take that management system to the cloud…*"(BF_CPUT – R15). Additionally, PM processes can be simplified by utilizing applications that already exist in the cloud, in particular the project management program. This "…*assists on everything [processes], it's the program you use to create that program for your*

project …" (MR_ARCN – R2). Another tool that assists project managers with estimations and forecasting is a "cloud based application that project managers use on a day to day basis, called sales force…" (JM_DD – R18). This kind of operational flexibility that has been realized by project managers has persuaded service providers to develop applications for PM that "…*fit different methodologies so depending on what you want to do so it's from the whole 9 pillars of PM discipline*…" (DB_BCS – R35).

Lastly, the access to these resources from everywhere also provides operational flexibility. To illustrate this point, one of the project managers reflected on "…*a business case" making a hypothetical scenario, saying if "…my reviewer is in Timbuktu, I put it [a business item or file] on the cloud, he accesses it from Timbuktu, he reviews it, we get on the phone, we video conference, we talk through it, he does his, I don't know, he review things, he puts it back on the cloud, I access it from here and so forth and so forth and that's constant throughout the project*…" (NM_OM – R14). In this regard the important aspect of operational flexibility is also influenced by the ability to access and share such resources.

5.4.1.3 Sharing of information

Another advantage of cloud computing according to the participants is that it enables the sharing of information. It is "…*mostly used for sharing, more than what it can be used for or more than what it was intended for* (MR_ARCN – R28). For example, "… *in retail with your reps and staff where they want to have information on demand from a remote location*..." (DB _BCS – R33), sales representatives can all connect to the same cloud, which will enable them to share information within that boundary in real time.

Another example is given where the respondent is having a meeting with a stakeholder who is overseas. The stakeholder would "…*get into their meeting room, or sit at his desk at home, on his bed at home, wherever, we log onto the same place and we get the same documents and we talk through the same document*..." (NM_OM – R15). In fact, there are numerous additional advantages associated with the simplified sharing of information (Berl et al., 2009). In addition to added convenience in operations, this also allows individuals in the organisation to have "…*awareness … in terms of getting information out there for everyone* …"(MR_ARCN – R12).

5.4.1.4 Convenience

One of the reasons to explain the positive acceptance of cloud computing in PM is that it adds convenience to operations (Nicoletti, 2012).

Participants felt that cloud computing makes operations easier compared to the conventional ways. For example, one of the participants felt that "…*it enhances or makes life maybe a bit easier*" (DB _BCS – R36). The main reason is that "*there are no technical complications for the cloud because it's someone else's problem. Let's say Amazon provides you with the cloud service, it's their problem to worry about the electricity they are consuming, to worry about the space and how they are going to add all these machines when they see that traffic is spiraling or sky rocketing, that's their problem*…" (BF_CPUT – R18). For PM in particular, "…*it's a tool that assists the project managers*…" (DB _BCS – R36) in their operations, and "*it makes the sharing of information easier"* (MR_ARCN – R2).

From the perspective of structuration theory in section 5.3, however, it emerged that rules are a determining aspect of PM. Therefore, the cited convenience that cloud computing promises to PM may depend on the procedures and methodologies followed to integrate and implement PM to business processes of the organisation. The question of agency – as pertaining to the power and willingness of decision makers to adopt the tool and to encourage adjustments into new practices, will determine whether cloud computing is adopted, and whether the said conveniences are realized. In this respect, decision makers in the corporate sector may require more than just the convenience, but also cost-efficiency, time-efficiency and the quality enhancing aspects of the tool in order to buy into its adoption.

5.4.1.5 Cost efficiency

As shown in section 5.3, another advantage of cloud computing is that it reduces information management costs (Angeli & Masala, 2012; Misra & Mondal, 2011). For PM in particular, participants felt that "…*the cloud is always cheap*…" (BF_CPUT – R17) in that "…it cuts down on cost…" (MR_ARCN – R4). Obviously, the opportunity to outsource the hardware that would be costly to buy and to maintain (JM_DD – R13), is given as one of the reasons. It seems, in the eyes of the participants, that the cost-efficiency advantage even outweighs the convenience cost of migration from the traditional, to the cloud facilities. The belief is that moving processes to a cloud platform is actually "…cheaper than buying your own hardware. This is inclusive of "*Its lower cost to infrastructure, lower setup, it's a more tax efficient way of doing it*…"(TP_STM – R5), it minimizes costs (MR_ARCN – R4) and "…it definitely makes financial sense to move across…" (TP_STM – R2) to the cloud. For example, "…*starting up project costs are less, and also maintenance, post project delivery, if we are still using that technology it's still cheap, not cheap as such but it's still affordable*…" (NM_OM – R15). On this point however, a question can

be raised as to whether this cost saving benefit is a universal truth that generally applies across all contexts and conditions. The size of the entity and the volume of related work will also play a role. For example, "*smaller SMME's* [may] *find it a little bit more cost effective to use the cloud*…" because it affords you "…*access to a larger pool of resources than you would necessarily be able to afford yourself*…" (ER_UCT – R12).

Further, "*setting [up] hardware and then only using the X amount over peak periods for the rest of the time…it's actually a waste sitting there*…" (DB_BCS – R24). In this respect, expensive infrastructure may be under-utilized where the rate of turnover in projects does not justify the capital cost of purchasing and owning it – hence the cloud becomes a viable option for small entities. However, "…*huge organisations can afford the physical infrastructure* (NM_OM – R6), both in terms of a need for high volume and skills to put organisational infrastructure into optimal use – leading to a positive return on investment (ROI). However, the extent to which cloud computing can affect operational costs of a project generally may also be crucial for both small and large organisations. On this point, participants felt that cloud computing minimizes operational costs of PM generally, regardless of the size of the entity. It promotes the principle of specialization, freeing skills, space, time and resources so that these can be re-directed to the organisation's area of specialty whilst allowing the cloud service providers do the rest. That way, even large organisations can minimize the cost of employment and infrastructure. Further, "if you have scalability problems and you want to go out there and do stuff, the cloud will always be cheap" (BF_CPUT – R17). In addition, "…*the licensing model per user is cheaper than the MS project model*…" (DB _BCS – R32), meaning small and large organisations can save on hefty licensing costs. If it is not for cost-efficiency alone that cloud computing is appraised, but also that it reduces the time taken to carry out information management and exchange transactions in PM.

5.4.1.6 Time Efficiency and Quality

Another advantage of cloud computing is that it "…*saves time because some of these packaged programs and other computer program … does the specific task that you request*…" (MR_ARCN – R5). In other words, users can easily start using the cloud without spending time on searching and installing the appropriate software program that is required (Armbrust et al., 2010). In addition, as infrastructure and assets age it becomes a challenge because technology is always improving. For example "…*every 18 months there's almost a refresh of your IT components and if you are sitting stuck with resource based to maintaining it and you are sitting*

with the asset base, in 18 months' time those assets may not really be very…. or cutting edge anymore, they are not giving you a competitive advantage from a speed…point of view…" (TP_STM – R19). That is one way that cloud computing introduces time efficiency in organisations. In another way, another respondent acknowledged that because of cloud computing services, "…*time is being cut from them [project team]. Instead of calling for a meeting if you are in Johannesburg, for you to fly down to Cape Town should there be something, you can easily do that [access the cloud] and I can show you exactly what I need*…" (MR_ARCN – R6).

Time efficiency however, cannot be accepted as a given outcome of using cloud computing – regardless of the context and diligence of its use. Instead, it is only when cloud computing is wisely utilized, in appropriate contexts and within the conducive environment that both cost and time efficiency benefits can be realized (Angeli & Masala, 2012). For example, download from the cloud environment can still be very slow in limited broadband networks. However, the download speed will be fast and efficient in a broadband rich network. In conducive environments therefore, time efficiencies can be enormous. Commenting on the value of cloud computing, one project manager said for example, it will "… *save us a lot of time. There's no flying up and down to do presentation wherever*…." (NM_OM – R15). Further, "…*it cuts down time spent between the project team, especially if you have somebody else from another area so you don't have to put time to do the communications and stuff, that time is being cut from them*…" (MR_ARCN – R6).

The time factor in particular, is of essence to the rate of project-turn over in terms of the meeting of deadlines, with positive spin-offs on the product quality, productivity and, ultimately, profitability. However, one respondent was not convinced that cloud computing could benefit PM. The challenge, is that cloud computing might not have a direct link to enhancing quality. However, the time-efficiency gives project team members' ample time to re-check and revise the items in order to attain perfection, before deadlines are reached. Loyalists also seem to hold positive perceptions about the impact of cloud computing on quality, though in most instances, the skill factor that is linked to the ability of putting the cloud resource into effective use is implied. The words of one project manager illustrate the point better. He felt that he "…*could go to a bunch of professionals that I* [he] *know they do this [cloud computing] everyday, it will give me* [him] *a level of comfort that my* [his] *quality expectations will be met*…" (TP_STM – R23). The point of this comment is one of positive perceptions, with the acknowledgement that without the skill to use the tool, it is possible for the desired outcomes not to be realized.

5.4.1.7 Scalability

Scalability is one of the benefits that was acknowledged by the respondents during interviews. It refers to the huge capability of the cloud to store data (Saini et al., 2011). There "*have always been issues with physical storage with infrastructure* …" and cloud computing is **"…***a fairly new technology that allows predominantly storing of info on the cloud …* (NM_OM – R1). The challenge is that the more data processing required the more space is required to speed up the processing. Therefore, since "…*cloud computing is about horizontal scalability*…" (BF_CPUT – R1) with "…*space as a driver*…" (JM_DD – R6), it is an important benefit. Particularly, with "…*rapid elasticity,* [it is possible to] *effectively automatically scale out, scale down*…" (ER_UCT – R4) in accordance with the space required. As a result, "…*customers [organisations] want to do away with their own ability and their own requirement to be able to provide that compute and server capacity*…"(JM_DD – R13). Some service providers of cloud computing like, "…*the oracles of this world, where they provide big warehousing facilities and companies are allowed or able to via the cloud store stuff on their specific servers*…" (TP_STM – R1). Another advantage with going onto the cloud is that it allows "…*a team to pull it together…understanding servers, databases, network and integration*..." (TP_STM – R22).

Another project manager felt that the cloud is mostly beneficial for project teams in that they do not need to inherit the responsibility of ensuring adequate severs and databases as part of the project. This is especially appropriate for remote teams as "…*it bypasses the legalities of where we place the physical servers*…" (NM_OM – R14). In addition, whenever a project is managed using the cloud, and for some reason there is a need to expand resources, there will be "…*the same level of service, so the cloud will intelligently expand*…" (BF_CPUT – R15).

In line with other benefits of the cloud, the ability of the cloud to intelligently expand can be seen as an innovative response to the ever increasing storage needs, making the facility even more appropriate for organisations with finite projects that have unexpected needs to grow. With this background and with hindsight, it is clear that participants found cloud computing to be predominantly useful in facilitating PM functions.

5.4.2 Uses of Cloud Computing in Project Management

Under this issue of investigation the researcher wanted to know how cloud computing was being used in PM. The researcher was also interested in knowing how cloud computing affects PM in relation to the key aspects of business processes that are part of PM. This information would

help the researcher to identify the areas where PM can/has benefited the most from cloud computing. For this purpose 3 project managers and 2 service providers were interviewed, Table 6 outlines the results from the 3 project managers.

Table 6: The Uses of Cloud Computing in Project Management

Questions	# of TR*	Responses				
		Supplements PM integration BP**	Infrastructure limitations	Remotely working teams	DK/ NR***	
1. How is cloud computing applied in project management (in your org)?	6	5	4	3	1	Number of respondents per response item

* Total Respondents
** Business Processes
*** Don't Know/No Response

The question that was presented to the respondents for this issue of investigation was, " How is cloud computing applied in PM, particularly in an organisation?" Responses illustrated how cloud computing is applied in relation to the business processes linked to PM. In the structuration theory sense, implications are made on whether the adoption of this tool affects "regular social practices" in PM. A total of 6 respondents were interviewed, two service providers and three project managers. However one project manager from Metropolitan life did not attend the interview. The three most frequently acknowledged responses were, Supplementation of PM integration to business processes, Supplementation of infrastructure limitations and Supplementation of remotely working teams.

5.4.2.1 Project Management Integration with Business Processes

Outsourcing has become a means for which businesses opt when it comes to utilizing resources at a reduced cost (Nevo & Kotlarsky, 2014). Some responses illustrate that outsourcing resources through the use of cloud computing has enhanced PM efficiencies. It is safe to say that, "*As years have gone by, the technology has advanced that's becoming a very, very expensive overhead for many organisations which are not IT organisations. They would rather outsource all of that to a service provider*…" (JM_DD – R6) like "…*the oracles of the world,*

where they provide big warehousing facilities and companies are allowed or able to via the cloud store stuff on their specific servers…" (TP_STM – R1). Thus cloud capabilities put project managers at ease, and as a result they can focus on the deliverables of the project.

In the structurational "systemic" sense, a slight transformation in the rules of operation, and ultimately, an amendment in regular social practices is evident. For example, it emerges from the interview statements above that technological changes have raised technology management costs. This has called for a paradigm shift in related management practices – towards a technology-outsourcing trend. Due to the ever-changing technology, "…*there might be a reskilling that is required of all of the staff members that are on your payroll, which might have to change*…" (TP_STM – R20). With cloud computing in particular, an organisation would not require to train individuals or be concerned about the skilled labor as it is part of a package. Therefore another driver of cloud computing is the aspect associated with skilled human resources (JM_DD – R6).

Another business process that is closely linked to PM is logistics (Larson & Gray, 2011). Logistics include the management of transportation and the times during which project managers can access certain information or resources (ibid.). It was interesting to see that there is a level of efficiency that cloud computing brings in financial management. For example, "*It's just easy with the way you are doing your billing, your payment method. In that I think there's ways around it as well. So I can purchase something on demand or pay as you go. I can buy like I do with my cell phone now*…" (DB_BCS – R39). Cloud computing is also applied in the actual managing of projects. As one respondent stated, it is applied "…*during monitoring and control or execution, during the execution of the work. As you know PM is quite document intensive, it's quite communication intensive so there's documents from the day you open your mouth about wanting to start a new project to the day you want to close it*…"(NM_OM – R14). It is clear therefore, because it can be applied to these purposes, that cloud computing is put to a number of uses in PM. In the ST systemic sense, a change in operational procedures (rules), leading to a slight transformation in regular social practices, is evident. Under the cloud regime for example, the project team no longer have "…*to call meetings and inform people that things have changed, they just put it up* [on the cloud]…" (MR_ARCN – R7) and the project team will be aware of all changes that have had an effect on the project.

5.4.2.2 Cloud Computing Supplements Infrastructure Limitations

Respondents also feel that using cloud computing helps to alleviate infrastructure limitations in an organisation. Among a number of aspects concerning the infrastructure, the setting up of infrastructure was one of the processes that respondents said was time consuming, and that it also affected business processes, including PM as a business process in an organisation. For example, "…*setting up infrastructure normally takes time, getting it organized, and it takes teams of people, to debate, what's the right way of doing it and all of that. Whereas if you had cloud computing as an option, that happens quicker, you can go through the processes a lot quicker with cloud computing concept, as opposed to setting up your own infrastructure, yah, absolutely so again from a PM perspective, that's another way of trying to save some time on projects*…" (TP_SANTAM – R14). What comes out clearly in these sentiments is that whilst there are complications associated with sourcing and setting up some infrastructural aspects, cloud computing, in contrast, offers simplified alternatives – efficiently and adequately.

For this reason organisations would "…*rather want to have a service provider delivering that* [infrastructure] *to them…*" (JM_DD – R13). This becomes even more convenient in projects associated with the events industry where projects may occur once a year. Under such circumstance, lengthy processes of setting up complex infrastructure for once-off purposes would seem a gross underutilization of such capital equipment, which is certainly not a cost efficient exercise. The cloud innovation on the other hand, would adequately addresses the project infrastructural needs. One respondent used an example of "…*the Argus tour", saying* in his example, *"why should they go out and purchase their own hardware for an event that last for maybe 4/5 weeks or 5 months out of the year and the rest of the time its idle, because they start at September and they wait until next September before doing something again. Why would they then spend that money when they are not working when they could just rent and make use of cloud computing and just use that processing power at sky up as demand comes because their big demand is when people enroll and it's probably 2 or 3 weeks peak then its full so something like that is…why do they need all that processing power sitting there idle for the rest of the year when they actually use it for 3 weeks*" (DB _BCS – R27). PM is present as a purpose-driven field and discipline in these statements. For example, participants are questioning unscrupulous use of cost- ineffective alternatives, using cloud computing as an example of diligent practice. Further, financial prudence in the allocation and management of project resources, as well as diligence in forecasting the most relevant resources to carry out certain projects, are revealed clearly in these arguments.

5.4.2.3 Teams Working Remotely

Cloud computing was found to be particularly useful in facilitating projects undertaken by teams whose members are working remotely (Larson & Gray, 2011). In the words of another project manager for example, "…*during execution the teams are in different places, we don't have to get on the phone or be in the same place to know how they are progressing within the project*…" (NM_OM – R14). Therefore it "…*would make remote teams working fantastic and it bypasses the legalities of where we place the physical servers, if we have to have physical servers. "Do we place it in Cape Town", "no we they will do it in Timbuktu but once they put it in Timbuktu but then the laws in Timbuktu says we can't access them because we are on the other side of the equator", you know, it bypasses those legalities*…" (ibid.). In other words the location of the contractor does not matter, project teams can get connected and start working immediately, regardless of legal constraints associated with laws that might apply in a different location. Even better, is that you can create a "…*project program calendar managing it from there and everyone can see what is happening, you can even do documents there save it and leave them there, anyone who wants to access it can access it from there [cloud]*…" (MR_ARCN – R26). Obviously, the advantages of using cloud computing in the management of projects across geographical locations are convincing. Unless project managers are aware of, and receptive to, the usefulness of cloud computing, they may not use and access these benefits.

5.4.3 Awareness & Perceptions on Cloud Computing in the Private Sector

Under this theme, the researcher wanted to know whether cloud computing was known and to what extent is it accepted in the private sector. Findings on the levels of awareness and on perceptions held about cloud computing in the private sector are presented in Table7 and Table 8, respectively, and are discussed in detail in subsequent passages.

Table 7: Awareness of Cloud Computing in the Private Sector

Questions	# of TR*	Responses				
		Large Corporates	SMMEs	Projects	DK/ NR**	
1. Which spheres is cloud computing normally used in the PS***?	6	3	1	2	1	Number of respondents per response item

* Total Respondents
** Don't Know/No Response
*** Private Sector

On the awareness aspect, interviews were held with 4 project managers and 2 client service officers from both the financial institutions and organisations in the engineering sector. All participants, except one participant from Metropolitan participated in the interview. The question that was posed is "In which spheres does business make the most use of cloud computing in the private sector?" As shown in Table 7, large Corporates, SMMEs and independent projects.

5.4.3.1 Large Corporates, SMMEs and Independent Projects in the Private Sector

Reponses show that large corporates are using more cloud computing than SMMEs, which may mean that "…*the bigger you go as a company there more you are forced to go to this channel* [cloud computing]…" (MR_ARCN – R10). Additionally, service providers that were interviewed said that they offer cloud computing services mostly to big corporates. A client service officer said that, "…*as a service provider we mostly deal with large corporates. We don't really engage the SMME sector so from our perspective, we are dealing with large corporates* …" (JM_DD – R15). It is clear that service providers are "…*working with big corporates*…" (DB_BCS – R5). Big corporates have a larger clientele and therefore a larger quantity of data to process and more complicated business processes to manage, than small organisations. In section 5.3 Information Technology tools and systems are the most prevalent of non-human resources in the transcripts. It is therefore logical for big corporates to migrate their processes to the cloud for the purpose of increased storage and processing power, among other benefits.

However cloud computing has also been very useful for, "…*young, creative, start-ups, probably managed by people born in the seventies and eighties and that are still susceptible to change, and they welcome it, they do, they do, they use it*…" (NM_OM – R6). There is easy access to a

pool of affordable resources and these resources are also flexible. Cloud computing is not only used by the large corporates and SMMEs but also in many private sector projects, as its clearly a "…*new concepts that come out there, project managers will get involved in those concepts [cloud computing], they will get a good understanding of it, your good project managers are the ones that understand the trends*" (TP_STM – R5). Hence, "…*there are a lot of companies who use it* [cloud computing]…" (MR_ARCN – R9). The involvement of project managers to new technologies exposes them to possible new practices that may be adopted in an organisation or in projects. To this effect, project managers in various organisations are aware of the use of cloud computing (NM_OM – R6). When there is awareness of a technology the next step in the progression is perception.

Table 8: Perception of Cloud Computing in Private Sector

Questions	**# of TR***	**Responses**					
		Useful without any challenges	**Difficult or too simple to understand**	**Sever complications**	**Lacks security features**	**DK/ NR****	
1. What is the perception of cloud computing in the PS***?	6	0	3	2	4	1	Number of respondents per response item

* Total Respondents
** Don't Know/No Response
*** Private Sector

Under this theme the researcher aimed at understanding the perception that employees in the private sector have of cloud computing. In order to achieve this objective, interviews were planned with six participants: 4 project managers and 2 client service officers. However, only five interviews were possible: one project manager from Metropolitan unable to be present at the interview. The question that was posed to the respondents was "What is the perception of cloud computing in the private sector?" The four types of response are shown in, Table 8, 1.usefulness without any challenges, 2.difficulty in understanding, 3.server complications and 4.lack of security and features.

5.4.3.2 Too Difficult or Too Easy to Understand

This refers to the challenges that people have in understanding cloud computing. Some people think they understand it well only to find out that they do not have the correct concepts of cloud computing. For example, respondents pointed out that cloud computing has become, "…*a big buzz word, people know about it but as to whether they have a proper definition and understanding is another thing*…" (JM_DD – R10). People know it exists and it is or can be used in some manner or another, however there is lack of adequate understanding of the use and benefits of cloud computing. Another example is of people who use cloud computing quite often because of the nature of their work like, "…*people who are IT literate as well and a layer furthest from that with end user sitting at the desk and just doing their work and that's not just IT literate but computer literate, they know about it but do not really grasp the concept, I think that the general public… if you talk about cloud computing its completely not there yet*…" (DB_BCS – R13). The lack of understanding that exists about cloud computing can also bring a lack of trust in the technology. This situation may cause organisations to delay or reject the adoption of cloud computing.

5.4.3.3 Server Complications

This theme focuses on the physical location of the server. One of the respondents made a comment that "…*servers crash, some people lose their stuff that was actually in those servers so there's always a risk*…"(MR_ARCN – R16). Cloud computing has introduced a concept of having servers located anywhere in the world (Saini et al., 2011). Therefore a user can access information or applications from a server that they cannot physically access. The fact that these servers cannot be accessed ended up being a concern. The main concern is that when there are server complications, organisations must rely on the ability of the service providers to deal with a faulty server. In the view of another respondent "…*one of the disadvantages is depending on the service provider you choose, if a service provider tries to cut corners by not having a proper data recovery in place, backups, regular backups, data recovery disaster plan backup, because when you go into cloud computing, you take all of those as given, your service provider is gonna make sure my data is backed up even if their sites burns down, even if multiple sights burns down…if the service provider takes the rigor of making sure they don't cut corners, it will do away with that disadvantage, its more about what happens in a disaster, am I gonna be able to retrieve all of my data still or not*…"(TP_STM – R24). It is clear therefore, that, some people and organisations still perceive going into the cloud as taking a risk because of the "unknown" factor regarding the physical state and accessibility of severs especially when faults occur. For

this reason, the selection of a service provider becomes an important task in ensuring that they are accredited, have a good record in the industry and have extensive knowledge in IT.

5.4.3.4 Lack of security features

The focus in this aspect is the security of the information that is in the cloud. It is mostly concerned with ensuring that the information that users place on the cloud is secured, that only relevant stakeholders can access it (Zhang et al., 2010). The majority of the respondents were convinced that the major perception that exists is that when information is on the cloud, it is not protected. One respondent said that, "...*the reality is that if something gets to a network it's no longer officially yours because anyone can crack something and access it. It's a matter of cracking some codes so it's a matter of that, anyone can get access, anything that is always on a network, you cannot say no, it's secrete I have it, it's mine. I don't think anyone can put that guarantee*…" (MR_ARCN – R16). As much as this is a fact, it is equally true that most individuals and organisations are connected to the Internet one-way or the other. This means that the issue of security is not necessarily a cloud computing problem but an Internet problem, which affects everyone who has any information device connected to the Internet. Nonetheless, it still stands that "…*there is still a sort of fear of security around cloud computing and how secure is "my data" on the cloud. I think that's the biggest…I think it will come over time as people become more used to cloud computing and the security around it and they find out that it is quite secure and then it will take off more*…" (DB_BCS – R5).

It becomes an even more complex matter when it comes to businesses. Various stakeholders or organisations require security for different reasons, for example larger companies or "…*bigger players may want the security of knowing that their data, their information is safe and secure and some companies believe that the intellectual property is the way they store data and the retrieval of their data*…" (TP_STM – R6). As a result "…*there are so many stakeholders that frequently ask questions for just around security and I think it's an unknown that business does not have the appetite to handle just yet, maybe*…" (NM_OM – R10).

These arguments illustrate that there are still negative perceptions that threaten the adoption of cloud computing. Perhaps it is the reason behind the slow uptake of cloud computing in the corporate sector and in government as well. With these perceptions in mind, a question concerning the adequacy of efficiencies in contemporary PM practices can be raised.

5.4.4 The Status of Project Management Efficiencies in the Private Sector

The objective of questions under this theme was to understand the state of efficiency in PM outcomes in the last five years within the private sector.

Table 9: The Status of Project Management Efficiencies in the Private Sector

Questions	# of TR*	Responses					
		Improved Project delivery	Improved Skills	Demystific	Sharing of information	DK/ NR**	
1. What is the status of PM*** in the private sector?	4	3	1	1	1	1	Number of responden ts per response item

* Total Respondents
** Don't Know/No Response
*** Project Management

Table 9 outlines the responses that were given to the question, "What is the status of PM efficiencies in the private sector?" The question was posed to project managers, who mostly acknowledged that there is improvement in project delivery where the "…*maturity is growing in PM, I think there are still pockets of excellence, clearly there's more mature environments*…" (TP_STM – R25). For example, "…*the projects that have been done recently, in terms of time to be specific, we've seen more success stories*…"(MR_ARCN – R29). What has been observed is that "…*there's a lot more buy into PM than there was before and people are seeing the benefits of it, organisations are seeing the benefits of it and adopt it at a faster rate than it was earlier*…" (NM_OM – R25). Though there has been improvement, it is important to note that there is still "…*a long way to go…but we are fast getting there than we were in 2004 or 2005*…" (NM_OM – R25). One of the reasons for this "…*success of projects is partly because, people know what they are doing and they are doing it the proper way…*" (ibid.), so improved skill for project managers and workers has managed to affect PM positively.

There was general agreement that "…*there's room for improvement* …" (TP_STM – R25). However as PM becomes popular, some certifying organisations have lowered the standards, causing an influx of project managers who are not adequately skilled. It was acknowledged "…*certification of PM, used to be a lot more stricter, the code of conduct, making sure you have had the relevant experience before you can get a certification was an important driver…"*

(TP_STM – R25). Now concerns are that standards have deteriorated, due to unscrupulous practices in the training regime. Complaints are that "…*what the organisations that control the certification have done to their detriment is they've allowed people to go and certify without the relevant experience".* Observations are that *"…now a person just having a year or two experience and in some environment can do a certification pass, and they can call themselves a project manager or a project coordinator that does not help the industry*" (ibid.).

Despite this concerning development, a paradox is reported - instead of deteriorating standards increasing the rate of failure in projects, the failure rate is actually said to be decreasing. In fact, sentiments are that "…*the rate of failure is decreasing and it's because of the demystification of PM and the adoption by other industries*…" (NM_OM – R25). However, reasons are not linked to the skills related quality, but to the emergence of innovative information handling resources that yield a "…*bit of improvement in terms of sharing of information…* [and in turn], *when information sharing is easy, things get done*…" (MR_ARCN – R29). The ease with which information can be managed and shared is, evidently, given prominence over skills and standards. In this regard technological tools and systems have the potential of enhancing PM outcomes.

5.5 Conclusion of chapter 5

The aim of this study was to understand the adoption of cloud computing to enhance PM efficiencies and outcomes in the South African private sector. Thus, in this chapter findings were presented, discussed and critiqued in conjunction with the interpretation of the data that emanated from the interview transcripts. For the analysis of the data, the Structuration Theory (ST) framework was applied within the content analysis technique.

Initially, the key concepts of the ST were used to categorize data for interpretation and critique; this is shown Table 11 (Appendix 1). These ST conceptual categories such as Structure (consisting of Rules and Resources), Structuration and Systems were then used to identify associated data from the transcripts. Under rules, the data that was identified and presented was PM policies, Regulations, Methodologies and Guidelines Under this sub-concept, the researcher found that PM is a rules-based discipline with heavy reliance on methodologies and compliance to standards and procedures. Therefore the uptake of any technology in the PM discipline is dependent on the extent to which it can embrace rules to ensure compliance and adequate application of PM methodologies.

With resources as another sub-concept of structure, human resources and non-human resources emerged from the data. Human resources consist of Professionals, Expertise (skills) and Project Managers. Non-human resources consist of IT Infrastructure; Software Programs and Applications; Internet and Connectivity; Internet-based innovations such as Cloud Computing and its related solutions. Both the human and non-human resources proved to be equally important. On one hand, human resources were deemed to be of significance because of the aspect of agency and power, as humans/agents interact with the purpose of achieving project objectives. They also exercise power to either maintain the regular PM practices (re-enforcement of structure) or to bring about change to improve PM (transformation of structure). On the other hand non-human resources were deemed important as they enable human resources to carry out project activities adequately and efficiently, depending on the type of non-human resources in use. Within non-human resources, the findings showed that technology tools were cited the most, particularly cloud computing related tools. This also shows the level of importance that these tools proved to have.

The next concept in this regard is structuration, which was divided into two categories. The first category was the conditions to transform structure, the identified data in this regard were Limited Storage; the Evolving Technology; Cost of Employee Training; Infrastructure Costs and Maintenance; the Estimated Future Trends appeared; Improvement to Service Level; Resource Distribution Intelligence; Demand of Processing Power; Opportunity to Solve Industry Problems; Efficiency; Time to Market, and the Growth of the Organisation. The second category was conditions that tend to reinforce the structure. The data identified were, a Lack of Trust in the Security of Unfamiliar Innovations; Belief in the Potency of Existing Employee Training Practices; Preference of In-house Infrastructure, and Contentment with Old Technology. According to the findings the number of conditions to transform the structure was greater than the number of conditions that tend to reinforce the structure. This illustrates that there are more reasons to transform the structure than to reinforce it. In other words, the reasons for the adoption of cloud computing in PM outweigh the reasons for the rejection of cloud computing.

The data that were identified under systems, the last concept in ST, are Constant Communication, Accountability/Follow up, Meetings, Reporting/Feedback and the Sharing of Information. In this regard, findings show that cloud computing presents an opportunity to improve the communication or relations/social practices between stakeholders. The main aspects that were identified are that stakeholders can communicate, access information remotely and hold regular meetings for feedback or reporting purposes.

The data that was identified in the transcripts, using the ST framework, was then used as a base to attend to specific issues of investigation. Basically, the researcher draws on the main research question to reflect on the extent to which the research objectives have (or have not) been achieved. To achieve this, the research question was broken down into 4 issues of investigation, the Benefits, the Uses, the Awareness and Perceptions of cloud computing in PM, and the Status of PM efficiencies in the private sector. In the first and second issues of investigation, cloud computing was found to be an innovation that adds value, making functions and processes flexible, convenient and accessible especially remotely. Under the third issue of investigation, it was found that there is an acceptable level of awareness of cloud computing in the private sector. Additionally, it was also found that there are negative perceptions that may threaten the adoption of cloud computing in PM in the private sector. In the last issue of investigation, it was found that as PM has gained popularity in the sector, standards have tended to be compromised by rivals in the discipline. However the project failure rate is on the decline, this improvement is also enhanced by the innovation provided by technological tools and systems. The conclusion of the thesis, together with recommendations, is presented in chapter 6.

CHAPTER SIX

6. RECOMMENDATIONS AND CONCLUSION

6.1 Introduction

The purpose of this section is to reflect on the process of the research that was conducted during this thesis, with particular emphasis of how the research questions were addressed, and how the research objective was (or was not) realized.

In order to address this process, the chapter opens with a summary of the thesis in section 6.2, which reflects on the literature, the methodology and the theory that was applied. The reflections on the research questions and findings are in section 6.3. This leads to a set of recommendations in section 6.4, a conclusion in section 6.5 and finally, research considerations in section 6.6.

6.2 The Summary of the Thesis

The objective of this research was to understand the adoption of cloud computing to enhance PM efficiencies and outcomes in the South African private sector. The opening argument of the thesis was that cloud computing offers information handling benefits for the enhancement of business processes. An observation of the researcher however, was that despite these innovative advantages, the South African private sector remains challenged in terms of operational efficiencies in the delivery of projects. Yet, these challenges can easily be solved through the use of cloud computing. An additional challenge was that even the literature in the field of cloud computing in the South African context, was inadequate to help the researcher to understand this problem sufficiently by means of scientific research. To support this assertion, Figure 2 (section 2.1) presents a synopsis of the state of the research in cloud computing.

Methodologically, constructivist ontology and the intepretivist epistemological paradigm were followed to conduct a qualitative investigation. Within the qualitative framework, the purposive sampling technique was used to identify data sources. Thus, participants consisting of academic experts, project managers and service providers were used as the tools for data collection. When data collection was complete, the analysis of the data was undertaken. Content analysis was selected as an analytical tool to analyse the data. This technique was used together with structuration theory (ST), which operated as a framework to simplify the complex phenomena of the study. Structuration theory is a theory that has been used by other researchers in socio-

technical studies that look at Information Technology and management in organisations. ST provided the researcher with analytical lenses to analyse and understand the interaction between cloud computing and varying aspects of PM in organisations. The key concepts of structuration theory were outlined, and the links between the concepts were discussed. These concepts were then used to categorize data from the transcripts (Table 11, in Appendix 1) for the purposes of interpretation and critical analysis. The output data from the use of the ST were then used as a base to look at the issues of investigation. The issues of investigation were drawn from the main research question to reflect on the extent to which the research objectives had (or had not) been achieved.

These issues were also identified from the transcripts and analysed using the content analyzing tool and the output data from ST. The issues of investigation served as a base for developing relevant themes. The development of themes was guided by the purpose of each issue of investigation, the questions to be answered and the hypotheses to be tested. When the themes had been identified, the color-coding technique was used by assigning a specific color to each theme. Therefore each theme was highlighted in the transcript with its assigned color. This enabled the researcher to identify findings in the transcripts. ST theory helped in breaking down the PM and cloud computing phenomena into various components that were significant to the objectives of the study. These processes allowed a broad and holistic analysis and understanding and enabled the translation of data from the transcripts, which then lead to the findings.

6.2.1 Findings

Findings in Section 5.3 (Chapter 5) provides the descriptive presentation of findings, as clearly outlined by ST the findings. A research question was then broken down into several issues of investigation - the Benefits, Uses, Awareness and Perceptions of cloud computing in PM and the Status of PM efficiencies in the private sector in section 5.4.

Over all, findings indicate that the level of awareness in cloud computing is adequate in the private sector. Furthermore, the uses and benefits of cloud computing were acknowledged and understood in PM in the private sector. It was also found that negative perceptions exist, that may threaten the adoption of cloud computing in PM in the private sector. Lastly, it emerged that as PM has gained popularity in the sector, standards have tended to be compromised by rivals in the discipline. However it was found that the failure rate is on the decline. This showed that the success rate has been enhanced by the innovation of technological tools and systems. As

the research process continues, the following section outlines recommendations made by the researcher.

6.3 Recommendations

The following Table outlines the objectives of the study, the main question, issues of investigation, findings and recommendations. The purpose of the table is to provide a framework illustrating the heart of the thesis, but primarily to reflect on the recommendations developed after the investigation.

Table 10: Findings and Recommendations

Objective of the study: The objective of this study was to understand the adoption of cloud computing to enhance project management efficiencies and outcomes in the South African private sector. **Main Question:** What is the extent of the adoption of cloud computing in the South African private sector?		
Issue of Investigation	**Findings**	**Recommendations**
Benefits of cloud computing in project management, generally.	• Cloud computing has ample benefits that can enhance PM efficiencies (section 5.4.1).	• Executive Managers and Project managers are to evaluate both the needs of a project and the benefits of Cloud Computing in relation to the project before adopting it.
Effective uses of cloud computing in project management, generally.	• Cloud computing assists with outsourcing resources (ERP systems) to enhance processes in PM integrating with other business processes. • Cloud computing supplements infrastructure limitations in organisations. • It is useful in facilitations project teams working remotely.	• It is recommended that larger organisations that are either using or planning to use ERP systems in their business processes to migrate their operations to cloud computing. • It is recommended that organisations without infrastructure or growing organisations use the cloud infrastructure. • Teams working remotely, with large data and processes to manage, is recommended to use of cloud computing as it allows remote accessibility for virtual project teams.
Awareness & Perceptions on cloud computing in the Private sector	• Large corporates, SMMEs and independently managed projects are aware of cloud computing. • It is perceived as either too difficult or too easy to understand and use. • Traditional organisations have concerns about the physical locations of servers. • It was perceived as having a lack of security features	• Executive Managers and Project Managers are to stay informed of the new innovations in technology to empower them in making the correct decision of adopting cloud computing.
Status of project management efficiencies in the private sector	• Standards tend to be compromised as time progresses but the failure rate is on the decline due to innovations of technological tools.	• As a rules based discipline technological innovations must have PM methodologies and guidelines embedded on the technological tools to further increase the general level of success in PM.

The objective of this study was to understand how the adoption of cloud computing can be used to enhance PM efficiencies and outcomes in the South African private sector. The issues of investigation were used to guide the researcher to seek those findings relevant to the objective of the study. Recommendations were made by the researcher as a result of the findings. The findings showed clearly that cloud computing has many benefits to offer in the discipline of PM in the private sector. These recommendations are explained further in the following sub-sections.

6.3.1 Benefits of cloud computing in project management, generally

The findings have revealed that cloud computing has benefits that can enhance PM efficiencies. The benefits include, Accessibility of resources, Operational flexibility, sharing of information, Convenience, Time efficiency, Cost efficiency and Scalability. These benefits are diverse, some are direct and others are indirect. Therefore, it is recommended that the project managers identify the most important needs in their operations together with the relevant uses of cloud computing, articulate their ideas to their teams, and integrate these innovations with their current purposes. If their projects, and PM as a discipline, are to positively benefit from the advantages provided by cloud computing, then the adoption of cloud computing is advised. However, if the advantages of cloud computing are not adequate to enhance the PM outcomes then it may not be necessary to adopt cloud computing, the reverse is also true. It is also recommended that executive support be given to project managers and their teams. This is based on the fact that executives have a major influence in bringing about positive change in organisations. Therefore executive support can assist project managers who may require the adoption of cloud computing in the discipline on PM.

6.3.2 Effective uses of cloud computing in project management, generally.

As organisations grow and technology advances, new requirements arise because systems and business processes become complex. This forces organisations to spend frequently in order to upgrade systems and infrastructure. As outlined in the literature and confirmed in the findings, cloud computing removes that burden from organisations. It is therefore recommended that organisations consider taking complex business processes onto the cloud platform. This is especially true for organisations that use ERP systems for running business processes, including PM as a business process. ERP systems are difficult to implement and can take up a lot of time before they are ready for optimal use. Cloud computing can remove the burden from organisations associated with such systems.

Whilst larger organisations using ERP systems have much to benefit, it is also recommended that start up organisations and organisations without adequate infrastructure adopt cloud computing. The main advantage here, among other benefits previously stated, is cost efficiency. The requirement of capital for ICT purposes in a start-up organisation can be reduced. The last recommendation in this aspect is for teams working remotely with processes and large volumes of data and to manage. They are recommended to adopt cloud computing as it allows remote accessibility to a pool of resources for virtual project teams.

6.3.3 Awareness & Perceptions of cloud computing in the Private sector

The awareness of cloud computing in the private sector is adequate; however some of the perceptions are negative. Negative perceptions become a stumbling blocks in the adoption of cloud computing. This situation is unfortunate as cloud computing can provide many benefits for the improvement of PM efficiencies and for an organisation, generally. It is therefore recommended that project managers and executive managers form relationships with service providers of technological tools to ensure continuous updates of technological innovations that may enhance PM and other business processes in the private sector. The ability to stay informed about new innovations empowers executives and project managers to make informed decisions on the adoption of cloud computing and other innovations that will come in the future.

6.3.4 Status of project management efficiencies in the private sector

The two traits that emerged in this regard are that PM is a rules based discipline and that rules are being compromised as rivals enter the discipline. This has caused project managers to be cautious of the project members they allow to be part of their projects. They are also cautious of the technological tools they use that might compromise established methodology and guidelines. This is because methodologies and guidelines are kept in place to minimize failure in projects. Therefore, it is recommended that developers and service providers of these innovations ensure that methodologies and guidelines are embedded in technological tools. The adoption of technological innovations like cloud computing might not be an issue if methodologies and guidelines were included in the tool. In cases where this has happened, project managers have been given confidence. This situation could mean that the adoption of such technologies may be easier in future. It has been observed that the success rate in PM has improved over the years. One of the reasons for this, among others , is the enhanced innovation of technological tools and systems .

6.4 Conclusion of chapter 6

This study was motivated by the continuous need to improve PM efficiencies and outcomes in the PM discipline. With cloud computing being one of the emerging innovations in ICT, which comes with ample benefits, the researcher decided to explore the possibilities that cloud computing could have in improving PM. Hence, the objective of the study was to understand how the adoption of cloud computing could enhance PM efficiencies and outcomes in the South African private sector. The private sector was selected because it is a sector that is profit driven, requiring efficiency in its projects. This consideration rendered it the best sector in which to conduct this research in order to answer the research question.

The main data sources that were used to conduct this investigation were literature from scientific sources and experts in the field of cloud computing and PM. As a means of data collection, interviews were conducted with academic experts, cloud computing service providers and technologically literate project managers. The data collected from these three pools of expertise provided holistic data and minimized subjectivity. This then lead to findings. In the summary of the findings, it was revealed that cloud computing has quite a number of benefits. In fact, the benefits are not inconsequential but may prove to be key factors for organisations to improve their project outcomes. For example, cloud computing may be the best option for an organisation that is using ERP systems, which integrates PM processes with other business processes. Cloud computing can reduce infrastructure inefficiencies and enhance processing power. In other findings, it was also revealed that start up organisations may not necessarily need to purchase their own IT infrastructure, because with cloud computing all the required IT tools are accessible, even for remote members of a project or an organisation. Though the above paints a rosy picture, it was also found that there is a lack of trust in the use of cloud computing. Perceptions around it showed that individuals and organisations are not comfortable with this innovation. The most questioned aspect of cloud computing was the capabilities of its security features. The lack of understanding of and trust in cloud computing caused a resistance to its adoption.

In summary, it is recommended that executive managers and project managers keep themselves informed of technological innovations. Resources have not only proved to be a significant matter in PM discipline but they have been instrumental in advancing PM efficiencies, leading to improved PM successes.

6.5 Considerations for the future

One of the aims of this study was to advance both scientific and practical insight, and ultimately, to make a contribution to informed solutions that will improve efficiencies in PM in South Africa. A similar study could be useful in the public sector to improve PM efficiencies (in particular service delivery). Other future considerations could include an exploration of the implementation of ERP systems in the cloud infrastructure rather than in organisations. A number of project failures in the implementation of ERP systems have been identified. Perhaps accessing ERP systems in the cloud could minimize, even if not eliminate, high project cost overruns that are caused by the complex nature of implementing ERP systems.

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8. APPENDICES

This section presents additional information and points of references (for elaborative inferences) on the work outlined in the body of the thesis. The section consists of four appendices, starting with a table of data analysis (Table 11) In Appendix 1; followed by examples of data transcripts in Appendix 2; examples of ethics approval letter/s in Appendix 3; an example of interview request letter in Appendix 4, and an example of interview questions in Appendix 5.

Appendix 1: Table of Data Analysis

Table 11 represents key data in a structuration theory thematic format. In the content analysis fashion as elaborated under the findings in chapter 5, the thematic format is used to present and interpret data from transcripts.

Table 11: Structuration Theory Analytical Perspective

Concept	*Concepts applied to the study*
Structure - the medium or outcome of action (Carmack, 2008) represented by **rules** and **resources** used by **agents** to interact, with **agency** as the ability for **human actors** (agents) to exercise **power** by recreating or **transforming** the existing structure (Gediehn, 2008).	**Rules:** PM procedures, methodologies, guidelines, policies, cloud computing rules. Thematical inferences in findings: *(1)* ***Policies and regulations*** *(x7)* Regulated like in the financial services, regulatory requirement (privacy) (ER_UCT – R15) **(x1)**, green compliant (JM_DD – R9) **(x1)**, governance (DB_BCS – R17) **(x1)**, service models (TP_STM – R26) **(x1)**, legalities & laws (NM_OM – R14) **(x3)**, *(2)* ***Methodology*** *(x9)* PM methodology (DB_BCS – R35) **(x3)**, techniques (TP_STM – R25) **(x1)**, certification of PM (TP_STM – R25) **(x4)** , planning, executing and close out (MR_ARCN – R15) **(x1)**. *(3)* ***PM Procedure /guidelines*** *(x5)* 9 pillars of project management discipline (DB_BCS – R35) **(x1)**, project management really is a way of delivering initiatives (TP_STM – R3) **(x1)**, project guidelines, budgetary guidelines (TP_STM – R13) **(x1)**, code of conduct (TP_STM – R25) **(x1)**, PMBok (ER_UCT – R25) **(x1)**. **Resources:** Technological tools (ERP systems, cloud computing, software programs), human, financial resources & suppliers Thematical inferences in findings: **Non- Human Resources** **Software programs and Applications (x40)** *(1)* ***Project management software*** (BK _CPUT – R15) **(x1)**. *(2)* ***Microsoft project*** (BK _CPUT – R15) **(x2)** (ER_UCT – R18) **(x2)**, (ER_UCT – R20) **(x2)**, (ER_UCT – R25) **(x2)**; (DB_BCS – R31) **(x1)**; (DB_BCS – R32) **(x1)**. *(3)* ***Dot project*** (BK _CPUT – R15) **(x2)**. *(4)* ***Microsoft office*** (BK _CPUT – R15) **(x1)**, (JM_DD – R11) **(x1)**. *(5)****Microsoft office 365*** (JM_DD – R11) **(x1)**, (ER_UCT – R6) **(x1)**. *(6)* ***Microsoft office outlook*** (JM_DD – R11) **(x1)**. *(7)* ***Programs/ ASANA*** (MR_ARCN – R27) **(x3)**. *(8)* ***HR application*** (ER_UCT – R17) **(x5)**. *(9)* ***Project Management Application*** (ER_UCT – R18) **(x1)**, (ER_UCT – R22) **(x2)**, (DB_BCS – R31) **(x2)**; *(10)* ***Web based application*** (DB_BCS – R30) **(x1)**, (DB_BCS – R31) **(x1)**, (DB_BCS – R32) **(x2)**, (DB_BCS – R35) **(x1)**; (DB_BCS – R37) **(x2)**; *(11)* ***flat line application*** (DB_BCS – R37) **(x1)**; *(12)* ***SAP***(JM_DD – R11) **(x1)**. ***Cloud computing resources (x147)*** *(13)* ***RAM*** (BK_CPUT – R1) **(x16)**, RAM (BK_CPUT – R2) **(x1)**, (BK_CPUT – R12) **(x7)**, (BK_CPUT – R19) **(x16)**. *(14)* ***Scalability*** (BK_CPUT – R1) *(x7)*, (BK_CPUT – R6) **(x1)**, (BK_CPUT – R8) **(x1)**, (BK _CPUT – R17) **(x1)**, (ER_UCT – R12) **(x1)**; (ER_UCT – R17) **(x1)**, (ER_UCT – R4) **(x1)**, (ER_UCT – R19) **(x1)**, (ER_UCT – R21) **(x2)**, (ER_UCT – R26) **(x1)**. *(15)* ***Server*** (BK_CPUT – R1) **(x1)**, (BK_CPUT – R7) **(x1)**, (BK _CPUT – R15) **(x1)**, (BK _CPUT – R17) **(x4)**, (BK_CPUT – R22) **(x2)**, (BK_CPUT – R23) **(x1)**, (DB_BCS – R31) **(x3)**, (DB_BCS – R37) **(x5)**, (JM_DD – R11) **(x1)**, (JM_DD – R13) **(x1)**, (JM_DD – R24) **(x1)**, (TP_STM – R1) **(x1)**, (TP_STM – R22) **(x1)**, (TP_STM – R24) **(x1)**, (NM_OM – R2) **(x1)**, (NM_OM – R14) **(x2)**, (MR_ARCN – R16) **(x1)**, (MR_ARCN – R17) **(x4)**. *(16)* ***Web server*** (BK_CPUT – R1) **(x2)**, (BK _CPUT – R15) **(x1)**, (BK _CPUT – R22) **(x1)**. *(17)* ***Cloud computing-Drop box/Google drive/Hotmail*** (ER_UCT – R11) **(x1)**, (ER_UCT – R12). *(18)* ***Resource pooling*** (ER_UCT – R4) **(x2)**, (ER_UCT – R12) **(x2)**, (ER_UCT – R26) **(x1)**. *(19)* ***Computing power*** (BK_CPUT – R6) **(x1)**, (BK_CPUT – R13) **(x1)**, (BK_CPUT – R23) **(x2)**. *(20)* ***Storage*** (ER_UCT – R6), (DB_BCS – R1) **(x2)**, (DB_BCS – R9) **(x2)**, (DB_BCS – R14) **(x2)**, (DB_BCS – R18) **(x2)**, (DB_BCS – R20) **(x2)**, (DB_BCS – R22) **(x1)** **(x2)**, (NM_OM – R1) **(x2)**, (NM_OM – R16) **(x2)**, (JM_DD – R11) **(x1)**, (JM_DD – R13) **(x2)**, (JM_DD – R24) **(x1)**, (TP_STM – R1) **(x4)**, (NM_OM – R10) **(x2)**, (TP_STM – R22) **(x1)**. *(21)*

	Processor (BK_CPUT – R1) **(x11)**, (BK_CPUT – R2) **(x1)**, (DB_BCS – R1) **(x1)**, (DB_BCS – R22) **(x1)**, (DB_BCS – R27) **(x2)**; **Internet (x37)** ***(22) Internet or network connectivity*** (BK_CPUT – R6) **(x3)**, (BK_CPUT – R9) **(x1)**, (BK _CPUT – R15) **(x1)**, (BK_CPUT – R20) **(x2)**, (BK_CPUT – R22) **(x1)**, (BK_CPUT – R23) **(x1)**, (ER_UCT – R12) **(x1)**, (ER_UCT – R16) **(x2)**, (ER_UCT – R16) **(x1)**, (DB_BCS – R36) **(x1)**, (DB_BCS – R37) **(x3)**, (DB_BCS – R37) **(x2)**, (JM_DD – R17) **(x1)**, (JM_DD – R20) **(x2)**, (JM_DD – R21) **(x1)**, (JM_DD – R21) **(x2)**, (JM_DD – R24) **(x2)**, (JM_DD – R1) **(x1)**, (JM_DD – R16) **(x1)**, (TP_STM – R22) **(x1)**, (TP_STM – R26) **(x1)**, (MR_ARCN – R16) **(x1)**, (MR_ARCN – R16) **(x3)**, (NM_OM – R13) **(x2)**. **IT Infrastructure (x60)** ***(23) Infrastructure*** (ER_UCT – R1) **(x1)**, (ER_UCT – R2) **(x1)**, (ER_UCT – R4) **(x1)**, (ER_UCT – R17) **(x3)**, (ER_UCT – R18) **(x2)**, (ER_UCT – R20) **(x1)**, (ER_UCT – R22) **(x1)**, (JM_DD – R1) **(x2)**, (JM_DD – R2) **(x1)**, (JM_DD – R6) **(x2)**, (JM_DD – R7) **(x1)**, (JM_DD – R9) **(x2)**, (JM_DD – R11) **(x5)**, (JM_DD – R13) **(x2)**, (TP_STM – R1) **(x2)**, (TP_STM – R2) **(x2)**, (TP_STM – R3) **(x2)**, (TP_STM – R5) **(x1)**, (TP_STM – R10) **(x2)**, (TP_STM – R14) **(x2)**, (TP_STM – R17) **(x2)**, (TP_STM – R19) **(x1)**, (TP_STM – R20) **(x2)**, (TP_STM – R21) **(x2)**, (TP_STM – R22) **(x1)**, (TP_STM – R23) **(x1)**, (TP_STM – R24) **(x3)**, (TP_STM – R24) **(x3)**, (NM_OM – R1) **(x1)**, (NM_OM – R2) **(x3)**, (NM_OM – R3) **(x1)**, (NM_OM – R7) **(x1)**, (NM_OM – R11) **(x1)**, (NM_OM – R14) **(x1)**, (NM_OM – R16) **(x3)**. **Human Resources (x64)** **Expertise (x11)** ***(24) Skill*** (BF_CPUT – R23) **(x3)**, (BF_CPUT – R23) **(x1)**, (JM_DD – R6) **(x1)**; (JM_DD – R14) **(x2)**, (TP_STM – R19) **(x3)**, (TP_STM – R20). **Project managers (x6)** ***(25) Project managers*** (JM_DD – R19) **(x1)**, (JM_DD – R20) **(x2)**, (TP_STM – R5) **(x2)**, (TP_STM – R13) **(x1)**. **Professionals (x47)** ***(26) Project team members*** (BK_CPUT – R13) **(x1)**, (ER_UCT – R21) **(x2)**, (ER_UCT – R21) **(x1)**, (TP_STM – R14) **(x1)**, (TP_STM – R22) **(x1)**, (TP_STM – R23) **(x4)**, (TP_STM – R24) **(x2)**, (TP_STM – R25) **(x7)**, (TP_STM – R26) **(x4)**, (NM_OM – R10) **(x1)**, (NM_OM – R11) **(x3)**, (NM_OM – R13) **(x1)**, (NM_OM – R14) **(x1)**, (NM_OM – R15) **(x1)**, (NM_OM – R16) **(x3)**, (MR_ARCN – R5) **(x1)**, (MR_ARCN – R6) **(x1)**, (MR_ARCN – R10) **(x1)**, (MR_ARCN – R10) **(x5)**, (MR_ARCN – R20) **(x2)**, (MR_ARCN – R25) **(x1)**, (MR_ARCN – R26) **(x1)**, (MR_ARCN – R30) **(x1),** (ER_UCT – R4) **(x1)**.
Structuration - Conditions governing the continuity or transformation of structures, & the reproduction of systems (Giddens, 1979).	**Conditions to: Reinforce** continuity in PM **rules**, enablers, **resources** i.e. use of technological tools (agency), & the perpetuation of established practices. Thematical inferences in findings: ***(1) Preference of in-house infrastructure (x1)*** They still prefer to send the infrastructure dude to the server (NM_OM – R2) **(x1)**. ***(2) Continuity of training of IT employees (x2)*** IT people now obviously they have to continually be in training (JM_DD – R14)**(x2).** ***(3) Lack of trust in security measures (x4)*** huge sensitivity…in wealth management (NM_OM – R4) **(x1)**, when people get comfortable with it that's when they'll start engaging with it (TP_STM – R11) **(x1)**, contentment with security (NM_OM – R10) **(x1)**,

	Confidentiality of the information (NM_OM – R13) **(x1)**. ***(4) Contentment with old technology (x1)*** it's difficult for them to adopt change (current technology) (TP_STM – R26) **(x1)**. **Conditions to: Change** (transform) PM rules, enablers, resources, practices, i.e. use of technological tools (agency) leading to changes in practices. Thematical inferences in findings: ***(1) The need to maintain/improve a level services (x2)*** It became popular, for them to continue giving people the same service, they had to go into the cloud (BK_CPUT – R9) **(x1)**, if you don't you don't grow the service deteriorates (BK_CPUT – R12) **(x1)**. ***(2) Creating intelligence to distribute resources (x1)*** create this intelligence that that distributes resources (BK_CPUT – R12) **(x1)**, ***(3) High demand of processing power (x1)*** high demand at short periods (DB_BCS – R27) **(x1)**. ***(4) Opportunity to solve industry problems (x1)*** In the private sector you can identify a need, come up with a solution (DB_BCS – R34) **(x1)**. ***(5) Evolving Technology (x3)*** Technologies evolve (JM_DD – R14) **(x1)**, constant upgrade of versions of all of the IT components (TP_STM – R19) **(x1)**; Technology is certainly a massive disruptive factor (TP_STM – R26) **(x1)**. ***(6) Expense training Employees due to evolving skill (x3)*** skill that people need to have as well evolved (JM_DD – R14) **(x1)**, human resources would be another driver (JM_DD – R16) **(x1)**, skills set required keeps changing (TP_STM – R19) **(x1)**. ***(7) Expensive maintenance/ infrastructure cost (x3)*** Cost is one of the drivers (JM_DD – R16) **(x1)**, costing you to maintain it (TP_STM – R17) **(x1)**, a refresh of your IT components (TP_STM – R19) **(x1)**; ***(8) Efficiency (x1)*** Efficiency for many organisations could be the main driver (JM_DD – R16) **(x1)**. ***(9) Limited storage Space (x11)*** space would be the main driver (JM_DD – R16) **(x1)**, we would need storage facilities (NM_OM – R14) **(x1)**, it's going to give me the storage (JM_DD – R24) **(x1)**, to worry about the space… that's their problem (BK_CPUT – R18) **(x1)**, all you need is the space. And this is where now where cloud technology comes in (BK_CPUT – R1) **(x1)**, its more storage at that people are after (DB_BCS – R14) **(x1)**, demand is for storage and cheap storage (DB_BCS – R20) **(x4)**, storage on demand (DB_BCS – R22) **(x1)**. ***(10) Estimated future trends (x3)*** In years to come certain things are going to become by default available from the cloud (JM_DD – R17) **(x1)**, absolutely the way to go for future times (TP_STM – R6) **(x1)**, will be utilized in future (TP_STM – R8) **(x1)**. ***(11) Decreased time to market for a product (x1)*** need for time to market and (TP_STM – R19) **(x1)**. ***(12) Growth of organisations (x1)*** Scale of a company (MR_ARCN – R10) **(x1)**.
System - Reproduced relations between actors or their collectivities, organized as regular practices, over time & space (Giddens, 1984).	**Systems: re-enforcement** of stakeholders **relationships** & regular practices - Thematical inferences in findings: Regular practices comprise of the integration of business processes like outsourcing, human resource management, and financial management and project management. The enforcement of stakeholder relationships are achieved through: ***(1) Reporting & feedback (x1)*** maybe the boss can see the progress and they can raise issues on that system (BK _CPUT – R15) **(x1)**. ***(2) Meetings (x1)*** You can easily call meetings (MR_ARCN – R6) **(x1)**. ***(3) Accountability/follow up (x2)*** Hold them accountable (MR_ARCN – R13) **(x1)**, Bits of follow-ups are needed (MR_ARCN – R25) **(x1)**. ***(4) Constant communication (x6)*** Breakdown of communication impacts everything, we have phones and videos and what not for communication (NM_OM – R11) **(x1)**, we get on the phone, we video conference, we talk through it (NM_OM – R15) **(x1)**, it's quite communication intensive (NM_OM – R14) **(x1),** face to face helps (MR_ARCN – R26) **(x1),** before it was face to face only, now its online (TP_STM – R26) **(x1),** it takes teams of people, to debate, what's the right way (TP_STM – R14) **(x1)**. ***(5) Sharing information (x1)*** sharing online and sharing information via the web (TP_STM – R16) **(x1)**.

Appendix 2: Data Transcripts

Interview Questionnaire (Technology literate project managers)

The purpose of this study is to investigate the adoption of cloud computing in business processes with an interest in project management. This study is for academic purposes; it will not be used against the organisation and the person who is being interviewed. It is also the interviewee's prerogative to give authority not to use his\her name and the organisations name in the study. The interview will only be recoded with the permission given by the interviewee.

Name: [redacted]

Organisation: Santam

Department: Project management

Occupation: Project Manager

Q. In the context of your environment, what is your understanding of cloud computing?

TP_STM – R1. Well, my understanding of cloud computing is really a way of providing ***data storage,*** via a cloud type of pool so, where we have file transfers and collation of files, a repository of it creating ***virtual storage*** for it for the multiple ways of ***storage*** that we've had before. Databases is also a way of allowing organisations not to spend in the ***infrastructure*** of their own where they can actually go and share ***infrastructure*** via the cloud way of doing it. Cloud providers are technically the bigger organisations, like the oracles of the world, where they provide big warehousing facilities and companies are allowed or able to via the ***cloud store*** staff on their specific servers.

Q. Do you use cloud computing in your projects?

TP_STM – R2. We as a group, a lot of our ***infrastructure i***s outsourced to specific vendor that provides it for the Santam group, specifically we wouldn't look at cloud computing for our projects at this stage but our ***infrastructure*** service provider is and they are certainly looking at doing cloud computing. I guess the thing about cloud computing, it's about getting the business case to make sense for you. So those companies that are sitting with the ***infrastructure*** already, it definitely makes financial sense to move across, especially if that ***infrastructure*** is already written off in their books. If it's there for more than five years, it does not make sense to move because moving and you are paying for your cloud computing as opposed to the cost being reduced at the moment. For new companies, for smaller companies, medium to small companies and for new organisations clearly cloud computing is the way to go.

Q. Do you think that cloud computing cloud computing can enhance project management in any way?

TP_STM – R3. Cloud computing is really an IT concept that is very specific to IT and the way we do ***infrastructure*** in IT. ***Project management really is a way of delivering initiatives*** so yes, I think a project manager knowing about cloud computing and how it operates might be in a position to advise initiations or ***advise projects business owners on project and IT personnel around the benefits of cloud computing and providing it as an alternative*** but there's no real benefit or direct correlation between project management and cloud computing. I just think a project manager should know all about what's happening there, in the environment, what's changing, what are the new concepts, cloud computing being one of those.

Q. You said that you use vendors for your IT infrastructure, would you say that perhaps they use cloud computing like on your behalf?

TP_STM – R4. Yes but we are not doing it as yet, but I know there is a view to have a look at that and how we do it in the future so ya clearly they are looking at it. And like I said, you know, projects are all about the benefit and the cost benefit analysis, of what's costing us and how we are going to benefit from it. And generally projects in an organisation will normally follow the architectural style and design of those projects...of the architectural design of the organisation. ***So if the organisation itself hasn't decided on a strategy of using cloud computing all the projects won't be considering it or cant.***

Q. Is it something that's popular in the industry, in project management generally, cloud computing? Like, is there an awareness of some sort among project managers?

TP_STM – R5. Yeah, I'd say so, clearly any of the new concepts that come out there, ***project managers*** will get involved in those concepts, they will get a good understanding of it, your good ***project managers*** are the ones that understand the trends. They understand the current world and they understand future mode of operations of what happening in the environment, what are the trends from an IT and/or business perspective so yah, there's talk about it clearly there is a desire to what to understand how it affects projects. If you consider, if there is a project out there to start up a new business clearly cloud computing must be one of the options that should be considered. Its lower cost to ***infrastructure***, lower setup, it's a more tax efficient way of doing it, so yah.

Q. What about yourself, were you aware of it because something came up while you were running your projects or was a thing of you basically trying to keep up with the trends in technology?

TP_STM – R6. Well it was part of my job before so prior to me taking over the PMO in July last year, I was the ICT exec, executive responsible for specific business units in Santam and my job was to create and maintain the ICT strategy for those business units. So I'd look at my business strategy and try and provide an ICT strategy that would follow to service their needs. In that strategy cloud computing is one of the avenues that I looked at, I went to a few seminars on it to get an understanding of how it's being done, I attended the oracle seminar so yah, I think that its ***absolutely the way to go for future times.*** But you know I don't know I don't know how its going to suit the bigger players though, that's gonna be the challenge because bigger players may want the security knowing that their data, their information is safe and secure and some companies believe that the intellectual property is the way they store data and the retrieval of their data. We'd have to see how cloud computing addresses those people.

Q. Yes because it's a risk when it come to that.

TP_STM – R7. Absolutely, anything going in via the cloud is a risk.

Q. And now considering, as you said that you were a…I forgot what position that was, before being in the project management office, generally in management where would you see it being beneficial/ not just project management but generally in management?

TP_STM – R8. In my view any executive, any Senior executive, any business manager that has strong reliance on IT should understand cloud computing because it's a concept now and ***its growing and its something that will be utilized in future.*** You know, as a business owner you should be asking your IT service providers or trusted advisers what its about. To understand it at least and to see how it can benefit your business. Use appropriately, it should be bringing down your cost.

Q. Yah, that should be the whole point.

TP_STM – R9. It's the whole point.

Q. How about its reputation among your colleagues and the industry? Does it have a good reputation as to it being able to address maybe issues of scalability maybe?

TP_STM – R10. Ayanda, what I haven't picked up…well you know there's always the security issue, there's always the security risk but you know even if we look in environments that have their own service, and provide their own ***infrastructure***, they also have challenges. The whole bank statement debacle and exposure, banks traditionally always had their own ***infrastructure***, their own ***servers because of the confidentiality of the information*** they deal with, the data they deal with so clearly they are not even in the cloud computing environment at all. Look at the way they have been compromised so I think that the debate is there, there'll always be this concern. Again it's like online shopping, trusting online shopping whereby you as a consumer will go online and put your personal credit card details online but it's not that easy but once you start it and you experience it you realize that it's pretty safe and people shop, I think there's probably more crime with you submitting your credit card to vendors whereby they are now duplicating your credit card as opposed to online fraud.

Q. That's true, yes.

TP_STM – R11. But again it's when people get ***comfortable with it that's when they'll start engaging with it,*** so there's no negative connotations, I don't think there is negative connotations to it, about cloud computing in a lot of discussion and debate.

Q. I think we've talked about the usefulness of it, the question I have here is, how useful really can it be in project management? Are there things you see it helping in as to the processes of project management?

TP_STM – R12. No I don't, I think it'll be strenuous to try and create a direct correlation, what I can say though, how it could assist project management is to help look at the cost of your infrastructure differently, that what makes sense.

Q. The cost of the infrastructure….

TP_STM – R13. You know how ***project managers*** always maintaining their costs and looking at ways of ***holding a piece of work project within the guidelines, within budgetary guidelines,*** and that's the challenge.

Q. Especially when it comes to, like the projects that, I don't know, like your stadiums that were built for 2010, and how that project is basically not running within a specific organisation, its project managers put together for a specific period of time to build those stadiums and, I mean, its big projects, in terms of infrastructure, you would not want to start a new infrastructure completely, it's easier, I think to go with cloud computing and use that as an infrastructure, so that when you are done, you literally, are done, you don't have to worry about so much money that you've spent, but what about time efficiencies now because I know in projects time is also a big thing, is there any way where it can help in that?

TP_STM – R14. Absolutely, setting up ***infrastructure*** is not that…that normally takes time. ***Getting it organized and it takes teams of people, to debate, what's the right way of doing it and all of that.*** Whereas if you had cloud computing as an option, that happens quicker, you can go through the processes a lot quicker with cloud computing concept, as oppose to setting up your own ***infrastructure***, yah, absolutely so again from a project management perspective, that's another way of trying to save some time on projects.

Q. And what about project managers living in different towns or countries can that help somehow?

TP_STM – R15. By sharing knowledge or managing projects?

Q. Yes sharing knowledge and the actual management of the project. Just by the virtue that they live in remote areas or far from each other.

TP_STM – R16. They are doing that already, without cloud computing, its already been done with the sharing ***online and sharing information via the web*** so for me that's not specifically cloud computing.

Q. Sorry, why did you say again you are not using it? / oh, you said you've got a vendor.

TP_STM – R17. Yes we've got a vendor that takes care of the ***infrastructure***, and you know again with Santam being 96 years old and its ***infrastructure*** is already bought and its in place so cloud computing does not make financial sense, to look at it now, because all you are doing is, you've got an asset base, of course you are maintaining it and its ***costing you to maintain it.*** But that cost of maintaining it will probably equal the cost of cloud computing because the asset base is already paid for, but if we had to be starting up a new company for example, it would cost you to put in that ***infrastructure***. It makes sense to rather go on the rental basis and instead of it being a part of your asset on your financials; it becomes an expense on your income statement because it's a rental, there is a tax benefit to it.

Q. When it comes to maintaining it, are the times that you find that…. because of the technology that's being upgraded all the time, that the infrastructure, becomes a limitation to the product that maybe you would like to use? Now I'm thinking of the flexibility of the infrastructure to accommodate whatever technology you would like to use.

TP_STM – R18. Flexibly to accommodate any of the...?

Q. Any kinds of technology you want to use in your processes?

TP_STM – R19. Its challenging, ***infrastructure***, the computing environment is challenging, there's constant upgrades, constant increase in need, need for speed, ***need for time to market and there's constant upgrade of versions of all of the IT components*** so its always a moving target and its difficult to stay abreast of it. Because your ***skills set required keeps changing*** and we had main frames, and we had developers that developed in specific languages, a lot of those languages have become obsolete and now you are sitting with permanent work ***force skilled*** in a specific domain, you need to either ***reskill*** them or look at other ways of dealing that complexity. Its challenging, ***from a resource point of view***, ***infrastructure point of view, every 18 months there's almost a refresh of your IT components*** and if you are seating stuck with resource based to maintaining it and you are sitting with the asset base, in 18 months' time those assets may not really be very….or cutting

edge anymore, they are not giving you a competitive advantage from a speed and cost point of view.

Q. Which is why I am asking, is therefore not making sense as well even for a business that's been around like this one to actually also use cloud computing because of the facts you've just mentioned?

TP_STM – R20. My view, absolutely, the problem though is in any organisation, there is always a lot of moving parts, there's always lots of challenges and if ***infrastructure*** is not a priority in your space, because remember it's going to take some effort to move from our current owned environment into a shared cloud environment, a lot of effort, so organisations sometimes, the reason they are not getting into it, ***it's because clearly you need to think about it, you need to create as strategy, you need to dedicate some people to get that sorted***. There might be a ***reskilling*** that is required of all of the staff members that are on your payroll, which might have to change. There's a lot of effort required, and if that's not top of mind and if that's not causing a problem then it does not make sense for the organisation to spend effort there. I think cloud computing will probably, its gonna grow in medium to small businesses clearly, the bigger companies will certainly look at it but I think their current focus is on their growth targets and profitability, that's really hurting them now. And even changing, changing from your ***infrastructure*** to your cloud computing is not gonna give them a big saving. It's not big enough to warrant they to consider it.

Q. To actually want to jump in. Okay. I would ask what are the benefits of this technology within project management but you already said that, you don't see the direct benefits but obviously indirectly.

TP_STM – R21. We spoke about the cost and time efficiency.

Q. Are there any positive changes you have seen since the cloud computing technology has come in?

TP_STM – R22. Definitely, I think if you give businesses especially the smaller to medium enterprise, if you give them an opportunity to either the market because there's a smaller setup cost and also remember besides just a cost there's the ***expertise***, setting up ***infrastructure*** is not an easy thing, you need to get ***professionals***, you need to get a team to pull it together and understanding ***servers, databases***, ***network***, integration, there's a couple of issues so I think

for me that's a definite benefit in that you can go to one place where they sort all of those questions out for you and you don't have to invest in any of these on a longer term bases.

Q. What about the quality outcomes are there any impacts on that, because quality is also a big thing?

TP_STM – R23. Yah, again, my view is certainly, ***I think by getting specialists that understand of cloud computing, and you get a pool of them, constantly, doing, learning and applying what they learn from an infrastructure for cloud computing, if you get a group of professionals*** that concentrate on that and that's their full time Job chances are things are gonna get a lot better with doing that so from a quality point of view I would as a ***project manager want to look at that option as opposed to employing a whole team of people to create that*** because I don't know what gonna be like, I don't know the level of competence I might get, there's too many pieces, there's too much uncertainty. I could go to a bunch of ***professionals*** that I know they do this every day; it will give me a level of comfort that my quality expectations will be met.

Q. And we spoke about the disadvantages of that, is there anything else you can think about that is a disadvantage either than the risk of your information being managed by a service provider?

TP_STM – R24. I guess anything that is out in a cloud...there's always a risk attached to that. We can't be oblivious to the fact that world class hackers can get into anything but my point is, how much more of the risk is that compared to your own ***infrastructure***. Now, with our ***infrastructure***, bringing your own devices, most of your ***team members*** and ***company staff members***, have access to your emails you know, which is sitting on your ***servers*** and they could easily get lines into your ***application*** so I think from a disadvantage point of view, I'm almost saying that because it exists in both environments, it could be compromised in both environments, I would not consider that a disadvantage. I think for me a disadvantage would be what current ***infrastructure*** provides that cloud computing cannot. I think the important thing there Ayanda is, one of the disadvantages is depending on the service provider you choose, if a service provider tries to cut corners by not having a proper data recovery in place, backups, regular backups, data recovery disaster plan backup, because when you go into cloud computing, you take all of those as given, your service provider is gonna make sure my data is backed up even if their sight burns down, even if multiple sights burns down, I'm going to be fine and that if service provider take the rigor of making sure they don't cut corners, it will do away

with that disadvantage, its more about what happens in a disaster, am I gonna be able to retrieve all of my data still or not. Sony as an example had a bridge two year ago, but that was on their own ***infrastructure***, a major bridge where their information was gone, lost, they lost their clients details to hackers. That's why I said it's not really a disadvantage, the security foe me is not an issue its all around the disaster recovery plan, if the rigor is there. The disadvantage is that you don't have control over that, you have to take their word for it and you will only realize when it's too late sometimes that, oops, they didn't take the necessary precaution in terms of disaster recovery.

Q. And generally, what is the status of project management like in your experience in your field. Do you think projects are doing well, do you think there's improvements, no improvements just the status of it besides the cloud computing?

TP_STM – R25. That's a good question, the maturity is growing in project management, I think there are still pockets of excellence, clearly there's more mature environments. I think project management is more matured in specific industries, industries that depend on high level of success rate like your building industry, your mining industry or engineering industry. Those industries have to succeed first time; they've used project management very well and they have used it for many years, now its part of the discipline of industry. Managers are not just managers, they are ***project managers***, they know how to use the disciplines of project managers and apply them but they are also content experts. That's where the pockets of excellence is sitting. I think in the bigger environments, finance is using it a lot more now. I think there there's rooms for improvement definitely there's room for improvement in that, we sometime don't know what we should be expecting of project management and all of the different roles that comes as part of the ***project management*** tools and ***techniques*** so I also think ***certification of project management***, it used to be a lot more stricter, ***the code of conduct,*** making sure you have had the ***relevant experience*** before you can get ***a certification*** was an important driver, so when I go in there and I say I'm a ***project manager*** and I am ***certified,*** it means something. What the organisations that control the certification have done to their detriment is they've allowed people to go and ***certify*** without the ***relevant experience***. So now a person just having a year or two ***experience*** and in some environment can do a ***certification pass***, and they can call themselves a ***project manager or a project coordinator*** that does not help the industry. That person is just not experienced enough to handle projects.

Q. In this environment, the financial sector, like Metropolitan, Sanlam, Santam they are very much into project management. Why is it like that?

TP_STM – R26. Generally the finance industry has staff members, it's also quite a mature industry, they've got ***staff members*** that understand the business that have been there for many years, whenever you try to change, whether its processes or adding new technology or delineation of technology or you are changing the roles of people that have been doing one type of job for 10/15/20 years, it's difficult for them to adopt change so project management and bringing in the ***project management team*** to take care of that often makes sense. It's difficult to ask someone that's been doing something for 20 years on how they should be doing it differently if they have had no exposure to that, then comes your project management team with a view of how things have been done outside, how things have been done in different industries, in different countries, in different geographic areas and bring that ***expertise*** to try and help businesses move to the next level or implement the change and that doesn't happen too well when using your own people, that's why they would bring in projects and bring in change via projects. I was fortunate enough to be part of the SARs tax payer services transformation project back in the day in 2003/4 and there the only way SARs is able to transform, was the commissioner, at that stage, Pravin Gordon, he brought on 320 consultants who were all people, ***experts*** in their fields from all walks of life to that Siyakha program as it was called 969 million program and he was able to transform it. Because he had people sitting there working for only for 20/25 years. They understood specific areas around the business and they've done it manually all along. How can you ask that person now to craft a new automated environment of they have not had exposure to that, it's very difficult and hence projects in the finance industry is big. ***And there's been a lot of changes. Technology is certainly a massive disruptive factor and if you look at what we've had over the last 20 to 30 years, from a technological point of view, we've made incredible advances and that's why this industry has had to change,*** the ***service models*** ***have had to change, interaction, client interaction, before it was face to face only, now its online***, people are now becoming more intelligent and wiser around the financial components, they are more intelligent around understanding what it is they need, how they can apply these financial components. You gonna get people wanting to read inline so these ***models*** have had to change.

Cape Peninsula
University of Technology

Interview Questionnaire (Service providers)

The purpose of this study is to investigate the adoption of cloud computing in business processes with an interest in project management. This study is for academic purposes; it will not be used against the organisation and the person who is being interviewed. It is also the interviewee's prerogative to give authority not to use his\her name and the organisations name in the study. The interview will only be recoded with the permission given by the interviewee.

Name: [redacted]

Organisation: Business Connexion Solutions

Occupation: Client Service Provider

Q. In your environment how would you describe cloud computing?

DB_BCS – R1. Cloud computing is the availability of ***processing power*** which is not physically yours, it's up in some environment somewhere else and its like…. exactly what the word says, it's like a cloud. You don't know where it is but you can connect a ***computing device*** and it can give you ***computing power and storage***. And you can make it available as you wish, on demand or you can purchase it upfront in fixed chunks like you can buy two or three processing power with a certain amount of memory or with a certain amount of discs. So it is very scalable on a very short-term bases. It is very easily scalable to demand.

Q. And do you offer cloud computing services in this company?

DB_BCS – R2. Yes.

Q. When did you start?

DB_BCS – R3. Probably 2 years ago, 2.5/3 years ago if not further back.

Q. So what motivated that?

DB_BCS – R4. ***The trending to new technologies, we saw where the future was going, and then we started preparing ourselves to move into that direction.***

Q. And has there been growth in that?

DB_BCS – R5. Slowly, the take on of cloud computing, we are working with big corporates and also public sector… and there is still a sort of fear of security around cloud computing and how secure is "my data" on the cloud. I think that's the biggest…I think it will come over time as people become more used to cloud computing and the security around it and they find out that it is quite secure and then it will take off more.

Q. Would you say it is secure though because I interviewed some project managers who are not necessarily in the technology sector, like in the financial sector and……. I mean that is their main thing, they are concerned that it's not secured at all. If you can prove that it is secure maybe will talk.

DB_BCS – R6. My question is going to be to them is on what premises do they make that assumption, that it's not safe, like any security in computing is "where does security lie", is the security lie where area where the computer is or is where is your biggest vulnerability, the biggest vulnerability is at the end user so yes I can put enough fire walls and other protection in place but if the person at the laptop gives out his password then how secure can I make my environment? So that is where security lies so it's not in the environment where the computing sits and where it is hosted, it is the user abusing that security. That is the weakest link in the security of computing. Just take that, there is a lot of hackers out there but they can hack into your laptop as well, they can hack into any main front, in your computer and if they are good enough, in a secured data center. There is a possibility for that so.

Q. So it's not a question of cloud computing as such, that's just the Internet.

DB_BCS – R7. And again it's a perceived fear out there because people are not used to the concept, they got this idea that I need to be the owner of something to make it secure.

Q. So now with regards to the growth of it, what is it that made it, that's making it to grow. What are drivers perhaps that are pushing it towards growth?

DB_BCS – R8. Currently the open source environment is a big driver because for open source users are very prone to it.

Q. What do you mean by open source?

DB_BCS – R9. Open source…your, none…what is the word I am looking for…your Linex, all those things that you do not buy as operating systems, its freeware. Open source is freeware. So your open source community is very prone to cloud computing because they are working in an open environment anyway so they are aware of this environment out there and they are aware about the securities that need to be put in place. Where your people working with Microsoft's and those things where you pay for ***applications*** are very protected in this environment so that why I say open source is big, your phase book and your twitter and those things, that is a big driver for cloud computing as well because with all your social networks these days you get free access to ***cloud based storage*** and our phones back up is made on the cloud so that's where the big growth is at this stage.

Q. What about businesses?

DB_BCS – R10. Businesses, as I said the reason for businesses being very slow on the taking of cloud computing is the security issue.

Q. So a lot of them, they take their time into it.

DB_BCS – R11. Into it yah, for businesses its very slow to take on, there has been companies that have done it but it has not taken off as people would have liked.

Q. And how well known is cloud computing generally?

DB_BCS – R12. Excuse me?

Q. How well known is cloud computing by the public or businesses out there?

DB_BCS – R13. I think that the people in our environment, people who are IT literate as well and a layer furthest from that with end user sitting at the desk and just doing their work and that's not just IT literate but computer literate, they know about it but do not really grasp the concept, I think that the general public if you talk about cloud computing its completely not there yet.

Q. What are the uses of cloud computing?

DB_BCS – R14. At this stage the big thing is a, social media, a lot of people know it from social media and mostly data storage, very few people might use it for the ***computing power*** available in the cloud so it's ***more storage*** at this stage so it's my opinion, it's my take on it, Very few people be buying ***computing power*** in the cloud. It's more storage that people are after at this stage and making use of it as well.

Q. And mostly like you said, social network

DB_BCS – R15. Social networks yah and your Anroid devices and things like that. Okay, IO has got their own cloud from an iphone point of view, in those environments its well-used.

Q. And what about in this environment, when you offer your services, who do you offer your services to?

DB_BCS – R16. Mostly financial companies, oil companies, retail, public sector.

Q. Do you know which area in the public sector?

DB_BCS – R17. We deal with all government department so yah, we try but again the public sector is also, they are driven with a….SETA. SETA is a driver for public sector that they need to provide. They are sort of bound to the ***governance*** around SETA and making use of SETA but it's not hard cast and stone so they are allowed to go out to private people, as the public sector. But again the adoption of that is also very, very slow.

Q. And what kind of cloud computing services do you provide as an organisation?

DB_BCS – R18. The whole stack, ***computing as well as storage***. And then obviously the bandwidth in those environments.

Q. Can you elaborate on that?

DB_BCS – R19. Bandwidth, you need connectivity and we also provide the connectivity as well.

Q. Which one do your clients often use, what is it that you get your clients coming for? Storage.

DB_BCS – R20. ***Storage*** at this stage yah, the demand is for ***storage*** and ***cheap storage*** because people want to archive staff then they want to make use of cloud computing or of ***storage***.

Q. Because they probably don't have capacity.

DB_BCS – R21. Capacity yah. So its things they are deeming as low risk, which they want to store into the cloud.

Q. What would you say are the greatest advantages of cloud computing?

DB_BCS – R22. As I said one of meanings, it is scalable; you can request it on demand if you provide a model where you can provide ***computing power on demand***, ***memory on demand*** and ***storage on demand***. It is very scalable; you can do it with a click of a mouse. You can provide addition ***computing processing power*** as well as ***memory as well as storage***. So its very, very flexible in that regard. I think that is the biggest driver because if a big organisation like a financial institution needs ***processing power*** over the end of the month and the rest of the month then computing is as much as low, then they only require that amount of mbps at the month end so on demand I need that, I paid that for that period and then it becomes available to someone else again.

Q. So would you say its less costly compared to using your own IT infrastructure.

DB_BCS – R23. Definitely I would say that, yah.

Q. Is it obvious or is it very clear that it's better to use cloud computing.

DB_BCS – R24. There is always a type of scale in terms of economy of scale, the more people start using it, the cheaper it will become. So initially it might be still expensive but it will be cheaper than buying your own hardware. And setting hardware and then only using x amount over peak periods so the rest of the time…so its actually a waste sitting there.

If you take all of that into consideration and do your financial calculation and you working on wastage then yes….

Q. Especially over a long period of time.

DB_BCS – R25. Yes, especially over a long period of time. Economy of scale…so the more people start using it the more cheaper it will become.

Q. And the way its going now, people are going to start using it quite often. And what are the most critical areas where cloud computing can be put to use in business organisations?

DB_BCS – R26. The most critical areas?

Q. Yah. Where you think definitely in this area the company can benefit?

DB_BCS – R27. ***As I said just now that in financial institutions where they need high demand at short period then they can request it*** so I think that is where it will become very critical for them is to say… or if you take, let's take an event like the Argus tour, why should they go out and purchase their own hardware for an event that last for maybe 4/5 weeks or 5 months out of the year and the rest of the time its idle, because they start at September and they wait until next September before doing something again. Why would they then spend that money when they are not working when they could just rent and make use of cloud computing and just use that ***processing power*** at sky up as demand comes because their big demand is when people enroll and its probably 2 0r 3 weeks peak then its full so something like that is…why do they need al that ***processing power*** sitting there idle for the rest of the year when they actually use it for 3 weeks.

Q. Someone should actually suggest that with the 2 oceans guys.

DB_BCS – R28. That's right all these guys all these major events like that…there's…

Q. It will actually benefit them quite a lot.

DB_BCS – R29. Yes

Q. So, do your clients use cloud computing for project management?

DB_BCS – R30. The concept of cloud is, if you refer to ***web based applications***.

Q. Anything actually…..

DB_BCS – R31. A ***web based application*** can be used in the cloud or isn't in the cloud. There's ***project management applications***, which can be, cloud computing as well. Its typically not because…e, you can refer to it as cloud computing. You've got a massive ***server*** sitting somewhere in a location and everybody make use for instance in that ***server*** or that computer to run off his project on or his ***project application*** on so yes, there is ***web based applications*** out there which does not really compete with your typical ***server*** environment like the ***MS***

project but yes there are definitely ***project management applications*** out there that use cloud computing concept and we have got one client, media 24 that make use that service, I'm not sure if they are still using it and how far they've developed in it but I was involved with project when we rolled it out an application for project management.

Q. What was their reason for going into the cloud?

DB_BCS – R32. ***Cost, your licensing model per user was quite cheaper than the MS project model.***

Q. Is it, I guess that would make sense to the cloud. Okay, there's something else I wanted to ask you on that particular point. I wanted to ask, when it comes to applications that can be used or web base software that can be used, is it a matter of a client will advise on software they would want to use or does it come on a package like that, how does that work?

DB_BCS – R33. You get packages as cloud computing or ***web based*** which is of the shelve but you can get special applications as well where people say, I have this requirement or this need and then you develop according to the specific need of the client. And yes we have been developing quite a lot of ***web based applications*** lately and especially around world organizers where people want to make use of a specific ***application*** geared to a specific requirement in the…. oh and also retail with your reps and staff where they want to have information on demand from a remote location and they are web based so those applications are….

Q. So you are the one who advises them on those applications?

DB_BCS – R34. We do advise them and we do try and sell those ***applications*** as well. It does not work like that in the public sector but ***in the private sector you can identify a need, come up with a solution and do a solicited proposal to the client and show them this is what you can do as a solution and they can decide if they want to go for that solution or not.*** But we also have got already developed ***applications,*** which we can take to the market, which are more ***generic applications***, which can be used broadly across by different environments.

Q. What are the most common project management functions…. but as you said you only have one client or had one client on that, anyway I was not sure if there's actually a particular, I don't know, project management area that perhaps they thought they cloud use cloud computing to actually solve, when you put it like that.

DB_BCS – R35. Applications that's out there which is ***web based come*** with the entire ***project management methodology*** or it can be adopted suit the ***project management methodology*** so what they do is that they build the project ***management methodology*** into the application so your different phases is catered for. ***So it's a slightly tweaking into the application to fit different methodologies*** so depending on what you want to do so is from the whole ***9 pilars of project management discipline***, it covers all of that, it may be weaker on some ***websites*** and strong on other but yes I think the guys are quite ingenious on developing applications that is suiting the requirement and making it more user specific.

Q. Would you say there would a difference between a project manager that uses cloud computing and the one does not?

DB_BCS – R36. No, it's the tool that assists the project manager in doing his job, project management is a discipline of interaction with people and putting processes together where the technology, the project management, your Gantt chart all those things it's just a tool to facilitate project management. I can do project management on an excel spreadsheet, I don't he needs assistance. So yes it enhances or makes life maybe a bit easier and it's a tool that assists the project manager. I don't think cloud computing id going to make the life of a project manager easier if its cloud computing versus a server based computing, the only thing that will assist in helping making it easier, you'll be more accessible from anywhere depending on if there is coverage or ***connectivity.***

Q. Because I was about to ask like when project manager are working from various areas, I mean one could just put a server on the net and they can all be able to have access to it anyway, in terms of connectivity, I don't know, are there any disadvantages with putting that server there compared to just using cloud computing straight on.

DB_BCS – R37. No I don't think there's a difference, if I have to access the ***server*** in a closed domain environment, there is ways to VPN into my environment from outside so I can do that, sometimes it's just a bit slow, that's the only drawback based on ***connectivity*** but if you have fast ***connectivity*** it's not going to make a difference. ***Web based applications*** turn to be a bit quicker than normal flat line ***applications*** but yah, I don't think…the reason why we as an organisation as BCS (Business Connection Solutions) had problems with using applications like ***project server, MS project server was connectivity***, The ***server*** sits up in Midrand and we do not have a duplicate ***server*** in Cape Town or a connected ***server*** in Cape Town. We've got bandwidth problems and you've got a thin pipe and you've got bandwidth problems and it

becomes slower you always need to do something. ***Web based applications*** may be a bit quicker on a slower link because of the way that they communicate versus a flat line, yes its slightly, its not a big difference. If you have connectivity problems, you have connectivity problems, it makes for both environments, it makes it slow so yah,

Q. Have you experience problems with cloud computing, maybe clients calling in, maybe they…..

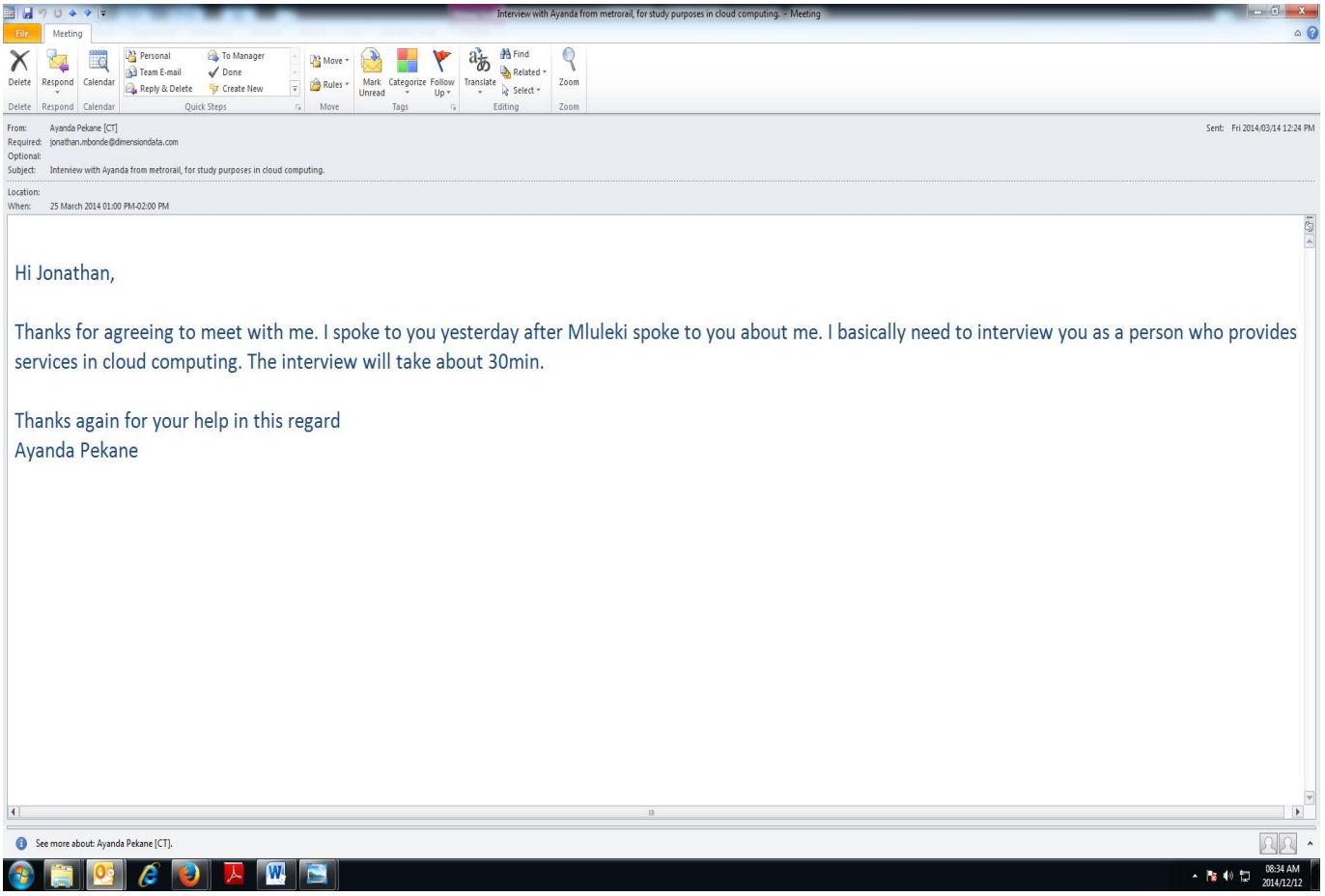
DB_BCS – R38. I'm not that involved with the actual operations of cloud computing so it's difficult to say what is experienced of customers of cloud computing but I think once the operations are running, it's like any other thing. The only that will give problems is ***connectivity***, if you've got lots of connectivity, if you rely on a third party supplier or a Telkom or whatever to provide you with ***connectivity*** and its down for a day then you are stuck but its like that anyway with ***web based applications*** as well.

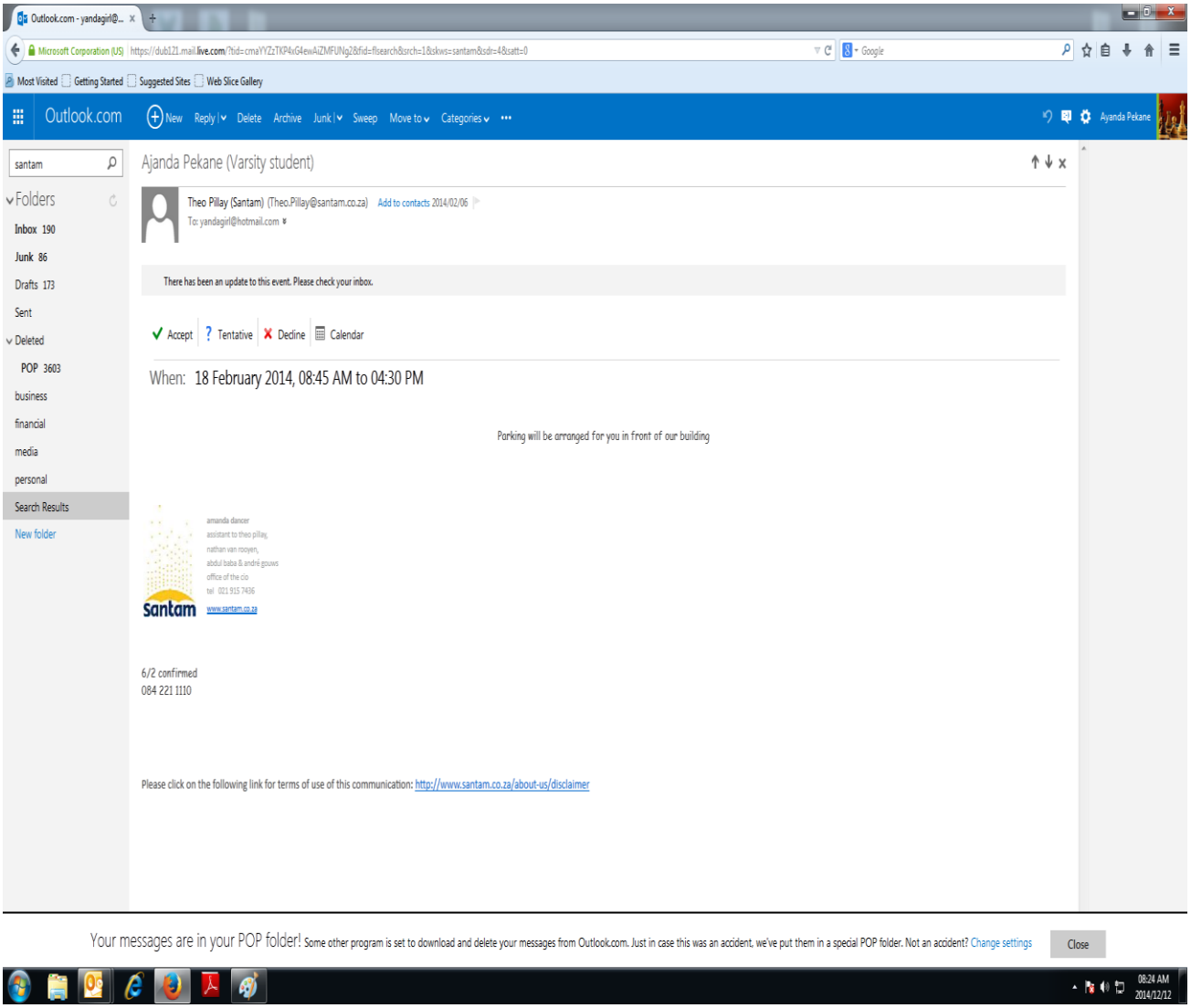
Q. With your clients, like in terms of the payment options, is it all pay as you go or contracts or anything like that.

DB_BCS – R39. It's different, there's different models so you can have ***pay as you go or you can buy upfront*** and say I'm going to buy upfront and say I'm going to buy upfront for a year so much amount of power for a year, I don't want to scale up and down, I want that, that's my need and I want x amount of storage, then you can purchase that. You probably going to have, so it's gonna be a very flexible paying model so I think with that its quite easy these days to flex it. It's just easy with the way you are doing your billing, your payment method. In that I think there's ways around it as well. ***So I can purchase something on demand or pay as you go.*** I can buy like I do with my cell phone now, I can buy the 2Gbyte of data which I can use over the network or can buy 15Gigs of storage up front or I can do by metering, billing by metering, monitor how much you use and see how much you use and I can bill you for that afterwards. There are various models and all those models can work, it's just how you are going to develop your application for the cloud.

Q. Thank you very much that was very helpful, that's all I really needed to know.

Appendix 3: Ethics of approval

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Outlook.com
New
Reply
Delete
Archive
Junk
Sweep
Move to
Categories
Ayanda Pekane
santam
Folders
Inbox 190
Junk 86
Drafts 173
Sent
Deleted
POP 3603
business
financial
media
personal
Search Results
New folder
Ajanda Pekane (Varsity student)
Theo Pillay (Santam) (Theo.Pillay@santam.co.za)
Add to contacts 2014/02/06
To: yandagirl@hotmail.com
There has been an update to this event. Please check your inbox.
Accept
Tentative
Decline
Calendar
When: 18 February 2014, 08:45 AM to 04:30 PM
Parking will be arranged for you in front of our building
amanda dancer
assistant to theo pillay,
nathan van rooyen,
abdul baba & andré gouws
office of the cio
tel 021 915 7436
www.santam.co.za
6/2 confirmed
084 221 1110
Please click on the following link for terms of use of this communication: http://www.santam.co.za/about-us/disclaimer
Your messages are in your POP folder! Some other program is set to download and delete your messages from Outlook.com. Just in case this was an accident, we've put them in a special POP folder. Not an accident? Change settings
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Appendix 4: Interview request letter

D6 Plaza Place

Bower road

Wynberg

12 April 2014

The Project Manager

Old Mutual, Cape Town

Request for a master's research interview appointment

Dear Sir/Madam

I am Ayanda Pekane (Ms), a master's student in Information Technology at CPUT (Cape Peninsula University of Technology).

In my research specialization, I am investigating 'The adoption of cloud computing to enhance project management in the South Africa in the private sector'. The success of this project will depend on the observation of best business practices.

Your organisation has been recommended as a leader in sound business practices, and an ideal case for analysis. The purpose of this letter is to kindly request an interview and, possibly, moments where I can learn through observations of selected instances as you work.

I look forward to your favorable response.

Sincerely,

Ayanda Pekane

0842211110

Appendix 5: Example of interview questions

Interview Questionnaire (Technology literate project managers)

The purpose of this study is to investigate the adoption of cloud computing in business processes with an interest in project management. This study is for academic purposes. It will not be used against the organisation and the person who is being interviewed. It is also the interviewee's prerogative to give authority not to use his\her name and the organisations name in the study. The interview will only be recorded with the permission given by the interviewee and it will take +/- 40min at the most.

Name:

Organisation:

Department:

Occupation:

Questions

1. In the context of your environment, what is your understanding of cloud computing?
2. Do you use cloud computing in the management of your projects?

2.1 If no, what are your reasons for not using it?

2.2 If those reasons were not a problem, would you use it?

3. When did you start using cloud computing?
4. What brought on the awareness of cloud computing in your organisation?
5. Do other companies in this industry within the project management context use cloud computing?
6. What kind of reputation does this technology have among your colleagues who are project managers? Is it a norm for it to be used?

7. As a project manager do you find it useful or would you say it is useful if it were to be used?

7.1 If yes what have you found useful in it?

7.2 If no, what reasons are there, that may cause it to be of little use?

8. How exactly is cloud computing used in project management? / what area of project management do you use it in. At what stage or phase is it applied?
9. What are the benefits of this technology in project management?
10. As a project manager what challenges have you seen or experienced in the use of cloud computing?
11. What are the positive changes you have seen since the adoption of cloud computing in your projects? That is in comparison to prior its adoption.
12. What are the negative changes you have seen since the adoption of cloud computing in your projects?
13. What would be its advantages in project management, in terms of time efficiencies?
14. What would be its advantages in Project management, in terms of cost efficiencies?
15. Does the use of cloud computing in project management impact the quality of the outcome? If so how?
16. In your experience are there any best practices of cloud computing in project management in terms of application?
17. Are there any concerns or disadvantages that are there in its use in project management?
18. Would you say that projects that have been undertaken recently are successful in terms of time and cost efficiencies?

Thanks for your help.